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GENERAL

WORK COVERED BY CONTRACT DOCUMENTS

The work consists of the abandonment and removals of existing entry points of the Niblock (NB) and David Thompson Highway (DTH) (Provincial Highway 11) entry points onto the Icefields Parkway (Provincial Highway 93), with the installation of new designs for both areas. Work of the contract includes, but is not limited to the total performance of the work (labour, materials, and equipment).

The scope of work is for:

- Removals of existing septic system at DTH existing Park entry point site.
- Rehabilitation of DTH existing Park entry point site
- Tree removals, grubbing and clearing (NB)
- Signage removals (NB, DTH)
- Stripping and grading (NB, DTH)
- Asphalt milling (NB, DTH)
- Coordination of relocation of existing power utilities (NB)
- Grade and base preparation of approximately 10,500 square metres of road base (NB, DTH)
- Filling grading and compaction of kiosk service area (DTH)
- Supply and installation Concrete curbing (NB, DTH)
- Supply and installation/construction including fit out of new kiosk building(s) including structural as well as all mechanical, electrical and communication servicing (NB, DTH)
- Mechanical, Electrical and Instrumentation work required to complete the building installation (mentioned above) and supporting infrastructure including lighting, septic and water servicing. (NB, DTH)
- Supply and installation and hookup of septic and greywater tanks, including pump systems (NB, DTH)
- Supply and installation of all new street lighting (NB, DTH)
- Installation of concrete slabs including joinery at stop points near kiosk buildings (NB)
- Supply and placing of approximately 10,050 square metres of asphalt prime coat (NB, DTH)
- Supply, placing and compaction of approximately 10,050 square metres of 150mm thick asphalt paving (NB, DTH)

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- Installation of all concrete barriers (NB, DTH)
 - Supply and installation of all required road markings (NB, DTH)
 - Supply and installation of all required highway signage ((NB, DTH)
 - Supply and installation of all Parks Canada signage mounting posts (NB, DTH)
 - Design, Supply and installation of 20kW skid generator package (DTH)
 - Supply and installation of flat concrete work in all islands (NB, DTH)
 - Supply and installation of dry stack rundle boulder planters in all islands (NB, DTH)
 - Supply and installation of all tree and shrub planting including required planting soil (NB, DTH)
 - Installation of 3m asphalt path c/w compacted subbase (NB)
 - Supply and installation of all topsoil required for seed bed (NB, DTH)
 - Supply and install of all seed, hydromulch and tackifier (NB, DTH)
 - Warranty period (NB, DTH)

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

Construct Work under a Unit Price Contract.

WORK BY OTHERS

Co-operate with other contractors in carrying out their respective works and carry out instructions from Departmental Representative.

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

CONTRACTOR USE OF PREMISES

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

Departmental Representative occupancy according to Canadian Environmental Assessment Act (CEAA).

Departmental Representative usage.

Park Icefield Parkway access by public and government agencies.

Work by other contractors, if any.

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

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

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

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.

At completion of operations condition of existing work: to make good any work disturbed during construction to that of its original state.

DEPARTMENTAL REPRESENTATIVE OCCUPANCY

The Departmental Representative will have access to the premises during entire construction period for execution of normal operations.

Co-operate with the Departmental Representative in scheduling operations to minimize conflict with the institution and to facilitate the Departmental Representative's usage.

Construct Work to accommodate the Departmental Representative's use of premises during construction.

Co-ordinate Progress Schedule and co-ordinate with the Departmental Representative during construction.

Maintain fire access/control to the work site at all times.

Maintain park and public access to campground at all times.

The Roadway will be open during all phases of construction.

ALTERATIONS, ADDITIONS OR REPAIRS

Execute work with least possible interference or disturbance to Icefield Parkway, occupants, staff and normal use of premises. Arrange with the Parks Canada Departmental Representative to facilitate execution of work.

Execute work according to CEAA and National Parks Act.

EXISTING SERVICES

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

Where Work involves breaking into or connecting to existing services, give the Departmental Representative 96 hours notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Contractor shall inform Departmental Representative 96 hours in advance of interruption of underground utilities.

Contractor is to receive approval from Departmental Representative prior to any shutdowns.

Where work involves underground services, the Contractor must inform and obtain approval from the Departmental Representative before any excavation may commence.

Provide alternative routes for personnel and vehicular traffic.

Provide flagging, barricades and traffic controls at all times during work.

Maintain continuous access to Icefield Parkway for public at all times.

Maintain continuous access for Park visitors through work areas at all times.

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

Submit schedule to and obtain approval from the Departmental Representative for any shut-down or closure of active service or facility including power and communications services or roadways. Adhere to approved schedule and provide notice to affected parties. Only ½ of any road(s) may only be shut down at a given time.

Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic where required. Normal traffic includes buses and large trailers

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

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

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

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

DOCUMENTS REQUIRED

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

Contract Drawings.

Specifications.

Addenda.

Reviewed Shop Drawings.

List of Outstanding Shop Drawings.

Change Orders.

Other Modifications to Contract.

Field Test Reports.

Copy of Approved Work Schedule.

Health and Safety Plan and Other Safety Related Documents.

Minutes of Safety Meetings

Performance Bond

Other documents as specified.

END OF SECTION

PART 1 GENERAL

1.1 ACCESS AND EGRESS

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

1.2 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with the Departmental Representative to facilitate work as stated. Maintain Roadway access to public at all times.
- .2 Where security is reduced by work provide temporary means to maintain security.
- .3 The Contractor will provide onsite sanitary facilities for use by Contractor's personnel. Keep facilities clean.
- .4 Contractor shall provide its own waste bins and shall dispose of domestic waste on a daily basis. Contractor shall not use existing public waste bins on the work area. All construction waste to be placed in Contractor supplied bins on site.
- .5 Closures: protect work temporarily until permanent enclosures are completed.

1.3 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 96 hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions to a minimum. Carry out interruptions after normal hours of occupants.
- .3 Provide for personnel and vehicular traffic. Provide detours, flagging, barricades and traffic controls before beginning work.
- .4 Construct barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

1.4 SPECIAL REQUIREMENTS

- .1 Submit schedule in accordance with Section 01 32 18 - Construction Progress Schedules - Bar (GANTT) Chart.
- .2 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.

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- .3 Keep within limits of work and avenues of ingress and egress.
 - .4 Deliver materials during normal working hours unless otherwise approved by the Departmental Representative.
 - .5 Hours of work are normally from 7am to 7pm 7 days a week.
 - .6 No work will be permitted from noon Thursday before any long weekend until 7am on the Tuesday following the long weekend. The departmental representative will provide a list of non-working during scheduling of construction.
 - .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.
 - .9 No more than 30 metres of open trench may be left of at the end of the working day.
 - .10 The contractor must not impede traffic after 12 noon the day before a long weekend and 12 noon the day after the long weekend.
 - .11 No work between 19:30 and 7:30 or (dusk till dawn)
 - .12 There will be no delays in traffic greater than 15 minutes unless approved by Departmental representative.
 - .13 Where trenches are required along and across roadway(s), the Contractor shall ensure that trenches are covered at the end of each working day and shall be safe for public transportation.

END OF SECTION

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 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 will be done by the Departmental Representative.
- .4 The prices bid for supply and installation of materials shall be full compensation for supplying, hauling, 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.
- .5 All existing materials on-site whether structures, vegetation, topsoil, gravel, sand or other excavated, or piled materials are the property of the Owner on which the work is located. Only those materials specifically noted in the specifications or on the drawings as belonging to the Contractor shall become the Contractor's property.
- .6 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.
- .7 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 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.

PART 3 MEASUREMENT AND PAYMENT CLAUSES**3.1 GATE REHABILITATION**

- .1 Division 01 - General
 - .1 No measurement shall be made
 - .2 Payment shall be made on the lump sum price bid, pro-rated on a monthly basis according to the percentage of contract completion as determined by the Departmental Representative.
 - .3 Payment shall include the supply of all labour, material and plant as required for the Gate Rehabilitation project as identified on the plans and specifications.
 - .1 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .2 Division 02 – Existing Conditions
 - .1 No measurement shall be made
 - .2 Payment shall be made on the lump sum price bid, pro-rated on a monthly basis according to the percentage of contract completion as determined by the Departmental Representative.
 - .3 Payment shall include the supply of all labour, material as required for the Gate Rehabilitation project as identified on the plans and specifications.
 - .1 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .3 Division 03 – Concrete
 - .1 Measurement shall be in square metres
 - .2 Payment shall be made on the lump sum price bid, pro-rated on a monthly basis according to the percentage of contract completion as determined by the Departmental Representative.
 - .3 Payment shall include the supply of all labour, material as required for the Gate Rehabilitation project as identified on the plans and specifications.
 - .1 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .4 Division 04 – Masonry
 - .1 Measurement shall be made in square metres.
 - .2 Payment shall be made on the lump sum price bid, pro-rated on a monthly basis according to the percentage of contract completion as determined by the Departmental Representative.
 - .3 Payment shall include the supply of all labour, material as required for the Gate Rehabilitation project as identified on the plans and specifications.
 - .1 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .5 Division 05 – Metals

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- .1 No measurement shall be made
 - .2 Payment shall be made on the lump sum price bid, pro-rated on a monthly basis according to the percentage of contract completion as determined by the Departmental Representative.
 - .3 Payment shall include the supply of all labour, material as required for the Gate Rehabilitation project as identified on the plans and specifications.
 - .1 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .6 Division 06 – Wood and Plastic
 - .1 No measurement shall be made
 - .2 Payment shall be made on the lump sum price bid, pro-rated on a monthly basis according to the percentage of contract completion as determined by the Departmental Representative.
 - .3 Payment shall include the supply of all labour, material as required for the Gate Rehabilitation project as identified on the plans and specifications.
 - .1 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .7 Division 07 – Thermal and Moisture Protection
 - .1 No measurement shall be made
 - .2 Payment shall be made on the lump sum price bid, pro-rated on a monthly basis according to the percentage of contract completion as determined by the Departmental Representative.
 - .3 Payment shall include the supply of all labour, material as required for the Gate Rehabilitation project as identified on the plans and specifications.
 - .1 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .8 Division 08 – Opening
 - .1 No measurement shall be made
 - .2 Payment shall be made on the lump sum price bid, pro-rated on a monthly basis according to the percentage of contract completion as determined by the Departmental Representative.
 - .3 Payment shall include the supply of all labour, material as required for the Gate Rehabilitation project as identified on the plans and specifications.
 - .1 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .9 Division 09 – Finishes
 - .1 No measurement shall be made
 - .2 Payment shall be made on the lump sum price bid, pro-rated on a monthly basis according to the percentage of contract completion as determined by the Departmental Representative.

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- .3 Payment shall include the supply of all labour, material as required for the Gate Rehabilitation project as identified on the plans and specifications.
 - .1 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .10 Division 10 – Specialties
 - .1 No measurement shall be made
 - .2 Payment shall be made on the lump sum price bid, pro-rated on a monthly basis according to the percentage of contract completion as determined by the Departmental Representative.
 - .3 Payment shall include the supply of all labour, material as required for the Gate Rehabilitation project as identified on the plans and specifications.
 - .1 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .11 Division 26 – Electrical
 - .1 No measurement shall be made
 - .2 Payment shall be made on the lump sum price bid, pro-rated on a monthly basis according to the percentage of contract completion as determined by the Departmental Representative.
 - .3 Payment shall include the supply of all labour, material as required for the Gate Rehabilitation project as identified on the plans and specifications.
 - .1 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .12 Division 31 – Earthworks
 - .1 No measurement shall be made
 - .2 Payment shall be made on the lump sum price bid, pro-rated on a monthly basis according to the percentage of contract completion as determined by the Departmental Representative.
 - .3 Payment shall include the supply of all labour, material as required for the Gate Rehabilitation project as identified on the plans and specifications.
 - .1 All incidental work and items required to complete the work for which payment is not specified elsewhere.
 - .13 Division 32 – Exterior Improvements
 - .1 No measurement shall be made
 - .2 Payment shall be made on the lump sum price bid, pro-rated on a monthly basis according to the percentage of contract completion as determined by the Departmental Representative.
 - .3 Payment shall include the supply of all labour, material as required for the Gate Rehabilitation project as identified on the plans and specifications.
 - .1 All incidental work and items required to complete the work for which payment is not specified elsewhere.

.14 Division 33 – Utilities

- .1 No measurement shall be made
- .2 Payment shall be made on the lump sum price bid, pro-rated on a monthly basis according to the percentage of contract completion as determined by the Departmental Representative.
- .3 Payment shall include the supply of all labour, material and plant as required for the Gate Rehabilitation project as identified on the plans and specifications.
 - .1 All incidental work and items required to complete the work for which payment is not specified elsewhere.

.15 Division 40 – Process Integration

- .1 No measurement shall be made
- .2 Payment shall be made on the lump sum price bid, pro-rated on a monthly basis according to the percentage of contract completion as determined by the Departmental Representative.
- .3 Payment shall include the supply of all labour, material and plant as required for the Gate Rehabilitation project as identified on the plans and specifications.
 - .1 All incidental work and items required to complete the work for which payment is not specified elsewhere.

3.2 PAVING PROGRAM

.1 Subgrade Preparation/Prepaving w/ Subgrade Surface

- .1 Measurement shall be made in square metres (m²).
- .2 Payment shall be made on the unit price bid per square metre (m²).
- .3 Payment shall include the supply of all labour, material and plant for subgrade preparation and regrading. The work includes:
 - .1 Traffic control, flagmen, signage and detour signage
 - .2 Construction survey, layout, setting grades
 - .3 Cutting, trimming and removal of material to disposal or stockpile area.
 - .4 Scarifying subgrade 150mm deep.
 - .5 Shaping, watering, aerating, compacting, trimming and testing.
 - .6 Locating and protecting existing utilities and structures.
 - .7 Proof-rolling the entire surface area under pavement sections. Proof-roll using a heavily loaded truck, loaded to approximately 10 tonnes per axle and a minimum tire pressure of 550kpa. Minimum of 2 complete coverage of the surface area. Proof-rolling must be observed by the Geotechnical consultant or Engineer.
 - .8 All incidental work and items required to complete the work for which payment is not specified elsewhere.

- .2 Prime Coat
 - .1 Payment for Prime Coat is included in the granular base course payment. No separate payment for Prime Coat shall be made.
 - .1 All incidental work and items required to complete the work for which payment is not specified elsewhere.
- .3 Asphalt Pavement – 150mm Compacted Thickness
 - .1 Measurement shall be made in tonne (t) for the type and thickness specified.
 - .2 Payment shall be made in the unit price bid per tonne. Payment for tack coat is included in the asphalt pavement rate.
- .4 Regrading & Compacting Embankment Construction
 - .1 Measurement shall be made as a unit bid. .
 - .2 Payment shall be made on the unit price bid per completed unit (ea.) for each type of unit bid.
 - .3 Payment shall include the supply of all labour, material and plant for the regrading and recompaction of the existing gravel campsite pullout. The work includes:
 - .1 Traffic control, flagmen, signage and detour signage
 - .2 Construction survey, layout, setting grades
 - .3 Cutting, trimming and removal of material to disposal or stockpile area.
 - .4 Shaping, watering, aerating, compacting, trimming and testing.
 - .5 Locating and protecting existing utilities and structures.
 - .6 All incidental work and items required to complete the work for which payment is not specified elsewhere.

END OF SECTION

PART 1 GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

- .1 Particular requirements for inspection and testing to be carried out by testing laboratory designated by the Departmental Representative are specified under various sections.
- .2 Contractor shall provide test requirements and inspection milestones to Departmental Representative.

1.2 APPOINTMENT AND PAYMENT

- .1 The Departmental Representative will appoint and pay for services of testing laboratory except follows:
 - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
 - .2 Inspection and testing performed exclusively for the Contractor's convenience.
 - .3 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.
 - .4 Mill tests and certificates of compliance.
- .2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by the Departmental Representative to verify acceptability of corrected work.

1.3 CONTRACTOR'S RESPONSIBILITIES

- .1 Provide labour, equipment and facilities to:
 - .1 Provide access to Work for inspection and testing.
 - .2 Facilitate inspections and tests.
 - .3 Make good Work disturbed by inspection and test.
 - .4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.
- .2 Notify the Departmental Representative sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.
- .3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
- .4 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by the Departmental Representative.

END OF SECTION

PART 1 GENERAL

1.1 PRECONSTRUCTION MEETING

- .1 Preconstruction meeting will be arranged by the Departmental Representative after the Contract is awarded.

1.2 PROGRESS MEETINGS

- .1 The Contractor shall provide a site trailer for progress meetings on-site.
- .2 Progress meetings will be held on a bi-weekly basis or as assigned by the Departmental Representative. 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 copies will be distributed to attendees within three (3) working days after each meeting.
- .6 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.

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.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to the Departmental Representative within 10 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 Kiosks
 - .1 Award.
 - .2 Shop Drawings, Samples.
 - .3 Permits.
 - .4 Mobilization.
 - .5 Construction/Installation
 - .6 Servicing
 - .7 Testing
 - .8 Occupancy
 - .2 Site Servicing
 - .1 Award.
 - .2 Shop Drawings, Samples.
 - .3 Permits.
 - .4 Mobilization.
 - .5 Excavation.
 - .6 Backfill.
 - .7 Delivery of Tanks
 - .8 Delivery of Packaged Generator Station.
 - .9 Electrical.
 - .10 Piping.
 - .11 Controls.
 - .12 Testing and Commissioning.
 - .13 Supplied equipment long delivery items.

.3 Grading, Paving and Roadworks

- .1 Award.
- .2 Shop Drawings, Samples.
- .3 Permits.
- .4 Mobilization.
- .5 Grading
- .6 Paving
- .7 Completion of paving
- .8 Signage Installation
- .9 Testing

.4 Site Work

- .1 Award.
- .2 Shop Drawings, Samples.
- .3 Permits.
- .4 Mobilization.
- .5 Excavation of Sites
- .6 Repairs
- .7 Trail work
- .8 Landscaping
- .9 Testing

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 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, and samples in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable. 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.
- .5 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.
- .6 Verify field measurements and affected adjacent works are co-ordinated.
- .7 Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .8 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative's review.
- .9 Keep one reviewed copy of each submission on site.
- .10 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 10 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 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 or 6 copies of shop drawings for each requirement requested in specification Sections and as the Departmental Representative may reasonably request.
 - .13 Submit electronic or 6 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 or 6 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.
 - .15 Submit electronic or 6 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 or 6 copies of manufacturers instructions for requirements requested in specification Sections and as requested by the Departmental Representative.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
 - .17 Submit electronic or 6 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 or 6 copies 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 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.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 35 30.00 - Health and Safety Requirements
- .2 Section 01 35 43 - Environmental Procedures
- .3 Section 32 17 23 – Pavement Markings
- .4 Section 10 14 53 – Traffic Signs
- .5 Section 32 12 16 – Asphalt Paving

1.2 REFERENCES

- .1 Alberta Infrastructure and Transportation Traffic Accommodation in Work Zones latest edition.
- .2 Manual of Uniform Traffic Control Devices for Canada, (MUTCD) distributed by Transportation Association of Canada.

1.3 PROTECTION OF PUBLIC TRAFFIC

- .1 Comply with requirements of Acts, Regulations and By-Laws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out Work or haul materials or equipment.
- .2 When working on travelled way:
 - .1 Place equipment in position to minimize interference and hazard to travelling public.
 - .2 Keep equipment units as close together as working conditions permit and preferably on same side of travelled way.
 - .3 Do not leave equipment on travelled way overnight.
- .3 Close lanes of road only after receipt of written approval from the Department Representative.
 - .1 Before re-routing traffic erect suitable signs and devices to Traffic Accommodation in Work Zones.
- .4 Keep travelled way graded, free from pot holes and of sufficient width for required number of lanes of traffic.
 - .1 Provide 7 m wide minimum temporary roadway for traffic in two-way sections through Work and on detours.

1.4 INFORMATIONAL AND WARNING DEVICES

- .1 Provide and maintain signs, flashing warning lights and other devices required to indicate construction activities or other temporary and unusual conditions resulting from Project Work which requires road user response.
- .2 Supply and erect signs, delineators, barricades and miscellaneous warning devices to Traffic Accommodation in Work Zones.
- .3 Place signs and other devices in locations recommended in Traffic Accommodation in Work Zones.
- .4 Meet with Departmental Representative prior to commencement of Work to prepare list of signs and other devices required for project. If situation on site changes, revise list to approval of Departmental Representative.

- .5 Continually maintain traffic control devices in use:
- .1 Check signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.
- .2 Remove or cover signs which do not apply to conditions existing from day to day.

1.5 CONTROL OF PUBLIC TRAFFIC

- .1 Provide competent flag personnel, trained in accordance with, and properly equipped to Traffic Accommodation in Work Zones for situations as follows:
 - .1 When public traffic is required to pass working vehicles or equipment that block all or part of travelled roadway.
 - .2 When it is necessary to institute one-way traffic system through construction area or other blockage where traffic volumes are heavy, approach speeds are high and traffic signal system is not in use.
 - .3 When workmen or equipment are employed on travelled way over brow of hills, around sharp curves or at other locations where oncoming traffic would not otherwise have adequate warning.
 - .4 Where temporary protection is required while other traffic control devices are being erected or taken down.
 - .5 For emergency protection when other traffic control devices are not readily available.
 - .6 In situations where complete protection for workers, working equipment and public traffic is not provided by other traffic control devices.
 - .7 At each end of restricted sections where pilot cars are required.
 - .8 Delays to public traffic due to contractor's operators: 15 minutes maximum.
 - .9 When vehicles are entering or exiting gravel pits in the park and this will interrupt or cause disruptions to the normal highway traffic.
- .3 Where roadway, carrying two-way traffic, is restricted to one lane, for 24 hours each day, provide portable traffic signal system.
 - .1 Adjust, as necessary, and regularly maintain system during period of restriction.
 - .2 Ensure signal system meets requirements of Traffic Accommodation in Work Zones] [Traffic Control Manual for Work on Roadways.

1.6 OPERATIONAL REQUIREMENTS

- .1 Not Used.

2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

3 EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures

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 7 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.
- .3 Submit 1 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 in accordance with Section 02 61 33 - Hazardous Materials.
- .7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 10 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.

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.

1.7 REGULATORY REQUIREMENTS

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

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 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 be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.
- .3 The Contractor is the prime contractor for the site.

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 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 Warden 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 Warden Briefing: Wardens communicate information such as the geological and cultural histories of the parks, as well as messages dealing with safety and accident prevention on site.

1.2 REFERENCES

- .1 (2015-070L Niblock Gate Redevelopment) BMP
- .2 (2015-071L David Thompson Gate Redevelopment) BIA

1.3 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 EPP must be written by a qualified Environment Professional approved by the Parks Canada ESO.
- .3 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 is to present a comprehensive overview of known or potential environmental issues which must be addressed during construction.
- .4 Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .5 The Environmental protection plan shall include:

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- .1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.
 - .2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.
 - .3 Names and qualifications of persons responsible for training site personnel.
 - .4 Descriptions of environmental protection personnel training program.
 - .5 Erosion and sediment control plan which identifies type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
 - .6 Drawings, if any, showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
 - .7 Traffic control plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather. Plans include measures to minimize amount of mud transported onto paved public roads by vehicles or runoff.
 - .8 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use. Plan to include measures for marking limits of use areas including methods for protection of features to be preserved within authorized work areas.
 - .9 Spill Control Plan: including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
 - .10 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
 - .11 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off project site.
 - .12 Contaminant prevention plan that: identifies potentially hazardous substances to be used on job site; identifies intended actions to prevent introduction of such materials into air, water, or ground; and details provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.
 - .13 Waste water management plan that identifies methods and procedures for management and/or discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.
 - .14 Environmental/spill response plan that identifies contacts and provides methods and procedures to be undertaken in the case of an environmental incident or emergency.

1.4 FIRES

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

1.5 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 must be removed from Banff National Park.
- .3 All construction waste must be removed from Banff National Park.
- .4 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.
- .5 All food and domestic waste is to be removed daily. Contractor to supply bear proof waste bins.
- .6 Surplus gravel and clean waste fill to be removed from the work areas can be disposed of at an area outside of Banff National Park.
- .7 Contractor to provide portable sanitary facilities (Porta Potties) for Contractor's use.

1.6 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.

1.7 SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties where indicated.
- .2 Trees to be protected as per environmental mitigations in Environmental Screening Document.
- .3 Protect roots of any designated trees to drip line during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.
- .5 Restrict tree removal to areas indicated or designated by the Departmental Representative.

1.8 WORK ADJACENT TO WATERWAYS

- .1 Do not operate construction equipment in waterways.
- .2 Do not use waterway beds for borrow material without the Departmental Representative's approval.

- .3 Do not dump excavated fill, waste material or debris in waterways.
- .4 Design and construct temporary crossings to minimize erosion to waterways.
- .5 Do not skid logs or construction materials across waterways.
- .6 Avoid indicated spawning beds when constructing temporary crossings of waterways.
- .7 Do not blast under water or within 100m of indicated spawning beds.

1.9 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this contract.
- .2 Control emissions from equipment and plant to local authorities' emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area, by providing temporary enclosures.

1.10 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.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES AND CODES

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

END OF SECTION

PART 1 GENERAL

1.1 GENERAL ABBREVIATIONS

AASHTO	American Association of State Highways and Transportation Officials
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
ASTM	American Society for Testing and Materials
AWS	American Welding Society
CAN	National Standard of Canada
CCA	Canadian Construction Association
CEC	Canadian Electrical Code
CSA	Canadian Standards Association
CWB	Canadian Welding Bureau
ISO	International Organization for Standardization
SSPC	Steel Structures Painting Council
NBC	National Building Code
RTAC	Roads and Transportation Association of Canada
WCB	Worker's Compensation Board

1.2 UTILITIES

API	American Petroleum Institute
AWWA	American Water Works Association
CGA	Canadian Gas Association
CGSB	Canadian General Standards Board
CSPI	Corrugated Steel Pipe Institute
FM	Factory Mutual
IAO	Insurer's Advisory Organization
ULC	Underwriters Laboratories of Canada
TAC	Transportation Association of Canada

1.3 METRIC ABBREVIATIONS

.1 General

The specifications are metric and metric usage is based upon SI units in accordance with CSA Standard CAN/CSA-Z234.1-89 Canadian Metric Practice Guide. In this specification SI units are abbreviated in accordance with the Metric Units and Abbreviations below.

.2 Linear Measure

Metre	m
Millimetre	mm

	Kilometre	km
	Micrometre	micro-m
.3	Area	
	Square metre	m ²
	Square millimetre	mm ²
	Hectare	ha
.4	Volume	
	Cubic metre	m ³
	Litre	L
.5	Mass and Density	
	Kilogram	kg
	Gram	g
	Tonne	t
	Kilogram per metre	kg/m
	Gram per metre	g/m
	Kilogram per square metre	kg/m ²
	Gram per square metre	g/m ²
	Kilogram per cubic metre	kg/m ³
.6	Temperature	
	Degree Celsius	°C
.7	Force, Pressure and Stress	
	Newton	N
	Kilonewton	kN
	Pascal	Pa
	Kilopascal	kPa
	Megapascal	MPa
.8	Velocity, Rate of Flow	
	Metre per second	m/s
	Metre per hour	m/h

Kilometre per hour	km/h
Litre per second	L/s
Cubic metre per second	m ³ /s

.9 Power, Energy, Heat, Work

Watt	W
Kilowatt	kW
Kilowatt hour	kWh
Joule	J

.10 Electricity

Ampere	A
Volt	V

.11 Illumination

Footcandle	fc
Lumen	lm
Lux	lx

.12 Metric Pipe Size Equivalents – ISO Diameter Nominale (DN)

Metric (mm)	Imperial (in.)
8	1 / 4"
10	3 / 8"
15	1 / 2"
20	3 / 4"
25	1"
32	1-1/4"
40	1-1/2"
50	2"
65	2-1/2"
80	3"
90	3-1/2"
100	4"
125	5"
150	6"
200	8"
250	10"

300	12"
350	14"
400	16"
450	18"
500	20"
600	24"

1.4 USE OF ABBREVIATIONS

- .1 The abbreviations refer to Specifications, Methods and Standards issued by the respective Association, and the abbreviations are used in the specifications.
- .2 Alphanumeric designations following the abbreviations denote the specification, method, or standard.

END OF SECTION

PART 1 GENERAL

1.1 INSPECTION

- .1 Allow the Departmental Representative access to Work. If part of the Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 Notify Departmental Representative with requirements and schedule for special inspections.
- .3 Give timely notice requesting inspection if the Work is designated for special tests, inspections or approvals by the Departmental Representative instructions, or law of Place of Work.
- .4 If the Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .5 The Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction. If such Work is found in accordance with Contract Documents, the Departmental Representative shall pay cost of examination and replacement.

1.2 INDEPENDENT INSPECTION AGENCIES

- .1 An independent testing firm will be engaged by the Departmental Representative for purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by the Departmental Representative.
- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .4 If defects are revealed during inspection and/or testing, the appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by the independent testing firm at no cost to the Departmental Representative. Pay costs for retesting and re-inspection.

1.3 ACCESS TO WORK

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

1.4 PROCEDURES

- .1 Notify appropriate agency and 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.

1.5 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by the Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.
- .3 If in opinion of 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.

1.6 REPORTS

- .1 Submit 4 copies of inspection and test reports to the Departmental Representative.
- .2 Provide copies to the subcontractor of work being inspected or tested and the manufacturer or fabricator of material being inspected or tested.

1.7 TESTS AND MIX DESIGNS

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

1.8 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 Water for construction is available from the Lake Louise Water treatment plant for Lake Louise Site and David Thompson Site. The Contractor can apply to withdraw water from Bow River for work at the Niblock site or the North Saskatchewan for the David Thompson site . Note there is no guaranty that any permit will be approved to draw from either river.
- .3 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.
- .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:

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- .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. Be responsible for damage to heating system if use is permitted.
- .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 Provide and pay for temporary power during construction for temporary lighting and operating of power tools at no cost to the Departmental Representative.
- .2 Furnish and install all necessary temporary wiring, distribution boxes, panels, etc., and upon completion of the work, remove all such temporary materials.

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 buildings 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 area to be fenced and used by Contractor, 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.

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 meetings and furnished with drawing laydown table.
- .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.
- .3 Where compaction of backfill is specified, the Contractor shall perform the work in a manner such that compaction can be achieved.
- .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 Normal traffic includes large tour buses, large RV units and large camping trailers.
- .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 Normal traffic includes large tour buses, large RV units and large camping trailers.
- .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 Local RCMP Detachment
 - .2 Local Fire Department
 - .3 PWGSC
 - .4 Parks Canada
 - .5 Utility Companies
- .6 One lane of the Icefields Parkway (Highway 93) or David Thompson Highway (Highway 11) must be kept open at all times.
- .7 The Contractor shall maintain/provide access to all Parks Canada facilities adjacent to the work at all times.
- .8 Contractor is to follow a logical progression of work that will allow the maximum number of campsites to be opened during the camping season.

- .9 Paving to proceed upon completion of all Site Repairs and must occur after the Labour Day Long Weekend.
- .10 Adequate construction parking meeting local regulations shall be provided by the Contractor.
- .11 Haul routes shall be maintained by the Contractor. They shall be kept open to traffic and shall be clean at all times.
- .12 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.
- .3 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', Version 10-2a (2010-10-07).

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 new 1.2m high snow fence wired to rolled steel "T" bar fence posts spaced at 2.4m on centre, around the lift station and storage tanks site and open trenching at the end of each work day. Provide one lockable truck gate. 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.

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.

1.8 PUBLIC TRAFFIC FLOW

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

1.9 FIRE ROUTES

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

1.10 PROTECTION FOR OFFSITE AND PUBLIC PROPERTY

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

1.11 PROTECTION OF BUILDING FINISHES

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

1.12 WASTE MANAGEMENT AND DISPOSAL

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

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 Within text of each 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 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.

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 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 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.

1.5 TRANSPORTATION

- .1 Pay costs of transportation of products required in performance of Work.
- .2 Transportation cost of products supplied by the Departmental Representative will be paid for by the Departmental Representative. Unload, handle and store such products.

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.

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- .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 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.
- .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.

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- .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 QUALIFICATIONS OF SURVEYOR

- .1 The Contractor shall provide and pay for the services of a land surveyor, licensed to practice in Place of Work, acceptable to the Departmental Representative.

1.2 SURVEY REFERENCE POINTS

- .1 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.
- .2 Make no changes or relocations without prior written notice to the Departmental Representative.
- .3 Report to the Departmental Representative when a reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- .4 Require the surveyor to replace control points in accordance with original survey control.

1.3 SURVEY REQUIREMENTS

- .1 Establish permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.
- .2 The Contractor shall provide detailed layout for trenching, sanitary, concrete, road work, signalization, illumination, landscaping and all appurtenances installation in accordance with the requirements of the applicable specifications.
- .3 The Contractor shall provide all necessary survey instruments, stakes, and other material required to establish lines and levels and layout of the Work, by instrumentation.
- .4 The Contractor shall give 96 hours advance notice to the Departmental Representative before the respective construction starts. The Departmental Representative's check on the Contractor's survey work and grade sheets shall not relieve the Contractor responsibility.
- .5 The Contractor shall locate, confirm and protect the control points, and legal pins, or he shall be charged with the resulting expense and shall be responsible for any mistakes that may be caused by their loss or disturbance.
- .6 The Contractor shall not proceed with the work until he has received from the Departmental Representative such base horizontal and vertical control points and instructions required for the execution of the work.
- .7 The Contractor shall, before commencing work at any point, satisfy himself and to the meaning and correctness of all stakes and instructions. No claims shall be considered for any allowance based on alleged inaccuracies, failure to read reference points correctly, or failure to interpret instruction correctly.

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- .8 If the Contractor, in the course of the work, finds any discrepancy between the drawings and the physical conditions of the locality or any errors or omissions in the drawings or in the layout as given by points and instructions, he shall inform the Departmental Representative immediately in writing, and the Departmental Representative shall promptly verify the same and issue appropriate instructions. Any work done after such discovery, before further work is authorized, will be done at the Contractor's risk.
 - .9 The Contractor shall be responsible for the correctness of the elevations and dimensions from the references provided by the Departmental Representative.
 - .10 The layout of the work shall be done in accordance with the current work schedule as prepared by the Contractor and reviewed by the Departmental Representative.

1.4 EXISTING SERVICES

- .1 Before commencing work, establish location and extent of service lines in area of Work and notify the Departmental Representative of findings.
- .2 Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as directed by the Departmental Representative.

1.5 LOCATION OF EQUIPMENT AND FIXTURES

- .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform the Departmental Representative of impending installation and obtain approval for actual location.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by the Departmental Representative.

1.6 RECORDS

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 On completion of foundations and major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.
- .3 Record locations of maintained, re-routed and abandoned service lines.

1.7 SUBMITTALS

- .1 Submit name and address of Surveyor to the Departmental Representative. On request of the Departmental Representative, submit documentation to verify accuracy of field engineering work.

- .2 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform to the Contract Documents.

1.8 SUBSURFACE CONDITIONS

- .1 Promptly notify the Departmental Representative in writing if subsurface conditions at Place of Work differ materially from those indicated in Contract Documents, or a reasonable assumption of probable conditions based thereon.
- .2 After prompt investigation, should the Departmental Representative determine that conditions do differ materially; instructions will be issued for changes in Work as provided in Changes and Change Orders.

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.
- .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 sightexposed 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.

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.

1.2 FINAL CLEANING

- .1 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .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 fittings, walls, and floors.

- .8 Clean lighting reflectors, lenses, and other lighting surfaces.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling.

END OF SECTION

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.
 - .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 Operation of systems has been demonstrated to Departmental Representative's personnel.
 - .6 Work is complete and ready for final inspection.
- .4 Final Inspection: when items noted above are completed, request final inspection of Work by Departmental Representative 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.
- .6 Commencement of Lien and Warranty Periods: date of Departmental Representative's acceptance of submitted declaration of Substantial Performance shall be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.
- .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 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

PART 1 GENERAL

1.1 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare instructions and data 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 CD.
- .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.

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

1.6 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 DESCRIPTION

- .1 Two demonstration and training sessions shall be provided: one upon completion of functional and performance testing, and one prior to Start-up in 2017. The sessions shall cover operation and maintenance of all equipment and systems.
- .2 The Departmental Representative will provide list of personnel to receive training, and will co-ordinate their attendance at agreed upon times.

1.2 QUALITY CONTROL

- .1 When specified in individual Sections, require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct the Departmental Representative's personnel, and provide written report that demonstration and instructions have been completed.

1.3 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for the Departmental Representative's approval.
- .3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .4 Give time and date of each demonstration, with list of persons present.

1.4 CONDITIONS FOR DEMONSTRATIONS

- .1 Testing, adjusting, and balancing have been performed in accordance with Section 01 91 13 - General Commissioning Requirements and equipment and systems are fully operational.
- .2 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.5 PREPARATION

- .1 Verify that conditions for demonstration and instructions comply with requirements.
- .2 A qualified representative of the packaged sewage lift station manufacturer shall be present for demonstration and training.
- .3 Verify that designated personnel are present.

1.6 DEMONSTRATION AND INSTRUCTIONS

- .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled times, at the designated location.
- .2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
- .3 Provide recommendations for winterization of sewage pump station.
- .4 Review contents of manual in detail to explain aspects of operation and maintenance.
- .5 Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instructions.

1.7 TIME ALLOCATED FOR INSTRUCTIONS

- .1 Ensure an adequate amount of time required for instruction of each item of equipment or system is scheduled. Allow for question and answer periods and operator feedback.

1.8 TRAINING LOGS

- .1 A sign in sheet is to be used to record the training provided, names of personnel trained, names of trainers and the dates such training was conducted. This log is to be kept in the Operations and Maintenance Manual.

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 upon completion of construction. Start-up of the system and the Start-up Test Period shall occur in Spring 2018 after opening of the building and septic tanks for the 2018 or 2019 season.

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 168 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.

GENERAL COMMISSIONING (CX) REQUIREMENTS

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- .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, if required, for functional/performance testing.
- .2 Start-up Test Period:

GENERAL COMMISSIONING (CX) REQUIREMENTS

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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.

GENERAL COMMISSIONING (CX) REQUIREMENTS

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- .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.

END OF SECTION

Contractor:

File No.
Project Name:
Project Number:
Project Location:

EQUIPMENT DATA:

Manufacturer
Type
Model Number
Serial Number

Building
Area
Floor
room

LOCATION DATA:

NAMEPLATE DATA:

	Specified	Shop Drawings	Installed	Verified
LPS				
Head Pressure				
Voltage/Phase				
Amperage				
RPM				
HP				

SUPPORT DOCUMENTS:

Manufacturer's report	Y / N / NA	Comments:	
Manufacturer's certificates	Y / N / NA	Comments:	
Pump & Fans Curves attached	Y / N / NA	Comments:	
Sub-Contractor's CM Own Forces' start-up report	Y / N / NA	Comments:	

Comments

SIGN-OFFS:

Contractor:

Date:

Engineer:

Date:

Department/Representative:

Date:

Component Verification Sheet		Section: XX XX XX
SYSTEM:	Equipment:	Tag:
Prepared By:		

PART 1 GENERAL

1.1 INSTALLATION/START-UP CHECK LISTS

- .1 Include the following data:
 - .1 Product manufacturer's installation instructions and recommended checks
 - .2 Special procedures as specified in relevant technical sections
 - .3 Items considered good installation and engineering industry practices deemed appropriate for proper and efficient operation
- .2 Equipment manufacturer's installation/start-up check lists are acceptable for use. As deemed necessary by the Departmental Representative supplemental additional data lists will be required for specific project conditions.
- .3 Use check lists for equipment installation. Document check list verifying checks have been made; indicate deficiencies and corrective action taken.
- .4 Installer to sign check lists upon completion, certifying stated checks and inspections have been performed. Return completed checklists to the Departmental Representative.
- .5 Use of check lists will not be considered part of commissioning process but will be stringently used for equipment pre-start and start-up procedures.

1.2 PRODUCT INFORMATION (PI) REPORT FORMS

- .1 Product Information (PI) forms compiles gathered data on items of equipment produced by equipment manufacturer, includes nameplate information, parts list, operating instructions, maintenance guidelines and pertinent technical data and recommended checks that is necessary to prepare for start-up and functional testing and used during operation and maintenance of equipment.
- .2 Prior to Performance Verification (PV) of systems complete items on PI forms related to systems and obtain the Departmental Representative's approval.

1.3 PERFORMANCE VERIFICATION (PV) FORMS

- .1 PV forms to be used for checks, running dynamic tests and adjustments carried out on equipment and systems to ensure correct operation, efficiently and function independently and interactively with other systems as intended with project requirements.
- .2 PV report forms include those developed by Contractor records measured data and readings taken during functional testing and Performance Verification procedures.
- .3 Prior to PV of integrated system, complete PV forms of related systems and obtain the Departmental Representative's approval.

1.4 COMMISSIONING FORMS

- .1 The Departmental Representative will develop and provide to Contractor project-specific Commissioning forms complete with specification data.
- .2 Revise items on Commissioning forms to suit project requirements.

1.5 CHANGES AND DEVELOPMENT OF NEW REPORT FORMS

- .1 When additional forms are required, but are not available from the Departmental Representative, develop appropriate verification forms and submit to the Departmental Representative for approval prior to use.
 - .1 Additional commissioning forms to be in same format as provided by the Departmental Representative.

1.6 COMMISSIONING FORMS

- .1 Use Commissioning forms to verify installation and record performance when starting equipment and systems.
- .2 Strategy for Use:
 - .1 Manufacturer's representative to supply commissioning forms specific to equipment.
 - .2 Contractor will provide required shop drawings information and verify correct installation and operation of items indicated on these forms.
 - .3 Confirm operation as per design criteria and intent.
 - .4 Identify variances between design and operation and reasons for variances.
 - .5 Verify operation in specified normal and emergency modes and under specified load conditions.
 - .6 Record analytical and substantiating data.
 - .7 Verify reported results.
 - .8 Form to bear signatures of recording technician and reviewed and signed off by the Departmental Representative.
 - .9 Submit immediately after tests are performed.
 - .10 Reported results in true measured SI unit values.
 - .11 Provide the Departmental Representative with originals of completed forms.
 - .12 Maintain a copy on site during start-up, testing and commissioning period.

1.7 LANGUAGE

- .1 To suit the language profile of the awarded contract

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 Niblock and David Thompson Gate Rehabilitation.
- .2 The septic tanks and system O&M manual is to describe and detail all operational and maintenance requirements of the retrofit including all building and process equipment and systems, new and existing, that interact with the upgraded system.
- .3 Provide an overview of the retrofit include both the existing and upgraded system. Describe process and 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.

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 CD.
 - .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.

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- .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.

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. The following components shall be defined:
 - .1 Pump Control Systems
 - .2 Kiosk Mechanical Systems
 - .3 Kiosk Electrical Systems
 - .4 Kiosk Water and Septic mains (valves, etc., draining and flushing)
 - .5 David Thompson Highway Generator Facility
 - .6 Electric Gates
 - .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

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .2 Province of Alberta
 - .1 Occupational Health and Safety Act, R.S.A. 2000.

1.2 MEASUREMENT AND PAYMENT

- .1 Measurement Procedures.
 - .1 Measure removal of Portland cement concrete pavement as lump sum.
 - .2 Measure removal of culverts, pipe sewers and drain and tanks as lump sum.
 - .3 Measure removal of [maintenance holes] [and] [catch basins] as lump sum.
 - .4 Payment for [salvage], [stockpiling], [sealing], [disposal], [alternative disposal], [recycling], [excavating] [backfilling] and restoration will be included in above removal items.
 - .5 Measure removal of [waste] [materials designated for alternate disposal] from site and from Banff National Park as lump sum.

1.3 REFERENCES

- .1 Definitions:
 - .1 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, may include but not limited to: asbestos PCB's, CFC's, HCFC's poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly.
 - .2 Waste Audit (WA): detailed inventory of materials in David Thompson and Niblock areas. Indicates quantities of reuse, recycling and landfill.
 - .1 Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project.
 - .2 Indicates quantities of reuse, recycling and landfill.
 - .4 Waste Management Coordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
 - .5 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. WRW is based on information acquired from WA.
- .2 Reference Standards:
 - .1 Canadian Council of Ministers of the Environment (CCME)
 - .1 PN1326, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products.
 - .2
 - .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
 - .4 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA), c. 34.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Site Meetings.
 - .1 Convene pre-demolition meeting [one] week prior to beginning [work of this Section] in accordance with Section [01 11 00.00 – Summary of Work - Section [01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart] to:
 - .1 Verify project requirements.
 - .2 Review conditions.
 - .2 Arrange for site visit with [Departmental Representative] [DCC Representative] [Consultant] to examine existing site conditions adjacent to demolition work, prior to start of Work.
 - .3 Hold project meetings every [week] [month].
 - .4 Ensure [key personnel] [site supervisor] [project manager] [subcontractor representatives] [WMC] attend.
 - .5 Reporting Requirements: WMC to complete.
 - .6 [WMC] must provide [written] [verbal] report on status of waste diversion activity at each meeting.
 - .7 [Departmental Representative] [DCC Representative] [Consultant] will provide [written] [verbal] notification of change of meeting schedule established upon contract award [24] hours prior to scheduled meeting.
- .2 Scheduling: meet project time lines without compromising specified minimum rates of material diversion.
 - .1 Notify [Departmental Representative] [DCC Representative] [Consultant] [in writing] when unforeseen delay[s] occur.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Hazardous Materials:
 - .1 Provide description of Hazardous Materials and Notification of Filing with proper authorities prior to beginning of Work as required.
- .2 Waste Reduction Workplan:
 - .1 Prior to beginning of Work on site submit detailed Waste Reduction Workplan in accordance with Section [01 74 21 - Construction/Demolition Waste Management And Disposal] and indicate:
 - .1 Descriptions of and anticipated quantities [in percentages] of materials to be salvaged reused, recycled and landfilled.
 - .2 Schedule of selective demolition.
 - .3 Number and location of dumpsters.
 - .4 Anticipated frequency of tipping.
 - .5 Name and address of [haulers] [waste facilities] [waste receiving organizations].
- .5 Sustainable Design Submittals:
 - .1 LEED Canada submittals: in accordance with [Section 01 35 21 - LEED Requirements].
 - .2 Construction Waste Management:
 - .1 Submit project [Waste Management Plan] [Waste Reduction Workplan] highlighting recycling and salvage requirements.
 - .2 Submit calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that [50] [75]% of construction wastes were recycled or salvaged.

1.6 QUALITY ASSURANCE

- .1 Regulatory Requirements: ensure Work is performed in compliance with [CEPA,] [CEAA,] [TDGA,] [and] [applicable Provincial/Territorial regulations].

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Store and manage hazardous materials in accordance with Section [01 35 43 - Environmental Procedures.
- .2 Storage and Protection.
 - .1 Protect in accordance with Section [31 23 33.01 - Excavating, Trenching and Backfilling].
 - .2 Protect existing items designated to remain and items designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of Departmental Representative at no cost to Departmental Representative.
 - .3 Remove and store materials to be salvaged, in manner to prevent damage.
 - .4 Store and protect in accordance with requirements for maximum preservation of material.
 - .5 Handle salvaged materials as new materials.
- .3 Develop [Construction Waste Management Plan] [Waste Reduction Workplan] related to Work of this Section.

1.8 SITE CONDITIONS

- .1 Site Environmental Requirements.
 - .1 Perform work in accordance with Section 01 35 43 - Environmental Procedures.
 - .2 Ensure that selective demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
 - .3 Do not dispose of waste of volatile materials including but not limited to, mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers.
 - .1 Ensure proper disposal procedures are maintained throughout the project.
 - .4 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.
 - .5 Control disposal or runoff of water containing suspended materials or other harmful substances as directed by Departmental.
 - .6 Protect trees, plants and foliage on site and adjacent properties where indicated.
- .2 Existing Conditions.
 - .1 Remove contaminated or hazardous materials at David Thompson Highway site, prior to start of demolition Work, and dispose outside of Banff National Park in safe manner in accordance with [TDGA and other applicable regulatory requirements] and [Section [02 81 01 - Hazardous Materials]].
 - .2 List of hazardous materials:
 - .1 Septic Tank and associated materials.
 - .2 Building remains.

2 PRODUCTS

2.1 EQUIPMENT

- .1 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

3 EXECUTION

3.1 PREPARATION

- .1 Inspect site with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
- .2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.
- .3 Notify and obtain approval of utility companies before starting demolition.
- .4 Disconnect and Cap [Designated] Mechanical Services.
 - .1 Natural Gas Supply Lines: [remove in accordance with gas company requirements] [contact utility company to arrange for removal] [as directed by Departmental Representative]
 - .2 Sewer and Water Lines: remove [in accordance with authority having jurisdiction] [contact utility company to arrange for removal] [as directed by Departmental Representative].
 - .4 Underground Storage Tanks: remove and dispose of in accordance with CCME PN1326 and directions of Departmental Representative and Section 02 65 00 - Underground Storage Tank Removal.

3.2 REMOVAL OF HAZARDOUS WASTES

- .1 Remove contaminated or dangerous materials defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to minimize danger at site or during disposal.

3.3 REMOVAL OPERATIONS

- .1 Remove items as indicated.
- .2 Do not disturb items designated to remain in place.
- .3 Removal of pavements, curbs and gutters:
 - .1 Square up adjacent surfaces to remain in place by saw cutting or other method approved by Departmental Representative.
 - .2 Protect adjacent joints and load transfer devices.
 - .3 Protect underlying and adjacent granular materials.
- .4 Prevent contamination with base course aggregates, when removing asphalt pavement for subsequent incorporation into hot mix asphalt concrete paving.
- .5 Remove [as many trees as required] [designated trees] during demolition.
 - .1 Obtain written approval of Departmental Representative prior to removal of trees [not designated].
- .8 Disposed of alternately trees [designated] for removal and [identified by Departmental Representative to be left].
 - .1 Grind, chip, or shred other vegetation for mulching and composting, or use as [mill pulp] [or] [process fuel].
- .9 Stockpile topsoil for final grading and landscaping:
 - .1 Provide erosion control and seeding if not immediately used.
- .10 Salvage:

- .1 Item[s] to be salvaged: [refer to drawing package];
- .2 Dismantle items containing materials for salvage and stockpile salvaged materials at locations [as indicated by the Departmental Representative].
- .11 Disposal of Material:
 - .1 Dispose of materials not designated for salvage or reuse on site [as instructed by Departmental Representative at authorized facilities approved in Waste Reduction Workplan.
 - .2 Trim disposal areas to approval of Departmental Representative.
- .12 Backfill:
 - .1 Backfill in areas as indicated and in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.4 STOCKPILING

- .1 Label stockpiles, indicating material type and quantity.
- .2 Designate appropriate security resources/measures to prevent vandalism, damage and theft.
- .3 Locate stockpiled materials convenient for use in new construction to eliminate double handling wherever possible.
- .4 Stockpile materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.

3.5 REMOVAL FROM SITE

- .1 Remove stockpiled material as directed by Departmental Representative when it interferes with operations of project.
- .2 Remove stockpiles of like materials by alternate disposal option once collection of materials is complete.
- .3 Transport material designated for alternate disposal using approved [haulers] [facilities] [receiving organizations] listed in [Waste Reduction Workplan] and in accordance with applicable regulations.
 - .1 Written authorization from Departmental Representative is required to deviate from [haulers] [facilities] [receiving organizations] listed in [Waste Reduction Workplan].
- .4 Dispose of materials not designated for alternate disposal in accordance with applicable regulations.
 - .1 Disposal Facilities: approved and listed in [Waste Reduction Workplan].
 - .2 Written authorization from [Departmental Representative] [DCC Representative] [Consultant] is required to deviate from disposal facilities listed in [Waste Reduction Workplan].

3.6 RESTORATION

- .1 Restore areas and existing works outside areas of demolition to [conditions that existed prior to beginning of Work] [match condition of adjacent, undisturbed areas].
- .2 Use soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

3.7 FIELD QUALITY CONTROL

- .1 Verification requirements in accordance with Section [01 47 17 - Sustainable Requirements: Contractor's

Verification], include:

- .1 Materials and resources.
- .2 Storage and collection of recyclables.
- .3 Construction waste management.
- .4 Resource reuse.
- .5 Recycled content.
- .6 Local/regional materials.
- .7 Wood.
- .8 Low-emitting materials.

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 Remove debris, trim surfaces and leave work site clean, upon completion of Work
 - .3 Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section [01 74 11 - Cleaning].
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section [01 74 21 - Construction/Demolition Waste Management and Disposal] [01 35 21 - LEED Requirements].
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.9 PROTECTION

- .1 Repair damage to adjacent materials or property caused by selective site demolition.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 35 31 Special procedures for Traffic Control
- .2 Section 01 35 43 Environmental Procedures

1.2 MEASUREMENT AND PAYMENT

- .1 Removal of existing asphalt pavement will be measured in square metres of asphalt surface completely removed, regardless of depth.
- .2 Asphalt cutting will be measured in linear metres of cutting regardless of depth of cutting or type of material cut.
- .3 Cold Milling of Asphalt Pavement less than 50mm thickness. Payment will be made at the unit bid price per square metre for asphalt milling for the corresponding depth.
- .4 Payment under the above items will include operations involved in removing, hauling and disposing of the asphalt at an approved asphalt disposal site and cleaning of remaining pavement surface.

1.3 REFERENCES

- .2 Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013) 3.16.6 and 3.40.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Construction Waste Management:
 - .1 Submit project Waste Management Plan highlighting asphalt recycling and salvage requirements.

2 PRODUCTS

2.1 EQUIPMENT

- .1 Use cold milling, planning or grinding equipment with automatic grade controls capable of operating from stringline, and capable of milling part of pavement surface to depths or grades indicated. Maximum particle size of milled materials shall be 50mm.
- .2 The Contractor may utilize any cutting methodology, provided the methods and equipment result in a clean and straight vertical cut. All proposed methods and equipment employed by the Contractor shall be reviewed and accepted by the Department Representative prior to the start of work.

3 EXECUTION

3.1 PREPARATION

- .1 Prior to beginning removal operation, inspect and verify with Departmental Representative areas, depths and lines of asphalt pavement to be removed.

- .2 Have appropriate Traffic Control measures in place for this work.

3.2 PROTECTION

- .1 Protect existing asphalt pavement not designated for removal, light units, and structures from damage. In the event of damage, immediately replace or make repair at no additional cost.

3.3 REMOVAL

- .1 Remove existing asphalt pavement to lines and grades as indicated.
- .2 Use equipment and methods of removal and hauling which do not damage or disturb underlying pavement.
- .3 Prevent contamination of removed asphalt pavement by topsoil, underlying gravel or other materials.
- .4 Suppress dust generated by removal process.
- .5 Sweep remaining asphalt pavement surfaces clean of debris resulting from removal operations using rotary power brooms and hand broom as required.
- .6 All asphalt concrete pavement and base course material that is cut-away shall be excavated, loaded, hauled and disposed of at an approved disposal site provided by the Contractor.

3.3 FINISH TOLERANCES

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

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 Sweep remaining asphalt pavement surfaces clean of debris resulting from removal operations using rotary power brooms and hand brooming as required.
- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .21 Removed asphalt pavement which could be recycled in hot mix asphalt concrete under this contract may be stockpiled at an approved designated asphalt plant site.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

1.2 REFERENCES

- .1 .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
- .2 Province of Alberta
 - .1 Occupational Health and Safety Act, R.S.A. 2000.
- .3 CCME PN 1299-[2006], Canadian Environmental Quality Guidelines.
 - .1 Chapter 7-[2006], Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health.
- .4 Canadian Federal Legislation
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .2 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
 - .3 Canada Labour Code (R.S. 1985, c. L-2).
 - .1 Part II (September 2000) - Occupational Health and Safety.
 - .4 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .5 Underwriters' Laboratories of Canada (ULC)
 - .1 ULC-S615-[1998], Standard for Reinforced Plastic Underground Tanks for Flammable and Combustible Liquids.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for [reuse] [and] [recycling] in accordance with Section [01 74 21 - Construction/Demolition Waste Management and Disposal].
- .2 Divert metal materials from landfill to metal recycling facility approved by [Departmental Representative] [DCC Representative] [Consultant].
- .3 Segregate and deliver non-salvageable or non-recyclable materials, including waste liquids and sludges to Provincially/Territorially licensed waste facility.

2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

3 EXECUTION

3.1 PREPARATION SAFETY AND SECURITY

- .1 Conform to or exceed Federal, Provincial and Territorial codes, local municipal by-laws, by-laws, and codes and regulations of utility authorities having jurisdiction.
- .2 Do construction occupational health and safety in accordance with Section [01 35 29.06 - Health and Safety Requirements].
- .3 Protection:
 - .1 Meet safety requirements of Occupational Safety and Health, Canada Labour Code Part II and Regulations for Construction Projects.
 - .2 Disconnect or remove source of ignition from vicinity of tank.
 - .3 Provide temporary protection for safe movement of personnel and vehicle traffic.
 - .4 Cut, braze or weld metal only in monitored areas established to be free of ignitable vapour concentrations.
 - .5 Ground and bond metal equipment, including tanks and transfer pipes, before operating equipment or transferring flammable materials.
 - .6 Use non-sparking tools and intrinsically safe electrical equipment.
 - .7 Smoking is not permitted.

3.2 DRAINING

- .1 Drain and flush piping into tank.
- .2 Pump out liquid from tank
 - .1 Use explosion proof, air driven or hand pump.
- .3 Remove sludge from tank bottom.
 - .1 Dispose of product and sludge in accordance with local, Provincial and Territorial regulations using waste disposal carrier licensed by Provincial/Territorial Environmental Agency having jurisdiction.

3.3 EXCAVATION TRENCHING AND BACKFILL

- .1 Do work in accordance with Section [31 23 10 - Excavation, Trenching and Backfilling].
- .2 Provide protective material around excavation.
- .3 Provide constant supervision during excavation and backfilling.
- .4 Excavation:
 - .1 Excavate until top of tank and connections and openings are exposed.
 - .2 Disconnect piping:
 - .1 Remove fill tube.
 - .2 Disconnect fill gauge, product and vent lines.
 - .3 Cap or plug open ends of lines that are not to be used further.
 - .4 Remove piping from ground.
 - .3 Temporarily plug tank openings.
 - .4 Continue excavation until tank is completely exposed.

-
- .5 Temporarily stockpile on site soil in vicinity of tank, until waste classification can be established prior to final disposal.
 - .5 Prevent movement, settlement or damage of adjacent [structures] [services] [walks] [paving] [trees] [landscaping] [adjacent grades]. Provide [bracing] [shoring] as required.

3.4 TANK REMOVAL

- .1 Remove tank in accordance with CCME Code of Practice PN 1326 and/or applicable provincial standards and regulations, and place in secure location.
- .2 Block tank to prevent movement.
- .3 Contact [Departmental Representative] [DCC Representative] [Consultant] immediately if there is evidence of contamination in tank excavation, stop Work until further notice.
- .4 Remove and replace contaminated soil and accumulated flammable or combustible liquid with clean fill common to local area in accordance with Section [31 23 10 - Excavating, Trenching and Backfilling].

3.5 VAPOUR REMOVAL

- .1 Purging:
 - .1 Purge vapours to less than 10% of lower explosive limit (LEL).
 - .2 Verify with combustible gas metre.
- .2 Inverting:
 - .1 Displace oxygen to levels below necessary to sustain combustion.
 - .2 Verify with combustible gas metre.
- .3 Water Method:
 - .1 Fill tank with water to expel vapours.
 - .2 Remove and dispose of contaminated water in accordance with regulations after tank is removed from site.
 - .3 Verify with combustible gas metre.
- .4 Dry Ice Method:
 - .1 Add [1.85] gm of solid carbon dioxide (dry ice) for each [100] litre capacity.
 - .2 Crush and distribute ice evenly over greatest area to secure rapid evaporation. Avoid skin contact.
 - .3 Verify dry ice has vapourized.
- .5 Air Method:
 - .1 Ventilate tank with air using small gas exhauster operated with [compressed air] [other suitable means].
 - .2 Air to enter opening at one end and to exit opening at other end to quickly remove vapour.
 - .3 Test interior of tank to determine when tank is free of vapour.

3.6 CAPPING

- .1 [Plug] [Cap] holes after tank has been freed of vapours and before tank is moved from site.
 - .1 Leave vent[s] open.
- .2 Plug corrosion leak holes using screwed (boiler) plugs.
- .3 Leave [3] mm vent hole in one plug to prevent tank from being subjected to excessive pressure differential caused by extreme temperature change.

3.7 SECURING AND REMOVAL FROM SITE

- .1 Check vapour levels prior to transport:
 - .1 Remove vapour if required.
- .2 Dispose of tank in accordance with local, Provincial, Federal or Territorial regulations.
- .3 Truck removal:
 - .1 Secure tank on truck for transport to disposal site.
 - .2 Cut suitable openings in tank sides to render tank unusable.
 - .3 Ensure [3] mm vent hole located at uppermost point on tank.

3.8 SITE REMEDIATION

- .1 To CCME PN 1299.
- .2 Repair/replace finish grade to match surrounding area, including but not limited to sods as specified in Section [31 22 13 - Rough Grading].
- .3 Prepare tank closure report containing results of soil sampling analysis to determine level and extent of hydrocarbon contamination.
- .4 In event of required site remediation, refer to Section [02 61 00.01 - Soil Remediation].

3.9 WORKMANSHIP AND DISPOSAL

- .1 Tanks destined for disposal:
 - .1 Dismantle, cut sufficient openings or otherwise render unusable.
- .2 Tanks for reuse:
 - .1 Refurbish to: [ULC-S603] [ULC-S615].

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 35 30.00 Health and Safety Requirements
- .1 Section 01 35 43 Environmental Procedures
- .2 Section 31 11 00 – Clearing and Grubbing
- .3 Section 32 17 23 – Pavement Markings
- .4 Section 32 12 13.16 – Asphalt Tack Coat
- .5 Section 32 12 13.23 – Asphalt Prime Coat.
- .7 Section 32 12 16 – Asphalt Paving

1.2 REFERENCES

- .1 Definitions:
 - .1 Dangerous Goods: product, substance, or organism specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.
 - .2 Hazardous Material: product, substance, or organism used for its original purpose; and is either dangerous goods or material that will cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.
 - .3 Hazardous Waste: hazardous material no longer used for its original purpose and that is intended for recycling, treatment or disposal.
- .2 Reference Standards:
 - .1 Export and Import of Hazardous Waste Regulations (EIHWR Regulations), SOR/92-637.
 - .2 National Fire Code of Canada 1995.
 - .3 Transportation of Dangerous Goods Act (TDG Act) 1992, (T-19.01).
 - .4 Transportation of dangerous Goods Regulations (TDGR), (SOR/85-77, SOR/85-585, SOR/85-609, SOR/86-526.

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 hazardous materials and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS in accordance with Health and Safety Requirements to Departmental Representative for each hazardous material required prior to bringing hazardous material on site.
 - .3 Submit hazardous materials management plan to Departmental Representative that identifies hazardous materials, usage, location, personal protective equipment requirements, and disposal arrangements.
- .3 Sustainable Design Submittals:
 - .1 Construction Waste Management:

- .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.
- .2 Low-Emitting Materials: submit listing of adhesives and sealants and paints and coatings used in building, comply with VOC and chemical component limits or restrictions requirements.

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 Transport hazardous materials and wastes in accordance with Transportation of Dangerous Goods Act.
- .4 Storage and Handling Requirements:
 - .1 Co-ordinate storage of hazardous materials with Departmental Representative and abide by internal requirements for labelling and storage of materials and wastes.
 - .2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.
 - .3 Store and handle flammable and combustible materials in accordance with National Fire Code of Canada requirements.
 - .5 Transfer of flammable and combustible liquids is prohibited within buildings.
 - .6 Transfer flammable and combustible liquids away from open flames or heat-producing devices.
 - .7 Solvents or cleaning agents must be non-flammable or have flash point above 38 degrees C.
 - .8 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.
 - .9 Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.
 - .10 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:
 - .1 Store hazardous materials and wastes in closed and sealed containers.
 - .2 Label containers of hazardous materials and wastes in accordance with WHMIS.
 - .3 Store hazardous materials and wastes in containers compatible with that material or waste.
 - .4 Segregate incompatible materials and wastes.
 - .5 Ensure that different hazardous materials or hazardous wastes are stored in separate containers.
 - .6 Store hazardous materials and wastes in secure storage area with controlled access.
 - .7 Maintain clear egress from storage area.
 - .8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.
 - .9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.
 - .10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.
 - .11 When hazardous waste is generated on site:
 - .1 Co-ordinate transportation and disposal with Departmental Representative.
 - .2 Comply with applicable federal, provincial and municipal laws and regulations for generators of hazardous waste.
 - .3 Use licensed carrier authorized by provincial authorities to accept subject material.
 - .4 Before shipping material obtain written notice from intended hazardous waste treatment or disposal facility it will accept material and it is licensed to accept this material.
 - .5 Label containers with legible, visible safety marks as prescribed by federal and provincial regulations.

- .6 Only trained personnel handle, offer for transport, or transport dangerous goods.
- .7 Provide photocopy of shipping documents and waste manifests to Departmental Representative.
- .8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide photocopy of completed manifest to Departmental Representative.
- .9 Report discharge, emission, or escape of hazardous materials immediately to Departmental Representative and appropriate provincial authority. Take reasonable measures to control release.
- .12 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.
- .13 Report spills or accidents immediately to Departmental Representative. Submit a written spill report to Departmental Representative within [24] hours of incident.

2 PRODUCTS

2.1 MATERIALS

- .1 Description:
 - .1 Bring on site only quantities hazardous material required to perform Work.
 - .2 Maintain MSDS in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

3 EXECUTION

3.1 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.
- .4 Recycle hazardous wastes for which there is approved, cost effective recycling process available.
- .5 Send hazardous wastes to authorized hazardous waste disposal or treatment facilities
- .6 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited
- .7 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal solid waste landfills is prohibited
- .8 Dispose of hazardous wastes in timely fashion in accordance with applicable provincial regulations
- .9 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes

END OF SECTION

PART 1.0 **GENERAL****.1** **Summary**

- .1 This section includes finishing of all decorative exterior site flatwork and cast-in-place concrete trench drains. Where discrepancies between work specified under this Section and related Sections or scopes of work occur, the most restrictive requirements are to take precedence.

.2 **Related Requirements**

- .1 Section 02528 – Concrete Sidewalks, Curbs and Gutters.

.3 **Quality Assurance**

- .1 Comply with CSA A23.1/A23.2 and CSA A3000, including the following, unless modified by the requirements of the Contract Documents:
 - .1 General requirements, including submittals, quality assurance, acceptance of structure, and protection of in-place concrete.
 - .2 Formwork and form accessories.
 - .3 Steel reinforcement and supports.
 - .4 Concrete mixtures.
 - .5 Handling, placing, and constructing concrete.

PART 2.0 **PRODUCTS****.1** **Concrete And Reinforcement**

- .1 In accordance with Section 02528 – Concrete Sidewalks, Curbs and Gutters.
- .2 Integral Colour Pigment:
 - .1 To ASTM C979, synthetic mineral oxide pigments or coloured water reducing admixtures; colour stable, non-fading, and resistant to lime and other alkalis.
 - .1 Basis-of-Design Colour: Davis Colors #5157 – “Monsoon”.

.2 **Sealers**

- .1 Flatwork: Concrete sealer; AR high gloss sealer.

- .1 Applied to all exterior decorative concrete.
- .2 Curing Materials: Membrane forming curing materials must not be used; the following non-liquid applied materials are preferable in all installations:
 - .1 Absorptive Cover: AASHTO M182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 300 g/m² dry weight.
 - .2 Moisture Retaining Cover: ASTM C171, polyethylene film or white burlap polyethylene sheet.
 - .3 Water: Potable.
- .3 Joint Sealants: Polyurethane sealant, single component, non-sag, for general construction, Shore A Hardness 15+, conforming to CAN/CGSB-19.13-M, Type 2, Classification MCG-2-25-A-N and ASTM C920, Type S, Grade NS, Class 25, Use NT, M, and A and as follows:
 - .1 Acceptable materials:
 - .1 Chemtron Multiflex
 - .2 Sikaflex 1-a
 - .3 Sika/Sternson RC-1
 - .4 Tremco Dymonic
 - .5 Sonneborn NP 1
 - .6 Mameco/Vulkem 116

PART 3.0 EXECUTION

.1 Examination

- .1 Ensure that cast-in-place concrete flatwork – produced in accordance with Section 02528, Section 03100, Section 03200, and Section 03300 are ready to receive work of this Section.
- .2 Verify that site conditions are ready to receive work. Notify Consultant for additional instructions where air-entraining agents have been specified for concrete mix.

.2 Finishing Unformed Surfaces

- .1 Finish exterior concrete flatwork true to line and sloped so that:
 - .1 water drains from the surface without ponding; and

- .2 it is possible to place a steel straight edge, supported at the ends on 3 mm diameter rods 50 mm long, anywhere on the surface without the edge touching the concrete at any point between supports or allowing a 6 mm diameter steel ball to pass under the edge anywhere along its length.
- .2 Establish pour breaks and control joint locations. Work from centre of intersection and work towards the four corners. Grade and hand screed concrete to correct levels.
- .3 After screeding, wood bull float to consolidate surface. Tool all edges with 3.8 mm diameter edge tool, trowel flat surfaces to remove impressions left by edge tooling. Do not use power trowels.
- .4 Finish concrete flatwork surfaces as indicated on the drawings, conforming to mock-ups accepted by the Consultant.

.3 Concrete Joints: Sidewalks And Walkways

- .1 Accurately and neatly tool joints at pour edges using a 3.8 mm maximum radiused edger or centerline tool. Trowel out 65 mm width flat plane from radius bead of edger or centreline tool.
- .2 **Saw cut slabs in pattern as described by consultant or Parks Representative on site.** Complete saw cutting within 16 hours after placing concrete. Saw cut not less than 32 mm deep unless otherwise specified.
 - .1 Provide sawcut control joints in accordance with Section 02528.
 - .2 Using an oscillating cutting tool, extend saw cuts to meet adjoining vertical surfaces, cutting to a depth not less than 10 mm.
 - .3 Provide saw cuts with an accuracy of plus or minus 5 mm. Make them straight to within 2 mm in any 10 m, and without any visible jogs or curvature.
 - .4 Coordinate joint pattern and layout with Contract Drawings. Review joint layout design intent with Consultant prior to first concrete placement. Submit proposed joint layout for Consultant's review.
- .3 Remove all traces of sawing residue promptly and simultaneous with saw cutting operations.

.4 Curing Methods:

- .1 Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
 - .1 Moist Curing: Keep surfaces continuously moist for a minimum of seven days with the following materials:
 - .1 Water
 - .2 Continuous water-fog spray
 - .3 Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 300 mm lap over adjacent absorptive covers.
 - .2 Moisture Retaining Cover Curing: Cover concrete surfaces with moisture retaining cover for curing concrete, placed in widest practical width, with sides and ends lapped at least 300 mm, and sealed by waterproof tape or adhesive; immediately repair any holes or tears during curing period using cover material and waterproof tape.

.5 Compatibility

- .1 Submit written declaration that components used are compatible and will not adversely affect adjacent materials.

.6 Sealing

- .1 Seal all concrete surfaces of all exterior flatwork with 2 coats of specified sealers. Apply sealers after completion of finishing requirements.

.7 Repairs And Protection

- .1 Remove and replace concrete sidewalk that is broken, damaged, or defective or that does not comply with requirements in this Section.
- .2 Protect concrete from damage:
 - .1 Exclude traffic from sidewalk for at least 14 days after placement.
 - .2 Maintain sidewalk as clean as possible by removing surface stains and spillage of materials as they occur when construction traffic is permitted.
- .3 Maintain concrete sidewalk free of stains, discolouration, dirt, and other foreign material.

- .4 Power wash concrete sidewalks maximum two days before date scheduled for completion inspection (s).

END OF SECTION

PART 1 - GENERAL

1.1 Documents

- .1 This Section of the Specifications forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 Description

- .1 Section includes:
 - .1 Furnishing of all labour, materials, services and equipment for the supply and installation of stone veneer for exterior building vertical facings as indicated on the drawings and specified herein.
 - .2 Work of this Section shall include, but shall not necessarily be limited to, the following:
 - .1 Supply and installation of anchor supported stone veneer including mortar.
 - .2 Supply and installation of associated sealants, caulking and accessory materials;
 - .3 Supply and installation of miscellaneous anchors, dowels, clips, angles, etc. as required for complete installation.

1.3 Related Work

- .1 Section 07 27 16 Sheet Membrane Air Barrier
- .2 Section 07 92 00 Joint Sealants
- .3 Section 09 21 16 Gypsum Board Assemblies

1.4 References

- .1 ASTM International (ASTM).
 - .1 ASTM C170/C170M – 2009, Standard Test Method for Compressive Strength of Dimension Stone.
 - .2 ASTM C207 - 2006, Standard Specification for Hydrated Lime for Masonry Purposes.
 - .3 ASTM C780 – 2009, Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
 - .4 ASTM C847-[10], Specification for Metal Lath
 - .5 ASTM C933-[9], Standard Specification for Welded Wire Lath.
 - .6 ASTM D422 - 1963(2007), Standard Test Method for Particle-Size Analysis of Soils.
- .2 CSA International (CSA)
 - .1 CAN/CSA-A3000-[98], Cementitious Materials Compendium.
 - .2 CAN/CSA A179-[04(R2009)], Mortar and Grout for Unit Masonry.
- .3 PCA – Portland Cement Plaster (Stucco) Manual.

1.5 Submittals

- .1 Shop Drawings
 - .1 Submit shop drawings of stone veneer in accordance with Section 01 33 00.
 - .2 Submit shop drawing showing detail of construction and jointing of stone veneer for review prior to processing any material. Show sections, dimensions and connections with other work. If anchored, typical and special anchors, grooves, etc., shall be shown.
 - .3 Submit setting drawings, numbered and marked to correspond with numbers and other marks on stone veneer. Show all necessary data to properly and efficiently set material.
- .2 Product Data: Product Data: Submit manufacturer's product data on stone, mortar products, and sealant products, including:
 1. Surface preparation and installation instructions.
 2. Storage and handling instructions.
- .2 Samples: Submit a representative sample of types, colours and finishes of stone for Consultant's review. All material shall conform to selected samples, subject to normal stone variation.

1. Selection Samples: Submit mortar color samples.
2. Verification Samples: Submit 2 manufacturer's full-size samples of natural thin veneer stone for each pattern specified.
- .3 Maintenance Data: Provide maintenance data for stone work for incorporation into maintenance manual.
- .4 Provide written inspection reports of field reviews and quality insurance reviews by the stone installer and submit to Consultant for review.

1.6 Environmental Requirements

- .1 Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install natural thin veneer stone under environmental conditions outside manufacturer's limits.
- .2 Hot and Cold Weather Requirements: ACI 530.1/ASCE 6/TMS 602.
- .3 Air Temperature: 40 degrees F (4 degrees C) or above during installation of natural thin veneer stone.
- .4 Mortar Mixing Water: Heat mortar mixing water when air temperature falls below 50 degrees F (10 degrees C).

1.7 Warranty

- .1 Submit manufacturer's standard warranty for natural thin veneer stone.

1.8 Quality Assurance

- .1 Source of Supply: All stone shall be obtained from local quarries within 200km having adequate capacity and facilities to meet specified requirements.
- .2 Design, fabrication and erection of stone veneer support system shall be in accordance with CAN/CSA-S16.1-94. Wind loading design requirements in accordance with Climatic Information for Building Design in Canada.
- .3 Manufacturer's Qualifications: Manufacturer regularly engaged, for preceding 10 years, in manufacture of natural thin veneer stone of similar type to that specified.
- .4 Mock-Ups: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
 1. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
 2. Refinish mock-up area as required to produce acceptable work.

1.9 Delivery, Storage and Handling

- .1 Properly protect all stone against damage in transit or at project site. Deliver all stone in a clean and good condition, in quality and in sequence as required to properly expedite installation.
- .2 Keep stone in original unopened packing, standing on edge one piece high, until ready for use. If delivered banded on pallets, keep pallets intact until ready for use. Do not stack pallets.
- .3 Properly protect and cover material exposed to weather before setting to prevent wetting and resultant staining from wrappings or other materials.
- .4 Store materials in accordance with manufacturer's instructions; on pallets on dry, level surface and cover with tarps.

1.10 Site Conditions

- .1 Environmental Requirements: Conform to requirements of Canadian Masonry Contractors Assoc.
- .2 Existing Conditions: Consult with and cooperate with other contractors in advance and build in or make provision for installation of work to avoid cutting, patching and making good.

PART 2 – PRODUCTS

2.1 Stone

- .1 Stone (Mortar Etc): Hand split 2” (50mm) thick brown Rundle Rock stone
- .3 Typical Building Stone: Random joint layout as shown in drawings details.

2.3 Accessory Materials

- .1 Sealant & Backup Material: See Section 07 92 00 – Joint Sealants. Colour to match stone as selected by Consultant.
- .2 Anchors, Cramps and Dowels: All anchors, cramps and dowels and other anchoring devices shall be Type 304 stainless steel or suitable non-ferrous metal of types and sizes shown on reviewed shop drawings.
- .3 Fasteners: All fasteners shall be Type 304 stainless steel.
- .5 Metal Flashings: All metal flashing supplied by Section 07 62 00 – Sheet Metal Flashings. Colour to match stone, as selected by Architect.
- .6 Shims: Stainless steel plates.
- .7 Expanded Metal Lath: ASTM C 847; galvanized, self-furring.
- .8 Lath Anchorage: Tie wire, nails, screws, and other metal supports; galvanized; type and size to suit application and to rigidly secure materials in place.
- .10 Concrete Bonding Agent: Latex type.
- .11 Setting Buttons and Shims: Lead or plastic.
- .12 Joint Sealants and Joint Fillers: As specified in Section 07 92 00.
- .12 Bonding Agent: Acrylic additive.
- .13 Sealer: Water-based silane or siloxane masonry sealer, clear

2.4 Mortar

1. Cement: ASTM C 270.
2. Lime: ASTM C 207.
3. Sand: ASTM C 144, natural or manufactured.
4. Color Pigments: ASTM C 979, mineral oxide.
5. Water: Potable.
6. Pre-Packaged Latex-Portland Cement Mortar: ANSI A118.4.

PART 3 - EXECUTION

3.1 Installers

- .1 Use only installers with 2 years minimum experience in work similar to work of this Section.
- .2 Do masonry work in accordance with good trade practices acceptable to Contractor's Masonry Institute.

3.2 Examination

- .1 All support system framing shall be assembled and erected in accordance with reviewed shop drawings and referenced standards, as applicable.
- .1 Examine surfaces to receive natural thin veneer stone.
- .2 Notify Architect of conditions that would adversely affect installation.
- .3 Do not begin surface preparation or installation until unacceptable conditions are corrected.
- .4 Do not begin installation until backing structure is plumb, bearing surfaces are level, and substrates are clean and properly prepared.
- .5 Verify location and secure installation if shelf angles are required.

3.3 Support System Erection

- .1 All support system framing shall be assembled and erected in accordance with reviewed shop drawings and referenced standards, as applicable.

3.4 Surface Preparation

1. Metal Lath:
 1. Install metal lath in accordance with ASTM C 1063.
 2. Apply metal lath with long dimension perpendicular to supports and with joints lapped a minimum of 1 inch (25 mm).
 3. Secure laps with tie wire where they occur between supports.
2. Fastening Metal Lath:
 1. Fasten lath to wood supports using galvanized nails at maximum 6 inches (152 mm) on center vertically and 16 inches (406 mm) on center horizontally.
 2. Fasten with a minimum of 1-inch (25-mm) penetration of wood studs.
 3. Stop lath 1 inch (25 mm) from finished edges.
4. Application of Base Mortar:
 1. Thoroughly mix mortar ingredients in quantities needed for immediate use to [ASTM C270].
 2. Add mortar colour and admixtures to requirements of mortar manufacturer's written instructions.
 3. Apply to nominal thickness of 1/2 inch to 3/4 inch (13 mm to 19 mm) over metal lath surfaces.
 4. Use mortar within 2 hours after mixing at temperatures of [26] oC, or 2-1/2 hours at temperatures under [10] oC.
 5. If weather is hot or surface is dry, dampen previous coat before applying mortar and thin stone veneer.
 6. Apply thin coat of mortar to back side of each stone before placing.
 7. Use rotating motion to press stone evenly into mortar and allow mortar to squeeze out freely beyond finished joint.
 - .1 Remove excess mortar from joints.

8. If scratch coat is done in advance, use notch trowel to create texture for better bond. Smooth surface is not acceptable for bond.
9. Set stones in full bed of mortar with vertical joints buttered and placed full, except where otherwise specified.
5. Prepare for Installation of Thin Veneer Stone:
 1. Coordination: Coordinate placement of reinforcement, anchors, accessories, flashings, weep holes, and other moisture-control products specified in other sections.
 2. Cleaning: Clean built-in items of loose rust, ice, mud, and other foreign matter before incorporating into wall.
 3. Prime or galvanize ferrous metal built into wall.
 4. Temporary Bracing:
 - a. Provide temporary bracing as required during installation of masonry.
 - b. Maintain bracing in place until building structure provides permanent support.

3.5 Veneer Masonry Stone Installation

- .1 Examine each piece of stone prior to installation for visible defects or damage. Do not install cracked, chipped, stained or physically damaged pieces.
- .2 Setting:
 - .1 All setting shall be done by competent stone setters, in accordance with reviewed shop drawings. Any discernable pattern shall be in one direction.
 - .2 Before being set, all stone shall be clean and free of ice and frost. Unless otherwise shown on shop drawings, each piece shall be carefully bedded in a full bed of mortar and tapped home with a rawhide mallet to a full and solid bearing. Exercise particular care to equalize bed and joint openings and eliminate need for redressing of exposed surfaces. Exposed surfaces shall be kept free of mortar at all times.
 - .3 Except for expansion joints and where otherwise specified, all joints and beds shall be completely filled, then raked out to a depth of not less than 19mm (3/4"), and every precaution shall be taken to prevent direct bearing contact between pieces.
 - .4 Stone facing shall in no case be built up more than two courses above backing, and no piece having a greater bed width than one below it shall be set until lower course is backed up. Sills and other pieces subject to uneven pressure shall be bedded at their ends only.
- .3 Anchorage: All stone shall be anchored and/or dowelled as shown on reviewed shop drawings. Anchors, dowels, etc. being inserted in mortar filled holes provided in stone in all cases, holes or kerfs in top of stones shall be filled with sealant or epoxy to prevent spalling of stone as a result of frost expansion of trapped water.
- .4 Pointing: Except where otherwise specified, all joints and beds, previously raked, shall be brushed clean and pointed with mortar to a flat cut joint. When thumb-print hard, joints and beds shall be tooled with a round jointer having a diameter 3.2mm (1/8) larger than width of joint.
- .5 All open beds and joints, such as under sills, shall be pointed for a depth of at least 25 mm (1").
- .6 All special locations, where so directed, joints and beds shall be pointed and finished as setting progresses.
- .7 Joints and beds shall be pointed with sealant, after first installing backup material and applying a primer if required, all in strict accordance with Section 079** - Joint Sealants. All sealants shall be tooled to insure maximum adhesion to contact surfaces.
- .8 All stone extending below grade shall be back-painted with a non-staining waterproofing compound acceptable to stone supplier.

3.6 Field Quality Control

- .1 Site Tolerances:
 - .1 Variation from plumb: Plus or minus 6 mm per 3 metres (0.25 inches per 10 feet) maximum.
 - .2 Variation from level: Plus or minus 13 mm per 6 metres (0.5 inches per 20 feet) maximum.

3.7 Ventilation and Weeps

- .1 Install system of weep holes/weep joints as necessary, placed inconspicuously, to areas of exposed free standing construction and other areas subject to absorption of water and liable to injury from subsequent freezing.
- .2 Coordinate location of weep holds with location and construction of air barriers and waterproofing membranes.

3.8 Flashing and Drips

- .1 Install flashings as detailed.
- .2 Provide drips to all projecting features.

3.9 Cleaning

- .1 Keep face of stone free of mortar as work progresses.
- .2 If residual mortar is on face of stone, allow to dry partially and brush mortar off surface and sponge off residue.
- .3 When work is completed and mortar has set for 2 to 3 days, clean surface from top to bottom using mild masonry detergent acceptable to natural thin veneer stone manufacturer.
- .4 Do not use harsh cleaning materials or methods that could damage stone.
- .5 Do not use metal brushes or acids for cleaning.

3.10 Protection

- .1 Protect installed natural thin veneer stone to ensure that, except for normal weathering, stone will be without damage or deterioration at time of Substantial Completion. All stone work in progress shall be protected at all times during construction by use of a suitable strong, impervious film or fabric securely held in place.
- .2 Touch-up, repair, or replace damaged stone before Substantial Completion.
- .3 After stone work is installed, properly and adequately protect from damage or staining.

*** END ***

PART 1 - GENERAL

1.1 Summary

- .1 This Section of the Specifications forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 Description

- .1 Section Includes: Furnishing of all labour, materials, service and equipment necessary for the supply and installation of rough carpentry, and associated accessories, as indicated, as scheduled and as specified.

1.3 Related Work

1. Section 09 21 16 Gypsum Board Assemblies

1.4 Source Quality

1. Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
2. Plywood identification: by grade mark in accordance with applicable CSA standards.

PART 2 - PRODUCTS

2.1 Lumber Materials

1. Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:
 - .1 CSA 0141-1970.
 - .2 NLGA Standard Grading Rules for Canadian Lumber, 1987 edition.
2. Framing and board lumber: in accordance with notes on structural drawings.
3. Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:
 - .1 S2S is acceptable for areas hidden from view in final structure.
 - .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.

2.2 Panel Materials

1. Panel standards: type, grade and thickness as specified in structural drawings, in accordance with following standards:
 - .1 Douglas fir plywood (DFP): to CSA 0121-M, standard construction.

2.3 Building Paper

1. Exterior wall sheathing paper: to CAN2-51.32-M77.

2.4 Dampproof Membrane

1. Polyethylene film: to CAN2-51.33-M80, Type 1, 0.15 mm thick.
2. Roll roofing: to CSA A123.2-M1979, Type S.

2.5 Adhesives

1. Subflooring adhesive: to CGSB 71-GP-26M, cartridge loaded.

2.6 Fasteners

1. Nails, spikes and staples: to CSA B111-1974.

2. Bolts: as indicated on structural drawings, complete with nuts and washers.
3. Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.
4. Galvanizing: to CSA G164-M1981, use galvanized fasteners for exterior work, interior highly humid areas and preservative or fire-retardant treated lumber.
5. Stainless steel: use stainless steel where specified on drawings.

2.7 Wood Preservative

1. Treat the following to appropriate CSA 080 commodity number using chromated copper arsenate (CCA) to obtain 4 kg/cu m net retention of wood:
 - .1 furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers.

PART 3 - EXECUTION

3.1 Construction

1. Comply with requirements of the National Building Code 2010.

3.2 Erection of Framing Members

1. Install members true to line, levels and elevations.
2. Construct continuous members from pieces of longest practical length.
3. Install spanning members with "crown-edge" up.
4. Install dampproofing course under all plates in contact with concrete.

3.3 Defacement Marks

1. Install lumber and panel materials, as indicated so that grade-marks and other defacing marks are not visible on surfaces specified to be left unfinished or to be finished with translucent or transparent type coating.
2. Surface cutting or sanding to remove defacement marks is acceptable only in locations where defacement will not be evident after finishing.

3.4 Panel-Type Subflooring

1. Install subflooring and combined subfloor and underlay with panel end-joints located on solid bearing, staggered at least 800 mm.
2. In addition to mechanical fasteners, apply subflooring adhesive under panels installed on wood joists. Place continuous adhesive bead sized in accordance with manufacturer's instructions, single-bead on each joist and double-bead on joists where panel ends butt.

3.5 Wall Sheathing

1. Install wall sheathing as indicated on structural drawings.

3.6 Furring and Blocking

1. Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding and other work as required.
2. Install furring to support siding applied vertically where sheathing is not suitable for direct nailing.
3. Align and plumb faces of furring and blocking to tolerance of 1:600.

3.7 Nailing Strips, Grounds and Rough Bucks

1. Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

3.8 Cants, Curbs, Fascia Backing

1. Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized steel fasteners.
2. Install wood backing, dressed, tapered and recessed slightly below top surface of roof insulation for roof hopper.

3.9 Sleepers

1. Install sleepers as indicated.

3.10 Fasteners

1. Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
2. Countersink bolts where necessary to provide clearance for other work.

3.11 Surface-Applied Wood Preservative

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 3 minute soak on lumber and one minute soak on plywood.
3. Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.
4. Treat all material as follows:
 - .1 Wood cants, fascia backing, curbs, nailers, sleepers on roof deck.
 - .2 Wood sleepers supporting wood subflooring over concrete slabs in contact with ground or fill.
 - .3 Other items indicated on drawings.

3.12 Electrical Equipment Backboard

1. Provide backboards for mounting electrical equipment as indicated. Use 19 mm thick plywood on 19 x 38 mm furring around perimeter and at maximum 300 mm intermediate spacing.

*** END ***

PART 1 - GENERAL

1.1 Documents

- .1 This Section of the Specifications forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 Related Work

- | | | |
|----|------------------------|------------------|
| .1 | Rough Carpentry | Section 06 10 00 |
| .2 | Millwork | Section 06 22 00 |
| .3 | Prefinished Wood Doors | Section 08 14 29 |
| .4 | Finish Hardware | Section 08 70 00 |
| .5 | Glazing and Mirrors | Section 08 80 00 |

1.3 Reference Standards

- .1 Do finish carpentry to Millwork Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC) Custom Grade.
- .2 CSA B111 Wire Nails, Spikes and Staples.
- .3 CAN/CSA-G-G164-M92 Hot Dipped Galvanizing of Irregularly Shaped Articles.
- .4 CSA 0121-M1978 Douglas Fir Plywood.
- .5 CAN/CSA 0141-91 Softwood Lumber.
- .6 CAN3-0188.1-M78 interior mat-formed wood particle board.
- .7 CAN/CSA 0151-M78 Canadian Softwood Plywood.

1.4 Samples

- .1 Submit 300 mm long samples of each type of interior trim, in accordance with Section 01 34 00.

1.5 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 33 00 Submittals.
- .2 Indicate details of construction, profiles, jointing, fastening and other related details.
- .3 Indicate all materials, thickness, finishes and hardware.

1.6 Product Delivery and Storage

- .1 Protect materials against dampness during and after installation.
- .2 Store materials in ventilated areas, protected from extreme changes of temperature and humidity.

PART 2 - PRODUCTS

2.1 Lumber Materials

- .1 Lumber Grades: Shall conform to NLGA Standard Grading Rule.
- .2 Lumber shall be all S4S unless otherwise required. Unless otherwise specified herein, the moisture content (MC) at the time of installation shall be in accordance with NLGA standards as follows: board and dimension exterior lumber shall be 19% moisture content or less, interior shall be 12% or less.
- .3 Finish lumber and moldings: All finish carpentry shall conform to AWMAC Custom Grade Standards.
- .4 Fasteners and adhesives: Shall conform to CSA G111 and shall be suitable for installation of finished wood products.

2.2 Panel Materials

- .1 Douglas Fir Plywood: to CSA 0121-M, good one side, exterior grade.

- .2 Medium density fibreboard: to ANSI A208.2, density 769 kg/m³.

2.3 Accessories

- .1 Nails and Staples: to CSA B111-1974; galvanized to CAN/CSA-G164 for exterior work, interior humid areas and for treated lumber; plain finish elsewhere.
- .2 Wood screws: to CSA B35.4 electroplated, type and size to suit applications.
- .3 Splines: metal.
- .4 Adhesives: as recommended by manufacturer.

2.4 Finishing

- .1 Finishing: As per sections 09 90 00, detailed and called for in drawings.

PART 3 - EXECUTION

3.1 Installation

- .1 Commencement of work of this trade shall indicate acceptance of conditions for proper and complete installation as specified. Should conditions be deemed unacceptable, notify General Contractor and Architect before proceeding.
- .2 Do finish carpentry to Quality Standards of the Architectural Woodwork Manufacturers Association of Canada except where specified otherwise.
- .3 Scribe and cut as required, fit to abutting walls and surfaces, fit properly into recesses and accommodate piping, columns, fixtures, outlets, or other projecting, intersecting or penetrating objects.
- .4 Form joints to conceal shrinkage.

3.2 Construction

- .1 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely in place.
- .2 Design and select fasteners to suit size and nature of components being jointed. Use proprietary devices as recommended by the manufacturer.
- .3 Apply water resistant building paper over wood framing members in contact with cementitious construction.
- .4 Set finishing nails to receive filler. Where screws are used to secure members, countersink screw in round clearly cut hole and plug with wood plug to match material being secured.

END

PART 1 - GENERAL

1.1 Summary

- .1 This Section of the Specifications forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 Section Includes

- .1 The work of this section includes the supply, fabrication, delivery to the job site, and installation of architectural woodwork indicated on the drawings and as specified. Finishes as per Finish Schedule included in specification.

1.3 Summary

- .1 Section Includes:
 - .1 Wood Casework
 - .2 Plastic Laminate
 - .3 Wood Wall Panels
 - .4 Wood Soffits
 - .5 Wood Ceiling Panels
 - .6 Shelving
 - .7 Decorate laminate incorporated into casework
 - .8 Structural supports incorporated into wood casework
 - .9 Acoustic Fabric
 - .10 Factory Finishing
- .2 Excluding:
 - .1 Metal support bracket and fittings that are part of the building structure
 - .2 Plumbing, electrical fixtures and telephone equipment.
- .3 Related Sections
 - .1 Finish Carpentry Section 06 20 00
 - .2 Sealants Section 07 92 00
 - .3 Finish Hardware Section 08 70 00
 - .4 Cabinet and Miscellaneous Hardware Section 06 41 93
 - .5 Resilient Sheet Flooring Section 09 65 16
 - .6 Painting Section 09 90 00

1.2 Quality Assurance Standards

- .1 The Quality Standards for Architectural Woodwork by the **Architectural Woodwork Standards Manual** (AWMAC Current Edition) and hereafter referred to as the Manual, together with authorized additions and amendments, shall be used as a reference standard and shall form part of this project specification.
- .2 Where modifications to the Standards contained within the Manual are included in this project specification, then such modifications shall govern in case of conflict. Modifications, however, may void warrantee. Contractor to coordinate with Architect all measures affecting warrantee prior to fabrication.
- .3 *All architectural woodwork shall meet the requirements of the Manual for Custom Grade.*
- .4 References in this specification to part and item numbers mean those parts and items contained within the Manual.

1.4 Submittals

- .1 Shop Drawings
 - .1 Submit Shop drawings in accordance with Section 01 33 00.
 - .2 Shop drawings shall show construction details of all architectural woodwork and general arrangements; typical and special installation conditions; materials being supplied and all connections, attachments, anchorage and location of exposed fastenings, as applicable.

- .3 Shop drawings shall incorporate plans, elevations, sections, and details for all architectural woodwork. The details shall show profiles, jointing, fastening, types and finishes, and all cabinet hardware.
 - .4 No work shall be fabricated until the shop drawings and specified submittals and samples have been reviewed.
- .2 Samples
- .1 Contractor shall allow for the provision of a maximum of three differently custom stained samples (of each of the different species identified in the project specifications) of wood to be supplied for project sample selection.
 2. Submit finished samples 600 x 600 mm of each species finished at the factory, to the Architect for approval. A project sample will be given to the Architectural Woodwork Manufacturer to match prior to submitting his own match.
 - .3 Different or alternate cabinet hardware from that specified shall be submitted to the Architect for approval along with manufacturer's information.
 - .4 Approved samples shall become the standard for the work.

1.6 Product Handling and Storage

- .1 The Architectural Woodwork Manufacturer and the Contractor shall be jointly responsible to make certain that architectural woodwork is not delivered until the building and storage areas are sufficiently dry so that the architectural woodwork will not be damaged by excessive changes in moisture content.
- .2 *Architectural woodwork delivery, storage, and handling shall be in accordance with Section 2 of the Manual.*
- .3 Delivered materials which are damaged in any way or do not comply with these specifications will be rejected by the Design Authority and shall be removed from the job site and replaced with acceptable materials.

1.7 Guarantee

- .1 *This Trade Contractor shall furnish the Owner with two-year AWMAC Guarantee Certificate to the full value of the Architectural Woodwork Sub-contract, certifying that the architectural woodwork has been manufactured and/or installed in accordance with the standards incorporated in the (AWMAC) Current Edition Quality Standards Manual. The Guarantee shall cover replacing and refinishing to make good any defects in architectural woodwork due to faulty workmanship or defective materials supplied by this Trade Contractor, which appear during the two-year period following the date of substantial completion of the project.*

1.8 Inspection Service

- .1 The subcontractor shall bear the cost of the AWMAC inspection.

PART 2 - PRODUCTS

2.1 General

1. Use clean stock only and comply with AWMAC Quality Standards for following materials and grades.

2.2 Manufactured Units

1. Casework: Plastic Laminate Finish.
 1. Casework shall conform to Section 400 of the Manual
 2. AWMAC quality grade: Custom.
 3. Construction: AWMAC design details for flush overlay construction and as detailed, 19mm thick.

4. Exposed parts:
 1. *Core: Combination-core.*
 2. Face: Book-matched vertical grain douglas fir veneer, finish to match project sample.
5. Semi-exposed parts:
 1. *Core: Combination-core.*
 2. Face: Book-matched vertical grain douglas fir veneer, finish to match project sample.
6. Concealed Parts:
 1. *Core: Combination-core.*
 2. Face: mill option
7. Casework Backs:
 1. Thickness, 13mm, unless otherwise noted on drawings
 2. *Core: Combination-core.*
 3. Face: Book-matched vertical grain douglas fir veneer, finish to match project sample.
 4. Back veneer, mill option
8. Cabinet Bases:
 1. 19mm plywood to receive rubber base by section 09 65 13.

2. Casework Drawers

1. Shall conform to the Manual, Custom Grade.
2. Box style construction:
 1. Face: Book-matched vertical grain douglas fir veneer, finish to match project sample.
 2. Sides, backs to be minimum 12mm
 3. Bottom to be 6mm thick minimum
 4. *Core: Combination-core.*
 5. Face: Standard plastic laminate to be selected by Architect
 6. Back veneer: Backing grade 2.
 7. Bottoms of drawers over 600mm wide to be 10mm thick minimum
 8. Provide Rubber bumpers.

3. Casework Doors

1. Shall conform to the Manual, Custom Grade, flush overlay construction.
2. Thickness: 19mm
3. *Core: Combination-core.*
4. Face: *Book-matched vertical grain douglas fir veneer, factory finished with custom stained finish to match project sample..*

4. Plastic Laminate Countertops and Backsplashes:

1. Construction: self-edge, Custom Grade *as per the relevant section* of the Manual.
2. *Core: Combination-core.*
3. Countertops: Standard plastic laminate to be selected by Architect, pencil edge, fully wrapped

5. Shelving Units

1. Thickness: 19mm
2. Core: plywood
3. Exposed Faces: *Book-matched vertical grain douglas fir veneer, factory finished with custom stained finish to match project sample.*

6. Veneered Wood Door and Window Frames

1. Thickness: 38mm
2. Core: MDF or plywood
3. Exposed Faces: *Book-matched vertical grain douglas fir veneer, factory finished with custom stained finish to match project sample.*

7. Built in Millwork

1. Thickness: 19mm
2. Core: plywood

3. Exposed Faces: *Book-matched vertical grain douglas fir veneer, factory finished with custom stained finish to match project sample.*

8. Hardware

- .1 Refer to Section 06 41 93

2.3. Factory Finishing

- .1 Factory Finish the following items:
All wood items in this Section.
- .2 Finishes shall be applied in accordance with Section 5 of the Manual.
Finish stain colour and tone to match project sample - refer to 1.4.2.1&2
Stain and top coat to have FSR of 150 or less unless otherwise noted.
- .3 All exposed parts of casework to be finished according to AWMAC No. 2, Catalyzed Lacquer, satin finish, Custom Grade, and modified as follows:
Stain - refer to 2.3.2
Sealer
Sand (220 Grit)
Top Coat
Top Coat 2.3
- .4 All semi-exposed parts to receive finish as above, except only one top coat is required.
- .5 *Top Coat Finishing Product (to be applied on top of custom stain):* Valtec pre-catalyzed self-sealing lacquer, #20 sheen by Valspar, or approved equal.
- .6 Field Touch-Up: Field touch-up shall be the responsibility of the installing contractor or the Architectural Woodwork Manufacturer, providing he or she is responsible for the factory finishing. Field touch-up shall include the filling and touch-up of exposed job-made nail and screw holes, refinishing of raw surface resulting from job fitting, repair of job-inflicted scratches and mars, and final cleaning up of the finished surfaces.

PART 3 - EXECUTION

3.1 Job Conditions

- .1 *Job Conditions for installation of architectural woodwork shall be as specified under Section 10 of the Manual.*

3.2 Installation

1. *Cabinet and Casework: Install in accordance with Section 10 of the Manual.*
2. Unacceptable conditions require notification of the Architect before proceeding.
3. Install all millwork over complete finished flooring.
4. Install architectural woodwork in accordance with AWMAC Quality Standards manual.
5. Plastic Laminate shall be installed in the longest practical lengths available giving consideration to both the number and location of joints and the available length of materials.
6. Set and secure all materials and components in place, rigid, plumb and square.
7. Fasten wall mounted cabinets, backsplashes, floor mounted cabinets and other architectural woodwork through GWB to sheet metal backing with appropriate screw anchors.
8. Use draw bolts in countertop joints.

9. Shelving to cabinet work to be adjustable unless noted otherwise.
10. After installation, fit and adjust operating hardware for cabinet doors, drawers and shelves.
11. Touch up and refinish any damaged factory finished architectural woodwork on site as required during installation, to satisfaction of the Architect.

3.3 Installation – Miscellaneous

1. All work to be securely screwed to studs of 38mm blocking, screwing to plywood less than 12mm (1/2”) is not acceptable for attaching finish materials.
2. Provide plastic cap covers to all exposed screws in plastic laminate surfaces, wood plugs in wood and wood veneer surfaces.

END

PART 1 - GENERAL**1.1 Summary**

- .1 This Section of the Specifications forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 Section Includes

- .1 Supply of cabinet and miscellaneous hardware.

1.3 Related Work

- | | | |
|----|---------------------|------------------|
| .1 | Finish Carpentry | Section 06 20 00 |
| .2 | Millwork | Section 06 22 00 |
| .3 | Joint Sealants | Section 07 92 00 |
| .4 | Finish Hardware | Section 08 70 00 |
| .5 | Glazing and Mirrors | Section 08 80 00 |

1.4 Reference Standards

- .1 CAN/CGSB-69.25-M90/ANSI/BHMA A156.9-1982 Cabinet Hardware.
- .2 CAN/CGSB-69.27-M90/ANSI/BHMA A156.11-1985 Cabinet Locks.
- .3 CAN/CGSB-69.32-M90/ANSI/BHMA A156.16-1981 Auxiliary Hardware.
- .4 CAN/CGSB-69.34-M90/ANSI/BHMA A156.18-1984 Materials and Finishes.

1.5 Samples

- .1 Submit samples in accordance with Section 01 33 00

1.6 Hardware List

- .1 Submit cabinet hardware list in accordance with Section 01 33 00.
- .2 Indicate specified hardware, including make, model, material, function, finish and other pertinent information.

1.7 Maintenance Data

- .1 Provide maintenance data, parts list, and maintenance manual specified in Section 01730 – Maintenance Manuals.
- .2 Brief maintenance staff regarding proper care, cleaning and general maintenance.

1.8 Delivery and Storage

- .1 Deliver, store, handle and protect material in accordance with Section 01005 - General Instructions.
- .2 Store cabinet hardware in locked, clean and dry area.
- .3 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

PART 2 - PRODUCTS**2.1 Hardware Items**

- .1 Use one manufacturer's product for all similar items.

2.2 Cabinet Hardware

- .1 Cabinet hardware: to CAN/CGSB-69.25 designated by letter.
 - .1 Hinges: Butt concealed continuous full surface olive knuckle pivot self closing semi concealed hinge, type, finish to brushed stainless finish.
 - .2 Pulls: Square 10mm wide right angle bar pull 96mm length in brushed nickel

- .3 Knobs: all millwork to use pulls
 - .4 Latches: elbow thumb bar turn child resistant touch or secret panel latch, type, finished to brushed stainless finish.
 - .5 Catches: friction roller spring magnetic touch or secret panel catch, type, finished to brushed stainless finish.
 - .6 Shelf rests and standards: shelf rest installed in holed drilled, type B 04013 adjustable shelf standards, type, with pen closed shelf rests, type, finished to brushed stainless finish.
 - .7 Shelf brackets and standards: ornamental shelf support, type vertical slotted shelf standard.
 - .8 Drawer slides: Richelieu full extension.
- .2 Cabinet Locks: CAN/CGSB-69.27.
- .1 Door or drawer locks: surface mounted half mortised into back of door or drawer, type, grade.
 - .2 Cylinders: key into keying system as noted and as directed. All locations to be coordinated with owner and architect.

2.4 Fasteners

- .1 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .2 Exposed fastening devices to match finish of hardware.
- .3 Use fasteners compatible with material through which key passes.

2.5 Keying

- .1 Padlocks and cabinet locks to be keyed differently, keyed alike, in groups; master keyed, grand master keyed, great grand master keyed as noted in Hardware Schedule as directed. Submit keying schedule for approval.
- .2 Provide keys in duplicate for every lock in the Contract.
- .3 Provide master keys for each MK or GMK group.
- .4 Stamp keying code numbers on keys and cylinders.

PART 3 - EXECUTION

3.1 Installation Instructions

- .1 Furnish manufacturer's instruction for proper installation of each hardware component.
- .2 Key control set up.

END

1. Examine all surfaces to receive damp-proofing and ensure that all condition are adequate to provide a satisfactory damp-proofing application in accordance with manufacturer's recommendations.
2. Report any unsatisfactory conditions and/or surfaces to the Contractor in writing. Starting work shall imply acceptance of areas and conditions.

3.2 Preparation

1. Apply damp-proofing to sound, dry surfaces.
2. Ensure form time hole to all walls below grade have been patched flush with the surrounding surface and that all concrete is cured.
3. Remove all loose material from concrete foundation wall by brushing wall surfaces with a wire brush and follow other directions so surface preparation required by manufacturer's literature.

3.3 Application

1. Apply damp-proofing by brush or spray in two (2) coats to exterior surfaces of cast-in-place concrete foundation wall to non-habitable areas below grade. Apply in strict conformance with manufacturer's directions using the coverage recommended by manufacturer.
2. Apply unfilled damp-proofing in accordance with CGSB 37-GP-12M.
3. Apply over footings and from bottom of foundation wall up to 102 mm (4") from finish grade at landscaped areas and to the underside of slabs at paving. Each coat shall cover completely all pin hole and crack in concrete.
4. Do not dilute mixing proportions more than manufacturer's specifications.
4. Allow prime coat to set and cure
5. Apply second coat at right angle to the first
6. Allow second coat to set and cure
7. Install protection board in planters before back filling as indicated and detailed.
8. Install filter drain mat in accordance with the manufacturer's recommendations.

3.4 Adjust and Clean

1. Protect all damp-proofing from rain and freezing until properly set and cured. Do not allow completed application to become wet
2. Protect adjacent finished and clean up any overspray to the acceptance of the architect.

***END ***

.1 This section of the Specifications forms part of the Contract Documents and is to be read interpreted and coordinated with all other parts.

1. Refer to Division 1, General Requirements
2. All Contract Documents form an integral part of this Section.

1. Section includes supply of materials and application of damp proofing to foundation walls as indicated on the drawings, schedules, details and as specified herein.
2. Submit cut-sheets and MSDS (Material Data Safety Sheets), for each product used in the building.

1. Section 03 31 00	Structural Cast-in-place Concrete
2. DIVISION 31	Site work and MMCD supplements

1. Perform work to CAN/CGSB 373.-M89.

1. Apply and cure damp proofing at temperatures above 5 degrees Celsius.
2. Do not proceed with work when wind chill effect would tend to set bitumen before proper curing takes place.
3. Do not apply damp proofing membrane in wet weather and do not apply Damp proofing membrane to frozen surfaces.

2.1 Materials

1. Damp-proofing (unfilled type): Shall be an unfilled (un-fibrated) asphalt emulsified mineral colloid type conforming to CGSB 37-GP-2M; or unfilled asphalt cutback solvent type conforming to CGSB 37-GP-6M or EPRO 20 mil application + 10 mil poly sheet.
3. Filter Drain Mat: Shall be as follows:
 1. Polymer core with a one side laminated geotextile, min 1.2m wide

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1. Examine all surfaces to receive damp-proofing and ensure that all condition are adequate to provide a satisfactory damp-proofing application in accordance with manufacturer's recommendations.
2. Report any unsatisfactory conditions and/or surfaces to eh Contractor in writing. Starting work shall imply acceptance of areas and conditions.

3.2 Preparation

1. Apply damp-proofing to sound, dry surfaces.
2. Ensure form time hole to all walls below grade have been patched flush with the surrounding surface and that all concrete is cured.
3. Remove all loose material from concrete foundation wall by brushing wall surfaces with a wire brush and follow other directions so surface preparation required by manufacturer's literature.

3.3 Application

1. Apply damp-proofing by brush or spray in two (2) coats to exterior surfaces of cast-in-place concrete foundation wall to non-habitable areas below grade. Apply in strict conformance with manufacturer's directions using the coverage recommended by manufacturer.
2. Apply unfilled damp-proofing in accordance with CGSB 37-GP-12M.
3. Apply over footings and from bottom of foundation wall up to 102 mm (4") from finish grade at landscaped areas and tot eh underside of slabs at pacing. Each cost shall cover completely all pin hole and crack in concrete.
4. Do not dilute mixing proportions more than manufacturer's specifications.
4. Allow prime coat to set and cure
5. Apply second coat at right angle to the first
6. Allow second coat to set and cure
7. Install protection board in planters before back filling as indicated and detailed.
8. Install filter drain mat in accordance with the manufacturer's recommendations.

3.4 Adjust and Clean

1. Protect all damp-proofing from rain and freezing until property set and cured. Do not allow completed application to become wet
2. Protect adjacent finished and clean up any overspray to the acceptance of the architect.

***END ***

PART 1 - GENERAL

1.1 Documents

- .1 This section of the Specifications forms part of the Contract Documents and is to be read interpreted and coordinated with all other parts.

1.2 Section Includes

- .1 Supply and application of rigid board insulation to surfaces as shown of the of foundation slab, exterior insulation installed outside of the wall sheathing, and insulation outside of the roof sheathing

1.1 Related Sections

- .3 Sheet Membrane Air Barrier Section 07 27 16
- .4 Composite Wall Panels Section 07 42 42

1.2 References

- .1 Canadian Standards Association
 - .1 CAN/ULC S701-97: Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .2 CGSB 71 GP 24M: Adhesive, Flexible for Bonding Cellular Polystyrene Insulation.

PART 2 - PRODUCTS

2.1 Materials

- .1 Rigid Extruded Polystyrene board insulation to be installed to the vertical exterior surfaces and unslab horizontal surfaces of the foundation slab:
 - .1 Rigid Polystyrene Type VI CAN/ULC-S701-97:RSI 0.87 per 25mm, thickness as per drawings min 40mpi compressive strength.
- .2 Exterior Mineral Wool wall sheathing board insulation:
 - .1 Non-combustible, rigid, water repellent, mineral wool insulation board for exterior non-structural commercial and industrial high performance insulation sheathing applications to ASTM C612, Type IVB.
 - .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: [0.70] m²K/W to ASTM C518.
 - .3 Moisture resistance:
 - .1 Moisture sorption: 0.28 % maximum to ASTM C1104/C1104M.
 - .2 Water vapour transmission: 2160 ng/Pa·s·m² to ASTM E96, Desiccant Method.
 - .3 Water absorption: 1.2 % to ASTM C209.
 - .4 Dimensional stability: 0.38 % maximum linear shrinkage at 650 °C to ASTM C356.
 - .5 Corrosive resistance:
 - .1 Steel to ASTM C665: Non-corrosive.
 - .2 Stainless steel to ASTM C795: Non-corrosive.
 - .6 Density: 176 kg/m³ to ASTM C303.
 - .7 Compressive strength: To ASTM C165.
 - .1 58 kPa at 10 %.
 - .2 90 kPa at 25 %.
 - .8 Recycled content: [16] [40] % minimum.
 - .9 Fungi resistance: To ASTM C1338.
 - .10 Acoustical performance sound absorption co-efficients to ASTM C423.

- .3 Rigid Extruded Polystyrene board insulation to be installed to the exterior surfaces of the roof sheathing:
 - .1 Rigid Polystyrene Type VI CAN/ULC-S701-97:RSI 0.87 per 25mm, thickness as per drawings min 40mpi compressive strength.

PART 3 – EXECUTION

3.1 Examination

- .1 Do not install insulation until surfaces are clean, free of deleterious matter and are adequate for proper installation.

3.2 Installation

- .1 Install insulation to maintain continuity of thermal protection to building elements and spaces.
- .2 Fit insulation tight to all items which protrude through plane of insulation. Do not leave any voids in plane of insulation.
- .3 Butt insulation boards tight at joints. Offset vertical joints. Do not leave any voids in plane of insulation.
- .4 Only use insulation boards free of chipped edges and faces.
- .5 Cut and trim insulation neatly to fit spaces. Do not cut and trim insulation when in place. Cut and trim insulation to required size and shape on flat working tables or platforms before installing in place.
- .6 Do not force insulation in place.
- .7 Interlock insulation at corners.
- .8 Back cut insulation to fit properly over items within the plain of insulation.
- .9 At foundations ensure backfill does not displace insulation or get between joints or insulation boards. Protect insulation from damage and displacement.
- .10 At exposed foundation walls, secure concrete faced insulation in place using mechanical fasteners in accordance with manufacturer's printed directions. Mechanical fasteners to be placed below finished grade level.
- .11 Install unfaced polystyrene insulation below grade with adhesive applied in accordance with manufacturer's printed instructions. Take care not to displace insulation during backfilling operations.
- .12 Do not enclose insulation until it has been reviewed and accepted by Architect.

END

PART 1 - GENERAL

1.1 Documents

1. This section of the Specifications forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 Summary

- .1 Section Includes:
 1. Supply & installation of Mineral Fibre Batt Insulation and Poly Vapour Barrier to exterior walls as detailed & scheduled.
 2. Supply & installation of Mineral Fibre Batt Insulation to interior walls as detailed & scheduled.

1.3 Related Work

- | | | |
|----|-------------------------|------------------|
| .2 | Gypsum Board Assemblies | Section 09 21 16 |
| .3 | Joint Sealants | Section 07 92 00 |

1.4 Reference Standards

- | | | |
|------------------------------|----|---|
| (supersedes

Coverings | .1 | CAN/ULC-S702, Standard for Thermal Insulation, Mineral (Glass) Fibre, for Buildings CSA A101-M1983); Type 1, pre-formed unfaced insulation. |
| | .2 | CAN/ULC-S102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies. |
| | .3 | CAN/ULC S102.2, Standard Test for Surface Burning Characteristics of Flooring, Floor and Miscellaneous Materials and Assemblies |
| | .4 | ASTM C1338, Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings |

1.5 Maintenance Data

- .1 Provide maintenance data for glass fibre and acoustic insulation.

1.6 Submittals

- .1 See Section 01 33 00 Submittal Procedures.
- .2 Product Data: Provide data on product characteristics, performance criteria and product limitations.
- .3 Manufacturers installation instructions: Include information on special environmental conditions required for installation and installation techniques.

1.7 Waste Management and Disposal

- .1 Any excess material to be disposed of outside Banff National Park at a facility accepting these materials. Comply with Provincial Waste Management Act.

PART 2 - PRODUCTS

2.1 Mineral Fibre Insulation

- .1 Mineral Fibre: To CAN/ULC-S702-97 and CAN/ULC S114 (Non-combustible) Type 1, friction fit mineral wool fibre insulation, thicknesses as indicated on drawings. Insulation to meet the thickness shown on the assemblies for interior and exterior walls as noted on wall assemblies legend.
 - .1 Batt Insulation for all stud walls: 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: 0.
 - .2 Smoke developed: 0.
- .2 Thermal resistance: To ASTM C518.
- .3 Density: 32 kg/m³ to ASTM C167.

2.3 Poly/Vapour Retarder

- .1 Polyethylene film to CAN/CGSB-51.34M, thickness 6 mil. Tape for sealing as recommended by manufacturer, or acoustical caulking.

2.4 Accessories

- 1. Sealant: Acoustical Sealant as per Section 07 92 00.
- 2. Tape for sealing joints.

PART 3 - EXECUTION

3.1 Installation

- 1. Architect is to inspect exterior walls to be insulated prior to installation. Provide Architect with 5 days notice prior to beginning work.
- 2. Commencement of work of this trade shall indicate acceptance of conditions for proper and complete installation as specified. Should conditions be deemed unacceptable, notify General Contractor and Architect before proceeding.

3.2 Concealed Spaces

- .1 Provide appropriate insulation type to other trades for installation in concealed spaces.

3.3 Thermal Insulation Installation

- 1. Install insulation to maintain continuity of thermal protection to building elements and spaces.
- 2. Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
- 3. Do not compress insulation to fit into spaces.

3.4 Vapour Barrier Installation

- 1. Install polyethylene on warm side of insulation as indicated and tight to insulation.
- 2. Attach vapour barrier to framing members with acoustic sealant or tape as required. Lap joints 150 mm minimum. Ensure joints occur over framing members. Provide extra material at deflection points (ref. drawing details). Tape and seal all joints & laps.
- 3. Tape seal areas where nails or staples penetrate vapour retarder and at points of penetration. Attach warning labels to walls with vapour retarder.
- 4. Extend Poly Vapour Barrier to lap over membrane air/vapour retarder a minimum of 65mm. Seal joint with acoustical caulking.

3.5 Acoustical Insulation Installation

- 1. Install acoustical insulation within sound insulated stud partitions full height of partitions, as indicated and scheduled.
- 2. Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through partitions.
- 3. Do not compress insulation to fit into spaces.

3.6 Inspection

- .1 On commencing installation, notify Architect with proposed schedule for completing installation; arrange for inspections.

END

PART 1 – GENERAL

1.1 Summary

- A. This section of the specification forms part of the contract documents and is to be read, interpreted and coordinated with all other parts.

1.2 Section Includes

- A. Supply and complete application of sheet air barrier over wood framed wall assemblies.

1.3 References

- A. ASTM International
 - 1. ASTM C920; Standard Specification for Elastomeric Joint Sealants
 - 2. ASTM C1193; Standard Guide for Use of Joint Sealants
 - 3. ASTM D882; Test Method for Tensile Properties of Thin Plastic Sheeting
 - 4. ASTM D1117; Standard Guide for Evaluating Non-woven Fabrics
 - 5. ASTM E84; Test Method for Surface Burning Characteristics of Building Materials
 - 6. ASTM E96; Test Method for Water Vapor Transmission of Materials
 - 7. ASTM E1677; Specification for Air Retarder Material for Framed Building Walls
 - 8. ASTM E2178; Test Method for Air Permeance of Building Materials
- B. AATCC – American Association of Textile Chemists and Colorists
 - 1. Test Method 127 Water Resistance: Hydrostatic Pressure Test
- C. TAPPI
 - 1. Test Method T-410; Grams of Paper and Paperboard (Weight per Unit Area)
 - 2. Test Method T-460; Air Resistance (Gurley Hill Method)

1.4 Submittals

- A. Refer to Section 01 33 00 Submittals
- B. Product Data: Submit manufacturer current technical literature for each component.
- C. Samples: Weather Barrier membrane, minimum 8-1/2 inches by 11 inch.
- D. Quality Assurance Submittals
 - 1. Provide manufacturer's written installation instructions.

1.5 Quality Assurance

- A. Qualifications
 - 1. Installer shall have experience with installation of similar weather barrier assemblies under similar conditions.
 - 2. Installation shall be in accordance with manufacturer's installation guidelines and recommendations.
 - 3. Source Limitations: Provide weather barrier and accessory materials produced by single manufacturer.

1.8 Scheduling

- A. Review requirements for sequencing of installation of self adhered membrane flashings (peel and stick) with installation of fasteners, flashings and steel fabrications.

PART 2 – PRODUCTS

2.1 Sheet Membrane Products

.1 Self Adhered Flashing:

.1 A self-adhering membrane consisting of an SBS rubberized asphalt compound laminated on a polyethylene film. Impermeable to air, moisture vapor and water,

2.4 Accessories

1. Sealants

1. Provide sealants that comply with ASTM C 920, elastomeric polymer sealant to maintain watertight conditions or sealants recommended by the weather barrier manufacturer.

2. Adhesive:

1. Provide adhesive recommended by weather barrier manufacturer.

3. Primer:

1. Provide flashing manufacturer recommended primer to assist in adhesion between substrate and flashing.

2. Products:

a. Primers recommended by the flashing manufacturer

PART 3 – EXECUTION

3.1 Examination

1. Verify that surfaces and conditions are ready to accept the work of this section. Notify Architect in writing of any discrepancies. Commence of the work or any parts there of shall mean acceptance of the prepared substrate.

3.2 Preparation

1. All surfaces must be sound, dry, clean and free of oil, grease, dirt, excess mortar or other containments. Fill spalled areas in substrate to provide an even plane.

3.3 Primer

1. Apply primer for membrane at rate recommended by manufacturer.
2. Primed surfaces not covered by membrane during the same working day must be re-primed.

3.4 Sheet Membrane

1. Position membrane for alignment and remove protective film. Press firmly into place. Ensure minimum 50mm overlap at all end and side laps. Promptly roll all laps with a counter top roller to effect seal. When installed horizontally, do so in a shingle fashion.
2. Tie-in to window frames, wood framing, roofing system and at the interface of dissimilar materials as indicated in drawings. Refer to manufacturers standard details.
3. Ensure all projections, including wall ties, are properly sealed with a trowel or caulk application of liquid membrane.
4. Install around windows and door openings at masonry unit wall assemblies where detailed.
5. Apply where deflection is required and detailed.

3.3 Seaming

1. Seal seams of weather barrier with seam tape at all vertical and horizontal overlapping seams.
2. Seal any tears or cuts as recommended by weather barrier manufacturer.

3.4 Protection

- A. Protect installed weather barrier from damage. Refer to manufacturers limit on UV and weather damage.

END

PART 1 – GENERAL

1.1 Summary

- A. This section of the specification forms part of the contract documents and is to be read, interpreted and coordinated with all other parts.

1.2 Section Includes

- A. Supply and complete application of sheet air barrier over wood framed wall assemblies.

1.3 References

- A. ASTM International
 - 1. ASTM C920; Standard Specification for Elastomeric Joint Sealants
 - 2. ASTM C1193; Standard Guide for Use of Joint Sealants
 - 3. ASTM D882; Test Method for Tensile Properties of Thin Plastic Sheeting
 - 4. ASTM D1117; Standard Guide for Evaluating Non-woven Fabrics
 - 5. ASTM E84; Test Method for Surface Burning Characteristics of Building Materials
 - 6. ASTM E96; Test Method for Water Vapor Transmission of Materials
 - 7. ASTM E1677; Specification for Air Retarder Material for Framed Building Walls
 - 8. ASTM E2178; Test Method for Air Permeance of Building Materials
- B. AATCC – American Association of Textile Chemists and Colorists
 - 1. Test Method 127 Water Resistance: Hydrostatic Pressure Test
- C. TAPPI
 - 1. Test Method T-410; Grams of Paper and Paperboard (Weight per Unit Area)
 - 2. Test Method T-460; Air Resistance (Gurley Hill Method)

1.4 Submittals

- A. Refer to Section 01 33 00 Shop Drawings.
- B. Product Data: Submit manufacturer current technical literature for each component.
- C. Samples: Weather Barrier membrane, minimum 8-1/2 inches by 11 inch.
- D. Quality Assurance Submittals
 - 1. Provide manufacturer's written installation instructions.

1.5 Quality Assurance

- A. Qualifications
 - 1. Installer shall have experience with installation of similar weather barrier assemblies under similar conditions.
 - 2. Installation shall be in accordance with manufacturer's installation guidelines and recommendations.
 - 3. Source Limitations: Provide weather barrier and accessory materials produced by single manufacturer.

1.6 Delivery Storage and Handling

- B. Deliver weather barrier materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Store weather barrier materials as recommended by system manufacturer.

1.7 Scheduling

- A. Review requirements for sequencing of installation of weather barrier assembly with installation of windows, doors, louvers and flashings to provide a weather-tight barrier assembly.

PART 2 – PRODUCTS

2.2 Materials

1. Vapour Permeable Self Adhered Air Barrier Membrane
 - a. A three ply spun-bonded polypropylene with a centre water tight polymeric sheet, must pass ASTM D 1970 Nail Sealability
3. Basis of Design: Self adhered membrane to building envelope to form a continuous monolithic vapour permeable air barrier.
4. Performance Characteristics:
 2. Water Vapor Transmission: 214 g/m²/24h when tested in accordance with ASTM E96-05, Method A. 343 g/m²/24 h when tested in accordance with ASTM E96-05, Method B.
 3. Vapour Permeance: 31 perms [grains/h/ft²/in Hg] when tested in accordance with ASTM E96-05, Method A. 50 perms [grains/h/ft²/in Hg] when tested in accordance with ASTM E96-05, Method B.
 4. Air Leakage of Air Barrier Assemblies: <0.2L/(sm2)@75 Pa as per ABAA and NBC requirements and ASTM E2357-11
5. Low toxicity, water based LEED VOC compliant

PART 3 – EXECUTION

3.1 Examination

- A. Verify substrate and surface conditions are in accordance with air barrier manufacturer recommended tolerances prior to installation of air barrier and accessories.

3.2 Installation – Weather Barrier

- A. Install air barrier over exterior face of exterior wall substrate in accordance with manufacturer recommendations.
- B. Start air barrier installation at a building corner, leaving 6-12 inches of weather barrier extended beyond corner to overlap.
- C. Install air barrier in a horizontal manner starting at the lower portion of the wall surface. Maintain air barrier plumb and level.
- D. Extend bottom roll edge over sill plate interface 2” to 3” minimum. Seal air barrier with sealant or tape. Shingle air barrier over back edge of thru-wall flashings and seal air barrier with sealant or tape. Ensure weeps are not blocked.
- E. Install in accordance with following:

The following areas of the *continuous air barrier* in the *building envelope* shall be wrapped, sealed, caulked, gasketed, or taped in an approved manner to minimize air leakage:

 - a. Joints around *fenestration* and *door* frames (both manufactured and site-built).
 - b. Junctions between *walls* and *floors*, between *walls* at building comers, between *walls* and *roofs or ceilings*.

- c. Penetrations through *the air barrier in building envelope roofs, walls, and floors*.
- d. Building assemblies used as ducts or *plenums*.
- e. Joints, seams, connections between planes, and other changes in air barrier materials.
- f. The *continuous air barrier* shall extend over all surfaces of the *building envelope* (at the lowest floor, exterior *walls*, and ceiling or *roof*).
- g. The *continuous air barrier* shall be designed to resist positive and negative pressures from wind, stack effect, and mechanical *ventilation*.

3.3 Seaming

- A. Seal seams of weather barrier with seam tape at all vertical and horizontal overlapping seams.
- B. Seal any tears or cuts as recommended by weather barrier manufacturer.

3.4 Protection

- A. Protect installed weather barrier from damage.

END

PART 1 - GENERAL

1.1 Documents

- .1 This section of the Specifications forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.1 Section Includes

- .1 This section includes the supply and installation of fiber-cement cladding project to, but not necessarily limited to:
 - .1 Trim, horizontal plank, board & batten and soffits as indicated on drawings

1.2 Related Sections

- .1 Section 06 10 10 Rough Carpentry
- .2 Section 07 27 19 Sheet Air Barrier
- .3 Section 08 40 10 Aluminum Windows

1.3 Work Included

- .1 Furnish and install Claddings, Soffit, Trim and Fascia boards, moldings and accessories where shown on the drawings or as specified herein.
- .2 Coordinate this section with interfacing and adjoining work for proper sequence of installation.

1.4 References

- .1 ASTM: C1186

1.5 Warrantee

- .1 Product to have limited project warranty against manufacturing defects in lap and vertical siding for 50 years. Trims to have 10 year manufacturer's warrantee

1.4 Shop Drawings

- .1 Submit in accordance with Submittals Section 01 33 00.
- .2 Indicate size and description of components, materials, attachment devices, description of frame and finish, and construction details.

1.7 Maintenance Data

- .1 Provide maintenance data for Maintenance Manual.

PART 2 - PRODUCTS

2.1 Materials

- .1 Non-asbestos fiber-cement siding to comply with ASTM Standard Specification C1186 Grade II, Type A.
- 2. Smooth Lap Siding:
 - 1. Smooth, factory finished, 6 1/4" width(5" exposure) x 5/16" thickness. 2.40lbs/sq/ft. factory painted. 30yr limited warranty. Colour to be selected by Architect
- 3. Fasteners:
 - .1 Colour matched Manufacturer Supplied fasteners, review installation instructions for correct fastener length

- .4 Board and Batten: Panel 5/16" thick Primed smooth factory primed. To be painted on site.
Battens are smooth 3/4" thick 5.43 lbs/sq/ft 2 1/2" thick factory primed, to be painted on site.
- .5 Soffits: 1x4 clear tight grain western red cedar. Finish as per painting 09 90 00

PART 3 – EXECUTION

3.1 Examination

- .1 Correct conditions detrimental to timely and proper completion of the work.
- .2 Do not install insulation until surfaces are clean, free of deleterious matter and are adequate for proper installation.

3.2 Installation

- .2 Installation –Soffit:
 - .1 Block framing between studs where joints occur.
 - .3 Fasten through gypsum into furring channels Fasteners must penetrate minimum 3/4", confirm with manufacturer
 - .4 Place fasteners no closer than 3/4" from panel edges and 2" from panel corners.
 - .5 Specific framing and fastener requirements refer to Tables 2 and 3 in National Evaluation Service Report No. NER-405.
- .3 Finishing:
 - .1 Prefinished fibre cement products to have colour selected from all available factory finishes and colours, recoat all cut edges as per manufacturers instructions. Cut edges must be cut straight and clean with a track saw or similar.
 - .2 Wherever possible all cut ends to be orientated at the top of the installation

END

PART 1 - GENERAL

1.1 Documents

- .1 This Section of the Specifications forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 Related Work

- | | | |
|----|-----------------------|------------------|
| .2 | Composite Wall Panels | Section 07 42 42 |
| .7 | Painting | Section 09 90 00 |

1.3 Samples

- .1 Submit 50 mm x 50 mm samples of sheet metal material, colour and finish in accordance with Section 01 33 00 Submittals.
- .2 Submit shop drawings for review and approval from the Architect of the shapes and profiles with all dimensions prior to installation.

1.4 Quality Assurance

- .1 Do roof flashing work in accordance with applicable standards in Architectural Sheet Metal Manual, to ULC requirements and the Alberta Roofing Contractors Association (ARCA) Standards Manual together with authorized additions and amendments.

1.5 Delivery Storage and Handling

- .1 Provide and maintain dry, off ground, weatherproof storage.
- .2 Store rolls of roofing membrane on end that is to be used in conjunction with metal flashings.
- .3 Remove in quantities required for same day use.
- .4 Indicate on sheet metal flashings or wrappings:
 - .1 Manufacturer's name and brand.
 - .2 Compliance with applicable codes.
- .5 Deliver fasteners in original boxes and protect in storage until used. Do not use oil or grease.
- .6 When requested, make available copies of purchase orders to Architect or Roofing Inspector.

1.6 Inspection and Warranty

- .1 Contractor hereby warrants that the metal flashings will stay in place and remain leakproof in accordance with GC 12, but for a minimum period of five (5) years.
- .2 Upon completion of work, this Contractor shall furnish Owners with a five (5) year Company guarantee for work of this section.
- .3 Provide for inspection in accordance with Specifications and Consultants Standards. Include inspection fees in this Contract.

1.6 Compatibility

- .1 Compatibility between metal flashing components is essential. Materials to be incorporated into the system must be compatible.
- .2 Provide written declaration that metal flashings will be installed to comply with SMACNA, and CRCA Standards.

ARCA

PART 2 - PRODUCTS

2.1 Sheet Metal Materials

- .1 All non-window flashings to be pre-painted PVDF/Kynar G90 Galvanized 24ga steel. Colour to be selected by Architects from full PVDF range of colours
- .2 All flashings in contact with the windows shall be supplied and installed by the window installer, colour and material to match the window profile.

2.2 Accessories

- as
length
- .1 Isolation Coating: Alkali resistant bituminous paint.
 - .2 Plastic Cement: to CGSB 37-GP-5M.
 - .3 Underlay for Metal Flashing: Roofing membrane cap flashing as per section 07525.
 - .4 Sealants: in accordance with Section 07 90 00, colour selected by Architect.
 - .5 Cleats: of same material and temper as sheet metal, minimum 50 mm wide. Thickness same as sheet metal being secured.
 - .6 Fasteners: of same material as sheet metal, to CSA B111-1974, flat head roofing nails of length and thickness suitable for metal flashing application.
 - .7 Washers: of same material as sheet metal, 1 mm thick with rubber backings.
 - .8 Touch Up Paint: as recommended by metal flashing and trim manufacture.

2.3 Fabrication

- .1 Fabricate metal flashings and other sheet metal work in accordance with applicable ARCA Roofing Practices Manual.
- .2 Form pieces in 2400 mm maximum lengths. Make allowance for expansion at joints.
- .3 Hem exposed edges on underside 12 mm. Mitre and seal corners with sealant.
- .4 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .5 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.
- .6 All sill flashings to have a min upturn dam of 25mm, 1".

2.4 Metal Flashings

- .1 Form flashings, copings, and fascias with from a single piece to a maximum length as available from steel manufacturer.

PART 3 - EXECUTION

3.1 Installation

- .1 Commencement of work of this trade shall indicate acceptance of conditions for proper and complete installation as specified. Should conditions be deemed unacceptable notify the Contractor and Architect before proceeding.
- .2 Install sheet metal work in accordance with ARCA Roofing Practices Manual.
- .3 Use concealed fastenings except where approved before installation.
- .4 All cap flashings shall be standing seamed and caulked. S lock joints must be formed on the sheet and be fully caulked.
- .5 Cross brake all cap flashing.
- .6 Provide underlay under sheet metal. Secure in place and lap joins 100 mm.
- .7 All exposed edges shall be formed complete with a double edge and drip.
- .8 Lap seams will not be acceptable unless approved by the Roofing Inspector.
- .9 All metal work shall have allowance for expansion and contraction.
- .10 All gum edge flashings must come complete with a rigid bar.
- .11 Exposed screws shall be neoprene washer type.
- .12 All metal scraps, nails, etc., must be removed from the roof at the end of each working day.

END

PART 1 - GENERAL

1.1 Summary

- .1 This Section of the Specifications forms part of the Contract and is to be read, interpreted and coordinated with all other parts.

1.2 Section Includes

- .1 Supply & installation of joint sealants, backer material and accessories as required and as per drawings; section includes sealing of all baseboards to the floor in all rooms.
- .2 General Requirements: Conform with requirements of all Sections of Division 1, General Requirements, as it applies to the work of this Section.

1.3 Related Sections

Includes but are not limited to the following:

- | | |
|---------------------|---|
| 1. Section 07 21 16 | Batt and Blanket Insulation & Poly Vapour Barrier |
| 2. Section 08 11 14 | Steel Hollow Metal Frames |
| 3. Section 09 21 16 | Gypsum Wall board |
| 4. Section 09 90 00 | Painting |

1.4 References

- .1 Canadian General Standards Board (CGSB)
 - .1 CGSB 19-GP-5M, acrylic terpolymer.
 - .1 Reference product: 'Tremco 555' by Tremco Ltd.
 - .2 CAN/CGSB 1917., acrylic latex.
 - .1 Reference product: 'Tremco 100 Latex' by Tremco Ltd.
 - .3 CAN/CGSB 192.1, single component synthetic rubber.
 - .1 Reference product: 'Tremco Acoustical Sealant'
 - .4 CAN/CGSB 192.2, silicone containing anti-fungicide properties.
 - .1 Reference product: 'Sanitary 1700' by GE Silicones.
 - .5 CAN/CGSB 1924., epoxidized polyurethane terpolymer.
 - .1 Reference product: 'Dymeric' by Tremco Ltd.
 - .6 Thermoplastic elastomeric.
 - .1 Reference product: 'Tremco 830' by Tremco Ltd.
 - .7 Single component self-leveling polyurethane joint sealant.
 - .1 Reference Product: Tremflex S/L by Tremco Ltd.

1.5 Samples

- .1 Submit colour chart of available colours, in accordance with Section 01 33 00.

1.6 Environmental Conditions

- .1 Sealant and substrate materials to be minimum 5 degrees Celsius.
- .2 Should it become necessary to apply sealants below 5 degrees Celsius, consult sealant manufacturer and follow their recommendations.

1.6 Warranty

- .1 Contractor shall provide a written guarantee that caulking work of this Section is under warranty against leakage, cracking, crumbling, melting, shrinkage, running, loss of adhesion, or staining adjacent surfaces for a in accordance with G.C12 from the date of Substantial Performance.

PART 2 - PRODUCTS

2.1 Materials

- .1 Primers: Type recommended by sealant manufacturer.
- .2 Joint Fillers:
 - .1 General: Compatible with primers and sealants, outsized 30% to 50%.
 - .2 Polyethylene, Urethane, Neoprene: Extruded closed cell foam, Shore A hardness 20, tensile strength 140 kPa to 200 kPa.
 - .3 Neoprene or Butyl Rubber: Round solid rod, Shore A hardness 70.
- .3 Bond Breaker: Pressure sensitive plastic tape, which will not bond to sealants.
- .4 Sealants:
- .5 Colour of Sealants: As selected by Architect to match adjacent finishes.
- .6 Joint Cleaner: Xylol, or non corrosive type recommended by sealant manufacturer and compatible with joint forming materials.

PART 3 - EXECUTION

3.1 Installation

- .1 Commencement of work of this trade shall indicate acceptance of conditions for proper and complete installation as specified. Should conditions be deemed unacceptable, notify General Contractor and Architect before proceeding.
- .2 All baseboards and rubber base to be sealed to the floor in all rooms.
- .3 Caulk all gaps left between the floor and drywall after mud and tape is completed, prior to baseboard install.

3.2 Examination & Preparation

- .1 Remove dust, paint, loose mortar and other foreign matter. Ensure dry joint surfaces.
- .2 Remove rust, mill scale and coatings from ferrous.
- .3 Remove oil, grease and other coatings from nonferrous metals with joint cleaner.
- .4 Prepare concrete, glazed and vitreous surfaces to sealant manufacturer's instructions.
- .5 Examine joint sizes and correct to achieve depth ratio 1/2 of joint width.
- .6 Install joint filler to achieve correct joint depth, as per drawings.
- .7 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

3.3 Application

- .1 Apply sealant, primers, joint fillers and bond breakers to manufacturer's instructions. Apply sealant using gun with proper size nozzle. Use sufficient pressure to fill voids and joints solid. Superficial pointing with skin bead is not acceptable.
- .2 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities. Neatly tool surface to a slight concave joint.
- .8 Clean adjacent surfaces immediately and leave work neat and clean. Remove excess sealant and droppings using recommended cleaners as work progresses. Remove masking after tooling of joints.

END

PART 1 - GENERAL

1.1 Documents

1. This Section of the Specifications forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 Summary

1. Section includes:
 1. Standard welded hollow metal door.

1.3 Related Sections

- | | |
|---------------------|---------------------------|
| 1. Section 07 92 00 | Joint Sealants |
| 2. Section 08 11 14 | Steel Hollow Metal Frames |
| 3. Section 08 14 29 | Prefinished Wood Doors |
| 4. Section 08 70 00 | Finish Hardware |
| 5. Section 08 80 00 | Glazing and Mirrors |
| 6. Section 09 90 00 | Painting |

1.4 Requirements of Regulatory Agencies

- .1 Fire rated doors and frames: labeled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104M and CAN4-S105M for ratings indicated.
- .2 For applicable assemblies submit documents showing conformance to the CW class according to AAMA/WDMA/CSA 101/I.S.2/A440-08 and CSA A440S1-09, as per National Building Code of Canada. All applicable products shall bear a permanent marking indicating the product manufacturer's identity in a location that is visible when the product is installed. Performance ratings shall be indicated on a non-permanent label or signed letter of conformance showing the testing of the sizes specified in the architectural documents and shall include:
 - .1 Performance Grade – CW – 35 PG
 - .2 Minimum design pressure – 1680 Pa
 - .3 Minimum Structural test pressure – 2520 Pa
 - .4 Water penetration test pressure – 260 Pa
 - .5 The Canadian air infiltration and exfiltration level – A3 - 0.5 L/s*m²@75 Pa
- .3 For exterior doors submit documentation showing conformance to NECB,
 1. Max assembly U value – 0.45

1.5 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Indicate each type of door material, size, core thickness, mortises, reinforcing, location of exposed fastenings, openings, glazing or louvers.

PART 2 - PRODUCTS

2.1 Materials

- .1 Sheet Steel: 18 ga. commercial grade steel to ASTM A924, continuous welded seam galvanized to ASTM A653, Class ZF075, wiped zinc coated, Z275 zinc finish for exterior doors.
- .3 Door Core:
 - .1 Polyurethane to a min of R12.2.
 - .2 Vertically stiffened.
 - .3 Insulated urethane or isocyanurate board insulation to CGSB S1-GP-21M.

- .4 Primer: for touch up to CGSB 1-GP-181M+Amdt-Mar-78 zinc rich
- .5 Frames to be thermally broken
- .6 Painting for doors as per 09 90 00
- .7 Refer to door schedule for additional hardware and accessory requirements

2.2 Fabrication

Association ,
hollow

include

- .1 Fabricate steel doors as detailed, to Canadian Steel Door and Frame Manufacturers "Canadian Manufacturing Specifications for Steel Doors and Frames", latest edition, for steel construction, except where specified otherwise.
- .2 Prepare doors to receive hardware supplied by Section 08 70 00. Door preparation shall the installation of flexible conduit or wire raceway within door assemblies where required. Coordinate with all affected trades.
- .3 Mortise, reinforce, drill and tap doors and reinforcements to receive hardware using templates and installation instructions provided under Section 08 70 00.
- .4 Install louvers & glazing stops as indicated or scheduled.
- .5 Touch up doors with primer where galvanized finish damaged during fabrication.

2.3 Doors and Infill Panels

accumulations.

- .1 Make provisions for mechanical grilles and undercuts where indicated or scheduled. Refer to mechanical information for grille layouts and undercuts.
- .2 Fabricate with longitudinal edges seamless; welded, filled and sanded flush.
- .3 Equip exterior doors and infill panels with flush steel top caps to prevent water accumulations.
- .5 Provide minimum 12 mm long fillet welds along top and bottom edges of each hinge reinforcement plates, in addition to typical plate spot welds. Use low heat to minimize visible metal distortion.

PART 3 - EXECUTION

3.1 Installation

- .1 Commencement of work of this trade shall indicate acceptance of conditions for proper and complete installation as specified. Should conditions be deemed unacceptable, notify the General Contractor and the Architect before proceeding.
- .2 Install doors and hardware in accordance with hardware templates and manufacturers installation instructions provided under Section 08 70 00.
- .3 Adjust operable parts for correct function.

END

PREFINISHED WOOD DOORS

PART 1 - GENERAL

1.1 Documents

1. This section of the Specifications forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 Summary

1. Section Includes: Supply of wood doors, including all accessories and items of related work, indicated on the drawings, as scheduled and as specified herein.
2. Related Sections
 1. Section 06 20 00 Finish Carpentry
 2. Section 08 70 00 Finish Hardware
 3. Section 08 80 00 Glazing and Mirrors
 4. Section 09 90 00 Painting

1.3 References

1. American Woodwork Institute (AWI) – Quality Standards Illustrated.
2. National Fire Protection Association – NFPA 80 Fire Doors & Windows.
3. National Wood Window and Door Association (NWWDA) – Industry Standards Manual.
4. Underwriters Laboratories of Canada (ULC).
 1. CAN/ULC-S104-M80, Fire Tests of Door Assemblies
 2. CAN/ULC-S105-M85, Fire Door Frames Meeting the performance required by CAN/ULC S104.
 3. CAN/ULC-S106-M80, Fire Tests of Window & Glass block Assemblies.
 4. CAN/ULC-S113-79 Wood Core Doors Meeting the Performance Required by CAN/ULC S104-77 for Twenty-Minute Rated Closure Assemblies.

1.4 Regulatory Requirements

1. Fire Rated Doors: Provide fire label on doors by either ULC or WHI
2. Installation to comply with NFPA 80, CAN ULC S104 & CAN/ULC-S105.

1.5 Submittals

1. Shop Drawings
 1. Submit shop drawings in accordance with Section 01 33 00 Submittals.
 2. Indicate door types and cutouts for lights and louvers.
 3. Indicate necessary blocking to suit assigned & scheduled hardware.
 4. Complete schedules with architectural door numbers.
 5. Manufacturers data for each type of door, including details of core and edge construction.
 6. Factory finish specifications and recommendations (if any) of finish coats.
2. Samples
 1. Submit sample in accordance with Section 01 33 00 Submittals.
 2. Submit one (1) 300mm x 300mm corner sample of each type wood door.
 3. Show door construction, core, glazing detail and faces.
3. Certificates
 1. Quality and construction of the door including reference standard.
 2. Warranty certificate.

PREFINISHED WOOD DOORS

1.6 Quality Assurance

1. Conform to NWWDA I.S.-1A, latest Edition.
2. Conform to AWI and AWMAC Quality Standards, latest Edition.
3. Allowable Tolerances:
 1. Sizes designated on drawings for hinged doors are doorframe-opening dimensions. Maximum clearance between door leaf and frame at head and jamb shall be 3mm.

1.7 Delivery, Storage and Handling

1. Delivery:
 1. Deliver doors directly from factory to site complete with cutouts ready for grilles and vision panels and protected as necessary to prevent damage or deterioration.
 2. Deliver doors to project complete with individual architectural door numbers marked in top hinge cavity.
 3. Do not deliver doors until job conditions within the building are dry and clean.
 4. Doors to be delivered to site in individual shrink-wrap plastic.
2. Storage:
 1. Doors to be stored and handled in accordance with NWWDA's standards.
 2. Where doors are to be stored at site for more than one (1) week, seal all edges,
 3. Store doors flat on a level surface in a dry, well ventilated area where relative humidity is from 50 to 55% at 70 degrees F.
 4. Cover doors to keep clean but allow for air circulation.
 5. Doors are not to be subjected to sudden or abnormal changes of heat, dryness or humidity; condition doors to building prevailing humidity before hanging.
 6. Handle doors with clean gloves and do not drag across one another or other surfaces.
 7. Warped or surface marked doors shall be replaced.

1.8 Warranty

1. Provide a warranty issued in the name of the Owner stating that the doors are warranted against defects in material and workmanship for a period of five (5) years from the date of Substantial Performance.
2. Defective door(s) shall be replaced, accurately re-hung and finished to match original door at no cost to the Owner.

PART 2 - PRODUCTS

2.1 General

1. Doors shall be pre-fitted, Pre-hung, beveled and machined at the factory for all mortise hardware items as per templates and approved hardware schedules provided.

2.2 Flush Wood Doors

1. Grade: AWMAC solid core custom grade.
2. Size: As scheduled.
3. Finish: Clear VG Douglas Fir factory finished with AWI System TR-6/OP-6 Catalyzed Polyurethane with Clear Finish

PREFINISHED WOOD DOORS

4. Core to be formed flat panel consisting of wood particles bonded together with synthetic resins and other added binders, with a density of 28-32 lbs per cubic foot. The material shall meet or exceed the requirements of grade 1L1 particleboard as described in the latest edition of ANSI A208. 1. Mat Formed Wood Particle Board.
5. Flame Spread Rating: Not more than 200.
6. Reference Product: Lynden Doors CD 200

2.3 Stiles & Rails for Hardware

1. Stiles and rails shall conform to manufacturer's standard for approved type of institutional doors.
2. Top rail shall be minimum 127mm wide for full width of door.
3. Lock blocks to be a minimum of 127 mm x 510 mm.
4. Provide 127mm wide intermediate rails; on doors which require panic hardware as scheduled.
5. Coordinate scheduled hardware with stiles & rails and provide adequate blocking to suit.

2.5 Frames and trim

1. Solid wood frames to match door, factory finish to match door leaf.
2. 12.7mm x 57mm solid clear VG fir trim, clear coated to match door and frame. Head joints mitred.

2.4 Fabrication

1. Block and reinforce grille and glazing openings.
3. Doors scheduled to be undercut shall be factory fabricated to finished dimension.
4. Provide waterproof (non-staining) membrane at cutouts on exterior doors to exclude moisture from core.

PART 3 - EXECUTION

3.1 Preparation

1. Carefully inspect the location and the frame conditions where the doors will be installed. Notify Architect and Project Manager of conditions that would adversely affect the installation or the operation of the doors. DO NOT proceed until unsatisfactory conditions are corrected.
2. Allow doors to become acclimated to the building heat and humidity before installation.
3. Install non-fire rated doors in accordance with manufacturer's written instructions and AWI Section 1300 S-6 and G-8.

PREFINISHED WOOD DOORS

4. Install doors to operate freely, but not loosely, free from hinge bound conditions, striking or binding. Hang free from rattling when in latched position. DO NOT install defective doors.
5. Use only skilled installers that have experience installing commercial grade wood doors and hardware.

3.2 Finishing

1. Pre-finish doors according to AWI 8th Edition Section 1500 Custom TR6 system, catalyzed Polyurethane. Doors shall be prefinished at Manufacturer's plant.

3.3 Adjust and Cleaning

1. Verify and adjust each door to ensure proper operation.
2. Carefully wipe clean doors of dust created from the hanging procedure and from installing the finish hardware.
3. Repair or replace any door as directed by Architect.

***END ***

PART 1 - GENERAL

1.0 Scope of Work

- .1 Supply and installation of exterior electrically operated roll shutters to kiosk openings as detailed to locations shown on drawings.
- .2 Supply and installation of interior shutter doors to locations indicated on door schedule.

1.2 Related Work

- | | | |
|----|------------------|-------------------------|
| .3 | Division 08 | Openings |
| .4 | Section 09 21 16 | Gypsum Board Assemblies |
| .5 | Section 09 90 00 | Painting |

1.3 Shop Drawings

- .1 Submit shop drawings in accordance with Submittals Section 01 33 00.
- .2 Clearly indicate description of components; guide rails, panel box housing, operators, sizes, base materials, finishes, hardware, attachment devices, rough-in, required clearances, etc.
- .3 Provide a schedule listing location, width and height.
- .4 Submit samples of standard colours for approval.

1.4 Maintenance Data

- .1 Provide data for rolling metal shutters and hardware for incorporation into Maintenance Manual .

1.5 Guarantee

- .1 Manufacturer to provide a written warranty that all components are guaranteed against defects in material, design and workmanship for five years from date of installation. Installer to provide written guarantee that there will be no labour charge for warranty repairs for one year from date of installation.

1.6 Delivery Handling and Storage

- .1 Deliver materials to site in shipping crates and packing. Store off the ground on wood supports spaced to prevent damage. Store inside building under cover to prevent damage from weather or construction activities. Coordinate delivery with construction schedule to prevent loss or damage.

PART 2 - PRODUCTS

2.1 Materials

- .1 General: Vertical lift, crank rod operation for exterior application , maintenance free design.
- .2 Curtain: The Rollshutter curtain is to be made from individual rollformed aluminum profiles with an injected super-hard resin foam core and shall have a cover width of 38mm and a thickness of 9mm. Minimum aluminum gauge to be 0.62mm. Finish to be baked-on enamel with a dry film thickness of at least 0.05mm. The minimum weight per square metre to be 8.0 kg. Custom Colour to be chosen by Architects
- .3 Guide Rails: The guide rails are to be minimum 0.065" or 1.60mm gauge aluminum extrusions fitted with two noise and weather insulating strips. All guide rails must have

undergone a multiple stage pretreatment procedure and be painted with a baked-on paint. Guide rails to be acid, alkali and oil resistant. The guide rail is to be made of two snap-together parts that prevent unauthorized access to the mounting screws. Curtain penetration into the guide rail shall be at least 41mm (1 5/8") for sections less than 1.83m (72") in width and at least 66mm (2 5/8") for sections over 1.83m (72") in width.

- .5 Sills: Provide a 30mm x 47mm (1-1/8" x 1-13/16") U-shaped aluminum sill to hold the curtain securely in place when closed. Drill a minimum of four "weep" holes in the inside channel of the U-sill to allow for moisture drainage.
- .6 Panel Box Housing: Panel boxes are to be precision rollformed from 1.0 – 1.2mm (0.040" – 0.0472") aluminum with an electro-statically bonded and baked finish. Lower half of the panel box must be detachable for future servicing access. Panel box service lid to be secured with tamper-proof security screws on all panel boxes below 2.13m (7') off the ground. All panels to be delivered to jobsite covered with protective, adhesive plastic film to prevent scratching. The protective film is to be removed by installer after job completion. All panel box endplates to be manufactured by pressure die-casting procedure from high grade aluminum alloy. Endplates must be chromed and laminated with a resistant PVC surface. The panel box style to be 5-corner. Panel box sizes to suit rollshutters dimensions. Custom colour to be chosen by Architect.
- .7 Axels: Octagonal axles with motorized units to carry the imposed loadings.
- .8 Bottom Keeper: Provide a continuous heavy gauge extruded aluminum "Safe Sill" to keep the lead rail from being pulled out from the closed position. Provide notches in rear vertical leg and weep holes to bottom of sill channel to provide positive drainage from behind and within sill extrusion. Attach using stainless steel screws.
- .9 Colours: Custom chosen by Architect

2.3 Operation

- .1 The roll shutters shall be The operation shall be manual by means of a crank rod control. The rollshutter panel box housing shall incorporate a sealed, permanently lubricated worm wheel or crown & pinion gear. Each gear shall be of sufficient reduction and be equipped with a brake. Each gear shall incorporate either a bottom limit or an Anti-Blocking-System (A.B.S.) clutch. A double-jointed universal with a ball bearing base shall be connected to the gear at a downwards slope as shown on the drawings. A folding crank rod of at least 1,330mm length made of silver anodized aluminum shall be connected securely to the universal. The crank rod's turning
There shall be a wall mounting clip for crank rod storage when not in use. For curtain weights over 30kg the lifting capability of the operator shall be augmented with the addition of a shaft spring support. The combined capacities of the gear and torsion spring support shall exceed the load of the rollshutter's curtain.
- .2 Locking Devices: All rollshutters will be equipped with hanger locks constructed of corrosion resistant materials. Hanger locks are to be installed at sufficient intervals between shaft and curtain in order to prevent the curtains from being lifted by more than 40 mm (1 9/16") from the closed position, without the use of an operator. Hanger locks meet the requirements of European Standard EN 13659 and resist an upward force of 100kg (220lbs)

2.4 Ref. Product

- .1 Exterior security shutters: Safe Mini
.1 Talus Rollshutters

- .2 Architect approved alternates equivalent to specified product.

PART 3 - EXECUTION

3.1 Installation

- .1 Install shutters in accordance with manufacturer's instructions by factory approved installer.
- .2 Commencement of work of this trade shall indicate acceptance of conditions for proper and complete installation as specified. Should conditions be deemed unacceptable, notify General Contractor and Architect before proceeding.
- .3 Install shutters in accordance with manufacturer's instruction.
- .4 Adjust operable parts for correct function.

END

PART 1 — GENERAL

1.1 Documents

1. This section of the Specifications forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 Summary

1. Work shall consist of supply and installation of all labour and materials necessary for installation of glazed aluminum framed storefront framing including accessories as required and as per drawings.
 1. Included in the work is supply and installation of glazed aluminum framed doors with hardware and accessories.

1.3 Related Sections

- | | | |
|----|------------------|-------------------------|
| .1 | Section 06 10 00 | Rough Carpentry |
| .2 | Section 07 21 16 | Blanket Insulation |
| .3 | Section 07 92 00 | Joint Sealants |
| .4 | Section 08 70 00 | Finish Hardware |
| .5 | Section 09 21 16 | Gypsum Board Assemblies |

1.4 Shop Drawings

- .1 Submit shop drawings clearly indicating materials, details of heads, jambs, sills, profiles of attachment components, elevation of units, anchorage details, deflection anchors, location of isolation coating, description of components, finishes, drainage paths, expansion joints, air barrier detailing and continuity. Scale of shop drawing need to be as shown on architectural drawings or larger. Note on shop drawings all deflection provisions and all structural loads and requirements. Shop drawings shall bear the seal of the registered designing engineer.
- .3 Submit documents for applicable glazing components showing conformance to the CW class of glazing according to AAMA/WDMA/CSA 101/1.S.2/A440-08 and CSA A440S1-09, as per NBC All fenestration products shall bear a permanent marking indicating the fenestration product manufacturer's identity in a location that is visible when the product is installed. Performance ratings shall be indicated on a non-permanent label and shall include:
 - .1 Performance Grade – 30 psf
 - .1 Positive design pressure, where applicable – 1530 Pa
 - .2 Negative design pressure, where applicable – 1530 Pa
 - .3 Water penetration test pressure – 260 Pa
 - .4 The Canadian air infiltration and exfiltration level. _ 1.5 L/s*m²@75mpa
- .4 Submit documentation that the units meet the following:
 1. Max assembly U value – 0.44
 2. Max assembly SHGC - 0.40
- .5 Information and details relating to the automatic door operator is to be included. Confirm electrical requirements and provide this information to General Contractor to coordinate with Electrical Contractor.
- .6 Provide a sample for all glazing types including spandrel and samples of all aluminium profiles with selected coating and colour. Include data sheets and colour selection for all sealants used during installation.
- .7 Provide a copy of all applicable warranties of all products shown on the shop drawings with the signed and sealed shop drawings.

1.5 Systems

- .1 All systems assemblies shall conform to National Building Code requirements relating to air infiltration, water resistance, uniform load, thermal transmittance, and condensation resistance.
 1. When requested by the Consultant, provide written confirmation of the above noted requirements.
2. System members shall provide structural strength to meet required performance for installations shown.

1.6 Warranty

1. Submit manufacturers written two year warranty for all components except glazing, aluminum framed doors and automatic operator.
 1. Glazing warranty shall be 10 years for sealed insulating glass units.
 2. Glazed aluminum framed doors shall have a lifetime warranty.

1.7 Alternatives

1. Requests for approval of alternatives to the specified product to be submitted to the Consultant not less than ten days prior to closing of tender.
 1. Submit sufficient material information relating to alternative proposed to permit Consultant to make decision regarding approval.

1.8 Maintenance Data

- .1 Provide manufacturer's printed data for operating, cleaning and maintaining products provided as part of this Section.

PART 2 — PRODUCTS

2.1 Storefront System

- .3 Max 2" (50.8mm) sightline, 4 ½" depth, min ¼" thermally broken polyurethane separation to AAMA TIR-A8, centre glazed
- .3 All aluminum components shall be from a single source, finish to be to AA-M10C21A44, min .7 mils, colour selected from light bronze, medium bronze, champagne range.
- .4 Approved Alternate: Requests for alternative to the specified product to be submitted to the architect for approval 10 (ten) days prior to closing date.

2.2 Fabrication

- .1 Fabricate components per manufacturer's installation instructions.
- .2 Aluminum Extrusions: Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" (1.8 mm) wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6 alloy and temper.
 - .1 Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof
(Site verify all measurements.)
 - .2 Prepare components to receive anchor devices. Arrange fasteners and attachments to conceal from view.

2.3 Installation

- .1 Install in prepared openings plumb, level, and true to line .
- .2 Provide support and anchor in place.
- .3 Install in a bed of sealant or with joint fillers or gaskets to provide weather tight construction. Provide separation of aluminum components from adjacent non aluminum materials
- .4 Install glazing, hardware
- .5 Coordinate installation with wall flashings and other components of construction.
- .6 Clean aluminum and glazing in conformance with manufacturer's written instructions prior to Owner's acceptance.
- .7 Remove all excess materials and debris resulting from work of this Section.

PART 3 — EXECUTION

3.1 Examination

1. Site Verification of Conditions: Verify substrate is acceptable for product installation in accordance with manufacturer's instructions. Verify openings are sized to receive storefront system and sill plate is level in accordance with manufacturer's acceptable tolerances.
2. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.
3. Coordination: As required with work under related sections.

3.2 Installation

1. General: Install storefront systems plumb, level, and true to line, without warp or rack of frames with manufacturer's prescribed tolerances and installation instructions. Provide support and anchor in place.
2. Dissimilar Materials: Provide separation of aluminum materials from sources of corrosion or electrolytic action contact points.
3. Apply sealant in accordance with Section 07 92 00. Conceal sealant within aluminum work except where exposed use is permitted by Architect.

3.3 Protection and Cleaning

1. Protection: Protect installed product's finish surfaces from damage during construction. Protect aluminum storefront system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.
2. Cleaning: Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

END

PART 1 – GENERAL

1.1 Documents

- .1 This section of the specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 Section Includes

- .1 This section includes the supply only of all Finish Hardware as specified herein. Refer to section 06 20 00 Finish Carpentry for installation
- .2 Furnish labor and materials for the supply, installation, wiring, testing and commissioning of electrified hardware as specified herein.
- .3 Security access system (by owner) includes Keypads, Electric Strikes and Mag locks. Coordinate access system installation with owner as applicable.

1.3 Related Sections

- | | | |
|----|------------------|---------------------------|
| .1 | Section 06 20 00 | Finish Carpentry |
| .2 | Section 06 40 00 | Millwork |
| .3 | Section 08 11 14 | Steel Hollow Metal Frames |
| .4 | Section 08 14 29 | Prefinished Wood Doors |
| .5 | Section 08 80 00 | Glass and Glazing |

1.4 Quality Assurance

- .1 Suppliers shall have a minimum of five (5) years experience furnishing architectural hardware and with adequate equipment, maintenance and advisory facilities to fulfill contract obligations. Suppliers shall have on staff an accredited Architectural Hardware Consultant (AHC) directly responsible for supervision of this contract.
- .2 Approved Hardware Suppliers:
 1. McGregor & Thompson Hardware Ltd
 2. Shanahans
 3. Other Suppliers: Only upon written consultant acceptance of written request for approval.
- .3 Doors and hardware shall be installed by qualified trades people regularly engaged in the installation of finish hardware. Electrified hardware shall be installed by qualified trades people regularly engaged in the installation of electrified door hardware. Installers shall have a minimum of five (5) years documented experience in the installation of hardware of the type required for the Work. If requested provide a written statement outlining installers experience and provide a demonstration of said qualifications to the satisfaction of the Owners representative prior to commencing work.
- .4 The General Contractor is responsible to insure all of the electrical requirements for power, conduits, junction boxes etc. have been included in the electrical scope of the electrician for door power or security requirements.

1.5 References

- .1 This document has been prepared with terms and references to the publications or associations listed herein.
 - .1 AWMAC (Architectural Woodwork Manufacturers Association)
 - .2 BHMA (Builders Hardware Manufacturers Ass'n) A156 Series

.3	CSDFMA	(Canadian Steel Door and Frame Manufacturers Assoc.)
.4	DHI	(Door and Hardware Institute) – A115 Series
.5	NFPA 80	Fire Doors, Fire Windows
.6	NFPA 101	Life Safety Code
.7	NFPA 252	Fire Tests of Door Assemblies
.8	UL 10B	Fire Tests of Door Assemblies
.9	UL 305	Panic Hardware

1.6 Submittals

- .1 Submit shop drawings and samples in accordance with Section 01 33 00 - Submittals General Conditions and Contract Documents.
- .2 Submit outline of hardware to be provided for reach door, indicate the manufacturer and finish. Provide catalogue cut for each different item.
- .3 Bid only those products specified, or for purposes of tendering, products listed as equivalents. No other products will be considered.
- .4 Make a detailed review of the included Schedule of Finish Hardware and make whatever allowance in tender price appropriate to accommodate changes which may be necessary.
- .5 Persons responsible for scheduling, detailing ordering a coordinating hardware for this project shall be a Certified Architectural Hardware Consultants (AHC) participating in the Continuing Education Seal Program and members in good standing with the Door and Hardware Institute (DHI).

1.7 Maintenance Data

- .1 Provide Operations and Maintenance data for finish hardware for incorporation in the manual specified in Section 01 33 00 – Submittals.

1.8 Maintenance Materials

- .1 Supply three (3) wrenches for door closer, locksets and fire exit hardware.

1.9 Delivery, Storage And Handling

- .1 Deliver all hardware in manufacturers original packages. Each item shall be clearly tagged with the item number for which it is intended.
- .2 General Contractor to provide suitable secure storage space with shelving for storing hardware. The space shall be a locked, clean, dry and shall be well illuminated. Prior to installation sort hardware on shelving provided and confirm that all hardware delivered is accounted for.
- .3 If requested, deliver hardware for aluminum doors to door supplier in ample time to allow for completion of work in accordance with construction schedule.

1.10 Sequencing And Coordination

- .1 Confer with various sections of work and refer to detail drawings prior to ordering hardware to ensure that they will conform to and fit actual conditions on site. Refer to door schedule for correct sizing of all hardware. The contractor is required to ensure the electrical sub-contractor has reviewed all door specifications and schedules
- .2 Coordinate hardware with aluminum, metal, and wood door manufacturers to ensure correct door and frame preparation. Provide templates and any required preparation instructions to applicable trades. Provide instruction and technical assistance for the application, location and installation of all hardware.

- .3 All electrified hardware applications and products specified herein have been selected to allow for all available options and flexible functionality and therefore the exact operation is deemed to be a site configurable variable for hook-up. It will be the responsibility of this contractor to determine the exact functionality and operational requirement for all electrified hardware as well as the exact requirements for interface to related systems prior to commencing work. This work will include reviewing all applications and potential operational characteristics with the Owner to confirm desired functions. Revise all support documentation to accurately reflect the actual requirements and coordinate all revised conduit and back box requirements with Division 16.
- .4 Coordinate final conduit system design, device locations, and electrical service allocations and requirements. Division 16 contractor shall be responsible for installation of all conduit, back boxes, junction boxes, device boxes, and terminal panels to provide a complete conduit system. Provide all manufactured system specific enclosures to Division 16 contractor for installation as part of the conduit system. Industry standard device and junction boxes shall be provided by Division 16 contractor. Substantial corrosion resistant pull strings to be installed in all conduit runs.
- .5 Coordinate power and fire system interface with Division 16 Contractor. Fire system to provide release of all electromagnetically locked doors. All system components shall be connected to emergency powered circuits if available. Division 16 shall provide 120VAC power and fire system interface to all designated power supply locations.

1.11 Warranty

- .1 All products shall be guaranteed against defects in design, workmanship, materials, and finishes. Warranty periods shall commence from date of Substantial Performance. Any defects will be made good by the manufacture at not additional cost to the owner.

.1	Finish Hardware not listed below	One (1) Year
.2	Exit Devices	Three (3) Years
.3	Door Closers	Ten (10) Years
.4	Locks	Seven (7) Years

PART 2 - PRODUCTS

- .1 Specified products have been selected to establish a minimum requirement for design, finish, operation and functionality and have been proven to be compatible with systems or products specified in other sections. Approval for alternate products or systems may be granted provided that quality and functional criteria has been retained, and submissions are executed in accordance with General Conditions. Be responsible for costs incurred by other trades where an alternate product or system is not compatible with products or systems specified in other sections.
- .2 All like products shall be of one manufacture.

2.1 Specified Manufacturers

- .1 The manufacturers listed herein have been used in the preparation of this document.

.1	Hinges	Stanley
.2	Locksets, Cylinders	Schlage
.3	Exit Devices	Von Duprin
.4	Door Closers	LCN
.5	O/H Stops and Holders	Glynn Johnson
.6	Floor and Stops	Gallery
.7	Push, Pulls and Door Protection	Gallery

.8 Thresholds and Seals

Draftseal

2.2 Materials And Fasteners

- .1 Furnish hardware with all necessary fasteners, mounting brackets, and special tools required for the proper installation as recommended by the manufacturer.
- .2 Provide machine screws and lead anchors for floor stops toggle bolts for wall stops. Provide sex bolts or through bolts where required on rated mineral core doors. Provide wall stops in lieu of floor stops wherever possible.
- .3 All flatware shall be .050" Type 304 satin stainless steel with radius corners, and fastened with self tapping sheet metal screws or wood screws. Generally protective plates on single doors shall be 50mm less than door width on push side and 25mm less than door width on pull side. Plates on pairs of doors shall be 25mm less than door width on both sides.
- .4 Provide 114 x 101mm butts for doors up to 950mm and 127 x 101mm butts for doors over 950mm wide. Provide 3 butts per leaf for doors up to 2200mm in height and one additional butt for each additional 600mm in door height. Exterior out swinging doors shall have non removable pins.
- .5 All locksets and exit devices shall be provided with Rhodes or 06 lever design.
- .6 Mounting screws for electromagnetic locks shall be machine thread type secured to a reinforced door frame and covered with flush fitting security plugs. Armature strike shall be fastened with 25mm diameter mushroom head case hardened sex bolt and an insulating washer shall isolate the strike armature from the door assembly.

2.3 Finishes

- .1 Finishes shall be as listed herein except where noted otherwise.

.1	Butts	BHMA 630	Satin Chromium Plated
.2	Cylinders	BHMA 626	Satin Chromium Plated
.3	Locksets	BHMA 626	Satin Chromium Plated
.4	Exit Devices	BHMA 628	Satin Aluminum Lacquer
.5	Door Closers	BHMA 689	Satin Aluminum Lacquer
.6	O/H Stops, Holders	BHMA 652	Satin Chromium Plated
.7	Flush Bolts	BHMA 626	Satin Chromium Plated
.8	Floor, Wall Stops	BHMA 626	Satin Chromium Plated
.9	Flatware, Pulls	BHMA 630	Satin Stainless Steel
.10	Thresholds		Anodized Aluminum

2.4 Keying System

- .1 All hardware cylinders to match existing Interface renovations, confirm existing Schlage keyway prior to ordering locks and cylinders.
- .2 Provide: (4) Master Keys per Master
(2) Change Keys per Cylinder

2.5 Power Supplies

- .1 Power supplies shall be CSA approved and provide 1.5 ampere output @ 24VDC. Power supplies shall contain integral battery charging Power Supplies shall not be loaded to more than 75% capacity when all devices are in operation and under full load. All power supplies shall be connected to the fire alarm system for emergency release

PART 3 - EXECUTION

3.1 Inspection

- .1 Verify that flex conduit and electrical boxes for conduit termination have been applied prior to installing doors and frames. Verify that frames have been installed plumb and within tolerances as set out in DHI document "Installation of Commercial Steel Doors and Frames".
- .2 Verify that all hardware has been installed according to the approved hardware schedule and manufacturers instructions, and ensure correct operation.
- .3 Verify that all conduit, back boxes, junction boxes, device boxes, and terminal panels have been installed where required prior to commencing work.
- .4 Test all electrical hardware and monitoring devices to ensure correct operation and outputs. Verify that all electromagnetic locks and holders release as required during fire system test.
- .5 Provide verification list to Consultant that openings are ready for inspection and verification when all work is complete and opening is operational in every way including control inputs and monitoring outputs.

3.2 Installation

- .1 Install hardware in accordance with approved hardware schedule, manufacturers installation instructions, and DHI document "Installation Guide for Doors and Hardware". Install hardware to the degree of opening as listed in the approved hardware schedule.
- .3 Template and install O/H stops and holders to the required degree of opening to protect exposed trim from contacting other surfaces.
- .4 Install adhesive fastened materials on a clean dry surface. Ensure that gasketing does not interfere with closing or latching of door assemblies.
- .5 Install wall stops to contact levers or pulls where they protrude from the door. Where push plates and pulls are mounted back to back, through bolts for pulls shall be countersunk and plates shall cover bolt heads.
- .6 Size all universal closers to suit site conditions and in accordance with barrier free accessibility code.
- .7 If shimming is necessary use only approved corrosive resistant metal shims. Organic materials are not acceptable.
- .8 All electrical hardware at each door assembly shall be installed by this section and connected to the associated hardware controller and shall be made fully operational.
- .9 All wiring for system from the hardware controllers controllers to the door devices shall be supplied, installed, and terminated by this section. All wiring shall be installed in conduit.
- .10 All wiring shall be terminated in terminal strips or blocks and neatly installed, laced tagged where required. Connections to terminal blocks shall be made with solderless connectors with separate terminal for each conductor. All wiring shall be clearly labeled.

3.3 Adjusting And Cleaning

- .1 Adjust all hardware as required to ensure correct operation. Make final adjustment to door closers after HVAC system has been balanced.
- .2 Clean and polish all hardware and replace any item that is scratched, marred, or damaged. If paint is to be removed from an exposed finish, use only cleaning solutions that will not remove the protective coatings.

3.4 Protection And Maintenance

- .1 Be responsible for protective treatment and other precautions required to ensure that door, frame and hardware components will be without damage until completion of the Project.

3.5 Hardware Sets

See attached Hardware Schedule for all hardware sets.

***END ***

PART 1 - GENERAL

1.1 Documents

1. This section of the Specifications forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 Section Includes

1. Supply and installation of all glazing and mirrors indicated on the drawings, as scheduled and as specified herein (including demountable office partition system glazing).
3. Caulking of joints between frames and other building components.

1.3 Related Sections

- | | | |
|----|------------------|-----------------------------|
| 1. | Section 08 11 13 | Steel Hollow Metal Doors |
| 2. | Section 08 14 29 | Prefinished Wood Doors |
| 3. | Section 08 43 13 | Aluminum Framed Storefronts |

1.4 References

- .1 CAN/CGSB-122.-M90: Tempered or laminated safety glass.
- .2 CAN/CGSB-123.-M91: Flat, clear float glass.
- .3 CAN/CGSB-128.-M90: Insulating glass units.
- .4 NBC 2012, Part 4, 9 & Appendix A.

1.5 Performance Requirements

- .1 Provide glass and glazing materials for continuity of building enclosure vapour retarder and air barrier:
 - .1 In conjunction with materials described in Section 07 92 00 Joint Sealants.
 - .2 To utilize the inner pane of multiple pane sealed units for the continuity of the air barrier and vapour retarder seal.
 - .3 To maintain a continuous air barrier and vapour retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

1.6 Warranty

- .1 Provide a ten (10) year warranty to include coverage for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.
- .2 Provide a ten (10) year warranty to include coverage for delamination of laminated glass and replacement of same.

1.7 Submittals

- .1 Section 01 33 00: Submittals.
- .2 Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
- .3 Shop Drawings:
 - .1 Prepare Glazing Shop Drawings in conjunction with aluminum framed glazing under direct supervision of a Professional Registered Engineer experienced in design of this work and licensed at the place where the Project is located.
- .6 Samples: Submit two (2) samples

1.7 Quality Assurance

- .1 Perform Work in accordance with GANA Glazing Manual for glazing installation methods
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
- .3 Installer Qualifications: Company specializing in performing the Work of this section with minimum three (3) years documented experience.

1.8 Environmental Requirements

- .1 Do not install glazing when ambient temperature is less than 10 degrees C (50 degrees F).
- .2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

PART 2 - PRODUCTS

2.1 Glass Materials

- .1 Glass thickness shall be determined by size of glazed openings and conforming to the wind load requirements of NBC 2012.
- .2 Float Glass: to CAN2-12.3-M91+Amdt-Jan-80, glazing quality.
- .3 Tempered safety glass to CAN/CGSB-12.1-M90, clear.

2.2 Glass Assemblies

- .1 Storefront: Exterior lite of 6mm low E (#2 surface), interior lite of 6mm glass, tempered (where required to code) with 12.7mm aluminum spacer.
 - .1 Visible light transmittance: min 75%.
 - .3 U-Value (imperial): max 0.26-Summer daytime.
 - .4 Solar heat gain coefficient (SHGC): max 0.27.
 - .5 Light to Solar Gain (LSG) ratio: 2.37
- .2 Mirrors: Minimum 6mm laminated glass mirrors as noted on Interior Design drawings. Refer to Interior Design drawings for mirror frames and accessories.

2.2 Glazing and Sealing Compound Material

1. Sealant Compound: One component silicone rubber, to Materials CAN2-191.3-M90, gun grade, colour selected by Architect.
2. Sealant Compound: Multi-component, chemical curing, to CAN2-192.4-M-90, Type 2, Class A, colour selected by Architect.
3. Glazing Tape: Preformed butyl tape, 10-15 durometer hardness, paper release, black colour. Thickness and width to suit glazing methods.
4. Setting Blocks: Neoprene, Shore A durometer hardness 80, 100 mm long x 6 mm thick x width to suit glass thickness.
5. Spacer shims: Neoprene, Shore A durometer hardness 80, 75 mm long x 24 mm thick x 10 mm high.
6. Primer-Sealers and Cleaners: To glass manufacturer's standard.

PART 3 - EXECUTION

3.1 Installation

1. Commencement of work of this trade shall indicate acceptance of conditions for proper and complete installation as specified. Should conditions be deemed unacceptable, notify General Contractor and Architect before proceeding.

3.2 Workmanship

1. Remove protective coatings and clean contact surfaces with solvent and wipe dry.
2. Apply primer-sealer to contact surfaces.
3. Place setting blocks as per manufacturer's instructions.
4. Install glass, rest on setting blocks; ensure full contact and adhesion at perimeter.
5. Provide edge clearance of 3 mm minimum.
6. Use tape/tape method for interior single glazing.

3.3 Finishing

1. Immediately remove sealant and compound droppings from finished surfaces. Remove labels after work is completed.

END

PART 1 – GENERAL

1.1 Summary

- .1 This Section of the Specifications forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 Section Includes

- .1 Work of this section includes:
 - .1 Supply and installation of gypsum wallboard as indicated, scheduled and specified herein.
 - .2 Sealing of perimeter joints within gypsum wallboard, sound rated partitions.
 - .3 Supply and installation of suspended ceilings, steel furring for gypsum wallboard finishes, and associated accessories, as indicated, as scheduled and as specified.
 - .4 Installation of access panels in gypsum wallboard partitions.

1.3 Related Sections

- | | | |
|----|--------------------|-------------------------|
| .1 | Section 06 20 00 | Finish Carpentry |
| .2 | Section 07 21 16 | Blanket Insulation |
| .3 | Section 07 84 00 | Fire Stopping |
| .4 | Section 07 92 00 | Joint Sealants |
| .5 | Section 09 90 90 | Painting |
| .6 | Division 15 and 16 | Supply of access panels |

1.4 Quality Assurance

- .1 Section 9.6 - Gypsum Wallboard of the Association of Wall and Ceiling Contractors (A.W.C.C.) Specification Standards Manual, together with authorized additions and amendments, shall be used as a reference standard and shall form part of this project specification.
- .2 Where modifications to the standards contained within the A.W.C.C. Specification Standards Manual are included in this project specification, then such modifications shall govern in case of conflict.
- .3 The installer of gypsum wallboard and ceiling suspension members and furring shall keep a copy of Section 9.6 - Gypsum Wallboard of the A.W.C.C. Specification Standards Manual available at the project site for reference purposes.
- .4 All gypsum wallboard products, ceiling suspension members, furring and accessories to be used in the project shall meet or exceed the requirements specified under Part 2 - Products of Section 9.6 and Section 9.7 of the A.W.C.C. Specification Standards Manual. The proposed product manufacturer shall provide the Architect, if requested, with satisfactory evidence indicating conformance of his products with the requirements specified in the A.W.C.C. Specification Standards Manual. Any product failing to meet those requirements will be rejected by the Architect.
- .5 Reference in these project specifications to Section Numbers, Parts and Item Numbers means those Section, Parts and Items contained within Section 9.6 of the A.W.C.C. Specification Standards Manual.
- .6 Application must conform to CSA A823.1-M1980.

1.5 Product Delivery, Storage and Handling

- .1 Deliver and store materials undamaged in original wrapping or containers, with manufacturer's labels intact.
- .2 Prevent damage to materials during handling and storage. Keep gypsum wallboard, and cementitious materials under cover and free from dampness.

1.6 Job Conditions

- .1 Ensure temperature and ventilation conditions are maintained as required under Section 9.6 - Part 3, Item 2.
- .2 Protect work of other sections from damage resulting from work of this section.
- .3 Take necessary protection to avoid spattering of surfaces adjacent to gypsum wallboard areas, particularly aluminum and glass. Dropping from this work shall be promptly removed.
- .4 Examine the underlying visible surfaces and adjoining work and report defects at time of installation which might impair the gypsum wallboard to the Contractor and Architect in writing.

PART 2 - PRODUCTS

2.1 Materials

- .1 Gypsum board products, materials and accessories shall conform to A.W.C.C., Section 9.6, Part 2 and as follows:

2.2 Gypsum Wallboard

- .1 Type "X": shall conform to Section 9.6 - Part 2, Item 1.2. Thickness as noted on drawings.
- .2 Use Moisture resistant gypsum for all walls within 2m of a faucet or sink.

2.3 Backer Boards

- .1 Description: Fire resistant, heat-cured, acrylic surface on tile application side, inorganic glass mats embedded into both sides of moisture resistant core, or fibreglass matting & cement.
- .2 Edges: solid, straight.
- .3 Accessories: G-P DWS shield or fibreglass tape, stainless fasteners and tile mastic for joint filler.
- .4 Product: Dens Shield Fireguard Type X, 15.9 mm thick Tile Backer or Cement Board.

2.5 Drywall Screws

- .1 Shall conform to Section 9.6- Part 2, Item 21.1 except where the tile backer is used, in which case stainless steel is required.

2.6 Joint Treatment Materials

- .1 Shall conform to Section 9.6 - Part 2, Item 2.2.

2.7 Accessories

- .1 Corner beads shall conform to Section 9.6 - Part 2, Item 3.1 and 3.2 or 3.3 or 3.4.
- .2 Provide PVC shadow molding at reveals where noted on drawings.

2.8 Furring Members

- .1 Drywall Furring Screw Channels shall conform to Section 9.6 - Part 2, Item 4.1.
- .2 Drywall Resilient Channels shall conform to Section 9.6 - Part 2, Item 4.2. A Reference Manufacturer: Mantane by Bailey Metal Products OR approved equal signed off by Parks Representative.
- .3 Z Bars shall conform to Section 9.6 - Part 2, Item 4.3.

2.9 Ceiling Suspension Members

- .1 Drywall Furring Channels shall conform to Section 9.7 - Part 2, Item 4.
- .2 Ceiling suspension members, hangers and tie wires shall conform to Section 9.7 - Part 2, Item 4.

PART 3 - EXECUTION

3.1 Installation

- .1 Commencement of work of this trade shall indicate acceptance of conditions for proper and complete installation as specified. Should conditions be deemed unacceptable, notify General Contractor and Architect before proceeding.

3.2 Workmanship

- .1 As required by Section 9.6 - Part 2, Item 1 and Section 9.7 Part 3, Item 2.

3.3 General Application

- .1 Apply gypsum wallboard in accordance with Section 9.6 - Part 2, Item 3.

3.4 Maximum Spacing of Supports

- .1 Maximum spacing of supports for gypsum wallboard shall be as required by Table 9.5/1 and in accordance with Section 9.6 - Part 3, Item 4

3.5 Screw Channel Wall Furring

- .1 Apply gypsum wallboard screw channel wall furring to surfaces as indicated in accordance with Section 9.6 - Part 3, Item 5.

3.6 Single Layer Application

- .1 Apply single layer gypsum board using screw fasteners in accordance with Section 9.6 - Part 3, Item 6.

3.7 Corner Beads

- .1 Install corner beads on all external and internal angles in accordance with Section 9.6 - Part 3, Item 11.1.

3.8 Casing Beads and Miscellaneous Trim

- .1 Install casing beads and miscellaneous trim to all openings and at junction with dissimilar materials in accordance with Section 9.6 - Part 3, Item 11.2.

3.9 Finish/Joint Treatment

- .1 Finish gypsum wallboard in accordance with Section 9.6 - Part 3, Item 12.2, Level of finish: Level 4.
- .2 Seal joints between sound rated partitions and adjoining construction with acoustical sealant in joint locations.
- .3 Extrude a full 3/8" diameter bead into joint between first layer of wallboard and floor and other adjoining surfaces to effectively block airborne sound transmission.
- .4 Fill joints around penetrations in sound rated partitions with fibre insulation.

3.10 Acoustical Sealant

- .1 Seal joints between sound rated partitions and adjoining construction with acoustical sealant in joint locations to provide minimum sound resistance of 50 STC.

- .2 Extrude a full 9 mm (3/8") diameter bead into joint between first layer of wallboard and floor and other adjoining surfaces to effectively block airborne sound transmission.
- .3 Fill joints around penetrations in sound rated partitions with acoustical batt insulation.
- .4 Seal joints in all party/demising walls.

3.11 Acoustical Insulation

- 1. Install batt insulation, as specified in Section 07 21 16, between studs in sound rated partitions as scheduled. Insulation shall fit tightly between studs and be installed full height of partition.

3.12 Cutting & Fit

- .1 Include all cutting and fitting of gypsum wallboard to accommodate recessed items in partitions and/or furring including, but not necessarily limited to, mechanical and electrical equipment and other recessed fixtures as indicated or required.

3.13 Patching & Pointing

- .1 Point up and patch gypsum wallboard; point up and around trim and other set work and leave work complete and perfect.

3.14 Clean Up

- .1 Clean up rubbish due to gypsum wallboard operations daily and keep the site and premises in clean and acceptable condition at all times.

END

PART 1 - GENERAL

1.1 Summary

- .1 This Section of the Specifications forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 Section Includes

- .1 Supply and installation of tile including accessories over existing concrete suspended slab, new and existing walls:
 - .1 Floor tile
 - .2 Wall tile

1.3 Related Sections

- .2 Section 07 92 00 Joint Sealants
- .3 Section 09 21 16 Gypsum Board Assemblies

1.4 References

- .1 American National Standards Institute.
 - .1 ANSI A118.1-1992: Dry-Set Portland Cement.
 - .2 ANSI A118.2-1992: Conductive Dry-Set Portland Cement Mortar.
 - .3 ANSI A118.3-1992: Water Cleanable Tile Setting and Grouting Epoxy.
 - .4 ANSI A118.4-1992: Latex-Portland Cement Mortar.
 - .5 ANSI A118.5-1992: Furan Mortars and Grouts.
 - .6 ANSI A118.6-1992: Ceramic Tile Grouts.
 - .7 ANSI A118.8-1992: Modified Epoxy Emulsion Mortar/Grout.
 - .8 ANSI A118.9-1992: Cementitious Backer Units (CBU).
- .2 Canadian General Standard Board
 - .1 CAN/CGSB-25.20-95: Surface Sealer for Floors.
 - .2 CAN/CGSB-51.34-M86: Vapour Barrier, Polyethylene Film for Use in Building Construction.
 - .3 CAN/CGSB-75.1-M88: Tile, Ceramic.
- .3 Terrazzo Tile & Marble Association of Canada
 - .1 Terrazzo Tile & Marble Association of Canada (TTMAC): Tile Specification Guide.
 - .2 Terrazzo, Tile and Marble Association of Canada 2000 Maintenance Guide.

1.5 Samples

- .1 Submit samples to requirements of Section 01340.
- .2 Samples: 300 x 300 mm size panel c/w approved grout colour; mounted to a 19 mm thick plywood backer.

1.6 Submittals

- .1 Submit 2 copies of TTMAC Maintenance Guide for inclusion in the operations and maintenance manual prepared and submitted in Section 01730. Give specific warning of any maintenance practice or materials that may damage or disfigure the finished work.
- .2 Submit product data and WHMIS MSDS sheets for floor sealer products.
- .3 Where more than one manufacturer's products are part of a single tile assembly, arrange for each manufacturer to submit a written statement of compatibility with respect to the other manufacturers' materials.

1.7 Quality Assurance

- .1 Installer: employ skilled installers trained and experienced in tile work, company must be registered as members in good standing with the Terrazzo, Tile and Marble Association of Canada, with a minimum of two years proven experience. If requested by Consultant, submit a listing of at least three previously completed projects of similar size and scope.
- .2 Supplier: a member in good standing with the Terrazzo, Tile and Marble Association of Canada, providing materials meeting the minimum standards of TTMAC.

1.8 Environmental Conditions

- .1 Do not install tiles at temperatures less than 12 degrees C or above 38 degrees C.
- .2 Maintain temperatures at or above 12 degrees C until cementitious materials have fully cured.
- .3 Do not apply epoxy mortar & grouts at temperatures below 15 degrees or above 25 degrees C.

1.9 Delivery Storage and Handling

- .1 Store materials in a dry area, protected from freezing, staining and damage.
- .2 Store cementitious materials on a dry surface.

1.10 Extra Materials

- .1 Provide extra stock to requirements of Section 01 33 00 Submittals
- .2 Package tile products neatly in original containers, to prevent damage.
- .3 Provide 2% reserve replacement material stored on site where directed by owner.

PART 2 - PRODUCTS

2.1 Tile Materials

.1 Floor Tile

1. Product: through colour rectified porcelain tile
2. Size: 12" x 24", 6 mohs, max water absorption 0.05%, min PEI 4
3. Install in pattern as described in drawings and details.
4. Colour as described in drawings and details.
5. Grout: Single component, sanded commercial grout with advanced polymers with inorganic fillers and pigments. Meets A118.7 and A118.3. Stain proof, does not require additional sealers. Architect to choose from standard range of colours.
6. Alternates: To be considered upon receipt of complete written submission.

2.3 Accessories

- .1 Electric heating mats to be a preformed, max 1/8" thick, with a 25 yr warranty. Provide a GFCI protection. Produce 12 watts or 41 BTU per square foot. Consist of 21.5 – 31 awg insulated resistance wire attached to a porous nylon polyester blended fabric.
- .2 Electric Thermostat Controls:
 1. Programmable control features
 2. Controllable temperature

3. Four programs per day
4. Floor sensor of thermo-coupler that ensures the power cycles, once time reaches temperature.
5. Built in GFCI
- .2 Cleavage Membrane: 6-mil thick polyethylene film, to CAN/CGSB-51.34-M.
- .3 Latex Additive: formulated for use in Portland cement mortars and grouts.
- .4 Organic Adhesive: to ANSI A136.1, Type 1 or 2; as recommended by tile manufacturer.
- .5 Water: Potable, clean and free of chemicals and contaminants detrimental to mortar or grout.
- .6 Thresholds, Transition & Reducer Strips: Schluter Reno-TK-AETK 100 (and as per details).
- .7 Joint Sealant: As specified under Section 07 92 00.
- .8 Sealer: to CAN/CGSB-25.20, Type 1 or 2; as recommended by tile manufacturer.

PART 3 - EXECUTION

3.1 Examination

- .1 Verify existing conditions are ready to receive work. Level floors in accordance with TTMAC standards with a cementitious based leveler.
- .2 Ensure substrate surfaces are clean, dimensionally stable, cured and free of contaminants such as oil, sealers and curing compounds.
- .3 Ensure concrete floors scheduled to receive thin-set applied tile or cleavage membranes are steel troweled to a fine finish.
- .5 Notify Consultant in writing of unacceptable substrate conditions. Beginning of installation implies the trade acceptance of existing conditions.

3.2 Preparation

- .1 Protect surrounding work from damage or disfiguration.
- .2 Thoroughly clean existing surfaces, which are to receive tile finish, to ensure the removal of all grease, oil or dust film.
- .3 Apply a latex cementitious leveling coat wherever a slight substrate irregularity exists. Limit leveling coat thickness to less than 8 mm where thin-set tile methods are to be used. A leveling coat in excess of 8 mm shall be set with a mortar bed method.

3.3 Application

- .1 Install materials to requirements of TTMAC Tile Specification Guide, as scheduled below.
- .2 Fit tile units around corners, fitments, fixtures, drains and other built-in objects to maintain uniform joint appearance.
- .3 Make cut edges smooth, even and free from chipping. Do not split tile.
- .4 Lay out tiles according to drawings and patterns so that perimeter and all cut tiles are no less than half size.

- .5 Prior to installation ensure that the back of each tile is free of contaminants.
- .6 For tile with raised or textured backs, bonding material must be pressed into the back of the tile to ensure a minimum of 95% coverage. Set tile in place while bond coat is wet and tacky, prior to skinning over. Notch bond coat in horizontal straight lines and set on the freshly set bonding material while moving (sliding) tile back and forth at 90° to the notches. Ensure corner and edges are fully supported by bonding material. Avoid lippage.
- .7 Clean excess bonding material from surface prior to final set.
- .8 Sound tiles after setting materials have cured; replace hollow sounding tile before grouting.
- .9 For interior tile installation a minimum of 90% bond coverage is required.
- .10 Protect exposed edges of floor tile with appropriately sized transition strips. Provide reducer strips where uneven transitions between 6 mm and 12.5 mm occur.
- .11 Do not install tile floors over membrane until the membrane has been tested and accepted. To confirm the proper power consumption of your mat, perform the resistance test. Ensure that the resistance reading is within the range of plus 10% to minus 5% of the resistance rating listed on the mat tag.
- .12 To confirm that there is no short to ground in the mat, perform the insulation test. Mark test results on warranty card and ensure they match manufacturer's recorded information on the mat tag.

3.4 Grouting

- .1 Allow proper setting time prior to grouting.
- .2 Pre-seal tiles requiring protection from grout staining.
- .3 Force grout into joints to ensure dense finish.
- .4 Remove excess and polish with clean cloths.

3.5 Field Quality Control

- .1 Inspect completed work and replace broken, cracked, hollow sounding or damaged tile.

3.6 Tolerances

- .1 Set and level tile flush with adjacent tile

3.7 Cleaning

- .1 Apply floor sealer in accordance with manufacturer's instructions.

3.8 Protection

- .1 Protect finished areas from traffic until setting materials have sufficiently cured. Refer to TTMAC Tile Specification Guide 09300/2000.
- .2 Protect grouted areas from traffic for 24 hours after grouting.
- .3 Provide protective covering until Substantial Performance of the Work.
- .4 Protect tiles and bases from impact, vibration, heavy hammering on adjacent and opposite walls for at least 14 days after installation.

END

PART 1 - GENERAL

1.1 Summary

- .1 This Section of the Specifications forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 Section Includes

- .1 Preparation of substrate, supply and installation of rubber base to locations as indicated on drawings.

1.3 Related Work

- | | | |
|----|------------------|-------------------------|
| .1 | Section 06 10 00 | Rough Carpentry |
| .2 | Section 06 40 00 | Architectural Woodwork |
| .2 | Section 09 21 16 | Gypsum Board Assemblies |

1.4 Submittals

- .1 Samples
 - .1 In accordance with Section 01 33 00 Submittals.
 - .2 Minimum 300mm long size samples of base, and accessory components. With full sized samples, submit smaller sized samples indicating full colour range available for each item.
 - .3 Installation instructions and data sheets on adhesives.

1.5 Warranty

- .1 Submit Manufacturer's 10 Year Warrantee with the Installer's Warranty.

1.6 Maintenance Data

- .1 Provide maintenance data for incorporation into manual specified in 01 33 00 Submittals.

1.7 Maintenance Materials

- .1 Provide maintenance materials of resilient base and accessory components and adhesive in accordance with 01 33 00 Submittals.
- .2 Provide 5% of each colour of base material required for project for maintenance use.
- .3 Extra materials to be from same production run as installed materials.
- .4 Clearly identify each container of floor tile and each container of adhesive.
- .5 Store on site where directed by Architect.

1.8 Jobsite Mock-up

- .1 Prepare in accordance with 01 33 00 Submittals.
- .2

1.9 Environmental Requirements

- .1 Do not commence with installation until painting and finishing work is complete and all overhead work has been tested and approved.
- .2 Do not commence with installation until air and substrate temperatures are adequate for proper installation of flooring. Verify moisture content of substrates is acceptable for proper installation.
- .3 Do not commence with installation until lighting is at a level adequate for proper installation of flooring.

- .4 Ensure sufficient ventilation is provided to properly dry substrates, to allow proper curing of adhesives.
- .5 Maintain room temperature between minimum 20°C and maximum 25°C during application and until flooring adhesives have adequately cured, as recommended by manufacturer.

PART 2 – PRODUCTS

2.1 Resilient Base

- .1 25 mm thick x 102 mm high white square cellular PVC vinyl.
- .2 To be installed to all wall and built in joinery bases.

PART 3 – EXECUTION

3.1 Protection

- .1 Protect adjacent work and surfaces from damage and soiling. Clean and repair damage caused due to lack of protection.

3.2 Preparation

- .1 Clean and wash floor surfaces designated to receive base and accessory components.
- .2 Remove soil, dust, grease, paint, oil, curing compounds, loose and flaky material, and any other matter, which would affect quality of adhesive bond and quality of installation.

3.3 Installation

- .1 Install in accordance with manufacturer's directions. Only use adhesives recommended and approved by manufacturers.
- .2 Distribute variations in shade or pattern of production runs to obtain a uniform effect. Abrupt variations will not be accepted.
- .3 Caulk all gaps between base and wall or floor.

3.4 Cleaning

- .1 Remove excess adhesive from surfaces, without causing damage to finishes.
- .2 Prior to completion of work, clean surfaces to flooring manufacturer's written instructions.

END

PART 1 - GENERAL

1.1 Summary

- .1 This Section of the Specifications forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts. The Contractor is required to review and fully understand all of the requirements, including the requirements noted in the MPI Manual for each Sub-Contractor including preparation, priming, and construction sequencing to allow for all painting.

1.2 Requirements Included

- .1 All labour materials, tools & other equipment, services & supervision required to complete all interior & exterior painting & decorating work as scheduled and to full extent of drawings & specifications.

1.3 Related Work

- | | | |
|----|--------------------------|------------------|
| .1 | Rough Carpentry | Section 06 10 00 |
| .2 | Finish Carpentry | Section 06 20 00 |
| .3 | Steel Hollow Metal Doors | Section 08 11 13 |
| .5 | Prefinished Wood Doors | Section 08 14 29 |
| .6 | Gypsum Board Assemblies | Section 09 21 16 |
| .8 | Mechanical | Division 15 |
| .9 | Electrical | Division 16 |

1.4 Environmental Requirements

- .1 Conform to requirements of MPI.
- .2 Do not apply paint finish in areas where dust is being generated.

1.5 Reference Standard

- .1 Master Painters Institute (MPI) Architectural Painting Specification Manual, latest edition.

1.6 Warranty

- .1 All painting must be completed and included in a installers two (2) Year Guarantee.

1.6 Jobsite Mock-up

- .1 Prepare in accordance with Section 01 33 00.
- .2 Finish one complete room or area designated by Architect, using specified colour scheme, to serve as a mock-up.
- .3 Notify Architect at least 24 hours in advance for review of mock-up.
- .4 Mock-ups will be reviewed by Architect to conformance with specified requirements. Make changes to installation methods and procedures that may be recommended by Architect.
- .6 Mock-ups may be considered part of Work, provided it meets approval of Architect and establish minimum standard of quality and workmanship expected for painting work.

PART 2 - PRODUCTS

2.1 Materials

- .1 Products, in accordance with the MPI Manual

- .2 Must be Environment Canada tested and approved showing the three dove / maple leaf emblem on the label. Reference product is Benjamin Moore.
- .3 Alternate Paint Manufacture's will only be accepted on written pre-approval. Alternate painting paint materials to be from a single manufacturer.

2.2 Colours

- .1 Colours are noted on drawings.
- .2 Consultant will review and reconfirm Colour Schedule after contract award. Submit samples of proposed Colour Schedule to Consultant for approval.
- .3 Selection of colours will be from the manufacturer's full range of colours.

PART 3 - EXECUTION

3.1 Preparation of Surfaces

- .1 Prepare surfaces to receive paint as per recommendations contained in the MPI Manual.

3.2 Installation

- .1 Commencement of work of this trade shall indicate acceptance of conditions for proper and complete installation as specified. Should conditions be deemed unacceptable, notify Contractor and Architect before proceeding.

General

3.3 Application

- .1 Consult MPDA Manual to determine the exact procedures for preparation of surfaces, priming and application of successive coats..
- .2 Sand and dust between each coat to remove defects visible from a distance up to 1.5m.
- .3 Finish bottoms, edges, top and cutouts of doors after fitting as specified for door surfaces.
- .4 Finish projecting ledges; above and below sight lines as specified for surrounding surfaces.

3.4 Mechanical and Electrical Equipment

- .1 Paint exposed conduits, piping, hangers, ductwork and other mechanical and electric equipment. Colour and texture to match adjacent surfaces, except as noted otherwise.
- .2 Touch- up scratches and marks on factory painted finishes and equipment with paint as by manufacturer of equipment.
- .3 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

supplied

3.5 Painting Schedule

- .1 The specific items listed hereafter is intended for convenience to convey a "typical" list of items to be painted. The work to be painted is not restricted to these items.
- .2 Finish the following **interior** surfaces and components as scheduled:
 - .1 Exposed interior and exterior wood
 - .2 Woodwork under Section 06 20 00, Finish Carpentry.
 - .3 Steel doors and frames.
 - .4 Access doors and panels, including mechanical and electrical doors /panels.

- .5 Gypsum board walls and ceilings.
- .6 Wood doors
- .7 exterior board and batten fibre cement board

- .3 Paint mechanical and electrical components and surfaces as specified in this section.

3.6 Paint Systems

- .1 System references listed are MPI premium grade unless noted otherwise.
- .2 Architect to issue paint and finish colour schedule.

3.7 Interior Finishes

- .1 Gypsum Wallboard:
 - .1 INT 9.2B – G2
 - .2 INT 9.2B – G4 (Washrooms) – “Satin Cloth”
- .2 Pressed Steel Doors & Frames, Access Panels, Ducts and Grilles:
 - .1 MPI EXT 5.3G - G5
- .4 Millwork and Wood Doors:
 - .1 MPI INT 6.4U G5
- .5 Exterior fibre cement board cladding and trim
 - .1 MPI EXT 3.3F
- .6 Exterior Douglas Fir Trim:
 - .1 MPI EXT 6.2L
- .7 Interior mechanical ducts
 - .1 MPI INT 5.3A G4

END

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 35 31 Special Procedures for Traffic Control
- .2 Section 01 35 43 Environmental Procedures
- .2 Section 32 17 23 Pavement Marking
- .2 Section 34 71 13.01 Vehicle Concrete Barrier
- .3 Section 34 71 13 Vehicle Post Delineators. .

1.2 PRICE AND PAYMENT PROCEDURES

- .1 Measurement and Payment:
 - .1 Installation of signs payment will be made at the applicable unit price bid per sign for “Supply and Installation of Sign - Single Post”.
 - .2 Relocation and removal of signs payment will be made at the applicable unit price bid per sign for “Removal and Reinstallation or Disposal of Existing Signs – one post” or “Removal and Reinstallation or Disposal of Existing Signs – Two or More Posts”.
 - .3 When the sign has been provided by the Owner separate payment will be made for the supply and installation of sign posts and concrete bases under “Supply and Installation of Sign – Two posts – Excluding Supply of Sign”.
 - .5 All unit prices shall include traffic accommodation and temporary, construction signing; and all labour, materials, equipment, tools and incidentals necessary to complete the work.
 - .6 Because the condition of subsurface materials designed for salvage and reuse is unknown, the Contract may contain contingency bid items for units of work which may not be required. The Contractor shall have no claim against the Owner for the deletion of any bid items during construction.

1.3 REFERENCES

- .1 American Association of State Highway and Transportation Officials (AASHTO)
 - .1 Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, (5th Edition).
- .2 Transportation Association of Canada.
 - .1 Manual of Uniform Traffic Control Devices for Canada, (MUTCD).
- .3 Parks Canada
 - .1 Parks Canada Identity Program, Exterior Signage, Standards and Guidelines, (1 Version)
- .4 Alberta Transportation (AT)
 - .1 Highway Guide and Information Sign Manual (HGISM).
- .5 ASTM International
 - .1 ASTM A 123/A 123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM A 276-10, Standard Specification for Stainless Steel Bars and Shapes.
 - .3 ASTM B 209M-10, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric].
 - .4 ASTM B 210M-05, Standard Specification for Aluminum-Alloy Drawn Seamless Tubes [Metric].

- .5 ASTM B 211M-03, Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod and Wire [Metric].
- .6 Canadian General Standards Board (CGSB)
 - .1 CGSB 62-GP-9M-80, Prefabricated Markings, Positionable, Exterior, for Aircraft Ground Equipment and Facilities.
 - .2 CGSB 62-GP-11M-78, Marking Material, Retroreflective, Enclosed Lens, Adhesive Backing and Amendment.
- .7 CSA International
 - .1 CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA O80 Series-08, Wood Preservation.
 - .3 CSA O121-08, Douglas Fir Plywood.
 - .4 CSA W47.2-11, Certification of Companies for Fusion Welding of Aluminum.
 - .5 CAN/CSA-Z809-08, Sustainable Forest Management.
- .8 Forest Stewardship Council (FSC)
 - .1 FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship.
- .9 Green Seal Environmental Standards (GS)
 - .1 GS-11-11, Paints and Coatings.
- .10 Sustainable Forestry Initiative (SFI)
 - 1 SFI-2010-2014 Standard
- .11 Transportation Association of Canada Traffic Control Signal Specifications.
- .

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's instructions, printed product literature and data sheets for traffic signage, including product characteristics, performance criteria, physical size, finish and limitations.
 - .1 Wood Certification: submit vendor's Chain-of-Custody Certificate number for CAN/CSA-Z809 or FSC or SFI certified wood.

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 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan Waste Reduction Workplan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 PRODUCTS

2.1 DESIGN CRITERIA

- .1 Relocated signs to be per HGISM Drawing TCS-A4-300
- .2 Steel sign posts to be installed as per HGISM Drawing TCS-A4-310.
- .2 Installation and maintenance of signs to PCIP Exterior Signage Chapter 6.
- .3 Permanent highway signs with sign face greater than 3m² shall be installed with breakaway ground mount sign support assembly.
- .4 Signs greater than 5.5m width require 3 post mounting.
- .5 Signs with wooden posts installed as per HGISM Drawing TCS-A4-300.
- .6 Structural deflections and vibration in accordance with American Association of State Highway and Transportation Officials (AASHTO), "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals".
- .7 The single Flashing Light is required 24/7 and should meet the Transportation Association of Canada Traffic Control Signal Specifications Division B3 "Display and Configuration for Traffic Control Signals" with signal visibility at 60km/h as shown in Table B3-1 and the flash rate for Amber Ball as shown in Table B3-2

2.2 MATERIALS

- .1 Sign supports:
 - .1 The Contractor shall supply materials as required for the installation and re-installation of permanent signs including concrete bases, steel breakaway posts, wooden posts, and all bolts and required mounting hardware.
 - .2 When the Work necessitates the removal, salvage, and reinstallation of signs, only materials from the existing installations shall be used. Contractor stockpiles of used material from other sources will not be acceptable.
 - .3 Warning Beacons to be supplied by Contractor.
 - .1 Flashing lights to be 200mm in diameter.
 - .2 Lights to flash simultaneously.
 - .3 Continuous operation of lights is required 24/7.
 - .4 Timber posts:
 - .1 Dimensions: 100x100mm, 100x150mm, 150x150mm, 200x200mm.
 - .2 Species: Natural wood post, No. 1 Structural grade S4S red pine, Douglas fir, Jack pine, eastern spruce, and eastern or western cedar.
 - .3 Grade: Natural wood post, No 1 Structural grade.
 - .4 Treatment: In ground portion to be encapsulated with an epoxy system formulated for wood products that come into direct contact with water. Posts to have the end, sides, and 100mm above grade finished with two coats of a two-part resin, West System Epoxy 105 resin with 205 or 206 hardeners or equivalent. Final mill thickness to be 4mm on sides and 6mm on end. Minimum 48 hours of cure time. .
 - .5 CAN/CSA-Z809 or FSC or SFI certified.
- SPEC NOTE:** Delete the following paragraph when treated posts are not required.
- .5 Vertical tubular supports and connecting diagonal members: to ASTM B 210M.
- .6 Truss members: to ASTM B 210M.
- .7 Aluminum tubular members: belt ground satin finish.
- .8 Base plates for ground mounted signs: to ASTM B 209M. Base plates for overhead supports: to ASTM B 209M.

- .9 Tubular support caps for ground mounted signs: to ASTM B 210M or fabricated from aluminum plate as specified in ASTM B 209M. Castings for overhead signs: to ASTM B 211M.
- .10 Aluminum flanges: to ASTM B 211M.
- .11 Anchor and connecting bolts, 'U' clamps and miscellaneous hardware for overhead sign installations: fabricate from 304 stainless steel as specified in ASTM A276.
- .12 Fasteners: bolts, nuts, washers and other hardware for roadside signs to be cast aluminum alloy, or galvanized steel.

2.3 FABRICATION

- .1 Supports:
 - .1 Connect aluminum support members by welding in accordance with CSA W47.2. Work to be performed by Canadian Welding Bureau qualified members only. Flame cutting of members not permitted.
 - .2 Welds to be of same strength as adjacent member or casting.
 - .3 Reinforce in area of electrical hand holes to equal strength of full section member.
 - .4 Remove sharp edges and burrs.
- .2 Signboards:
 - .1 Plywood blanks:
 - .1 Cut plywood blanks to required shapes and dimensions. Fill edges with wood filler suitable for outdoor use and sand smooth.
 - .2 Lightly sand surfaces, wipe clean with xylene thinner and allow to dry for 8 hours.
 - .3 Spray signboard back and edges with one prime coat maximum VOC content 250 350 g/L to SCAQMD Rule 1113 GS-11] and two white finish coats maximum VOC content 250 g/L to SCAQMD Rule 1113 GS-11 in the same colour as the sign face.
 - .2 Aluminum blanks:
 - .1 Degrease, etch and bonderize with chemical conversion coating.
 - .2 Clean surfaces with xylene thinner. Dry.
 - .3 For non-reflective signs, spray face with one coat vinyl pretreatment coating and two finish coats of required colour.
 - .4 For aluminum signboards that are to be painted before installation, spray and bake face of signboards with two coats of enamel in accordance with MPI-EXT 5.4A.
 - .3 Reflective background sheeting and lettering:
 - .1 Cut and apply in accordance with manufacturer's instructions.
 - .2 Apply adhesive coated material with heat lamp vacuum applicator or by squeeze roll application method. Apply pressure sensitive material with roller or squeegee.
 - .3 Edge wrap sheeting on each extrusion prior to bolting extrusions. Match pieces of sheeting from different rolls for each signboard to ensure uniform appearance and brilliance by day and night.
 - .4 Reflective signboard faces may be prepared using silk screen transparent ink.

3 EXECUTION

3.1 INSTALLATION

- .2 Sign support:
 - .1 Erect supports as indicated. Permissible tolerance: 50 mm maximum departure from vertical for direct buried supports. Where separate concrete footings have been placed, erect posts with base plates resting on levelling nuts and restrained with nuts and washers. Permissible tolerance: the smaller of 12 mm maximum departure from vertical or 1.5 degrees.
 - .2 The Contractor is responsible for locating power/ telephone / gas lines / services / utilities at all proposed sign locations.
 - .3 The Contractor is responsible for layout and measurements to ensure signs are installed as per accepted drawings.

- .4 The Contractor is responsible for hauling all materials to and from each work site.
- .2 Coat underside of base plate with corrosion protective paint before installation. Connect shoe base to shaft with inside and outside fillet welds.
- .3 Close open aluminum tubes and posts with aluminum cap. Cut oblong holes in shoe bases to drain condensation. Install aluminum bolt cover on each base plate restraining nut.
- .4 Bases must be perfectly plumbed.
- .5 Single channel steel posts:
 - .1 Drive to required depth without damage to posts.
 - .2 If rock or concrete is encountered, drill hole to required depth and set post in sand.
 - .3 In finished concrete surfaces, backfill with concrete or grout. Protect from adverse conditions until cured.
- .6 Wooden post installation:
 - .1 Excavate post holes to 300 mm minimum diameter. Compact bottom of hole to provide firm foundation. Set post and backfill in 150 mm layers with excavated material. Compact each layer before placing each subsequent layer.
 - .2 Leave or make depression, approximately 150 mm deep, around posts until paint is dry, then backfill and compact with excavated material to ground elevation.
 - .3 Install posts with rectangular cross-sections such that the longer dimension is orientated with the longer dimension parallel to the roadway.
 - .4 Wood posts with dimensions greater than 100mm x 100mm are required to be breakaway as per drawing TEB 1.81.

3.2 REPAIR/ RESTORATION

- .1 Signs deemed to be damaged in field to be replaced by Contractor.
- .2 Removal of existing signs
 - .1 Carefully salvage and reinstall existing signs which must be removed in the prosecutions of the Work.
 - .2 New wooden posts shall be used if the existing posts cannot be salvaged.
 - .3 Critical signs necessary for the protection of traffic such as railroad crossing signs or stop signs shall be maintained.
 - .4 Existing signs designated for removal and disposal shall become property of the contractor

3.3 CORRECTING DEFECTS

- .1 Correct defects, identified by Departmental Representative in sign message, consistency of reflectivity, colour or illumination. Correct angle of signboard to approval of Departmental Representative.

3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Carefully dismantle and salvage wood, aluminum and steel materials for reuse and recycling.
 - .2 Dismantle electrical equipment. Terminate power feed as indicated. Salvage luminaires and pack in weatherproof containers with glassware adequately protected. Salvage brackets and hardware. Salvage Dispose of lamps, wiring, conduit and accessories.
 - .3 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

- .4 Salvaged materials are the responsibility of the Contractor.

3.5 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by traffic signage installation and salvage operations.

END OF SECTION

PART 1 - GENERAL

1.1 Documents

1. This Section of the Specifications forms part of the Contract and is to be read, interpreted and coordinated with all other parts.

1.2 Summary

1. Section includes: Supply & installation of all toilet accessories (Refer to floor plans for locations). Contractor is responsible to coordinate all required structural backing.

1.3 Related Work

1. Section 09 21 16 Gypsum Board Assemblies
2. Section 09 31 13 Thin-Set Ceramic Tiling

1.4 Submittals

1. Shop Drawings
 1. Submit shop drawings or catalogue illustrations in accordance with Section 01 33 00.
 2. Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices and description of rough-in frame.

PART 2 - PRODUCTS

2.1 Materials

1. Sheet Steel: Commercial grade, stretcher leveled sheet steel to ASTM A526-80 with ZF275 zinc coating to ASTM A525-79.
2. Stainless Steel Sheet: to ASTM A167-82, type 302 or 304 with No. 4 satin finish, minimum 08. mm thick.
3. Stainless Steel Tubing: to AISI Type 304, commercial grade seamless welded, 12. mm wall thickness.
4. Fasteners: Screws and bolts hot dip galvanized. Expansion shields fibre, lead or rubber as recommended by fixture manufacturer for component and its intended use.
5. Mirrors: Tempered glass size recommended by manufacturer

2.2 Finishes

1. Stainless Steel: to AISI No. 4 satin luster finish

2.3 Accessories

1. Combination Paper Towel Dispenser/Waste Receptacle:
 - .1 Acceptable products: Towel Dispenser
Bobrick B-3944 Classic Series Recessed Paper Towel Dispenser / Waste Receptacle
 - .2 Alternate Products: Only upon written request and pre-approval.
- .2 Fixed Grab bars: quantity:3
 - .1 120 Degree Bar: 32mm O.D. x 1.6 mm wall thickness, 76mm x 5mm flanges stainless steel, type 304 tubing compete with concealed mounting flanges including appropriate steel back plates and all accessories. Surface shall be

peened grip. Grab bar and anchorage to withstand downward pull of 2.2 kN.
Reference product Reference product Bobrick 816723.

- .3 Soap Dispenser:
liquid push-in valve, corrosion resistant valve, Stainless Steel, satin finish with lockable hinged-top filler and soap window Vandal resistant concealed wall fastening.
 - .1 Reference products: Bobrick B-4112
- .5 Mirror:
Stainless steel framed fixed with tempered silvered float glass in stainless steel channel frame with tight fitted mitred corners, galvanized sheet steel back and concealed mounting.
 - .1 Reference product: Bobrick B-166-1830 Series, as noted on drawings.

PART 3 - EXECUTION

3.1 Installation

- 1. Commencement of work of this trade shall indicate acceptance of conditions for proper and complete installation as specified. Should conditions be deemed unacceptable, notify General Contractor and Architect before proceeding.
- 2. Install and secure fixtures rigidly in place as follows:
 - 1. General Contractor is responsible to insure all blocking is coordinated and installed.
 - 1. Stud walls: Install steel back plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.
 - 2. Hollow masonry units or plaster/drywall: use toggle bolts drilled into cell/wall cavity.
 - 3. Solid masonry or concrete: use bolt with lead expansion sleeve set into drilled hole.
 - 4. Toilet/shower compartments: use male/female through bolts.
- 3. Use specialty head stainless steel tamperproof fasteners where exposed to view.

END

PART 1 - GENERAL

1.1 Documents

- .1 This Section of the Specifications forms part of the Contract and is to be read, interpreted and coordinated with all other parts.

1.2 Related Work

- | | | |
|----|-------------------------|------------------|
| .1 | Rough Carpentry | Section 06 10 00 |
| .2 | Gypsum Board Assemblies | Section 09 21 16 |

1.3 Scope of Work

- .1 Provide all labour, materials and equipment necessary to provide a complete installation of lockers to total number and location indicated on the drawings.

1.4 Samples

- .1 Provide two (2) samples, minimum size 75 mm X 150 mm of each colour schedules on the actual base metal.

1.5 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 33 00.
(Product Data Sheets acceptable).
- .2 Indicate locker types, sizes, configurations, installation details, layout of groups of lockers, accessories, colour and finish and numbering.

1.6 Protection

- .1 Protect locker finishes, surfaces and materials adjacent, from damage or marring during installation.

PART 2 - PRODUCTS

2.1 Materials

- .1 Lockers shall be 305mmx457mmx1829mm double tier with the following;

Frame:	Horizontal Components	18ga
	Vertical Componentets	16ga
	Hasp	10ga
Door:	Outer Panel	16ga
	Inner Panel	20ga
Body:	Pre-painted galvanized to ASTM #A653Z120(G40)	
	Dividers	24ga
	Back Panel	24ga
Finish:	2mils dry film thickness powder coat white	

PART 3 - EXECUTION

3.1 Installation

- .1 Install lockers in locations, secure, plumb, square and in line.
- .2 Lockers to be installed on wood base provided by others.

- .3 Anchor lockers securely to wall with anchor devices suitable for the material encountered. Use blocks & shims if necessary.
- .4 Bolt adjoining locker units together to provide rigid installation.
- .5 Install metal end panels and filler panels to close off openings, as required.
- .6 Custom installation of sloped metal tops as required.

*** END ***

PART 1 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.
- .4 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.
- .5 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.

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- .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.
 - .5 Approvals:
 - .1 Submit 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 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly 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 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 filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .3 Provide one set of special tools required to service equipment as recommended by manufacturers.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 HVAC&R Equipment:
 - .1 Refrigerant:
 - .1 HCFC based refrigerant.
 - .2 HFC based refrigerant.

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 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 SYSTEM CLEANING

- .1 Clean interior and exterior of all systems. Vacuum interior of ductwork and air handling units.

3.3 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 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.

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

PART 1 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 Alberta, Canada.
 - .2 Indicate on drawings:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .4 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.
- .5 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.

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- .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 HVAC.
 - .5 Approvals:
 - .1 Submit 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 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur.
 - .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".
 - .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.

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- .9 Submit copies of as-built drawings for inclusion in final TAB report.

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 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.

PART 2 PRODUCTS

2.1 NOT USED

- .1 Not used.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
- .1 Visually inspect substrate in presence of 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 SYSTEM CLEANING

- .1 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

3.4 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 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.

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 equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME).
 - .1 ANSI/ASME B16.15-06 Cast Bronze Threaded Fittings, Classes 125 and 250.
 - .2 ANSI/ASME B16.18-01, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ANSI/ASME B16.22-01, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .4 ANSI/ASME B16.24-01, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.
- .2 ASTM International Inc.
 - .1 ASTM 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).
- .3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)
 - .1 ANSI/AWWA C111/A21.11-07, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA B242-05, Groove and Shoulder Type Mechanical Pipe Couplings.
- .5 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999, c. 33 (CEPA).
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
 - .1 MSS-SP-67-02a, 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) - 1995.
- .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.
- .3 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.3 DELIVERY, STORAGE AND HANDLING

PART 2 PRODUCTS

2.1 PIPING

- .1 Domestic hot, cold and recirculation systems, within building.
 - .1 Above ground: copper tube, hard drawn, type L: to ASTM B 88M.
 - .2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B 88M, in long lengths and with no buried joints.

2.2 FITTINGS

- .1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24.
- .2 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.
- .3 Cast copper, solder type: to ANSI/ASME B16.18.
- .4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
- .5 NPS 2 and larger: ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242.
- .6 NPS 1 ½ and smaller: wrought copper to ANSI/ASME B16.22 cast copper to ANSI/ASME B16.18; with 301 stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 kPa.

2.3 JOINTS

- .1 Rubber gaskets, latex-free 1.6 mm thick: to AWWA C111.
- .2 Bolts, nuts, hex head and washers: to ASTM A 307, heavy series.
- .3 Solder: 95/5.
- .4 Teflon tape: for threaded joints.

- .5 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

2.4 BALL VALVES

- .1 NPS 2 and under, screwed:
 - .1 Class 150.
 - .2 Bronze body, chrome plated brass ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle.
- .2 NPS 2 and under, soldered:
 - .1 To ANSI/ASME B16.18, Class 150.
 - .2 Bronze body, chrome plated brass ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle, with NPT to copper adaptors.

PART 3 EXECUTION

3.1 APPLICATION

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

3.2 INSTALLATION

- .1 Install in accordance with NPC, Alberta Plumbing Code and local authority having jurisdiction.
- .2 Assemble piping using fittings manufactured to ANSI standards.
- .3 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.
- .4 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.
- .5 Buried tubing:
 - .1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.
 - .2 Bend tubing without crimping or constriction. Minimize use of fittings.

3.3 VALVES

- .1 Isolate equipment, fixtures and branches with ball valves.

3.4 PRESSURE TESTS

- .1 Conform to requirements of Section 21 05 01 - Common Work Results for Mechanical.
- .2 Test pressure: greater of 1 times maximum system operating pressure or 860 kPa.

3.5 FLUSHING AND CLEANING

- .1 Flush entire system for 8 h. Ensure outlets flushed for 2 hours. Let stand for 24 hours, then draw sample off longest run. Submit to testing laboratory to verify that system is clean to Alberta potable water guidelines. Let system flush for additional 2 hours, then draw off another sample for testing.

3.6 PRE-START-UP INSPECTIONS

- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system can be completely drained.

3.7 DISINFECTION

- .1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction approval of Departmental Representative.
- .2 Upon completion, provide laboratory test reports on water quality for Departmental Representative.

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 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.
 - .3 Sterilize HWS and HWC systems for Legionella control.
 - .4 Verify performance of temperature controls.
 - .5 Verify compliance with safety and health requirements.
 - .6 Check for proper operation of water hammer arrestors. Run one outlet for 10 seconds, then shut of water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.
 - .7 Confirm water quality consistent with supply standards, and ensure no residuals remain as result of flushing or cleaning.
- .3 Reports:
 - .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Reports, using report forms as specified in Section 01 91 13 - General Commissioning (Cx) Requirement: Report Forms and Schematics.
 - .2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

3.10 OPERATION REQUIREMENTS

- .1 Co-ordinate operation and maintenance requirements including, cleaning and maintenance of specified materials and products.

3.11 CLEANING

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

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 ASTM International Inc.
 - .1 ASTM B 32-08, Standard Specification for Solder Metal.
 - .2 ASTM B 306-02, Standard Specification for Copper Drainage Tube (DWV).
 - .3 ASTM C 564-03a, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .2 Canadian Standards Association (CSA International).
 - .1 CSA B67-1972(R1996), Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
 - .2 CAN/CSA-B70-06, Cast Iron Soil Pipe, Fittings and Means of Joining.
 - .3 CAN/CSA-B125.3-05, Plumbing Fittings.
- .3 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-36-00, Commercial Adhesives.
- .4 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for adhesives, and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 1.04 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.

PART 2 PRODUCTS

2.1 SUSTAINABLE MATERIAL

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

2.2 COPPER TUBE AND FITTINGS

- .1 Above ground sanitary and vent] Type DWV to: ASTM B 306.
 - .1 Fittings.
 - .1 Cast brass: to CAN/CSA-B125.3.
 - .2 Wrought copper: to CAN/CSA-B125.3.
- .2 Solder: lead free, tin- 95:5, type TA, to ASTM B 32.

2.3 CAST IRON PIPING AND FITTINGS

- .1 Buried sanitary and vent minimum NPS 3, to: CAN/CSA-B70, with one layer of protective coating.
 - .1 Joints:
 - .1 Mechanical joints:
 - .1 Neoprene or butyl rubber compression gaskets: to CAN/CSA-B70. ASTM C564; or
 - .2 Stainless steel clamps.
 - .2 Hub and spigot:
 - .1 Caulking lead: to CSA B67.
 - .2 Cold caulking compounds.
- .2 Above ground sanitary and vent: to CAN/CSA-B70.
 - .1 Joints:
 - .1 Hub and spigot:
 - .1 Caulking lead: to CSA B67.
 - .2 Mechanical joints:
 - .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

PART 3 EXECUTION

3.1 APPLICATION

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

3.2 INSTALLATION

- .1 In accordance with Section 23 05 05 - Installation of Pipework.
- .2 Install in accordance with National Plumbing Code.

3.3 TESTING

- .1 Pressure test buried systems before backfilling.
- .2 Hydraulically test to verify grades and freedom from obstructions.

3.4 PERFORMANCE VERIFICATION

- .1 Cleanouts:
 - .1 Ensure accessible and that access doors are correctly located.
 - .2 Open, cover with linseed oil and re-seal.
 - .3 Verify that cleanout rods can probe as far as the next cleanout, at least.
- .2 Test to ensure traps are fully and permanently primed.
- .3 Storm water drainage:
 - .1 Verify domes are secure.
 - .2 Ensure weirs are correctly sized and installed correctly.
 - .3 Verify provisions for movement of roof system.
- .4 Ensure that fixtures are properly anchored, connected to system and effectively vented.
- .5 Affix applicable label sanitary, vent, etc. 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.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 ASTM International Inc.
 - .1 ASTM D 2235-04, Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
 - .2 ASTM D 2564-04e1, Standard Specification for Solvent Cements for Poly (Vinyl-Chloride) (PVC) Plastic Piping Systems.
- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-Series B1800-06, Thermoplastic Nonpressure Pipe Compendium - B1800 Series.
- .3 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-36-00, Commercial Adhesives.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 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 copies WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 29.06 - 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.

PART 2 PRODUCTS

2.1 MATERIAL

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

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.

PART 3 EXECUTION

3.1 APPLICATION

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

3.2 INSTALLATION

- .1 In accordance with Section 23 05 05 - Installation of Pipework.
- .2 Install in accordance with National Plumbing Code.

3.3 TESTING

- .1 Pressure test buried systems before backfilling.
- .2 Hydraulically test to verify grades and freedom from obstructions.

3.4 PERFORMANCE VERIFICATION

- .1 Cleanouts:
 - .1 Ensure accessible and that access doors are correctly located.
 - .2 Open, cover with linseed oil and re-seal.
 - .3 Verify cleanout rods can probe as far as the next cleanout, at least.
- .2 Test to ensure traps are fully and permanently primed.

- .3 Storm water drainage:
 - .1 Verify domes are secure.
 - .2 Ensure weirs are correctly sized and installed correctly.
 - .3 Verify provisions for movement of roof system.
- .4 Ensure fixtures are properly anchored, connected to system and effectively vented.
- .5 Affix applicable label sanitary, vent c/w directional arrows every floor or 4.5 m.

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

PART 1 GENERAL

1.1 REFERENCES

- .1 American National Standards Institute/Canadian Standards Association (ANSI/CSA)
 - .1 ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters - Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.
 - .2 ANSI Z21.10.1A-2006/CSA 4.1A-2006, Addenda 1 to ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.
 - .3 ANSI Z21.10.1b-2006/CSA 4.1b-2006, Addenda 2 to ANSI Z21.10.1-2004/CSA 4.1-2004, Gas Water Heaters - Volume I, Storage Water Heaters With Input Ratings of 75,000 Btu Per Hour or Less.
 - .4 ANSI Z21.10.3A-2007/CSA 4.3-2007, Gas Water Heaters - Volume III - Storage Water Heaters, with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA B51-03 (R2007), Boiler, Pressure Vessel, and Pressure Piping Code.
 - .2 CAN/CSA C22.2 No.110-94 (R2004), Construction and Test of Electric Storage Tank Water Heaters.
 - .3 CAN/CSA-C191-04, Performance of Electric Storage Tank Water Heaters for Household Service.
 - .4 CAN/CSA-C309-M90 (R2003), Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 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:
- .4 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, 12 months warranty period prescribed in subsection GC 32.1 of General Conditions "C" is extended to number of years specified for each product.

PART 2 PRODUCTS

2.1 ELECTRIC WATER HEATER

- .1 To CAN/CSA C22.2 No.110, CAN/CSA-C191 and CAN/CSA-C309 for glass-lined storage tanks, with zinc plated copper sheath immersion type elements, 1500 W each, and surface mounted or immersion type adjustable thermostats.
- .2 Tank: 37 L, glass, 457 mm diameter x 464 mm high, 50 mm mineral wool or fibreglass insulation, enamelled steel jacket, 3year warranty certificate.

2.2 TRIM AND INSTRUMENTATION

- .1 ASME rated temperature and pressure relief valve sized for full capacity of heater, having discharge terminating over floor drain and visible to operators.
- .2 Magnesium anodes adequate for 20 years of operation and located for easy replacement.

PART 3 EXECUTION

3.1 APPLICATION

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

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's recommendations and authority having jurisdiction.
- .2 Provide insulation between tank and supports.
- .3 Install oil burning domestic water heaters in accordance with CAN/CSA-B139.
- .4 Install natural gas fired domestic water heaters in accordance with CAN/CSA-B149.1.

- .5 Install propane gas fired domestic water heaters in accordance with CAN/CSA-B149.2.

3.3 FIELD QUALITY CONTROL

- .1 Manufacturer's factory trained, certified Engineer to start up [and commission] DHW heaters.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM A 126-04(2009), Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
 - .2 ASTM B 62-09, Standard Specification for Composition Bronze or Ounce Metal Castings.
- .2 American Water Works Association (AWWA)
 - .1 ANSI/AWWA C700-09, Standard for Cold Water Meters-Displacement Type, Bronze Main Case.
 - .2 ANSI/AWWA C701-12, Standard for Cold Water Meters-Turbine Type for Customer Service.
 - .3 ANSI/AWWA C702-10, Standard for Cold Water Meters-Compound Type.
- .3 CSA International
 - .1 CSA-B64 Series-11, Backflow Preventers and Vacuum Breakers.
 - .2 CSA B79-08, 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-R2010, Testing and Rating Procedure for Grease Interceptors with Appendix of Installation and Maintenance.
 - .2 PDI-WH201-R2010, Water Hammer Arresters Standard.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation Meetings:
 - .1 Convene pre-installation meeting 1 week prior to beginning work of this Section and on-site installation, with Departmental Representative to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building construction subtrades.
 - .4 Review manufacturer's written installation instructions and warranty requirements.

1.4 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 plumbing products and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures. 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, number of anchors, dimensions construction and assembly details and accessories for following: soap dispensing system.
- .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.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for plumbing specialties and accessories for incorporation into manual.
 - .1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list.

1.6 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 plumbing materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 PRODUCTS

2.1 FLOOR DRAINS

- .1 Floor Drains and Trench Drains: to CSA B79.
- .2 Type 1: general duty; cast iron body round, adjustable head, nickel bronze strainer, integral seepage pan, and clamping collar.

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 round cover with flush head securing screws, beveled edge frame complete with anchoring lugs.
 - .2 Floor Access: round cast iron body and frame with adjustable secured nickel bronze top and:
 - .1 Plugs: bolted bronze with neoprene gasket.
 - .2 Cover for Unfinished Concrete Floors: nickel bronze round gasket, vandal-proof screws.
 - .3 Cover for Terrazzo Finish: polished nickel bronze with recessed cover for filling with terrazzo, vandal-proof locking screws.
 - .4 Cover for Tile and Linoleum Floors: polished nickel bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws.
 - .5 Cover for Carpeted Floors: polished nickel bronze with deep flange cover for carpet infill, complete with carpet retainer vandal-proof locking screws.

2.3 WATER HAMMER ARRESTORS

- .1 Stainless steel construction, bellows type: to PDI-WH201.

2.4 BACK FLOW PREVENTERS

- .1 Preventers: to CSA-B64 Series, application reduced pressure principle type double check valve assembly back flow preventer with intermediate vacuum breaker.

2.5 VACUUM BREAKERS

- .1 Breakers: to CSA-B64 Series, vacuum breaker atmospheric.

2.6 HOSE BIBBS AND SEDIMENT FAUCETS

- .1 Bronze construction complete with integral back flow preventer, hose thread spout, replaceable composition disc, and chrome plated in finished areas.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for plumbing specialties and accessories installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval to proceed from Departmental Representative.

3.2 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written 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.
- .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 where indicated.

3.6 BACK FLOW PREVENTERS

- .1 Install in accordance with CSA-B64 Series, where indicated and elsewhere as required by code.
 - .1 Drains.
 - .2 Backwater Valves.
 - .3 Water Make-up Assembly.
 - .4 Grease Interceptors.

3.7 HOSE BIBBS AND SEDIMENT FAUCETS

- .1 Install at bottom of risers, at low points to drain systems, and as indicated.

3.8 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.
- .2 Provide continuous supervision during start-up.

3.9 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 Verify operation of trap seal primer.
 - .2 Prime, using trap primer. Adjust flow rate to suit site conditions.
 - .3 Check operations of flushing features.
 - .4 Check security, accessibility, removability of strainer.
 - .5 Clean out baskets.
- .6 Vacuum breakers, backflow preventers, backwater valves:
 - .1 Test tightness, accessibility for O&M of cover and of valve.
 - .2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.
 - .3 Verify visibility of discharge from open ports.
- .7 Access doors:
 - .1 Verify size and location relative to items to be accessed.
- .8 Cleanouts:
 - .1 Verify covers are gas-tight, secure, yet readily removable.
- .9 Water hammer arrestors:
 - .1 Verify proper installation of correct type of water hammer arrester.
- .10 Pressure regulators, PRV assemblies:
 - .1 Adjust settings to suit locations, flow rates, pressure conditions.
- .11 Strainers:
 - .1 Clean out repeatedly until clear.
 - .2 Verify accessibility of cleanout plug and basket.
 - .3 Verify that cleanout plug does not leak.
- .12 Hose bibbs, sediment faucets:
 - .1 Verify that flow and pressure meet design criteria.
 - .2 Check for leaks, replace compression washer if required.
- .13 Water meters:
 - .1 Verify location and accessibility.
 - .2 Test meter reading accuracy.

3.10 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.

3.11 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.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.12 PROTECTION

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

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-B45 Series-02(R2008), Plumbing Fixtures.
 - .2 CAN/CSA-B125.3-05, Plumbing Fittings.
 - .3 CAN/CSA-B651-04, Accessible Design for the Built Environment.
- .2 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-36-00, Commercial Adhesives.
- .3 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168-A2005, Adhesive and Sealant Applications.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 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 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 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
 - .2 Details of operation, servicing, maintenance.
 - .3 List of recommended spare parts.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer.

PART 2 PRODUCTS

2.1 SUSTAINABLE MATERIAL

- .1 Adhesives and sealants: maximum VOC limit 30 g/L to SCAQMD Rule 1168.

2.2 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 location to be product of one manufacturer and of same type.
- .6 Trim in any one location to be product of one manufacturer and of same type.

PART 3 EXECUTION

3.1 APPLICATION

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

3.2 INSTALLATION

- .1 Mounting heights:
 - .1 Standard: to manufacturer's recommendations.
 - .2 Barrier free: to most stringent CAN/CSA B651.

3.3 ADJUSTING

- .1 Conform to water conservation requirements specified in 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:
- .4 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.
- .2 Waste Management: separate waste materials for reuse and recycling.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-B45 Series-02(R2008), Plumbing Fixtures.
 - .2 CAN/CSA-B125.3-05, Plumbing Fittings.
 - .3 CAN/CSA-B651-04, Accessible Design for the Built Environment.

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

1.3 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Include:
 - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
 - .2 Details of operation, servicing, maintenance.
 - .3 List of recommended spare parts.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

- .1 Fixtures: manufacture in accordance with CAN/CSA-B45 series.
- .2 Trim, fittings: manufacture in accordance with CAN/CSA-B125.
- .3 Exposed plumbing brass to be chrome plated.
- .4 Number, locations: architectural drawings to govern.

.5 Fixtures to be product of one manufacturer.

.6 Trim to be product of one manufacturer.

PART 3 EXECUTION

3.1 APPLICATION

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

3.2 INSTALLATION

.1 Mounting heights:

.1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.

.2 Wall-hung fixtures: as indicated, measured from finished floor.

.3 Physically handicapped: to comply with most stringent of either NBCC or CAN/CSA-B651.

3.3 ADJUSTING

.1 Conform to water conservation requirements specified this section.

.2 Adjustments:

.1 Adjust water flow rate to design flow rates.

.2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.

.3 Checks:

.1 Aerators: operation, cleanliness.

.2 Vacuum breakers, backflow preventers: operation under all conditions.

.3 Wash fountains: operation of flow-actuating devices.

.4 Thermostatic controls:

.1 Verify temperature settings, operation of control, limit and safety controls.

3.4 CLEANING

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

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

.2 Waste Management: separate waste materials for reuse and recycling.

END OF SECTION

PART 1 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 HVAC.
- .5 Approvals:
 - .1 Submit 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 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 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 filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.
- .3 Provide one set of special tools required to service equipment as recommended by manufacturers.
- .4 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 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 PTAC units from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 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 Trial usage to apply to following equipment and systems:
 - .1 PTAC Units.
- .3 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.
- .4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.
- .6 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

PART 1 GENERAL

1.1 USE OF SYSTEMS

- .1 Use of new permanent heating and 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.

PART 2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

PART 3 EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

PART 1 GENERAL

1.1 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 B139-04, Installation Code for Oil Burning Equipment.
- .3 National Fire Code of Canada (NFCC 2005)

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 QUALITY ASSURANCE

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.

PART 2 PRODUCTS

2.1 MATERIAL

- .1 Paint: zinc-rich to CAN/CGSB-1.181.
 - .1 Coating: in accordance with manufacturer's recommendations for surface conditions.
- .2 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

PART 3 EXECUTION

3.1 APPLICATION

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

3.2 CONNECTIONS TO EQUIPMENT

- .1 In accordance with manufacturer's instructions unless otherwise indicated.
- .2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
- .3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.3 CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and National Fire Code of Canada CSA B139.
- .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 DIELECTRIC COUPLINGS

- .1 General: compatible with system, to suit pressure rating of system.
- .2 Locations: where dissimilar metals are joined.
- .3 NPS 2 and under: isolating unions or bronze valves.
- .4 Over NPS 2: isolating flanges.

3.6 PIPEWORK INSTALLATION

- .1 Install pipework to CSA B139.
- .2 Screwed fittings jointed with Teflon tape.
- .3 Protect openings against entry of foreign material.
- .4 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .5 Assemble piping using fittings manufactured to ANSI standards.
- .6 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.
 - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .7 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .8 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .9 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .10 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .11 Group piping wherever possible.
- .12 Ream pipes, remove scale and other foreign material before assembly.
- .13 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .14 Provide for thermal expansion as indicated.
- .15 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.
 - .3 Install with stems above horizontal position unless indicated.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Install globe valves in bypass around control valves.
 - .6 Use ball valves at branch take-offs for isolating purposes except where specified.

3.7 SLEEVES

- .1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.

-
- .2 Material: schedule 40 black steel pipe.
 - .3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.
 - .4 Sizes: 6 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
 - .5 Installation:
 - .1 Concrete, masonry walls, 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.

3.8 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.

3.9 PREPARATION FOR FIRE STOPPING

- .1 Install firestopping within annular space between pipes, ducts, insulation and adjacent fire separation.
- .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.

3.10 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.

3.11 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

- .1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.
- .2 PIPework: test as specified in relevant sections of heating, ventilating and air conditioning work.
- .3 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant mechanical sections.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
- .5 Conduct tests in presence of 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.

3.12 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

1.2 REFERENCES

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B31.1-07, Power Piping.
- .2 ASTM International
 - .1 ASTM A 125-1996 (2007), Standard Specification for Steel Springs, Helical, Heat-Treated.
 - .2 ASTM A 307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A 563-07a, 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 58-2002, 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)

1.3 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 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 Alberta of 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 1 copy of systems supplier's installation instructions.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 DELIVERY, STORAGE AND HANDLING

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

PART 2 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 Pipe hangers and supports: galvanized.
 - .2 Use electro-plating galvanizing process.
 - .3 Ensure steel hangers in contact with copper piping are copper plated.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
 - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut.
 - .1 Rod: 9 mm UL listed.
 - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL.
- .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 galvanized.
 - .2 Attachments for copper piping: copper plated black steel.
 - .3 Use insulation shields for hot pipework.
 - .4 Oversize pipe hangers and supports.

2.4 RISER CLAMPS

- .1 Steel or cast iron pipe: galvanized carbon steel to MSS SP 58, type 42, UL listed.
- .2 Copper pipe: carbon steel copper plated to MSS SP 58, type 42.
- .3 Bolts: to ASTM A 307.
- .4 Nuts: to ASTM A 563.

2.5 INSULATION PROTECTION SHIELDS

- .1 Insulated cold piping:
 - .1 64 kg/m² 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.

2.6 CONSTANT SUPPORT SPRING HANGERS

- .1 Springs: alloy steel to ASTM A 125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report (CMTR).
- .2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.
- .3 Provide upper and lower factory set travel stops.
- .4 Provide load adjustment scale for field adjustments.
- .5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.
- .6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.7 VARIABLE SUPPORT SPRING HANGERS

- .1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.
- .2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.
- .3 Variable spring hanger complete with factory calibrated travel stops.
- .4 Steel alloy springs: to ASTM A 125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.8 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

- .1 Provide templates to ensure accurate location of anchor bolts.

2.9 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.

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:
 - .1 Manufacturer's instructions and recommendations.

3.3 HANGER SPACING

- .1 Plumbing piping: to authority having jurisdiction.
- .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

PART 1 GENERAL

1.1 SUMMARY

- .1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.
- .2 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

1.2 QUALIFICATIONS OF TAB PERSONNEL

- .1 Submit names of personnel to perform TAB to Departmental Representative within 90 days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
 - .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.
 - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems-1998.
 - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing-2002.
- .4 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
 - .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
 - .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 PURPOSE OF TAB

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads
- .2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

- .1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

1.5 CO-ORDINATION

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.6 PRE-TAB REVIEW

- .1 Review contract documents before project construction is started and confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
- .2 Review specified standards and report Departmental Representative in writing proposed procedures which vary from standard.
- .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 START-UP

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in Division 23.

1.8 OPERATION OF SYSTEMS DURING TAB

- .1 Operate systems for length of time required for TAB and as required by Departmental Representative for verification of TAB reports.

1.9 START OF TAB

- .1 Notify Departmental Representative 7 days prior to start of TAB.
- .2 Start TAB when building is essentially completed, including:
- .3 Installation of ceilings, doors, windows, other construction affecting TAB.
- .4 Application of weatherstripping, sealing, and caulking.
- .5 Pressure, leakage, other tests specified elsewhere Division 23.
- .6 Provisions for TAB installed and operational.
- .7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
 - .1 Proper thermal overload protection in place for electrical equipment.
 - .2 Air systems:
 - .1 Filters in place, clean.
 - .2 Duct systems clean.
 - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
 - .4 Correct fan rotation.
 - .5 Fire, smoke, volume control dampers installed and open.
 - .6 Coil fins combed, clean.
 - .7 Access doors, installed, closed.
 - .8 Outlets installed, volume control dampers open.
 - .3 Liquid systems:
 - .1 Flushed, filled, vented.
 - .2 Correct pump rotation.
 - .3 Strainers in place, baskets clean.
 - .4 Isolating and balancing valves installed, open.
 - .5 Calibrated balancing valves installed, at factory settings.
 - .6 Chemical treatment systems complete, operational.

1.10 APPLICATION TOLERANCES

- .1 Do TAB to following tolerances of design values:
 - .1 HVAC systems: plus 10%, minus 0%.

1.11 ACCURACY TOLERANCES

- .1 Measured values accurate to within plus or minus 2% of actual values.

1.12 INSTRUMENTS

- .1 Prior to TAB, submit to Departmental Representative list of instruments used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative.

1.13 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit, prior to commencement of TAB:
- .2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY TAB REPORT

- .1 Submit for checking and approval of Departmental Representative, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
 - .1 Details of instruments used.
 - .2 Details of TAB procedures employed.
 - .3 Calculations procedures.
 - .4 Summaries.

1.15 TAB REPORT

- .1 Format in accordance with referenced standard.
- .2 TAB report to show results in SI units and to include:
 - .1 Project record drawings.
 - .2 System schematics.
- .3 Submit 6 copies of TAB Report to Departmental Representative for verification and approval, in 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 TAB standards of ASHRAE.
- .2 Do TAB of following systems, equipment, components, controls:
 - .1 PTAC units.
- .3 Qualifications: personnel performing TAB current member in good standing of AABC or NEBB qualified to standards of AABC or NEBB.
- .4 Quality assurance: perform TAB under direction of supervisor qualified to standards of AABC or NEBB.
- .5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.
- .6 Locations of equipment measurements: to include as appropriate:
 - .1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.
 - .2 At controllers, controlled device.
- .7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 OTHER TAB REQUIREMENTS

- .1 General requirements applicable to work specified this paragraph:
 - .1 Qualifications of TAB personnel: as for air systems specified this section.
 - .2 Quality assurance: as for air systems specified this section.
- .2 Building pressure conditions:
 - .1 Adjust HVAC systems, equipment, controls to ensure specified pressure conditions at all times.

.3 Measurement of noise and vibration from equipment specified in Division 23.

.1 TAB procedures:

.1 PTAC Units.

1.21 POST-OCCUPANCY TAB

.1 Measure air velocity, air flow patterns, NC levels, in occupied zone of following areas.

.2 Participate in systems checks twice during Warranty Period - #1 approximately 3 months after acceptance and #2 within 1 month of termination of Warranty Period.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 EXECUTION

3.1 NOT USED

.1 Not used.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
 - .2 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
- .2 SMACNA HVAC Air Duct Leakage Test Manual, 1985.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties. Include pressure test information and results as follows:
 - .1 Submit proposed report form and test report format to Departmental Representative for approval at least three months before proposed date of first series of tests. Do not start tests until approval received in writing from Departmental Representative.
 - .2 Prepare report of results and submit to Departmental Representative within 24 hours of completion of tests. Include:
 - .1 Schematic of entire system.
 - .2 Schematic of section under test showing test site.
 - .3 Required and achieved static pressures.
 - .4 Orifice differential pressure at test sites.
 - .5 Permissible and actual leakage flow rate (L/s) for test sites.
 - .6 Witnessed certification of results.
 - .3 Include test reports in final TAB report.
 - .4 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .5 Instructions: submit manufacturer's installation instructions.
 - .6 Manufacturer's field reports specified.

1.3 QUALITY ASSURANCE

- .1 Pre-Installation Meetings:
 - .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with other building subtrades.

- .4 Review manufacturer's installation instructions and warranty requirements.
- .2 Health and Safety:

PART 2 PRODUCTS

2.1 TEST INSTRUMENTS

- .1 Test apparatus to include:
 - .1 Fan capable of producing required static pressure.
 - .2 Duct section with calibrated orifice plate mounted and accurately located pressure taps.
 - .3 Flow measuring instrument compatible with the orifice plate.
 - .4 Calibration curves for orifice plates used.
 - .5 Flexible duct for connecting to ductwork under test.
 - .6 Smoke bombs for visual inspections.
- .2 Test apparatus: accurate to within +/- 3 % of flow rate and pressure.
- .3 Submit details of test instruments to be used to Departmental Representative at least three months before anticipated start date.
- .4 Test instruments: calibrated and certificate of calibration deposited with Departmental Representative no more than 28 days before start of tests.
- .5 Re-calibrated every six months thereafter.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 TEST PROCEDURES

- .1 Maximum lengths of ducts to be tested consistent with capacity of test equipment.
- .2 Section of duct to be tested to include:
 - .1 Fittings, branch ducts, tap-ins.
- .3 Repeat tests until specified pressures are attained. Bear costs for repairs and repetition to tests.
- .4 Base partial system leakage calculations on SMACNA HVAC Air Duct Leakage Test Manual.

- .5 Seal leaks that can be heard or felt, regardless of their contribution to total leakage.

3.3 SITE TOLERANCES

- .1 System leakage tolerances specified are stated as percentage of total flow rate handled by system. Pro-rate specified system leakage tolerances. Leakage for sections of duct systems: not to exceed total allowable leakage.
- .2 Leakage tests on following systems not to exceed specified leakage rates.
 - .1 Small duct systems up to 250 Pa: leakage 2%.
- .3 Evaluation of test results to use surface area of duct and pressure in duct as basic parameters.

3.4 TESTING

- .1 Test ducts before installation of insulation or other forms of concealment.
- .2 Test after seals have cured.
- .3 Test when ambient temperature will not affect effectiveness of seals, and gaskets.

3.5 FIELD QUALITY CONTROL

- .1 Departmental Representative to witness tests and to verify reported results.
- .2 To be certified by same TAB agency approved by Departmental Representative to undertake TAB on this project.

3.6 CLEANING

- .1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 Definitions:
 - .1 For purposes of this section:
 - .1 "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
 - .2 "EXPOSED" - means "not concealed" as previously defined.
 - .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.
 - .2 TIAC Codes:
 - .1 CRD: Code Round Ductwork,
 - .2 CRF: Code Rectangular Finish.
- .2 Reference Standards:
 - .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE/IESNA 90.1-04, SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.
 - .2 ASTM International Inc.
 - .1 ASTM B 209M-07, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
 - .2 ASTM C 335-05ae1, Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
 - .3 ASTM C 411-05, 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 547-07e1, Standard Specification for Mineral Fiber Pipe Insulation.
 - .6 ASTM C 553-02e1, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .7 ASTM C 612-04e1, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 - .8 ASTM C 795-03, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .9 ASTM C 921-03a, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
 - .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma-89, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).

- .5 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-03, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701-05, 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 Manufacturers' Instructions:
 - .1 Provide manufacture's written duct insulation jointing recommendations. and special handling criteria, installation sequence, cleaning procedures.

1.3 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards.

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 and ULC markings.

PART 2 PRODUCTS

2.1 FIRE AND SMOKE RATING

- .1 To CAN/ULC-S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

- .1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.
- .2 Thermal 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 Aluminum:
 - .1 To ASTM B 209 with moisture barrier as scheduled in PART 3 of this section.
 - .2 Thickness: 0.50 mm sheet.
 - .3 Finish: Smooth.
 - .4 Jacket banding and mechanical seals: 12 mm wide, 0.5 mm thick stainless steel.
 - .1 Stainless steel:
 - .5 Type: 304.
 - .6 Thickness: 0.25mm sheet.
 - .7 Finish: Smooth.
 - .8 Jacket banding and mechanical seals: 12 mm wide, 0.5 mm thick stainless steel.

2.4 ACCESSORIES

- .1 Vapour retarder lap adhesive:
 - .1 Water based, fire retardant type, compatible with insulation.
- .2 Tape: self-adhesive, aluminum, plain, 50 mm wide minimum.
- .3 Contact adhesive: quick-setting
- .4 Tie wire: 1.5 mm stainless steel.

- .5 Banding: 12mm wide, 0.5 mm thick stainless steel.
- .6 Facing: 25 mm galvanized steel hexagonal wire mesh stitched both faces of insulation.
- .7 Fasteners: 2mm diameter pins with 35 mm diameter clips, length to suit thickness of insulation.

PART 3 EXECUTION

3.1 APPLICATION

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

3.2 PRE-INSTALLATION REQUIREMENTS

- .1 Pressure test ductwork systems complete, witness and certify.
- .2 Ensure surfaces are clean, dry, free from foreign material.

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and as indicated.
- .3 Use 2 layers with staggered joints when required nominal thickness exceeds 75 mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Ensure hangers, and supports are outside vapour retarder jacket.
- .5 Hangers and supports in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
 - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .6 Fasteners: install at 300 mm on centre in horizontal and vertical directions, minimum 2 rows each side.

3.4 DUCTWORK INSULATION SCHEDULE

- .1 Insulation types and thicknesses: conform to following table:

TIAC Code	Vapour Retarder	Thickness (mm)
Round cold C-1 and dual temperature supply air ducts	yes	50

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

PART 1 GENERAL

1.1 PAYMENT PROCEDURES FOR TESTING LABORATORY SERVICES

- .1 Engage and pay for services of independent testing laboratory in accordance with Section 01 29 83 - Payment Procedures for Testing Laboratory Services.

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 Flexible ductwork;
 - .3 Mixing plenum boxes;
 - .4 Return air plenums including ceiling plenums;
 - .5 Cooling and heating coils and compartments;
 - .6 Condensate drain pans, eliminator blades and humidifiers;
 - .7 Fans, fan blades and fan housing;
 - .8 Filter housing and frames;
 - .9 Acoustically insulated duct linings;
 - .10 Diffusers, registers and terminal units;
 - .11 Dampers and controls;
- .2 Reference Standards:
 - .1 National Air Duct Cleaners Association (NADCA)
 - .1 ACR Standard, 2006 edition: Assessment, Cleaning and Restoration of HVAC Systems.
 - .2 North American Insulation Manufacturers Association (NAIMA)
 - .1 NAIMA 2005, Cleaning Fibrous Glass Insulated Duct Systems - Recommended Practices.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Site Evaluation: conduct site visit 2 weeks before start of work to establish specific co-ordinated video survey and cleaning plan to establish specific co-ordinated video survey and cleaning plan determining how areas of facility and HVAC systems will be protected during cleaning operations.
 - .1 Organize and lay out plan for video survey and identify camera and cleaning apparatus insertion points.
 - .2 Ensure plan identifies sequence and schedule of survey and cleaning operations for each individual HVAC system and for complete facility.

-
- .2 Take account of elbows, bends, turning vanes, dampers, transitions, take-offs and other internal features.
 - .3 Departmental Representative to review video survey and cleaning plan 1 week minimum prior to start of work.
 - .1 Proceed with survey and cleaning work only after receiving written approval from Departmental Representative.
 - .4 Scheduling: Hours of Operation: complete work during non-business hours as follows:
 - .1 Monday to Thursday between 18:00 hours and 07:00 hours.
 - .2 Friday from 18:00 hours to Monday at 07:00 hours.
 - .3 Work may not be carried out during statutory holidays.
 - .4 Hours of operation are subject to change with 12 hours notice.
 - .5 Project Co-ordination: assign Project Co-ordinator to oversee air duct cleaning processes.
 - .1 Provide Departmental Representative with contact information of Project Co-ordinator including: name, telephone number, cell phone number.
 - .6 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 copies of WHMIS MSDS in accordance with Section 01 35 30 - Health and Safety Requirements & 01 35 43 - Environmental Procedures for antimicrobial agents or coatings.
- .4 Testing Laboratory Services: submit name and address of laboratory engaged for work of this Section.
 - .1 Submit laboratory analysis report of particulate collection indicating:
 - .1 Location of collection;
 - .2 Particulate grade;
 - .3 Particulate size;
 - .4 Percentage concentration of individual particulates in each sample.
- .5 US EPA Registration: submit verification of EPA Registration of antimicrobial agent.

1.5 CLOSEOUT SUBMITTALS

- .1 Provide submittals in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Post Cleaning Inspection Report: submit 4 copies of Final Inspection Report, including data collected, observations and recommendations as well as following information:
 - .1 Name and address of facility;
 - .2 Name and address of HVAC cleaning contractor;
 - .3 Description of HVAC systems with drawings identifying systems cleaned;
 - .4 Identification scheme for location points in systems that were inspected with accompanying notes describing methods of inspection or tests used;
 - .5 Identification of points where samples were collected and type of analysis used for each collection;
 - .6 Identification of each sample collected;
 - .7 Comments complete with photographs of each sampling location and other observed system features;
 - .8 Identify systems tested, observations, actions taken and recommendations for future maintenance.
- .3 Record post cleaning video survey: submit 2 copies of video survey USB Drive memory card media, and include on video survey following:
 - .1 Areas tested for particulate analysis or microbial growth evaluation;
 - .2 Areas of special interest and location;
 - .3 Special internal features;
 - .4 Problems such as broken or damaged controls or components;
 - .5 Ensure system tested, locations, observations, actions taken and recommendations are clearly identified in English on video using text or voice over.

1.6 EXTRA MATERIALS

- .1 Extra Stock Materials:
 - .1 Supply 4 extra filters for each HVAC System cleaned.
 - .2 Ensure filters are correct match, size, type and configuration of existing HVAC Systems.

1.7 QUALITY ASSURANCE

- .1 Contractor: verification of membership in NADCA verification of 5 years minimum experience in work similar to or exceeding work of this Section.

PART 2 PRODUCTS

2.1 ACCESS DOORS AND PANELS

- .1 .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 200mm x 200 mm minimum.
 - .3 Secure access doors with sheet metal screws on 75 mm centres minimum. Ensure 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.
 - .2 Ensure brushes are sized to fit various duct sizes in HVAC system.
 - .3 Ensure brushes make scrubbing motion and full contact with HVAC system interior surfaces to be cleaned.

PART 3 EXECUTION

3.01 PREPARATION

- .1 Close down HVAC system.
- .2 Locate and identify externally visible HVAC system features which may affect cleaning process including:
 - .1 Control devices;
 - .2 Fire and smoke control dampers;
 - .3 Balancing dampers: indicate and record positions for resetting;
 - .4 Air volume control boxes: indicate and record positions for resetting;
 - .5 Fire alarm devices;
 - .6 Monitoring devices and controls;
- .3 Cut openings in equipment panels and ductwork for access to system interior.
 - .1 Square or rectangular opening sizes: 200 mm minimum each side.
 - .2 Circular opening sizes: 200 mm minimum diameter.

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- .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 and cooling coils;
 - .2 Fan units;
 - .3 Filters;
 - .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.
 - .6 Remove and reinstall ceiling anels to gain access to HVAC system as required.
 - .1 Replace ceiling panels damaged or soiled by air duct cleaning procedures.

3.2 EXAMINATION / PRE-CLEANING INSPECTION

- .1 Verification of Conditions:
 - .1 Make visual inspection of interior of HVAC system using remote controlled robotic camera.
 - .2 Insert camera at pre-established strategic locations to evaluate condition and cleanliness of HVAC systems and components.
- .2 Evaluation and Assessment:
 - .1 Identify location and type of internal components.
 - .2 Identify extent of potential problems.
 - .3 If toxic or hazardous materials or deposits are suspected after initial inspection immediately stop work and 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 3 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 4: collect at junction each air terminal unit and supply duct.

3.4 DUCT CLEANING

- .1 Do duct cleaning in accordance with NADCA ACR Standard.
- .2 Isolate and clean sections in zones to ensure that dirt deposits and debris from zone being cleaned does not pass through another zones which has already been cleaned.
 - .1 Isolate zone of duct using air inflated zone bag before cleaning.
- .3 Ensure vacuum units and evacuation fans are securely in place before starting cleaning operation of isolated section of HVAC air duct system.
- .4 Install HEPA filter evacuation fan at one end of zone section and insert full contact brushes at other end.
- .5 Clean HVAC supply air duct system and components where particulate sample collected from surfaces is greater than 75 mg of particulate per 0.01 square metres.
- .6 Clean exhaust, return, transfer ductwork and plenums, equipment and components where particulate sample collected from surfaces is greater than 75 mg of particulate per 0.01 square metres.
- .7 Energize brushes to travel from insertion point to HEPA filter evacuation fan.
 - .1 Pass brushes through sections as often as necessary to achieve required cleanliness.
 - .2 Change brush sizes as required to ensure positive contact with duct and component interiors.
 - .3 Clean corners and pockets where dirt and debris can accumulate.
- .8 Clean equipment, components and other features in isolated zone before moving to next zone of HVAC air duct system.
- .9 Clean diffusers, registers, louvers.
- .10 Advise Departmental Representative 72 hours minimum before deactivation of fire alarm and smoke detectors duct cleaning operations.
 - .1 Departmental Representative will pay for costs of deactivation of fire alarm and smoke detector system.

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 Carry out video survey as directed by Departmental Representative.
 - .2 Include in final survey areas inspected by Departmental Representative prior to cleaning.
 - .3 Identify on HVAC system record drawings access points used for inspection and cleaning.
 - .4 Re-collect and analyze particulates collected at same locations where original samples were collected before cleaning.
 - .5 Reset components including dampers and sensors, which have been disturbed during cleaning operations.

3.6 SYSTEM STARTUP

- .1 Install new system filters after cleaning operations are completed.
- .2 Cover each inspection opening with access door or panel and secure in place after inspection and cleaning are completed.
- .3 Restart each HVAC system.

3.7 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: separate waste materials for reuse and recycling.
 - .1 Dispose of existing HVAC filter materials to landfill.

END OF SECTION

PART 1 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-09b, 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-11, 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-12, Standard for the Installation of Air-Conditioning and Ventilating Systems.
 - .2 NFPA 90B-12, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
 - .3 NFPA 96-11, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .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.

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 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.

PART 2 PRODUCTS

2.1 SEAL CLASSIFICATION

- .1 Classification as follows:

<u>Maximum Pressure Pa</u>	<u>SMACNA Seal Class</u>
125	C
- .2 Seal classification:
 - .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.
 - .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.
 - .3 Class C: transverse joints and connections made air tight with sealant. Longitudinal seams unsealed.
 - .4 Unsealed seams and joints.

2.2 SEALANT

- .1 Sustainability Characteristics:
 - .1 Adhesives and sealants: in accordance with Section 07 92 00 - Joint Sealants.
- .2 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 Rectangular: standard.
 - .2 Round: smooth radius, centreline radius: 1.5 times diameter.
- .3 Mitred elbows, rectangular:
 - .1 To 400 mm: with single thickness turning vanes.
 - .2 Over 400 mm: with double thickness turning vanes.
- .4 Branches:
 - .1 Rectangular main and branch: with radius on branch 1.5 times width of duct.
 - .2 Round main and branch: enter main duct at 45 degrees with conical connection.
 - .3 Provide volume control damper in branch duct near connection to main duct.
 - .4 Main duct branches: with splitter damper.
- .5 Transitions:
 - .1 Diverging: 20 degrees maximum included angle.
 - .2 Converging: 30 degrees maximum included angle.
- .6 Offsets:
 - .1 Full radiused elbows.
- .7 Obstruction deflectors: maintain full cross-sectional area.
 - .1 Maximum included angles: as for transitions.

2.5 FIRE STOPPING

- .1 Retaining angles around duct, on both sides of fire separation.
- .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.
 - .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 concrete: manufactured concrete inserts.
 - .2 For steel joist: manufactured joist clamp.
 - .3 For steel beams: manufactured beam clamps:

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 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 and after receipt of written approval to proceed from Departmental Representative.

3.2 GENERAL

- .1 Do work in accordance SMACNA.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
 - .1 Insulate strap hangers 100 mm beyond insulated duct.
- .3 Support risers in accordance with SMACNA.

- .4 Install breakaway joints in ductwork on sides of fire separation.
- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

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 as follows:

<u>Duct Size</u>	<u>Spacing</u>
(mm)	(mm)
to 1500	3000
1501 and over	2500

3.4 SEALING AND TAPING

- .1 Apply sealant in accordance with SMACNA.
- .2 Bed tape in sealant and recoat with minimum of 1 coat of sealant to manufacturers recommendations.

3.5 LEAKAGE TESTS

- .1 Refer to Section 23 05 94 - Pressure Testing of Ducted Air Systems.
- .2 Do leakage tests in sections.
- .3 Make trial leakage tests as instructed to demonstrate workmanship.
- .4 Do not install additional ductwork until trial test has been passed.
- .5 Test section minimum of 30 m long with not less than three branch takeoffs and two 90 degrees elbows.
- .6 Complete test before performance insulation or concealment Work.

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

PART 1 GENERAL

1.1 REFERENCES

- .1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
 - .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 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.
 - .3 Turning vanes.
 - .4 Instrument test ports.

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.

PART 2 PRODUCTS

2.1 GENERAL

- .1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 INSTRUMENT TEST

- .1 1.6 mm thick steel zinc plated after manufacture.
- .2 Cam lock handles with neoprene expansion plug and handle chain.

- .3 28 mm minimum inside diameter. Length to suit insulation thickness.
- .4 Neoprene mounting gasket.

2.3 SPIN-IN COLLARS

- .1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.
- .2 Sheet metal thickness to co-responding round duct standards.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for air duct accessories installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Instrument Test Ports:
 - .1 General:
 - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
 - .2 Locate to permit easy manipulation of instruments.
 - .3 Install insulation port extensions as required.
 - .4 Locations:
 - .1 For traverse readings:
 - .1 Ducted inlets to roof and wall exhausters.
 - .2 Inlets and outlets of other fan systems.
 - .3 Main and sub-main ducts.
 - .4 And as indicated.
- .2 For temperature readings:
 - .1 At outside air intakes.
 - .2 In mixed air applications in locations as approved by Departmental Representative.
 - .3 At inlet and outlet of coils.
 - .4 Downstream of junctions of two converging air streams of different temperatures.

.5 And as indicated.

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 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.

PART 2 PRODUCTS

2.1 GENERAL

- .1 Manufacture to SMACNA standards.

2.2 SPLITTER DAMPERS

- .1 Fabricate from same material as duct but one sheet metal thickness heavier, with appropriate stiffening.
- .2 Single thickness construction.
- .3 Control rod with locking device and position indicator.
- .4 Rod configuration to prevent end from entering duct.
- .5 Pivot: piano hinge.
- .6 Folded leading edge.

2.3 SINGLE BLADE DAMPERS

- .1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm.
- .3 Locking quadrant with shaft extension to accommodate insulation thickness.
- .4 Inside and outside bronze end bearings.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for damper installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

- .3 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.
- .4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
- .5 Dampers: vibration free.
- .6 Ensure damper operators are observable and accessible.
- .7 Corrections and adjustments conducted by Departmental Representative.

3.3 CLEANING

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

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)
 - .1 AMCA Publication 201-[02(R2011)], Fans and Systems.
 - .2 ANSI/AMCA Standard 210-[2007]/(ANSI/ASHRAE 51-07), Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
 - .3 ANSI/AMCA Standard 300-2008, Reverberant Room Method for Sound Testing of Fans.
 - .4 ANSI/AMCA Standard 301-1990, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
 - .5 AMCA Publication 302-73(R2012), Application of Sone Ratings for Non-Ducted Air Moving Devices.
 - .6 AMCA Publication 303-79(R2012), Application of Sound Power Level Ratings for Fans.

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 domestic fans and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
 - .1 Submit in accordance with 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: 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 domestic fans from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 PRODUCTS

2.1 FANS - GENERAL

- .1 Maximum loudness: 5 sones.

2.2 WALL AND CEILING DISCHARGE FANS

- .1 Centrifugal direct drive, with plug-in type electric motor suitable for ceiling installation, zinc coated rectangular metal housing.
- .2 Sizes and capacity: as indicated.
- .3 Toggle switch operated complete with integral electrical outlet box with plug-in type receptacle.
- .4 Top duct outlet with integral backdraft damper.
- .5 Wall cap complete with spring loaded backdraft damper with neoprene gasket.
- .6 Silver anodized aluminum grille.

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 domestic fan installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Install in accordance with manufacturer's recommendations.

3.3 ANCHOR BOLTS AND TEMPLATES

- .1 Supply for installation by other divisions.

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

PART 1 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 for diffusers, registers and grilles and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Indicate following:
 - .1 Capacity.
 - .2 Throw and terminal velocity.
 - .3 Noise criteria.
 - .4 Pressure drop.
 - .5 Neck velocity.

1.2 MAINTENANCE MATERIAL SUBMITTALS

- .1 Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements 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 diffuser, registers and grilles from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

- .1 Performance Requirements:
 - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

2.2 GENERAL

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.
- .2 Frames:
 - .1 Full perimeter gaskets.
 - .2 Plaster frames where set into plaster or gypsum board.
 - .3 Concealed fasteners.
- .3 Concealed manual volume control damper operators.
- .4 Colour: as directed by Departmental Representative.

2.3 MANUFACTURED UNITS

- .1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

2.4 SUPPLY GRILLES AND REGISTERS

- .1 General: with opposed blade dampers.

2.5 RETURN AND EXHAUST GRILLES AND REGISTERS

- .1 General: with opposed blade dampers.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for diffuser, register and grille installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

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

3.2 INSTALLATION

- .1 Install in accordance with manufacturers instructions.
- .2 Install with flat head stainless steel screws in countersunk holes where fastenings are visible.

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 REFERENCES

- .1 American National Standards Institute/Air-Conditioning and Refrigeration Institute (ANSI/ARI)
 - .1 ANSI/ARI 210/240-2003. Unitary Air Conditioning and Air-Source Heat Pump Equipment.
- .2 American National Standards Institute/American Society of Heating, Refrigeration and Air-Conditioning Engineers (ANSI/ASHRAE)
 - .1 ANSI/ASHRAE Standard 15-2010, Safety Standard for Refrigeration Systems.
- .3 Air-Conditioning and Refrigeration Institute (ARI)
 - .1 ARI 320-1998, Standard for Water-Source Heat Pumps.
 - .2 ARI 325-98, Standard for Ground Water - Source Heat Pumps.
- .4 CSA International
 - .1 CAN/CSA-C656-05(R2010), Performance Standard for Split-System and Single Package Central Air Conditioners and Heat Pumps.
 - .2 CAN/CSA-C13256-2001(R2011), Water-Source Heat Pumps-Testing and Rating for Performance, Part 1 Water-to-Air and Brine-to-Air Heat Pumps.
- .5 Environment Canada, (EC) / Environmental Protection Services (EPS)
 - .1 EPS 1/RA/2-1996, Code of Practice for Elimination of Fluorocarbons Emissions from Refrigeration and Air Conditioning Systems.
 - .2 Environment Canada-1994, Ozone-Depleting Substances Alternatives and Suppliers List.
- .6 National Fire Protection Association (NFPA)
 - .1 NFPA 90A-2009, Standard for Installation of Air Conditioning and Ventilating Systems.

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 heat pumps 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.

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 heat pumps 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 heat pumps from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.

1.5 WARRANTY

- .1 12 months warranty period.

PART 2 PRODUCTS

2.1 DESCRIPTION

- .1 Heat pumps: to EPS 1/RA/2, CSA approved and with ARI or CSA certification seal.

2.2 REFRIGERANTS

- .1 Type of Refrigerant: R410A.

2.3 DRAIN PANS

- .1 Design and construct condensate drain pans under indoor coils so that no water can accumulate and install to allow for easy cleaning.

2.4 PTAC

- .1 General:
 - .1 One-piece, air-source roof mounted heat pump for year-round operation.
 - .2 Factory assembled and tested, complete with refrigerant charge, ready to operate.
 - .3 ULC Listed and labelled.
 - .4 Design for use with R410A.

-
- .2 Performance: as indicated.
 - .1 Ratings: in accordance with CAN/CSA-C656.
 - .3 Compressor:
 - .1 Welded, hermetic with crankcase heaters, vibration isolators.
 - .2 Design and test to operate with outside air at minus 29 degrees C on heating cycle without shutting off and at 1.6 degrees C on cooling cycle with specified air flow.
 - .3 Separate and independent refrigeration and control system for each compressor.
 - .4 Coils: aluminum fins, mechanically bonded to seamless copper tubes with all joints brazed.
 - .5 Condensate drain pan: under indoor coil stainless steel construction.
 - .6 Electric resistance heaters:
 - .1 Open wire, nickel chromium alloy, ULC listed and CSA approved.
 - .2 Safety controls to include over-temperature and over-current protection.
 - .7 Indoor supply air fan: forward curved, centrifugal, statically and dynamically balanced, supported from solid steel shaft running in heavy duty ball bearings.
 - .8 Filter:
 - .1 25 mm thick throw away.
 - .9 Cabinet: galvanized steel, with easily removable panels arranged for servicing components, internally insulated with 25 mm thick neoprene coated fibreglass, complete with outside air OA intake, bonderized and with baked enamel finish.
 - .10 Refrigeration piping:
 - .1 Between compressor, outdoor coil and indoor coil, complete with refrigerant metering devices and valves.
 - .11 Controls:
 - .1 Protection: manual reset high and low pressure stats, loss-of-charge, indoor coil freeze stat, current temperature overload devices.

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 heat pumps installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.

- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Install where indicated and in accordance with manufacturer's instructions.
- .2 Secure with hold-down bolts in accordance with manufacturer's recommendations.
- .3 Make duct connections through flexible connections.
- .4 Level unit with fans running. Align duct work, flexible connections. Misalignment with fan stopped not to strain or damage flexible connection.
- .5 Make piping connections.
- .6 Nothing to obstruct ready access to components or to prevent removal of components for servicing.

3.3 DRAIN PANS

- .1 Install so that no water can accumulate. Arrange easy access for cleaning.
- .2 Include internal or external trap for proper draining.

3.4 START-UP AND COMMISSIONING

- .1 Submit written start-up and commissioning reports to Departmental Representative.

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 heat pumps installation.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCE

- .1 Division 00 and Division 01 apply to and are a part of each Electrical Division Section.

1.2 APPLICATION

- .1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section of Electrical Divisions and is to be read accordingly.

1.3 SUBMITTALS

- .1 Submit shop drawings for products of this Section.
- .2 Additionally as part of shop drawing submission process, submit following to Parks Canada Representative for review:
 - .1 dimensioned location drawings indicating required sleeves and formed openings in structural poured concrete or precast concrete construction or in roofing, and locations of cutting or drilling required for Electrical Divisions work;
 - .2 samples of materials and any other items as specified in succeeding Sections of Electrical Divisions;
 - .3 weight loads of selected equipment (upon request);
 - .4 equipment nameplate and warning sign proposed nomenclature, print type, symbols, sizing and colours;
 - .5 fire stopping installation drawings with ULC certifications;
 - .6 copies of prior to start of construction approvals from local governing authorities having jurisdiction.
- .3 Prior to application for Substantial Performance of the Work, submit following to Parks Canada Representative for review (note: funds will be withheld until each of following items have been completed and documented to satisfaction of Parks Canada Representative):
 - .1 final distribution system testing performed and documented to satisfaction of Parks Canada Representative;

1.4 PRODUCT REQUIREMENTS IN SPECIAL AREAS

- .1 Products in non-climate controlled areas are to include weatherproof provisions such as gasketed covers, corrosion resistant hardware, weatherproof finishes, etc. Devices to be manufactured to operate in extreme temperatures.

PART 2 PRODUCTS

2.1 CONDUITS

- .1 EMT (Thinwall), galvanized electrical metallic tubing to CSA C22.2 No. 83, complete with factory made bends where site bending is not possible and joints and terminations made with steel couplers and steel set screw type connectors with insulated throats, and concrete tight where required.
- .2 Rigid galvanized steel to CSA C22.2 No. 45, with exterior zinc and interior enamel coatings, galvanized threads where factory cut and red lead coated threads where site cut. Factory made bends where site bending is not possible, factory made and threaded fittings, and connectors, and terminations with rigid couplings, and concrete tight where required.
- .3 Galvanized steel flexible liquid tight metallic conduit to CSA C22.2 No. 56, complete with Ideal "Steel Tough" liquid-tight flexible conduit connectors at terminations.
- .4 Galvanized steel flexible metallic conduit to CSA C22.2 No. 56, complete with proper and suitable squeeze type connectors at terminations.
- .5 CSA approved and labelled, FT-4 rated, rigid plastic (PVC) conduit complete with site made heat gun bends on conduit to 50 mm (2") diameter, factory made elbows in conduit larger than 50 mm (2") diameter, solvent weld joints, factory made expansion joints where required, and terminations made with proper and suitable connectors and adaptors.

2.2 OUTLET BOXES

- .1 CSA approved stamped galvanized steel outlet boxes.
- .2 Crouse-Hinds Canada Ltd., CSA certified, "FS", or "FD" Series cast Feraloy and aluminium outlet boxes.
- .3 Each outlet box and back box to be suitable in respects for application and complete with suitable securing lugs, connectors suitable for connected conduit, knockouts and, where necessary, suitable plaster rings, concrete rings, covers, carpet flanges and any other required accessory.
- .4 Electrical boxes exposed exterior of building or in non-climate controlled locations to be weatherproof boxes complete with gasketed covers/faceplates.

2.3 PULLBOXES AND JUNCTION BOXES

- .1 Galvanized or prime coat plated steel, suitable in respects for application and complete with screw-on or hinged covers as required, and connectors suitable for connected conduit.
- .2 Cooper Crouse-Hinds, "Condulet", threaded cast Feraloy outlet boxes of an exact type to suit application, each complete with screw-on gasketed cover.
- .3 Rigid plastic (PVC), CSA certified, junction boxes and access fittings with solvent weld type joints and screw-on PVC covers.
- .4 Physical size of pullboxes to be as required by local governing electrical code to suit number and size of conduits and conductors.

- .5 Each box to be suitable in respects for application and complete with suitable securing lugs, connectors suitable for connected conduit, knockouts and, where necessary, suitable plaster rings, concrete rings, covers and any other required accessory.
- .6 Boxes exposed exterior of building or in non-climate controlled locations to be weatherproof boxes complete with gasketed covers.

2.4 SLEEVES

- .1 Galvanized steel sleeves as follows:
 - .1 No. 24 gauge with an integral flange at one (1) end to secure sleeve to formwork construction;
 - .2 Schedule 40 pipe;
- .2 Schedule 40 PVC sleeves.

2.5 FIRESTOPPING AND SMOKE SEAL MATERIALS

- .1 Asbestos-free, elastomeric materials and intumescent materials, tested, listed and labelled by ULC in accordance with CAN 4-S115-M85, and CAN/ULC-S101-M for installation in ULC designated firestopping, and smoke seal systems to provide a positive fire, water and smoke seal and a fire resistance rating (flame, hose stream and temperature) no less than fire rating for surrounding construction.
- .2 Fire stopping and smoke seal material system to be specifically ULC certified with designated reference number for its specific installation. As part of shop drawing submission, submit copies of firestopping drawings with ULC certificate and number for each specific installation.
- .3 Smoke and fire seal materials and manufacturers must be specifically approved for each application of penetrated surfaces, listed in FM Global Approval Guide or ULC. Listed companies herein and other manufacturers are only acceptable if compliant with these requirements. As part of shop drawing submission, submit copies of firestopping drawings with FM Global Approval Guide or ULC listing details.
- .4 Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance ratings.
- .5 Systems to consist of both elastomeric and intumescent materials that are compatible with abutting dissimilar materials and finishes. Coordinate material requirements with trades supplying abutting areas of materials.
- .6 Typically, for openings of up to 250 mm (10") in diameter, provide putty pad type firestop materials equivalent to Specified Technologies Inc. "SpecSeal" intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibres or silicone compounds.
- .7 Typically, for openings of greater than 250 mm (10") in diameter, and for rectangular openings, provide pillow type firestop materials equivalent to Specified Technologies Inc. "SpecSeal" re-enterable, non-curing, mineral fibre core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag.
- .8 Supply products of a single manufacturer for use on work of this Division.
- .9 Installer to be manufacturer trained and certified on specific product. Submit copy of certificate with shop drawings.

- .10 Include for manufacturer's authorized representative to inspect and verify each installation and application. Submit test report signed and verified by system installer's authorized representative and manufacturer's representative.
- .11 Acceptable certification to also include certification by Underwriters Laboratories of Northbrook IL, using tests conforming to ULC-S115 and given cUL listing published by UL in their "Products Certified for Canada (cUL) Directory".
- .12 Acceptable manufacturers are:
 - .1 Specified Technologies Inc.;
 - .2 3M Canada Inc.;
 - .3 Tremco;
 - .4 A/D Fire Protection Systems;
 - .5 Nelson;
 - .6 Hilti Canada.

2.6 FASTENING AND SECURING HARDWARE

- .1 Concrete inserts - Crane Canada Ltd., No. 4-M for concrete work for single or double conduit, cable tray, etc., runs and equipment. Unistrut Ltd. multiple type inserts for runs of three (3) or more conduits etc., or where a grid support system is required.
- .2 Concrete fasteners – "WEJ-IT" anchors, lead cinch anchors and/or "STAR" or "PHILLIPS" self-drilling anchors.
- .3 Masonry inserts – "WEJ-IT" expansion shields and machine bolts or, for light loads, fibre or lead plugs and screws.
- .4 Drywall or plaster wall and/or ceiling fasteners – 2-wing spring toggles.
- .5 Structural steel - Crane Canada Ltd., beam clamps.
- .6 Metal framing channels – 40 mm (1-5/8") width, galvanized steel channels complete with required fittings and ancillary hardware; acceptable manufacturers are:
 - .1 Unistrut;
 - .2 Thomas & Betts;
- .7 Eaton B-Line.
- .8 Metal "J" hooks or Panduit "J-Pro" cable support systems for communications system cabling in accessible ceiling spaces where conduit or cable tray is not being provided. Obtain written approval of Parks Canada Representative for use of J-hooks.
- .9 Velcro tie wraps for bundling and securing cables.

2.7 ACCESS DOORS

- .1 Coordinate consistency of look and finish of access doors on project with each Division of Work. Coordinate exact requirements with General Trades Contractor.
- .2 Access doors to be rust resistant steel door panels, with concealed hinges and positive locking and self-opening screwdriver operated lock. Wall type frame to be suitable for wall installation and have integral keys for plaster walls. Doors in tile wall to be stainless steel and in ceilings to be suitable for plaster covering with only frame joint showing. All other doors to be prime painted steel.

- .3 Size access door to suit the concealed work for which they are supplied, and wherever possible they are to be of standard size for all applications, but in any case they are to be minimum 300 mm x 300 mm (12" x 12") for hand entry and 600 mm x 600 mm (24" x 24") for body entry.
- .4 Lay-in type tiles, properly marked, may serve as access panels. Coordinate marking of ceiling tiles with Parks Canada Representative. Panels in glazed tile walls to be 12 gauge, 304 alloy stainless steel, No. 4 finish, with recessed frame secured with stainless steel counter-sunk flush head screws.
- .5 Panels in plaster surfaces to have dish-shaped door and welded metal lath, ready to take plaster. Provide a plastic grommet for door key access.
- .6 Other access doors to be welded 12 gauge steel, flush type with concealed hinges, lock and anchor straps, complete with factory prime coat. Submit to Parks Canada Representative for review, details of non-standard door construction details.
- .7 Access doors in fire rated ceilings, walls, partitions, structures, etc., to be ULC listed and labelled and of a rating to maintain fire separation integrity.
- .8 Where access doors are located in surfaces where special finishes are required, they are to be of a recessed door type capable of accepting finish in which they are to be installed so as to maintain final building surface appearance throughout.
- .9 Acceptable manufacturers include Le Hage, SMS, Pedlar and Acudor.

2.8 IDENTIFICATION NAMEPLATES

- .1 Laminated plastic (Lamacoid) black-white-black with bevelled edges, stainless steel screws, and proper identification engraving. Each nameplate to be sized to suit equipment for which it is provided, and required wording. Confirm nomenclature with Parks Canada Representative. Various colour configurations to be used to differentiate systems. Confirm exact colour scheme with Parks Canada Representative.
- .2 Brother "P-Touch", portable electronic labelling system complete with self-adhesive, permanent printed labels with required nomenclature.

2.9 SYSTEM BACKBOARDS

- .1 FSC (Forest Stewardship Council), G1S (good one side) construction grade fir plywood, containing no added urea formaldehyde, flame retardant prime coat painted on exposed surfaces, minimum 20 mm (3/4") thick, as sized on drawings and with flame spread rating in accordance with local governing building code requirements.

2.10 SPRINKLER PROTECTION

- .1 Provide drip shields for protection of surface mounted equipment enclosures from water spray and dripping of liquids. Features of shields include:
 - .1 factory constructed by respective equipment manufacturers;
 - .2 constructed from non-combustible materials (sheet steel);
 - .3 enamel painted to match equipment;
 - .4 surfaces and edges filled/sanded smooth prior to painting;
 - .5 supported from equipment with structural steel rods/metal framing or other method approved by Parks Canada Representative;

- .6 structural support finish painted to match shield.
- .2 Include with equipment shop drawings, detailed dimensions of drip shields and methods of supporting.
- .3 Equipment with top cable/conduit entries to include additional sealing of entries with gasketting and/or waterproof sealant to prevent water from entering enclosure.
- .4 Design ventilation louvers such that live components are not exposed to water spray and dripping liquids.
- .5 Above requirements are additional minimum "sprinkler protection" standards for equipment specified as NEMA (EEMAC) 1, 2 or 12.
- .6 Obtain CSA approval where required by local governing authorities.

PART 3 EXECUTION

- .1 General Conduit Installation Requirements
 - .1 Install conduit concealed in finished areas, and concealed to degree made possible by finishes in partially finished and unfinished areas. Refer to and examine architectural drawings and room finish schedules to determine finished, partially finished or unfinished areas of building. Documents do not identify exact routing. Where shown, routing is diagrammatic, identifying general requirements of routing and locations. Include for necessary offsets, fittings, transformations and similar items required as a result of obstructions and other architectural or structural details not shown.
 - .2 Where conduits are exposed, arrange them to avoid interference with other work, parallel to building lines and install as high as possible. Do not install conduits within 150 mm (6") of "hot" pipes or equipment unless conduits are associated with equipment. Independently run conduit to be supported from wall/ceiling structure, not from ceiling hangers, ductwork, piping, cable trays, formed steel decking, etc. Do not run conduits within 900 mm (3') of equipment access opening covers.
 - .3 Where conduit is proposed to be embedded within structural concrete, obtain Owner's approval and review with Parks Canada Representative (Structural Engineer). Install such conduit in compliance with requirements of latest edition of CSA Standard CAN3-A23.1, "Concrete Materials, and Methods of Concrete Construction". Confirm and review with Structural Consultant, proper installation practices and methods. In areas where Parks Canada Representative has directed conduit not to be embedded in concrete, run conduits through beams via sleeved openings pre-coordinated and reviewed with General Contractor and by Consultant (Structural Engineer). Do not embed conduit runs in concrete slab of parking garage areas, unless approved by Parks Canada Representative.
 - .4 So as not to impair required strength of structure, following criteria to be generally followed but which is to be reviewed and coordinated with Parks Canada Representative prior to start of Work:

- .5 Where conduits pass by a column, stay at least two times thickness of slab and drop away from column;
 - .1 where conduits terminate adjacent to a column or wall, bring conduit in toward column/wall as close to 90° to face of column as possible within two times thickness of slab and drop away from column;
 - .2 maximum size of conduit in structural slabs is 1/5 of solid portion of slab thickness;
 - .3 where more than two conduits are adjacent to each other, they are to be spaced greater of 3 diameters or 100 mm (4") apart;
 - .4 total of depth of conduits crossing over each other is to be less than one-third thickness of slab;
 - .5 place conduit in middle third of thickness of slab; do not lay conduit directly on reinforcing steel;
 - .6 do not run conduit adjacent to parallel reinforcing bars;
 - .7 do not run conduit longitudinally in beam without approval of the Parks Canada Representative; pass through beams at right angles to span of beam;
 - .8 where conduits pass through beams, maintain at least twice depth of beam separation away from supports;
 - .9 do not run conduits in slab beside a drop or beam within twice depth of slab from edge of drop or beam;
 - .10 do not run conduits through shear walls or columns without approval of the Parks Canada Representative;
 - .11 do not place conduit in structural elements in parking garage structures, water retaining structures or structures subjected to de-icing chemicals, without approval of with the Parks Canada Representative.
- .6 For proposed use of conduit runs underground below slab include following provisions:
 - .1 concrete encased ductbank with conduits of non-ferrous materials and sloped to drain properly into pit;
 - .2 proper drain pit;
 - .3 system to be a pull-in system;
 - .4 20% spare conduits (with minimum of at least 1);
- .7 Conduits are sized on drawings, but in absence of type and sizing, type and size to suit intended application in accordance with applicable local governing electrical code requirements. Sizes identified on drawings are minimum sizes and are not to be decreased unless approved by Owner and reviewed with Parks Canada Representative.

3.2 INSTALLATION OF CONDUIT

- .1 Provide conduit for conductors except armoured cable and copper sheathed mineral insulated conductors, and except where duct or similar raceway materials are provided.
- .2 Provide conduit as follows:

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- .1 for exposed conduit outside building, for semi-exterior areas such as loading areas and within parking garage floor areas – rigid galvanized steel (rigid PVC where permitted by local codes and the Parks Canada Representative);
 - .2 for branch circuit conductors underground inside building, and underground outside building beneath concrete, asphalt, and similar paving material-rigid PVC;
 - .3 for branch circuit conductors underground outside building clear of concrete, asphalt and similar paving material-flexible polyethylene plastic conduit;
 - .4 for conductors in surface mounted conduit of garage/workshop – rigid galvanized steel; if approval obtained from Parks Canada Representative, rigid PVC may be used embedded in concrete slabs;
 - .5 for exposed conduit mounted at a height of less than 1500 mm (5') in electrical, mechanical or other service areas – rigid galvanized steel;
 - .6 for short branch circuit connectors to motorized equipment and distribution transformers (minimum length 450 mm (18"), maximum length 600 mm (24") with 180° loop where possible) – galvanized steel flexible liquid-tight conduit;
 - .7 at points, where conductors cross building expansion joints – galvanized steel flexible conduit with no less than 600 mm (24") of extra curve;
 - .8 for branch circuit conductors in poured concrete slab – rigid PVC;
 - .9 for interior conduit above 50 mm (2") diameter containing distribution conductors or communication systems conductors (fire alarm, telephone etc.) (except as noted above) – EMT with separate insulated ground conductor;
 - .10 for corrosive environments – epoxy coated rigid steel;
 - .11 for conductors except as noted above or elsewhere in this Specification – EMT.
- .3 Secure conduit located in poured concrete work in place in a manner such that conduit will not float or move when concrete is poured. Adequately protect such conduit from damage prior to and during concrete pour, and from concrete and water penetration.
 - .4 Review with Parks Canada Representative prior to Start of Work, maximum allowable size of conduit for installation in poured concrete. Placement of reinforcing steel in structural concrete work will take precedence over placement of conduit. Spaced adequately multiple runs of conduit in poured concrete work, as reviewed with Parks Canada Representative.
 - .5 Support underground conduit on a well-tamped flat bed of earth, free from rocks or protrusions of any kind. Grade and slope bed to provide conduits and ducts with proper drainage. Coordinate with General Trades Contractor for provision of means to carry away drainage water. Obtain required approvals of work from local governing electrical utility and review with Parks Canada Representative prior to back filling and covering. Provide pull cord in each duct run.
 - .6 Provide manufactured expansion joints in rigid PVC plastic conduit at spacing as recommended by conduit manufacturer.
 - .7 Provide a separate ground conductor in plastic conduits.
 - .8 Support and secure surface mounted and suspended single or double runs of metal conduit at support spacing in accordance with local governing electrical code requirements by means of galvanized pipe straps, conduit clips, ringbolt type hangers, or by other proper manufactured devices.

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- .9 Support multiple mixed size metal conduit runs with Unistrut Ltd., Electrovert Ltd. "CANTRUSS" or Burndy Ltd. "FLEXIBLE" conduit racks spaced to suit spacing requirements of smallest conduit in group.
 - .10 Unless otherwise noted, provide conduit fittings constructed of same materials as conduit and which are suitable in respects for application.
 - .11 Provide proper adaptors for joining conduits of different materials.
 - .12 Cut square and properly ream site cut conduit ends.
 - .13 Provide conduit as sized on drawings. Size conduit not sized on drawings in accordance with latest edition of local governing electrical code with consideration that sizes of branch circuit conductors indicated are minimum sizes and must be increased as required to suit length of run and voltage drop in accordance with voltage drop schedule found on drawings or at end of this section. Where conductor sizes are increased to suit voltage drop requirements, increase scheduled or specified conduit size to suit. Unless otherwise noted on drawings or required by local governing electrical code or specified elsewhere, conduit to be of minimum size 13 mm (1/2") diameter. Structured network cabling system conduit to be of minimum 19 mm (3/4") diameter, unless otherwise noted.
 - .14 Site made bends for conduit to maintain full conduit diameter with no kinking, and conduit finishes are not flake or crack when conduit is bent.
 - .15 Plug ends of roughed-in conduits which are exposed during construction with approved plugs.
 - .16 Ensure that conduit systems which are left empty for future wiring are clean, clear, capped and properly identified at each termination point. Provide end bushing and suitable fish wires in such conduits.
 - .17 Provide empty conduits to ceiling spaces from flush mounted panelboards located below and/or near hung ceiling. Refer to drawing detail.

3.3 EXPANSION FACILITIES FOR CONDUIT CROSSING BUILDING EXPANSION JOINTS

- .1 Wherever concealed or surface mounted conduits cross building expansion joints, provide expansion facilities to permit free movement without imposing additional stress or loading upon support system, and to prevent excessive movement at joints and connections, in accordance with drawing details.

3.4 INSTALLATION OF OUTLET BOXES AND BACK BOXES

- .1 Provide an outlet box or back box for each luminaire, wiring device, telephone outlet, communications systems components, and each other such outlet.
- .2 Size boxes to accommodate exact supplied components and for bending radii of installed cables. Confirm requirements with respective system vendors.
- .3 Outlet boxes flush mounted in interior construction, surface mounted in concealed interior locations, and surface mounted in exposed interior locations where connecting conduit is EMT, to be stamped and galvanized steel outlet boxes unless otherwise noted.

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- .4 Outlet boxes for surface mounted exterior lighting, receptacles, and other device outlets, boxes flush mounted in exterior building surfaces, and boxes mounted in interior device locations where connecting conduit is rigid and boxes in perimeter wall where insulation and vapour barrier is present, and boxes in non-climate controlled areas to be "FS" or "FD" Series cast boxes unless otherwise noted.
 - .5 Provide sealing around boxes in walls where insulation and vapour barrier is present or for walls of rooms that are sealed. Maintain sealing system of wall.
 - .6 Outlet boxes in underground plastic conduit systems to be rigid PVC plastic outlet boxes, unless otherwise noted.
 - .7 Outlet boxes for flush floor mounted devices to be concrete tight formed galvanized steel fully adjustable flush floor boxes. Locate in to position and install in accordance with manufacturer's instructions. Coordinate installation with trades pouring concrete floor slab or trade responsible for floor construction.
 - .8 Provide outlet boxes for special wiring devices, for special equipment and special applications. Refer to requirements specified in other Sections and/or on drawings.
 - .9 Size and arrangement of outlet boxes to suit device which they serve.
 - .10 Mounting heights and locations for outlet boxes are typically indicated on drawings, however confirm exact location and arrangement of outlets prior to roughing-in. Architectural drawings and Parks Canada Representative's instructions have precedence over electrical drawing diagrammatic layouts and specified mounting heights and locations.
 - .11 Do not install outlet or back boxes "back-to-back" in walls and partitions. Stagger such outlets and seal against noise transmission in accordance with drawing details. "Thru-wall" type boxes will not be permitted for any application.
 - .12 Provide blank coverplates over boxes left empty for future installation of devices. Clearly identify each box as to its intended use, to Owner's approval and reviewed with Parks Canada Representative. Generally, provide stainless steel type blank coverplates.

3.5 INSTALLATION OF PULLBOXES AND JUNCTION BOXES

- .1 Provide pullboxes in conduit systems wherever shown on drawings, and/or wherever necessary to facilitate conductor installations. Generally, conduit runs exceeding 30 m (100") in length, or with more than four - 90° bends, are to be equipped with a pullbox installed at a convenient and suitable intermediate accessible location.
- .2 Size boxes to accommodate exact supplied system and for bending radii of installed cables. Confirm requirements with respective system vendors.
- .3 Provide junction boxes wherever required and/or indicated on drawings and as required by local governing electrical code.
- .4 Provide sealing around boxes in walls where insulation and vapour barrier is present or for walls of rooms that are sealed. Maintain sealing system of wall.
- .5 Boxes in rigid conduit and EMT inside building to be stamped galvanized or prime coated steel.
- .6 Boxes in exterior rigid conduit and boxes in perimeter wall where insulation and vapour barrier is present, to be "Condulet" cast gasketed boxes, unless otherwise noted.

- .7 Boxes in plastic conduit to be rigid PVC plastic boxes complete with required couplings.
- .8 Pullboxes and junction boxes to be accessible after work is completed.
- .9 Accurately locate and identify concealed pullboxes and junction boxes on "As-built" record drawings.
- .10 Clearly identify main pull or junction boxes (excluding obvious outlet boxes) by painting outside of covers. Spray painting is not permitted unless approved by Owner and reviewed with Parks Canada Representative. Paint colours to be in accordance with following schedule:
 - .1 lighting-yellow;
 - .2 normal power-blue;
 - .3 UPS (essential) power-orange;
 - .4 telephone-green;
 - .5 miscellaneous signals-brown.
- .11 In addition to painting miscellaneous signal boxes, clearly identify specific system in which box is installed.
- .12 Cover boxes in fire walls with aluminium tape and seal with caulking.

3.6 INSTALLATION OF SLEEVES

- .1 Where conduits, round ducts and conductors pass through structural poured concrete, provide sleeves of type suitable for application, and approved by local governing codes.
- .2 Sleeves in concrete slabs, except as noted below, are to be No. 24 gauge or equivalent, with an integral flange to secure sleeves for formwork construction.
- .3 Sleeves in waterproof concrete slabs and in other slabs where waterproof sleeves are required are to be lengths of Schedule 40 pipe sized to extend 100 mm (4") above floor.
- .4 Sleeves in poured concrete walls and foundation are to be Schedule 40 pipe.
- .5 Size sleeves, unless otherwise noted, to leave 13 mm (1/2") clearance around conduit, duct, conductor, etc. Void between sleeves and conduit, duct, conductors, etc., to be packed and sealed for length of sleeves as in accordance with article entitled "Firestopping and Smoke Seal Materials" specified here in this Section. Ensure that sleeves set in exterior walls are packed and sealed with governing authority approved materials suitable for application and that both ends of sleeves are packed watertight with approved permanently flexible and water tight materials. Exact responsibility of work to be coordinated with General Trades Contractor.
- .6 Submit to concrete reinforcement detailer at proper time, drawings indicating required sleeves, recesses and formed openings in poured concrete work. Completely and accurately dimension such drawings and relate sleeves, recesses and formed openings to suitable grid lines and elevation datum.
- .7 Supply sleeves of a water protecting type in accordance with detail found on drawings for installation in following locations:
 - .1 In Mechanical and Fan Room floor slabs, except where on grade;
 - .2 In slabs over Mechanical, Fan, Electrical and Telephone Equipment Rooms or closets;

- .3 In floors equipped with waterproof membranes.
- .8 "Gang" type sleeving to be permitted only with approval of Owner and reviewed with Parks Canada Representative.
- .9 Terminate sleeves for work which is exposed, so that sleeve is flush at both ends with wall, partition, or slab surface such that sleeve may be covered completely by escutcheon plates.

3.7 INSTALLATION OF FIRESTOPPING AND SMOKE SEAL MATERIALS

- .1 Where electrical work penetrates or punctures fire rated construction, provide ULC certified, listed and labelled firestopping and smoke sealing packing material systems to seal openings and voids around and within raceway and to ensure that continuity and integrity of fire separation is maintained. Submit to Parks Canada Representative, copies of certificates of compliance from an independent testing agency, attesting that fire stopping and smoke seal materials meet ULC requirements. Openings not in immediate vicinity of working areas are to be firestopped and sealed same day as being opened.
- .2 Examine condition of voids to be filled to ensure suitability for systems. Verify installation of service penetrations and adjacent construction has been completed. Prepare substrates and surfaces to a clean, dry, frost-free condition, and primed to firestop system manufacturer's recommendations to receive firestopping system.
- .3 Install fire stopping and smoke seal materials for each installation in strict accordance with specific ULC certification number and manufacturer's instructions. Comply with local governing building code requirements and obtain approvals from local building inspection department. Ensure that openings through fire separations do not exceed maximum size wall opening, and maximum and minimum dimensions indicated in ULC Guide No. 40 U19 for Service Penetration Assemblies and fire stopping materials.
- .4 Ensure that continuity and integrity of fire separation is maintained and conform to requirements of latest edition of ULC publication "List of Equipment and Materials, Volume II, Building Construction".

3.8 SUPPLY OF ACCESS DOORS

- .1 Supply access doors to give access to junction boxes, pull boxes, conductor joints and other similar electrical work which may need maintenance or repair but which is concealed in inaccessible construction.
- .2 Before commencing installation of work, coordinate with other trades and prepare on a set of reflected ceiling plans and wall elevations, complete layouts of access doors. Submit these layouts for Parks Canada Representative's review and show exact sizes and locations of such access doors. Locate and arrange electrical work to suit.
- .3 Access doors to be installed by trade responsible for particular type of construction in which doors are required. Supply access doors to trade installing same at proper time.
- .4 Wherever possible, access doors to be of a standard size for each application. Confirm exact dimensions and minimum size restrictions with Parks Canada Representative prior to ordering.

- .5 Coordinate with Mechanical Contractor and General Trades Contractor to ensure that access doors on project are provided by a single manufacturer, installed as part of work of General Trades Contractor and that work involving both mechanical and electrical services should where possible be accessible from common access door. Coordinate work to ensure that common location access doors are not supplied by both Mechanical Divisions and Electrical Divisions.

3.9 INSTALLATION OF FASTENING AND SECURING HARDWARE

- .1 Provide fasteners and similar hardware required for conduit, duct, raceway, conductors, etc. and for equipment hanger and/or support material unless otherwise noted.
- .2 Accurately and properly set concrete inserts in concrete framework. Where multiple type inserts are used, space same to suit requirements of smallest conduit, etc., in group.
- .3 Fasten hanger and support provisions to masonry with expansion shields and machine bolts, or, for light loads, use plugs, and screws.
- .4 In drywall or plaster walls and/or ceilings use two wing toggles and for heavy loads, provide steel anchor plates with two or more toggles to spread load.
- .5 Provide beam clamps for attaching hanging and/or support provisions to structural steel, or where approved by Owner and reviewed with Parks Canada Representative, weld hanging and support provisions to structural steel.
- .6 Explosive powder actuated fasteners are not permitted unless specific written approval for their use and type has been obtained from Parks Canada Representative.
- .7 Under no circumstances use ceiling suspension hangers or grids for suspension of conduit and conductors. Install supports to permanent structure of building, limited to areas that will not damage structural stability.
- .8 Provide "J" hooks in accessible ceiling spaces where conduit is not provided for structured cabling runs or other telecommunication cabling, as approved by Parks Canada Representative.
- .9 Comply with J-hook manufacturer's loading limitations and spacing criteria. Do not exceed 1.2 m (4') spacing interval. Add additional J-hooks if cabling sags, at discretion of Parks Canada Representative. Drill anchors for J-hooks into slab not into post tensioned beams. Do not install more than one system on each J-hook.
- .10 Install Velcro tie wraps on bundled telecommunication cables and do not over tighten. Provide FT6/CMP rated wraps in plenum type spaces as per local building code requirements.
- .11 Comply with Consultant's (Structural Engineer's) limitations for maximum penetrations of securing hardware into concrete slabs.

3.10 INSTALLATION OF IDENTIFICATION NAMEPLATES

- .1 For each piece of electrical distribution equipment from electrical source of supply up to and including panelboards, for special control panels and cabinets, and for each other piece of electrical equipment, provide engraved Lamacoid identification nameplates secured to apparatus with stainless steel screws. Nameplates to indicate source of electrical supply and include Consultant's equipment identification number. Identify whether equipment is on "NORMAL POWER SYSTEM" or "ESSENTIAL POWER SYSTEM".

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- .2 Equip large multiple cell or component apparatus such as switchboards and distribution panels with main nameplates identifying equipment, voltage characteristics, capacity and source of supply, and with sub-nameplates clearly identifying each cell or component and its service.
 - .3 Panelboard nameplates to identify panelboard number as designated on drawings, unless otherwise instructed. Nameplates for disconnect switches, control panels, and cabinets to outline their service and source of supply.
 - .4 In areas where equipment having removable doors that can be commonly installed on different equipment, ensure that each door is identified to which piece of equipment it is associated with, such that nameplates are with correct equipment.
 - .5 Nameplates to be mechanically secured lamaroid and be colour coded as follows:
 - .1 Normal Power Black with white letters;
 - .2 Emergency Power Red with white letters;
 - .6 Above identification nameplate and nomenclature requirements are for typical requirements for pricing only.
 - .7 In pull boxes, junction boxes and at terminations, identify feeders by use of plastic plates indicating system voltage and circuit designations. Plates to be 25 mm (1") in diameter and have letter stamped 9 mm (5/8") high. Colour coding to be:
 - .1 Phase A – red;
 - .2 Phase B – black;
 - .3 Phase C – blue;
 - .4 Neutral – white;
 - .5 Ground - green.
 - .8 Confirm print size type and size, colours, sizing and nomenclature of nameplates with Parks Canada Representative prior to ordering. Submit sample board.

3.11 INSTALLATION OF TERMINAL BACKBOARDS

- .1 Provide specified terminal backboards for communication systems and electrical distribution equipment.
- .2 Securely wall mount each backboard with proper fasteners to suit wall construction.
- .3 Unless otherwise noted, size backboards to sufficiently provide adequate terminal space for each system, plus 20% space for future additions.

3.12 BRANCH CIRCUIT BALANCING

- .1 Connect branch lighting and power circuits to panelboards so as to balance actual loads (wattage) within 5%. If required, transpose branch circuits when work is complete to meet this requirement.
- .2 At request of Parks Canada Representative, perform necessary tests to show compliance with above requirement. Make such tests after building is occupied.

3.13 EXCAVATION AND BACKFILL

- .1 Unless otherwise noted, excavation and backfill work required for electrical work is to be done as part of work of Division 02 or 31, except for final hand grading work and backfill to 450 mm (18") above service which is to be done as part of electrical work. Mark out location and routing of excavation required for work as well as required depth. Ensure that bedding is graded to provide proper drainage for ducts as reviewed with Parks Canada Representative.
- .2 Inverts and locations of existing site services may have been site surveyed and approximate location may be shown on drawings. Confirm that local utilities have performed locates and marking out. Ensure inverts and locations are correct, prior to commencement of work. Where discrepancies are found, immediately inform Parks Canada Representative, and await direction.
- .3 Ensure that work is inspected by Parks Canada Representative before covering and backfilling. Failure to do so prior to backfilling will require re-excavating work and re-backfill at no additional cost to Owner.

3.14 CUTTING, PATCHING AND CORE DRILLING

- .1 Unless otherwise provided by General Trades, perform cutting, patching, and core drilling of existing building required for installation of your work. Perform cutting in a neat and true fashion, with proper tools and equipment. Patching is to exactly match existing finishes and be performed by tradesmen skilled in particular trade or application. Work is subject to review and acceptance by the Parks Canada Representative.
- .2 Criteria for cutting holes for additional services:
 - .1 cut holes through slabs only; no holes to be cut through beams;
 - .2 cut holes 150 mm (6") diameter or smaller only; review with and obtain direction from Consultant (Structural Engineer) for larger holes;
 - .3 keep at least 100 mm (4") clear from beam faces;
 - .4 space at least 3 hole diameters on centre;
 - .5 for holes that are required closer than 25% of slab span from supporting beam face, use cover meter above slab to clear slab top bars;
 - .6 for holes that are required within 50% of slab span, use cover meter underside of slab to clear slab bottom bars;
 - .7 submit sleeving drawings indicating holes and their locations for Consultant's (Structural Engineer's) review.
- .3 Where conduits and/or conductors penetrate existing construction, core drill or saw cut an opening. Size openings to leave 13 mm (1/2") clearance around conduit and/or conductors, and pack and seal and void between opening and conduit and/or conductor for length of opening with ULC listed and labelled material in accordance with article entitled "Firestopping And Smoke Seal Materials" specified herein this Section.
- .4 Do not cut or drill any existing work without approval of the Parks Canada Representative. Be responsible for damage done to building and services caused by cutting or drilling.

- .5 Prior to drilling or cutting an opening, determine, in review with the Parks Canada Representative, and by use of non-destructive radar scan (magnetic scan) of slab or wall, presence of any existing services and reinforcement bars concealed behind building surface to be cut and locate openings to suit. Be responsible for damage to existing services caused by core drilling or cutting openings. Coring is not permitted through concrete beams or girders.
- .6 Fire stop and seal openings as specified, and patch as required before end of workday. No openings are to be left open overnight unless approved by Owner and coordinated with the Parks Canada Representative.

3.15 FINISH PAINTING OF ELECTRICAL WORK

- .1 Unless otherwise noted, finish painting of exposed Electrical Divisions work is to be performed as part of work of Division 09.
- .2 Provide identification painting for electrical distribution equipment in accordance with application requirements of Division 09. Review exact finish colours with Consultant. Equipment requiring special colour identification painting to include but not be limited to following:
 - .1 pull boxes and junction boxes;
 - .2 communication system conduit;
 - .3 genset exhaust piping.
- .3 Spray painting is not permitted unless approved in writing by Owner and reviewed with Parks Canada Representative.

3.16 CONDUIT PROVISIONS FOR MISCELLANEOUS SYSTEMS

- .1 Provide following components to accommodate future installation of various miscellaneous systems by system installers who are to provide equipment and wiring:
 - .1 conduit - diameters as sized on drawings with non-metallic fish wires or pull cords and suitable bushings for conduit terminations, and as specified in Part 2; provide labelling at each end to clearly identify each conduit run with respect to system and path;
 - .2 outlet boxes - standard galvanized steel, each complete with a blank type faceplate, and as specified in Part 2;
 - .3 pull boxes, junction boxes, back boxes and sleeves - and as specified in Part 2.
- .2 Miscellaneous systems are typically as shown on drawings. Unless otherwise noted on drawings, provide dedicated conduit runs for each system. Coordinate sizes of boxes with respective system vendors to ensure proper sizing to accommodate components and that allows for wiring bending radii. Confirm conduit and box requirements also with system vendors.
- .3 Provide pullboxes in conduit runs longer than 30 m (100') or having more than two - 90 bends. Size pullboxes to be at least 8 times entering conduit in length. Pullbox sizes to comply with respective system standards.

- .4 Leave conduits free and clear of all obstructions and terminate as required. Equip terminations with bushing, and clearly identify each run. Provide fish wires in all empty conduits. Run telecommunications conduits to comply with separation from sources of electromagnetic radiation as per standard ANSI/TIA/EIA-569. Site bend telecommunications conduit elbows to comply with system conduit bending radii requirements.
- .5 Review exact requirements and locations of equipment with Parks Canada Representative and respective system installers prior to roughing-in.
- .6 Refer to system riser diagrams on drawings.
- .7 Quantities for outlets to be as per floor plan drawings and not riser diagrams.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for wire and box connectors.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-C22.2 No.18-98, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
 - .2 CSA C22.2 No.65-93(R1999), Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA).

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .3 Divert unused wiring materials from landfill to metal recycling facility as approved by Parks Canada Representative.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper alloy sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to EEMAC 1Y-2 NEMA to consist of:
 - .1 Connector body and stud clamp for stranded copper conductors.
 - .2 Clamp for stranded copper conductors bar.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper conductors.
 - .5 Sized for conductors as indicated.

- .4 Clamps or connectors for armoured cable, flexible conduit, as required to: CAN/CSA-C22.2No.18.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2No.65.
 - .2 Install fixture type connectors and tighten. Replace insulating cap.
 - .3 Install bushing stud connectors in accordance with EEMAC 1Y-2 NEMA.

END OF SECTION

PART 1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

1.2 REFERENCES

- .1 CSA C22.2 No .0.3-96, Test Methods for Electrical Wires and Cables.

1.3 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 00 50 - General Instructions.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.
- .2 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 PRODUCTS

2.1 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

PART 3 EXECUTION

3.1 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Materials and installation for connectors and terminations.

1.2 RELATED SECTIONS

- .1 Not used.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No. 65-03. Wire Connectors.
 - .2 CSA C22.2 No.41-M1987(R1999), Grounding and Bonding Equipment.

1.4 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 00 50 - General Instructions.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .3 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by DCC Representative.

PART 2 PRODUCTS

2.1 CONNECTORS AND TERMINATIONS

- .1 Copper compression connectors to CSA C22.2 No.65-03 as required sized for conductors.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.
- .2 Bond and ground as required to CSA C22.2 No.41.

END OF SECTION

PART 1 GENERAL

1.1 Submittals

- .1 Submit shop drawings for products and accessories.

PART 2 PRODUCTS

.1 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 Conductors: Solid copper, insulated and bare to suit application and code requirements; and bond conductors.
- .3 Ground Busbar: Solid copper busbar, predrilled for two-hole lug connections, of size of 50 mm x 9 mm x 600 mm (2" x 3/8" x 24"), for wall and backboard mounting using standoff insulators.
- .4 Ground Connections:
 - .1 Below Grade: Cadweld type connections, with exothermic-welded type connectors.
 - .2 Acceptable manufacturers are:
 - 1. Erico
 - 2. Harger
 - 3. Burndy
 - .3 Above Grade or in Manholes: Compression type connectors; exothermic connections permitted above grade if approved by DCC Representative.
 - .4 Acceptable manufacturers are:
 - 1. Erico
 - 2. Harger
 - 3. Burndy
 - .5 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 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.
- .6 Miscellaneous ancillary components to complete grounding and bonding work to requirements of local governing electrical authority and codes.

2.2 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. Provide local governing electrical utility's grounding requirements for electrical rooms, as applicable. 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 For the Niblock site, Applicable grounding requirements for the local electrical utility's pad mounted transformer shall be by the local utility.
- .4 For the David Thompson site, around the designated location of the generator building, provide a ground electrode consisting of minimum four (4) ground rods (unless otherwise detailed or otherwise required by local governing electrical code) 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.
- .5 Provide 50 mm x 9 mm x 600 mm (2" x 3/8" x 24") electrical grade copper ground bus on perimeter wall at service entry, 300 mm (12") above finished floor level. Secure ground bus on 20 mm (3/4") standoff insulators. Connect electrical rooms ground grid with ground bus with minimum 3/0 copper ground conductor in conduit. Connect each electrical room perimeter ground electrode system back to main electrical room ground electrode with minimum No. 3/0 copper conductors.
- .6 Ground and bond other equipment such as transformers, switchboards, panelboards, and similar metal work to perimeter ground bus. Provide minimum No. 3/0 insulated ground wire from ground bus in electrical rooms to switchboards, transformers, structure, floor, etc.
- .7 Extend conductors to metal piping of main water service and connect ground conductor to source side of any water meter present. If piping is not metallic, make necessary connections as typically required by a local governing electrical utility.
- .8 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.
- .9 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.

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- .10 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.
 - .11 Effectively bond building structures to main grounding system (grid).
 - .12 Provide separate insulated ground wire for each isolated ground receptacle.
 - .13 Connect grounding conductors to motors 10 hp and above or circuits 20A or above, with a solderless terminal and a bolt tapped to motor frame or equipment housing. Connect to smaller motors or equipment by fastening terminal to a connection box. Connect junction boxes to equipment grounding system with grounding clips mounted directly on box or with machine screws. Completely remove paint, dirt, or other surface coverings at grounding conductor connection points so good metal-to-metal contact is made.
 - .14 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.
 - .15 Ground and bond various telecommunications, audio visual systems, security, life safety and control systems in accordance with respective system manufacturer's recommendations and in accordance with local governing electrical code requirements.
 - .16 Make ground connections in slab or buried underground using local governing electrical authority approved welded copper connections.
 - .17 Ground conductors not sized on drawings are to be sized in accordance with local governing electrical authority requirements. Ground conductor size is to be no smaller than requirements specified herein this article or on drawings.

2.3 Additional Telecommunications Grounding

- .1 Comply with TIA/EIA-607 grounding and bonding requirements.
- .2 Provide wire and hardware required to properly ground, bond, and connect communications raceway, cable tray, metallic cable shields, and equipment to a ground source.
- .3 Ground bonding jumpers to be continuous with no splices. Use shortest length of bonding jumper possible.
- .4 Provide ground paths which are permanent and continuous with a resistance of 1 ohm or less from raceway, cable tray, and equipment connections to building grounding electrode. Resistance across individual bonding connections to be 10 milliohms or less.

2.4 Bonding Jumpers:

- .1 Use insulated ground wire of size and type if identified on Drawings if not identified, comply with local governing code, but which is to be a minimum of No. 6-AWG insulated copper wire.
- .2 Assemble bonding jumpers using insulated ground wire terminated with compression connectors.
- .3 Use compression connectors of proper size for conductors specified. Use connector manufacturer's compression tool.

2.5 Bonding Jumper Fasteners:

- .1 Conduit: Fasten bonding jumpers using screw lugs on grounding bushings or conduit strut clamps, or clamp pads on push-type conduit fasteners. When screw lug connection to a conduit strut clamp is not possible, fasten plain end of a bonding jumper wire by slipping this plain end under conduit strut clamp pad; tighten clamp screw firmly. Where appropriate, use zinc-plated external tooth lock washers.
- .2 Wireway and Cable Tray: Fasten bonding jumpers using zinc-plated bolts, external tooth lockwashers, and nuts. Install protective cover; e.g., zinc-plated acorn nuts, on any bolts extending into wireway or cable tray to prevent cable damage.
- .3 Ground Plates and Busbars: Fasten bonding jumpers using two-hole compression lugs. Use tin-plated copper or copper alloy bolts, external tooth lockwashers, and nuts.
- .4 Unistrut and Raised Floor Stringers: Fasten bonding jumpers using zinc-plated, self-drill screws and external tooth lockwashers.
 - .1 Building Ground Busbars:
 - .1 Provide busbar hardware at each communications room and connect to pigtail extensions of building grounding ring.
 - .2 Verify that ground ring pigtail is same type and size conductor used for main building grounding ring.
- .5 Telecommunications Ground Busbars:
 - .1 Provide telecommunications ground busbar hardware at telephone equipment backboard.
 - .2 Connect busbar to building ground busbar using two-hole compression lugs and a grounding jumper of same size as pigtail extension of main building grounding ring (usually 3/0 AWG).
- .6 Ground metallic conduits, wireways, and other metallic equipment located away from equipment racks or cabinets to cable tray pan or telecommunications ground busbar, whichever is closer, using insulated No. 6-AWG ground wire bonding jumpers.

- .7 Ground metallic conduit at each end using No. 6-AWG bonding jumpers.
 - .1 Comply with cable tray manufacturer's grounding and bonding recommendations. Bond metallic structures of wireway to provide 100% electrical continuity throughout wireway system.

END OF SECTION

PART 1 GENERAL

1.1 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .3 Divert unused metal materials from landfill to metal recycling facility as approved by Parks Canada Representative.
- .4 Fold up metal banding, flatten and place in designated area for recycling.

PART 2 PRODUCTS

2.1 SUPPORT CHANNELS

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Secure equipment to solid masonry, tile and plaster surfaces with lead anchors.
- .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 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .7 For surface mounting of two or more conduits use channels at 3000 mm 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 Parks Canada Representative.
- .12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-15, Canadian Electrical Code, Part 1, 23rd Edition.

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 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.

1.3 DELIVERY, STORAGE AND HANDLING

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

PART 2 PRODUCTS

2.1 SPLITTERS

- .1 Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Terminations: main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3 Spare Terminals: minimum three spare terminals or lugs on each connection or lug block sized less than 400 A.

2.2 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.

PART 3 EXECUTION

3.1 SPLITTER INSTALLATION

- .1 Mount plumb, true and square to building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 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.

3.3 IDENTIFICATION

- .1 Equipment Identification: to Section 26 05 00 – Basic Electrical Materials And Methods.
- .2 Identification Labels: size 2 indicating system name, voltage and phase, or as indicated.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 CSA C22.1-2015, Canadian Electrical Code, Part 1.

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

PART 2 PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1-2015
- .2 102 mm square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 347 V outlet boxes for 347 V switching devices.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 SHEET STEEL OUTLET BOXES

- .1 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

2.3 CONDUIT BOXES

- .1 Cast FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.4 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

- .1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables.

2.5 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA C22.2 No. 18-98, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware.
 - .2 CSA C22.2 No. 56-1977 (R1999), Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .3 CSA C22.2 No. 83-M1985 (R1999), Electrical Metallic Tubing.
 - .4 CSA C22.2 No. 211.2-M1984 (R1999), Rigid PVC (Unplasticized) Conduit.
 - .5 CAN/CSA C22.2 No. 227.3-M91 (R1999), Flexible Non-metallic Tubing.

1.2 WASTE MANAGEMENT AND DISPOSAL

- .1 Place materials defined as hazardous or toxic waste in designated containers.
- .2 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .3 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

PART 2 PRODUCTS

2.1 CONDUITS

- .1 Rigid galvanized steel threaded conduit: to CSA C22.2 No. 45.
- .2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83.
- .3 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .4 Flexible metal conduit: to CSA C22.2 No. 56, steel aluminum liquid-tight flexible metal.
- .5 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3.

2.2 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits NPS 2 50 mm. Two hole steel straps for conduits larger than NPS 2 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 3000 mm oc.
- .4 Threaded rods, 6 mm dia., to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" where 90E bends are required for NPS 1 25 mm and larger conduits.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

- .1 Polypropylene.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .2 Painted and exposed surface conduit acceptable where existing installation is in surface conduit. Paint to match final finished surface colour on which conduit is installed.
- .3 Use electrical metallic tubing (EMT) except in cast concrete above 2.4 m not subject to mechanical injury.
- .4 Use rigid metal conduit where subject to mechanical injury.
- .5 Use rigid PVC conduit underground in corrosive areas.
- .6 Use flexible metal conduit for connection to motors in dry areas connection to recessed incandescent fixtures without a prewired outlet box connection to surface or recessed fluorescent fixtures work in movable metal partitions.
- .7 Minimum conduit size for lighting and power circuits: NPS 3/4 19 mm.
- .8 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .9 Mechanically bend steel conduit over 19 mm dia.
- .10 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .11 Install fish cord in empty conduits.
- .12 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
- .13 Dry conduits out before installing wire.

3.2 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended or 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.

END OF SECTION

PART 1 GENERAL

1.1 SUBMITTALS

- .1 Submit shop drawings for products specified in this Section.

1.2 PRODUCT COMPATIBILITY

- .1 Lighting controls and luminaires when integrated together for control purposes must be 100% compatible with each other. Coordinate with ballast/driver and lamp manufacturers, control panel manufacturers and dimmer/occupancy control manufacturers to ensure that components are compatible with each other and that interconnections do not affect performance, life or any warranties.

PART 2 PRODUCTS

2.1 PHOTO TIMER CONTROLLERS

- .1 CSA approved, microprocessor controlled photo timer with features as follows:
 - .1 Silicon photosensor;
 - .2 microprocessor tracks dusk and dawn times for 24 hours and automatically sets its internal calendar in order to turn OFF at midnight during all seasons; back ON before dawn, and OFF at sunrise
 - .3 Automatically adjusts for daylight savings time;
 - .4 Two potentiometers are to be provided: one allows for field adjustment for longitude corrections or for additional energy savings; other allows user to set number of hours after middle of night that lights turn back on (AM burn);
 - .5 Solid brass locking type prongs;
 - .6 Relay provides positive snap action switching to assure a minimum contact life of 5,000 operations;
 - .7 Surge protection provided using a metal oxide varistor of 160 joules minimum;
 - .8 Enclosure of ANSI colour code, high impact, UV stabilized polypropylene and contain a UV resistant clear acrylic window; base of ABS construction with a cross linked polyethylene gasket;
 - .9 Provides a load rating of 1000 watt tungsten, 1800 VA ballast;
 - .10 Must fail in the on position.
- .2 Include for required wiring, standard turn-lock receptacle and mounting hardware.
- .3 Acceptable manufacturers are:
 - .1 Tork;
 - .2 Intermatic;
 - .3 Paragon Electric.

PART 3 EXECUTION

3.1 INSTALLATION OF OUTSIDE LIGHTING CONTROL

- .1 Provide a photo cell to switch designated outside lighting on, and time switch as required for programmed "off" control. Provide relays/contactors for control connections to multiple lighting loads. Refer to drawing details and notes for exact requirements. Provide required wiring in conduit and system connections to provide outside lighting control.
- .2 Install components in accordance with manufacturer's instructions to suit specific installation requirements.
- .3 Flush mount photo cell in north exterior wall or specified location on exterior of building at a height to permit cleaning. Confirm exact location prior to roughing-in.
- .4 Connect lighting circuits to photo cell and to time switch which will be located near panelboard.
- .5 When outside lighting control work is complete, test operation of control system and adjust as required.
- .6 Confirm exact sequence of operation with Parks Canada Representative prior to start of Work.

3.2 INSTALLATION OF TIMERS

- .1 Provide timers to control lighting and other equipment as required and confirmed by Parks Canada Representative.
- .2 Exact type of timers to be verified by manufacturer/supplier to ensure proper compatibility to interconnected equipment and loads. Confirm with respective manufacturers.
- .3 Install devices in accordance with manufacturer's instructions. Provide wiring in conduit. Provide required power connections and interconnection to luminaires, equipment, and power panels.
- .4 Programme timers as per schedule confirmed with the Parks Canada Representative.
- .5 Provide engraved nameplate identifying each timer.
- .6 After installation, adjust, test, and verify operation.

3.3 INSTALLATION OF OCCUPANCY SENSORS

- .1 Provide occupancy sensors and daylight sensors and associated devices to control lighting in areas as required.
- .2 Exact type of occupancy sensors and type of lenses to be verified by manufacturer/supplier to ensure proper coverage in sensed areas only, and compatibility to interconnected systems. Confirm with respective manufacturers.

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- .3 Supply, install, and aim appropriate sensors in correct location required for complete and proper volumetric coverage within range of coverage(s) of controlled areas per manufacturer's recommendations. Rooms to have 90-100% coverage to completely cover controlled area to accommodate occupancy habits of single or multiple occupants at any location within room(s). Locations and quantities of sensors shown and/or noted are illustrations only and should only be used as guidelines. Provide additional sensors if required to properly and completely cover respective room.
 - .4 Verify with manufacturer's factory authorized representative, exact type of sensor to be used in each area, placement of sensors and installation criteria, to best meet requirements of end user. Manufacturer's representative should be consulted for more non-typical installation types. Ensure that sensors connected to dimming system are 100% compatible with dimming system.
 - .5 Proper judgement must be exercised in executing installation so as to ensure that best possible installation in available space and to overcome local difficulties due to space limitations or interference of structural components. Also provide, at Owner's facility, training necessary to familiarize Owner's personnel with operation, use, adjustment, and problem solving diagnosis of occupancy sensing devices and systems.
 - .6 Install devices in accordance with manufacturer's instructions. Provide wiring in conduit. Provide required power connections and interconnection to luminaires and power panels. Provide manual switches to override control system in each area/room as shown.
 - .7 Confirm mounting heights with Architect and manufacturer prior to roughing-in and installation.
 - .8 Adjust sensitivity and time delays to best suit the layout drawings. Allow for minor adjustments of locations 1 m (3.3') of sensors.
 - .9 Refer also to testing and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

END OF SECTION

PART 1 GENERAL

1.1 Submittals

- .1 Submit shop drawings for products and accessories.

PART 2 PRODUCTS

2.1 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 volts, maximum 90°C (194°F) conductor temperature, -40°C (-40°F) minimum installation temperature, X-link polyethylene (XLPE) insulation, colour coded.
- .3 "T90 Nylon", CSA certified, single copper conductor to CSA C22.2 No. 75, 600 volts, maximum 90°C (194°F) dry conductor temperature, -10°C (-14°F) minimum installation temperature, PVC insulated, nylon covered.
- .4 "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.
- .5 "RWU90" CSA certified, single copper conductor to CSA C22.2 No. 38, 1000 volts, maximum 90°C (194°F) conductor temperature, -40°C (-40°F) minimum installation temperature, extra thickness X-link polyethylene (XLPE) insulation suitable for wet and buried installations, colour coded.
- .6 "AC90" flexible armoured cable with "RW90" conductors and bare copper ground conductor and overall interlocked aluminium tape armour, to CSA C22.2 No. 51 (R2004).
- .7 "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).
- .8 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.
- .9 Optionally, feeders of amperage rating exceeding 150A may be aluminum alloy conductors. 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. Resize conductors and conduits from copper based sizing as required, maintaining ampacity ratings noted, in compliance with local governing electrical code.

2.2 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.

2.3 Standard Control and Communications Cables

- .1 ULC listed and labelled, CSA certified to C22.2 No. 127, No. 18 AWG "TEW" thermoplastic insulated, solid copper wire rated for 600 volts service, and 105°C (220°F) conductor temperature, complete with required number of copper conductors and colour coding.

2.4 Conductor Pulling Lubricant

- .1 IDI Electric (Canada) Ltd., "Ideal Yellow 77" or "Wire Lube" as required.

2.5 Corflex Cables

- .1 CSA type "RA90" (X LINK) conductors, cable suitable for 600 volt service and consisting of cross linked polyethylene insulated single copper conductors, 90°C (194°F) rated, enclosed by a continuous extruded corrugated aluminum sheath with an overall PVC jacket.
- .2 Acceptable manufacturers are:
 - .1 Nexans;
 - .2 Prysmian Cables (Pirelli);
 - .3 General Cable;
 - .4 Aetna Cables;
 - .5 Kerite Company.

2.6 Teck Cables

- .1 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;
 - .3 600 V 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 dinner 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.

PART 3 EXECUTION

3.1 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 Confirm fire protection ratings of construction to ensure that rooms and paths of conductors are fire rated in accordance with local governing codes requirements. Include fire rated conductors as required to meet local governing codes requirements.

3.2 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.

3.3 Installation of Conductors

- .1 Provide required conductors. Ensure fire rated conductors are provided for applications as required by local governing codes, standards and local governing authorities.
- .2 In applications where multiple conductors in conduit are being run, provide a trapeze configuration of metal C-channels and threaded rod hangers to support cable/conduit from ceiling slab. Wall mounted cable/conduit brackets and ring type conduit hangers may also be permitted in applications approved by Parks Canada Representative. Provide required cable support system accessories which are not specified herein or shown on drawings but are required for proper installation.
- .3 Conductors, unless otherwise noted, to be as follows:
 - .1 Underground inside or outside building and for non-climate controlled areas - "TWU" or "RWU90";
 - .2 for connections to electric heating coils in supply air ductwork systems, and for connections to other electric heating equipment where use of 90 degrees C. rated conductors are recommended by heating equipment manufacturer - "RW90";
 - .3 For climate controlled areas wiring except as noted above or specified elsewhere in Specification or as noted on drawings - "T90 Nylon" or "RW90".

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- .4 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.
 - .5 Low voltage conductors to typically be No. 18 AWG "TEW" except for use in fire alarm system applications, unless otherwise noted. Provide specified fire alarm cables for fire alarm system applications or security system applications as approved by Code and local governing authorities. Conductors not installed in conduit or raceways to be fire insulated rated in accordance with latest governing Code Flame Spread requirements.
 - .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. Colours, unless otherwise noted, to be as follows:
 - .1 Phase A - red;
 - .2 Phase B - black;
 - .3 Phase C - blue;
 - .4 Ground - green;
 - .5 Neutral - white;
 - .6 Control - orange.
 - .9 When pulling wires into conduit use lubricant and ensure that wires are kept straight and are not twisted or abraided.
 - .10 Control conductors, in addition, to be numbered with Brady Ltd. or Electrovert Ltd. Z type markers.
 - .11 Colour code conductors for communications systems in accordance with system component manufacturer's recommendations.
 - .12 Neatly secure exposed wire in apparatus enclosures with approved supports or ties.
 - .13 Install low voltage conductors in conduits, unless otherwise noted within Documents.
 - .14 Comply with local electrical code requirements and conductor manufacturer's recommendations when terminating and connecting aluminium conductors.

3.4 Installation of Corflex Cables

- .1 Provide type RA90 (Corflex II) type cables for applications as required. Handle, install, and terminate in accordance with manufacturer's recommendations and instructions and as herein specified.

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- .2 Provide system of cable tray and Unistrut Corporation channel support system for overhead suspended Corflex II cable. Support system to consist of non-ferrous cable trays supported by channels, supported by suitable threaded steel rods secured to structure with suitable aluminum clips.
 - .3 Tie wraps are not acceptable for securing Corflex II cables. Utilize non-ferrous single screw cable clamps.
 - .4 Ground and bond single conductor Corflex II cables at both ends where sheath currents do not affect cable ampacity. For certain areas, where sheath currents will reduce cable ampacity, ground and bond cable at supply end and isolate cable at load end as recommended by cable manufacturer, and provide a No. 3/0 green TW ground conductor for each cable run. Refer to requirements of local governing electrical code.

3.5 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

Appendix – Voltage Drop Schedules

MAXIMUM BRANCH WIRING DISTANCE FOR 120 VOLT SYSTEM AT 2% VOLTAGE DROP

WIRE SIZE	BREAKER SIZE (AMPERES)	15	20	30	40	50	60	70	80	100
	MAX LOAD AT 80% (AMPERES)	12	16	24	32	40	48	56	68	80
No. 12	-	16.8	12.2	-	-	-	-	-	-	-
No. 10	-	25.9	19.0	12.9	-	-	-	-	-	-
No. 8	-	39.6	30.4	20.5	15.2	-	-	-	-	-
No. 6	-	62.4	47.2	32.0	23.6	19.0	16.0	-	-	-
No. 4	-	99.0	73.1	50.2	38.1	30.4	24.3	21.3	19.0	-
NO. 2	-		114.3	77.2	57.9	47.2	38.8	33.5	28.9	22.8
No.1	-	-	-	96.0	73.1	57.9	47.2	42.6	36.5	27.4
No. 1/0	-	-	-	-	85.3	68.5	56.3	48.7	41.9	33.5
No. 2/0	-	-	-	-	102.8	80.7	67.0	57.9	50.2	40.3
No. 3/0	-	-	-	-	-	95.2	79.2	68.5	59.4	47.2
No. 4/0	-	-	-	-	-	-	92.9	79.2	70.1	56.3
250 MCM	-	-	-	-	-	-	102.8	86.8	76.2	60.9
300 MCM	-	-	-	-	-	-	-	100.5	88.3	70.1

Note: Distances indicated in metres from panel to load for single phase.

Maximum Branch Wiring Distance for 120 Volt System At 3% Voltage Drop

WIRE SIZE	BREAKER SIZE (AMPERES)	15	20	30	40	50	60	70	80	100
	MAX LOAD AT 80% (AMPERES)	12	16	24	32	40	48	56	68	80
No. 12	-	24.4	18.3	-	-	-	-	-	-	-
No. 10	-	38.1	29.0	19.1	-	-	-	-	-	-
No. 8	-	59.4	44.2	30.5	22.9	-	-	-	-	-
No. 6	-	91.4	70.1	47.2	35.1	28.2	23.6	-	-	-
No. 4	-	-	109.7	73.2	54.9	42.7	38.1	32.0	27.4	-
NO. 2	-	-	-	114.3	85.3	68.6	57.9	50.3	41.1	35.0
No. 1	-	-	-	-	103.6	85.3	73.2	61.0	54.9	43.4
No. 1/0	-	-	-	-	128.0	102.9	85.3	73.2	64.0	48.8
No. 2/0	-	-	-	-	-	121.9	100.6	86.9	74.7	60.9
No. 3/0	-	-	-	-	-	-	118.1	102.1	88.4	70.1
No. 4/0	-	-	-	-	-	-	-	120.4	102.9	83.8
250 MCM	-	-	-	-	-	-	-	-	114.3	91.4
300 MCM	-	-	-	-	-	-	-	-	-	103.6

Note: Distances indicated in metres from panel to load for single phase.

END OF APPENDIX

PART 1 GENERAL

1.1 SUBMITTALS

- .1 Submit shop drawings for products specified in this Section.

1.2 LOCAL ELECTRICAL UTILITY REQUIREMENTS

- .1 Comply with latest conditions of supply requirements of local governing electrical utility. Confirm exact requirements with local governing electrical utility and coordinate utility 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 Underground inspection: submission of approval drawings and application for inspection prior to any inspection of work;
 - .3 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.

1.3 SERIES RATED COMBINATIONS

- .1 Series rated combinations of over-current protective devices are not permitted.

1.4 PROTECTIVE COORDINATION AND EQUIPMENT WITHSTAND RATINGS

- .1 Contractor to cover costs of completing required 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, bussing, and switches to interrupt and withstand short circuit faults greater than available fault current at its source of supply.

1.5 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.

PART 2 PRODUCTS

2.1 SPLITTER TROUGH

- .1 CSA approved, splitter trough each complete with:
 - .1 Formed, factory primed and painted steel box with knockouts;
 - .2 Hinged front cover plate;
 - .3 Suitable mounting provisions;
 - .4 A nameplate giving its rating.
- .2 Terminal blocks consist of pressure type main lugs and branch lugs approved for copper wiring and mounted on porcelain bases.
- .3 Enclosures for splitters mounted in climate controlled areas to be NEMA 1 . For standard non-climate controlled applications, enclosures to be minimum NEMA 3R. Use NEMA 4X for corrosive environment applications.
- .4 Splitter trough ratings are scheduled on drawings.
- .5 Acceptable manufacturers are:
 - .1 Bel Inc.;
 - .2 Hydrel;
 - .3 Hammond.

2.2 CONTACTORS

- .1 CSA approved, NEMA rated, factory assembled, magnetic, full voltage contactors as follows:
 - .1 To CSA C22.2 No.14;
 - .2 Non-reversing type for heating and motor loads; features long life twin break, silver cadmium oxide contacts and steel mounting plate; magnetically actuated switch to include remote operation capability;
 - .3 Series A202 electrically held, magnetically latched contactor for lighting loads; contactors designed to withstand large initial inrush currents.
- .2 Each contactor to be suitable in respects for application and complete with following, as applicable:
 - .1 "Hand-Off-Auto" switch and pilot lamp;
 - .2 "START/STOP" pushbutton;
 - .3 An enclosure of NEMA size to suit application with necessary accessories;
 - .4 Factory primed and painted enclosures;
 - .5 Minimum NEMA 1 type enclosures for climate controlled areas;
 - .6 Minimum NEMA 3R type enclosures for non-climate controlled areas;
 - .7 Ampere rating, number of poles, etc., as noted on drawings.

- .3 Acceptable manufacturers are:
 - .1 Eaton (Cutler-Hammer);
 - .2 Schneider Electric (Square D);
 - .3 Rockwell Automation (Allen-Bradley);
 - .4 GE.

2.3 DISCONNECT SWITCHES

- .1 CSA approved, disconnect (safety) switches. Features include:
 - .1 Front operated with a handle suitable for padlocking in "OFF" position and arranged so that enclosure cover cannot be opened while handle is in "ON" position
 - .2 Operating mechanisms: quick-break, positive acting with visible blades and a line terminal shield;
 - .3 Fusible units with fuse clips suitable for HRC fuses, unless otherwise noted;
 - .4 Ampere rating, number of poles and fuse requirements as indicated on drawings;
 - .5 Factory primed and painted switch enclosures.
- .2 Disconnects for variable speed drives to be suitable for use with such drives and include auxiliary switch/contact to de-energize control power circuit, as required and as applicable.
- .3 Enclosures for disconnects mounted in interior climate controlled areas and standard non-climate controlled areas to be NEMA 3R. For corrosive environmental applications, enclosures to be minimum NEMA 4X.
- .4 Acceptable manufacturers are:
 - .1 Eaton (Cutler-Hammer);
 - .2 Siemens Electric Ltd.;
 - .3 Schneider Electric (Square D).

2.4 FUSES

- .1 Unless otherwise indicated, fuses to be Form I, Class "J" HRC fuses for constantly running equipment, and Form II, Class "C" HRC fuses for motorized equipment that cycle "ON" and "OFF".
- .2 Unless otherwise indicated, fuses for use in motor control centres and motor starters to be equivalent to Mersen Class "J" type "AJT", dual element time delay type and in accordance with UL standards 248-8 and 198L.
- .3 Fuses to be of type suitable for applications as required by local governing electrical codes and in coordination with respective equipment manufacturer's recommendations in which fuses are required. Coordinate also with Mechanical Division Contractor for requirements for Mechanical Division equipment.
- .4 Fuses to be of product of one manufacturer.

- .5 Acceptable manufacturers are:
 - .1 Mersen (Ferraz Shawmut);
 - .2 English Electric Ltd.;
 - .3 Noram;
 - .4 Cooper Bussmann.
- .6 Fuse Cabinet
 - .1 Fuse storage cabinet, surface wall mounted, manufactured from aluminum, approximately 750 mm (30") high, 600 mm (24") wide, 300 mm (12") deep, with provisions for supporting fuses and hinged lockable front access door. Cabinet to be finished in grey enamel paint and include identification labelling.

PART 3 EXECUTION

3.1 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 ductbank;
 - .2 Provision of protection bollards around pad mount transformer;
 - .3 Provision of secondary conductors installed in ductbank;
 - .4 Coordination with local electrical utility for their secondary connections to main power transformer;
 - .5 Testing of secondary conductors;
 - .6 Coordination with local electrical utility for their low voltage metering components.

3.2 INSTALLATION OF SPLITTER TROUGH

- .1 Provide splitter trough 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 Ensure enclosure ratings are suitable for intended applications.
- .3 Secure splitter trough in place independent of connecting conduit, secure into position and connect complete.
- .4 Provide engraved Lamacoid nameplate with nomenclature reviewed with Parks Canada Representative.

3.3 INSTALLATION OF CONTACTORS

- .1 Provide contactors in enclosures for electric heating, outside lighting control and other equipment. Connect complete to equipment and auxiliary control devices as required.
- .2 Wall mount each enclosure independent to panelboard to which loads are connected.
- .3 Ensure enclosure ratings are suitable for intended applications.

- .4 Provide engraved Lamacoid nameplate with nomenclature reviewed with Parks Canada Representative.

3.4 INSTALLATION OF DISCONNECT SWITCHES

- .1 Provide disconnects switches and install into locations and connect complete. Ensure adequate clearance is provided as per local code requirements and as required for access for operation and maintenance. Install as follows:
 - .1 Wherever shown on drawings and/or specified herein;
 - .2 Wherever required by MCC/VFD/starter schedule drawings;
 - .3 For motorized equipment which cannot be seen from motor starter location or is more than 9 m (30') from starter location (in accordance with local governing electrical code requirements);
 - .4 For "packaged" equipment fed from a motor starter panel.
- .2 Ensure enclosure ratings are suitable for intended applications.
- .3 Provide engraved Lamacoid nameplate with nomenclature reviewed with Parks Canada Representative.

3.5 INSTALLATION OF FUSES

- .1 Install fuses in mounting devices immediately before energizing circuit.
- .2 Ensure correct fuses fitted to physically matched mounting devices.
- .3 Ensure correct fuses fitted to assigned electrical circuit.
- .4 Provide a complete set of fuses for each fusible disconnect, motor starter, and similar fusible equipment provided or supplied.
- .5 Supply 3 spare fuses of each size and type used on project, mount fuses in cabinet. Secure cabinet in wall location as reviewed with Parks Canada Representative.

3.6 ELECTRICAL CONNECTIONS FOR MECHANICAL, OWNER'S, ETC., EQUIPMENT

- .1 Provide required electrical connections to apparatus provided and/or supplied by Electrical Divisions. Review shop drawings and coordinate with each equipment vendor, requirements for power feeds and control/communication interconnections and provide these requirements to complete installations work.
- .2 In addition to providing electrical feeders and connections to equipment provided by Electrical Divisions, provide required electrical connections to apparatus provided and/or supplied by Mechanical Divisions, Owner and as part of other Divisions.
- .3 Unless otherwise noted, provide electrical connections including power and control wiring for equipment supplied by Owner or by other Divisions, and except where specified for control wiring of Mechanical Divisions automatic control systems specification Section. Provide complete wired and empty conduit systems with fish cord, junction boxes, pull boxes, outlet boxes, faceplates, sleeves, etc. Provide disconnect switches, receptacles and other required wiring and connection accessories. Coordinate work with respective Parks Canada Representatives and suppliers of equipment to be provided with electrical connections.

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- .4 Refer to Division 11, and include for coordination and interconnections of Division 11 requirements and equipment schedule.
 - .5 Coordinate with trades of other Divisions to ensure provision of proper electrical requirements. Unless otherwise noted or reviewed with Parks Canada Representative, be responsible for provision of interconnect wiring between remote operator devices, controllers, and equipment being controlled by operator devices, whether or not such devices/controllers are supplied by Electrical Divisions. Where equipment is of split unit design and line voltage is required to both units, be responsible for feeders to each unit as coordinated with equipment manufacturer and Division responsible for equipment. Provide disconnect switches, receptacles and other required wiring and connection accessories. Provide system/equipment power feeds with hard wired or receptacle type connections, as required. Coordinate exact requirements prior to start of work, at time of shop drawing submissions and prior to roughing-in of work. Coordinate work with suppliers of equipment to be provided with electrical connections which may include but not be limited to following:
 - .1 Telecommunication systems;
 - .2 Mechanical systems and equipment.
 - .6 Mechanical Divisions are responsible for supply of motor starters and is to provide Lamacoid identification throughout. Motor starters, are generally to be as scheduled. Generally starters are supplied in following manner:
 - .1 Loose starters for mounting adjacent to apparatus or on motor starter panels;
 - .2 Mounted starters on factory assembled and pre-wired packaged equipment.
 - .7 Be responsible for following work:
 - .1 Mounting loose starters and providing "line" and "load" power connections;
 - .2 making "line" side power connections to motor control centres and "load" side connections to motors or other apparatus supplied power from motor control centres - where applicable, sub-feed refrigeration machine starter from double lugs furnished in adjacent motor control centre for refrigeration equipment;
 - .3 Making "line" side power connections to starters on "packaged" equipment;
 - .4 Coordinating feeder entries to starters and starter assemblies with Mechanical Divisions;
 - .5 Providing additional disconnect switches (complete with identification) detailed on drawings, or required by Code, or for apparatus which cannot be seen from its starter or is in excess of 9 m (30') from its starter;
 - .6 connections to thermistors and provision of additional relays as required for connections to starters; generally, Mechanical Divisions are to supply required thermistors and relays necessary for starters; review Mechanical Divisions specifications and/or drawings defining these requirements and include necessary work, wiring, conduit and components not being supplied by Mechanical Divisions;
 - .7 performing required motor starter interlocking in accordance with requirements specified and as outlined on MCC/starter schedules; coordinate interlocking requirements with Mechanical Divisions;
 - .8 Ensure that an identification nameplate is provided on each motor starter or disconnect;

- .9 Replace motors due to abuse of above prior to acceptance of work. If additional starts are required, it is recommended that none be made until conditions affecting motor operation have been thoroughly investigated and apparatus examined for evidence of excessive heating. Restrict number of motor starts to absolute minimum since life of motor is affected by number of starts.
- .10 Where supplied by Mechanical Divisions and connected by Electrical Divisions, connect VFDs and harmonic filters in strict accordance with manufacturer's instructions. Provide manufacturer's recommended conductors and connectors to suit respective connected equipment. Provide required upstream fused disconnects or breakers and overload protection. Maintain separation of power and control conductors as per manufacturer's requirements to minimize effects of electromagnetic interference. Properly ground and bond equipment. Coordinate exact installation requirements with Mechanical Division and equipment vendors.
- .1 Refer also to testing and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

END OF SECTION

PART 1 GENERAL

1.1 Submittals

- .1 Submit shop drawings for products specified in this Section.

PART 2 PRODUCTS

2.1 Distribution Panelboards

- .1 Factory assembled dead front 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 "PRL4B" 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. Refer to Part 1 for requirements of breakers to be provided with solid-state adjustable trip units. Group mount circuit breakers.
- .3 Switch and fuse type "PRL4F" distribution panelboards, complete with quick-make, quick-break, visible contact load break switches with operating handles projecting through dead front panel and interlocked with switch mechanism, facilities for padlocking in either ON or OFF position, and, unless otherwise noted, HRC Form I, Class "J" fuses.
- .4 Distribution panelboards of rating greater than 1200 amperes rating to be series "Pow-R-Line C" switchboard types as specified in Section entitled Secondary Switchboards.
- .5 Panelboard interior to have three flat bus bars stacked and aligned vertically with insulators laminated between phases. Insulators support and provide phase isolation to entire length of bus. A solidly bonded equipment ground bar and a neutral bar to be provided.
- .6 Bus bars (phases, grounds and neutrals) to be hard drawn electrical grade copper, silver plated and extend throughout panel.
- .7 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.
- .8 Panelboard boxes to be constructed of code gauge, hot zinc dipped galvanized steel constructed in accordance with UL 50 requirements, complete with removable ends and wiring gutter space on sides in accordance with CSA requirements.
- .9 Floor mounted enclosures to be free-standing type, reinforced as required to provide adequate strength.
- .10 Include main breakers for panelboards as scheduled. Main breakers to be automatic moulded case breakers with solid state trip units as specified in Part 1 article.

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- .11 Enclosures located in climate controlled areas 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. Recessed backboxes (tubs) need not be finished painted.
 - .12 Distribution panelboards sized 600 and less and panelboards not located in secured electrical rooms/closets require doors. Panelboards sized up to 600A and panelboards located in unsecure areas to be complete with doors, latches, and keyed alike locks. Locks to be cylindrical tumbler type with larger enclosures requiring sliding vault locks with 3-point latching. Supply 2 keys with each lock.
 - .13 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.
 - .14 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 Type 1;
 - .2 In accordance with ANSI/UL 1449 3rd Edition, IEEE C62.41, C62.45, UL 1283, and CSA Standards;
 - .3 Maximum voltage protection rating to not exceed 700 V (120/208 V) (L-N, L-G, N-G);
 - .4 Minimum nominal discharge current rating of 10 kA;
 - .5 Minimum short circuit current rating of 100 kA;
 - .6 Peak surge current 150 KA per phase;
 - .7 Indicator LED on units to identify protection integrity status of metal-oxide varistors; indicator to be visible on front of panelboard;
 - .8 High-performance EMI/RFI noise rejection filter;
 - .9 Standard manufacturer's minimum 5 years parts and labour warranty.
 - .15 Acceptable manufacturers are:
 - .1 Eaton (Cutler-Hammer);
 - .2 Schneider Electric (I-Line Series);
 - .3 Siemens Electric Ltd.

PART 3 EXECUTION

3.1 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.

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- .2 Install floor mounted panelboards on concrete housekeeping pads. 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

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 26 28 16.02 Molded Case Circuit Breakers.

1.2 REFERENCES

- .1 CSA International
 - .1 CSA C22.2 No.29, Panelboards and Enclosed Panelboards.

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 panelboards and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Include on drawings:
 - .1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

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 panelboards 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 panelboards from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 PANELBOARDS

- .1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 250 V panelboards: bus and breakers rated for 10kA (symmetrical) interrupting capacity or as indicated.
- .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Minimum of 2 flush locks for each panel board.
- .6 Two keys for each panelboard and key panelboards alike.
- .7 Aluminum bus with neutral of same ampere rating of mains.
- .8 Mains: suitable for bolt-on breakers.
- .9 Trim with concealed front bolts and hinges.
- .10 Trim and door finish: baked enamel.
- .11 Include grounding busbar with 3 of terminals for bonding conductor equal to breaker capacity of the panel board.
- .12 Install drip shields suitable for sprinklered environment

2.2 BREAKERS

- .1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .4 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to the Departmental Representative.
- .5 Lock-on devices for exit and night light circuits.

2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Basic Electrical Materials And Methods.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on plywood backboards in accordance with Section 06 10 00 - Rough Carpentry. Where practical, group panelboards on common backboard.
- .3 Mount panelboards to height specified in Section 26 05 00 – Basic Electrical Materials And Methods.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.3 PROTECTION

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

END OF SECTION

PART 1 GENERAL

1.1 SUBMITTALS

- .1 Submit shop drawings for products specified in this Section.

PART 2 PRODUCTS

2.1 BRANCH CIRCUIT PANELBOARDS

- .1 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 1, for indoor locations, and NEMA 3R for outdoor locations. Box is to be 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;

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- .11 Current-carrying parts be insulated from ground and phase-to-phase by high dielectric strength thermoplastic;
 - .12 Filler plates covering unused mounting space;
 - .13 Non-automatic and automatic main breaker to function as an isolating switch, where shown and as required;
 - .14 Ground fault circuit interrupting (GFCI) type breakers to feed devices as scheduled and for applications required by local governing codes;
 - .15 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 circuit breakers connected to dedicated equipment or devices with handle locks.
 - .8 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 Type 1;
 - .2 In accordance with ANSI/UL 1449 3rd Edition, IEEE C62.41, C62.45, UL 1283, and CSA Standards;
 - .3 Maximum voltage protection rating to not exceed 700 V (120/208 V) (L-N, L-G, N-G);
 - .4 Minimum nominal discharge current rating of 10 kA;
 - .5 Minimum short circuit current rating of 100 kA;
 - .6 Peak surge current 100 KA per phase;
 - .7 Indicator LED on units to identify protection integrity status of metal-oxide varistors; indicator to be visible on front of panelboard;
 - .8 High-performance EMI/RFI noise rejection filter;
 - .9 Standard manufacturer's minimum 5 years parts and labour warranty.
 - .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 In addition to these requirements and scheduled load breakers, each normal power panelboard to include provisions for small power for miscellaneous mechanical loads, consisting of an additional quantity of five (5) 15A-1p breakers, each installed and each connected to 30 m (100') 2-No. 12 plus ground in 13 mm (1/2") EMT conduit branch circuit feeders, with termination to various mechanical loads to be determined at time of construction.
 - .11 Unless otherwise scheduled or noted, include a of minimum three (3) 15A-1P breakers to feed BAS panels.

- .12 Acceptable manufacturers are:
 - .1 Eaton (Cutler-Hammer);
 - .2 Schneider Electric (Square D);
 - .3 Siemens Electric Ltd.

PART 3 EXECUTION

3.1 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 Coordinate with Mechanical Division trades and Parks Canada Representative to determine extra mechanical loads and BAS panels requiring use of specified additional 15A circuits and connect complete.
- .5 Ground and bond equipment as per local governing electrical code and inspection authority requirements. Refer also requirements of Section entitled – Grounding and Bonding.
- .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 Install and connect SPD in accordance with manufacturer's instructions and with dedicated breaker. Test SPD as per manufacturer's instructions.
- .11 Test and verify ground fault circuit interrupting breakers as follows:
- .12 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;
- .13 Megger load side neutral on GFCI protected branch circuits to ensure that neutral is not grounded on load side of GFCI;
- .14 Verify GFCI operation with a temporary load (100 watt lamp in an insulated socket with pigtail leads);

- .15 Provide a written report confirming that tests have been performed and that system is functioning properly.
 - .1 Ground and bond panel as per local electrical code requirements. Refer also to requirements of grounding and bonding article.
 - .2 Additionally, refer to testing, coordination and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

3.2 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.

3.3 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 lamaroid 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

PART 1 GENERAL

1.1 SUBMITTALS

- .1 Submit shop drawings for products specified in this Section.

PART 2 PRODUCTS

2.1 SWITCHES

- .1 Switches to be CSA approved, ULC listed and labelled devices.
- .2 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.

2.2 RECEPTACLES

- .1 Receptacles to be CSA approved, ULC listed, certified and labelled devices.

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.
- .2 Extra heavy duty, specification grade, flush, nylon face, single, 20 ampere, 125 V, 3-wire grounding receptacles.
- .3 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 Heavy duty, specification grade, 15 ampere, 125 V, duplex, orange colour, nylon construction, back, and side wired isolated receptacles.
- .5 Specification grade, 15 ampere, 125 V, single, 2-pole, 3-wire grounding twist lock receptacle.
- .6 Where noted that 20 A receptacles are required, include for "T" slot type of respective series of receptacles.

- .7 Colour of special switches and receptacles (unless specified above), to be as specified in PART 3 of this Section of Specification.
- .8 Special switches and receptacles not specified above are to be specified on drawings. Low voltage lighting controls are specified in Section entitled Lighting Control.
- .9 Acceptable manufacturers are:
 - .1 Hubbell Canada Inc.;
 - .2 Cooper Wiring Devices (Arrow Hart);
 - .3 Legrand - Pass & Seymour;
 - .4 Leviton.

2.3 FACEPLATES

- .1 Grade 18 8, type 430, 1 mm (0.032") thick stainless steel, satin, brushed or natural finish, complete with a peel off protective plastic film, and stainless steel screws.
- .2 Hubbell Canada Inc., No. WP8E / WP8EH, NEMA 3R rated, CSA approved, ULC listed and labelled, single gang, vertical/horizontal mounting, weather-proof in-use, gasketed, cast aluminium faceplates for standard duplex receptacles in wet locations.
- .3 Hubbell Canada Inc., No. WP26E/WP26EH, 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.
- .4 Hubbell Canada Inc., No. HBL1795, ULC listed and labelled, single gang, vertical mounting, weather proof in-use, gasketed, clear bubble plate, silicone rubber faceplates for standard AC toggle switches in wet locations.
- .5 Galvanized steel stamped faceplates.

2.4 PUSHBUTTONS OPERATORS

- .1 Operators as follows:
 - .1 emergency off pushbuttons: oversized 60 mm (2-1/2") diameter red plastic mushroom head pushbutton with shroud, thrust washer, and an aluminum faceplate with "EMERGENCY POWER OFF" identification lettering or other nomenclature as required to suit application;
 - .2 pushbuttons: standard 30 mm (1-1/4") diameter plastic pushbuttons in Red/Green colours as required for application, momentary/maintained/2 position push-pull operations as required, flush/extended/mushroom heads; non-illuminated/illuminated, with aluminum faceplate with identification lettering nomenclature as required to suit application;
- .2 Exact type and ratings of devices are to suit specific applications.
- .3 Acceptable manufacturers:
 - .1 Rockwell Automation (Allen-Bradley);
 - .2 Eaton (Cutler-Hammer);
 - .3 Square D;
 - .4 GE.

PART 3 EXECUTION

3.1 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.

3.2 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 For pricing only, receptacles to be ivory for devices connected to normal power circuits,
- .3 Install exterior receptacles in accordance with drawing detail.
- .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 as per sample board submission specified in Part 1. Do not order any devices unless final finishes have been approved by Parks Canada Representative.
- .6 Additionally, refer to testing and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

3.3 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. Provide larger than standard type faceplates for devices that require engraved nomenclature to define special purpose for that device.
- .2 Provide nylon type standard size faceplates for flush mounted switches and receptacles circuited to normal power.
- .3 Provide galvanized stamped steel faceplates in service areas, workshop, and equipment rooms where devices are surface mounted.

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- .4 Provide weatherproof insulated faceplates with hinged and gasketed receptacle access flaps for weatherproof receptacles denoted "WP" on drawings.
 - .5 Generally, oversized faceplates to be provided where engraved lettering is required.
 - .6 Faceplates for flush floor mounted receptacles to be forged brass rectangular faceplates.

3.4 INSTALLATION OF PUSHBUTTON OPERATORS

- .1 Provide specified and suitable pushbutton operators and pilot lamps to suit various applications.
- .2 Where flush mounted, provide faceplate for mounting onto recessed boxes.
- .3 Where surface mounted climate controlled areas, provide suitable NEMA 1 box. In non-climate controlled areas, surface mounted devices to be mounted within minimum NEMA 3R rated boxes.
- .4 Install devices in accordance with manufacturer's instructions to suit application requirements of Owner. Connect complete to respective equipment being controlled. Provide required wiring in conduit.
- .5 Test and verify operation of each device. Provide engraved lamacoid nameplate to identify system being operated and any special instructions. Confirm exact nomenclature with Parks Canada Representative prior to ordering.

END OF SECTION

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 26 24 16.01 Panelboards.

1.2 REFERENCES

- .1 CSA International
 - .1 CSA C22.2 No. 5, 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 ampacity of 100A and over or 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, the Consultant reserves the right to request from the Contractor to submit 3 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 Prior to installation, the Contractor shall contact the Consultant for confirmation if the request for the certificates is required to review.
 - .2 Production certificate of origin must be submitted to Consultant 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. Unless complying with this requirement, Consultant 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.
- .5 Name and address of building where circuit breakers will be installed:
 - .1 List of circuit breakers.

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, in a dry location, 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.
- .4 Packaging Waste Management: remove for reuse packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 BREAKERS GENERAL

- .1 Moulded-case circuit breakers and ground-fault circuit-interrupters to CSA C22.2 No. 5
- .2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .3 Common-trip breakers: with single handle for multi-pole applications.
- .4 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.
- .5 Circuit breakers with interchangeable trips as indicated.
- .6 Circuit breakers to have minimum 10kA 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.

2.3 CURRENT LIMITING AND SERIES RATED THERMAL MAGNETIC BREAKERS

- .1 Thermal magnetic breakers with current limiters.
 - .1 Time current limiting characteristics of fuses limiters coordinated with time current tripping characteristics of circuit breaker.
 - .2 Co-ordination to result in interruption by breaker of fault-level currents up to interrupting capacity of breaker.
- .2 Series rated breakers to be manufacturer tested and listed. Breakers to be applied following manufacturer's guidelines and accepted best practice.
 - .1 Breakers applied following manufacturer's guidelines and accepted best practice.

2.4 SOLID STATE TRIP BREAKERS

- .1 Moulded case circuit breaker to operate by means of solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current trip under overload condition, and where indicated, ground fault short circuit protection.

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
 - .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 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 reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 GENERAL

1.1 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 70 12 – 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 70 12 – 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.

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 Provision for padlocking in on-off switch position by three locks.
- .3 Mechanically interlocked door to prevent opening when handle in ON position.
- .4 Quick-make, quick-break action.
- .5 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 26 32 13.03 Installation of Electric Power Generating Equipment.

1.2 REFERENCES

- .1 American Petroleum Institute (API)
 - .1 API Std. 650-2007 (A2008)/(A2009), Welded Steel Tanks for Oil Storage 11th Edition.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA MG1-2006 (R2007), Motors and Generators.
- .3 Canadian Environmental Protection Act (CEPA)
 - .1 CCME PN 1326-2008, Environmental Code of Practice for Aboveground and Underground Storage Tank Systems for Petroleum Products and Allied Petroleum Products.
- .4 CSA International
 - .1 CSA-B139-09, Installation Code for Oil Burning Equipment.
- .5 International Organization for Standardization (ISO)
 - .1 ISO 3046-1-2002, Reciprocating Internal Combustion Engines - Performance - Part 1: Declarations of Power, Fuel and Lubricating Oil Consumptions, and Test Methods - Additional requirements for engines for general use.
- .6 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S601-07, Standard for Shop Fabricated Steel Aboveground Horizontal Tanks for Flammable and Combustible Liquids.
- .7 Alberta Building Code 2014.

1.3 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, specifications and data sheets for power generators and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings, include:
 - .1 Dimensioned drawing of set including engine, alternator, control cubicle, exhaust system, fuel system and accessories.

- .2 Line diagram showing alternator, control cubicle, automatic transfer switch, manual bypass switch, voltage regulator, battery, battery charger, governor specifications.
- .3 Diagram for automatic engine ventilation.
- .4 Flow diagrams for:
 - .1 Fuel.
 - .2 Lubricating oil.
 - .3 Cooling air.
- .5 Continuous full load output at 0.8 power factor lagging.
- .6 Type and make of governor.
- .7 Cooling air requirements in m/s.
- .8 British standard or DIN rating of engine.
- .9 Set operation:
 - .1 Automatic starting, transfer to load, back to normal power and shut down.
 - .2 Manual starting.
 - .3 Automatic shut down on over cranking, overspeed, high engine temperature, low lube oil pressure, short circuit and alternator over voltage.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit data for incorporation into maintenance manual specified in Sections 01 78 00 - Closeout Submittals.
 - .1 Ensure that information is for unit supplied and not general description of units manufactured.
- .2 Operation and maintenance instructions for engine, alternator, control panel, automatic transfer switch, manual bypass switch, battery charger, fuel system and accessories to permit effective operation, maintenance and repair.
- .3 Technical data:
 - .1 Illustrated parts lists with parts numbers.
 - .2 Schematic diagram of electrical controls
 - .3 Flow diagrams for fuel, lube oil and cooling air.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Include:
 - .1 2 fuel filter replacement elements.
 - .2 2 lube oil filter replacement elements.
 - .3 2 air cleaner filter elements.
 - .4 Special tools for unit servicing.

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:
 - .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name address.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets crates padding and packaging materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

- .1 Generator set consists of:
 - .1 Engine.
 - .2 Alternator.
 - .3 Control cubicle.
 - .4 Automatic transfer switch.
 - .5 Battery charger and battery.
 - .6 Automatic engine room ventilation equipment.
 - .7 Fuel supply system.
 - .8 Engine exhaust system.
 - .9 Mounting base.
- .2 Set designed for emergency standby service to operate unattended.

2.2 GENERATING SET

- .1 Capacity:
 - .1 Total output of engine in hp (brake) = British standard rating as defined to ISO 3046-1 expressed in hp (brake), minus the sum of the following:
 - .1 Power to drive cooling fan.
 - .2 Power loss for site conditions.
 - .2 Site conditions; derate for:
 - .1 2000 m above sea level.
 - .2 Ambient temp: 40 degrees C.
 - .3 Relative humidity: 60 %.
 - .3 Generator rating in kW x 1.34 divided by generator efficiency.
- .2 Engine: to ISO 3046-1, liquid propane 4 cycle, operating speed 1800 rpm, air or liquid cooled:

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- .1 Liquid cooled: radiator with engine driven fan and propylene glycol anti-freeze non-sludging above -46 degrees C.
 - .2 Block heater: thermostatically controlled lube oil or liquid coolant heater connected to disconnect/receptacle to allow pre-heating of engine block.
 - .3 Starting system:
 - .1 12 V dc motor, remote control, 12 V lead-acid storage battery of sufficient capacity to crank engine for 3 min at 0 degrees C without using more than 25% battery capacity.
 - .2 Battery charger: constant voltage, solid state, two stage from trickle charge at standby to boost charge after use, regulation +/-1% output for +/-10% input variation. Provide power from Solar Power Battery system via isolating DC-AC inverter.
 - .1 Capable of returning battery to full charge within 2 hours after 10 cranking operations.
 - .2 Equipped with dc voltmeter, dc ammeter and on-off switch.
 - .4 Governor:
 - .1 Mechanical flyball, with speed adjustment
 - .1 Speed regulation no load to full load 5% maximum
 - .2 Mechanical hydraulic with:
 - .1 Steady state speed band of +/-0.5%.
 - .2 Speed regulation no load to full load 5% maximum.
 - .3 Electronic type, electric actuator, speed droop externally adjustable from isochronous to 5%, temperature compensated with steady state speed maintenance capability of +/-0.25%.
 - .5 Shock mounted engine instrument panel with:
 - .1 Lube oil pressure gauge.
 - .2 Lube oil temperature gauge.
 - .6 Fuel rack solenoid energized when engine running.
- .3 Alternator: to NEMA MG1, single bearing, revolving field, coupled to engine by means of semi-flexible coupling and SAE housing, drip proof, amortisseur windings, synchronous type, class H insulation with:
- .1 Brushless exciter, direct driven.
 - .2 Voltage regulator: solid state
 - .3 Output:
 - .1 25 kVA at 0.8 pf, 3 phase, 120/208 V, 4 wire, 60 Hz.
 - .2 150% full load for 1 min.
 - .3 110% full load for 1 hour.
 - .4 100% full load continuously at 40 degrees C ambient.

2.3 CONTROL PANEL

- .1 Totally enclosed, mounted on stand straddling generator.
- .2 Panel door with formed edges and lockable handle with 2 keys.

- .3 Flexible conductors between door and fixed panel.
- .4 Instruments: ac ammeter and voltmeter with selector switches, ac wattmeter, frequency meter, engine running time meter, with miniature glass fast acting fuses for indicating instruments fitted at rear of instrument.
- .5 Controls:
 - .1 Engine start and emergency stop buttons, test button, alternator output moulded case circuit breaker, program selector switch, power transfer switch, voltage control rheostat, "normal power" and "emergency power" pilot lights.
 - .2 Voltage control rheostat to be screwdriver adjust type with locking nut and mounted on the inside of the control panel.
- .6 Automatic shut-down and alarms:
 - .1 Engine overcrank, overspeed, high temp, low lube oil pressure, low coolant, short circuit, low battery voltage to alarm only, and alternator overvoltage.
 - .2 Alarms to be reported at annunciator, manual reset and a set of NC/NO contacts shall be provided wired to terminal block for future connection of all alarm signals to remote annunciator and monitoring system.

2.4 GENERATING SET OPERATION

- .1 Program selector switch set at "Automatic".
 - .1 On normal power failure, after 5 s adjustable time delay to ignore transients, engine starts. Load is transferred when frequency and voltage reach rated values.
 - .2 On restoration of normal power, load transfers back to normal source after 20 s adjustable time delay and engine shuts down.
- .2 Program Selector Switch set at "Manual".
 - .1 Start button controls engine but automatic transfer of load prevented.
 - .2 Manual transfer possible.
 - .3 Electrical transfer possible by use of power transfer switch.
- .3 Program selector switch set at "OFF".
 - .1 Engine will not start.
 - .2 Switch lockable in this position.
- .4 Test full load - unit starts up and assumes building life-safety load initially. Second transfer switch shall then apply non-essential load through test transfer switch without interrupting building life-safety load.

2.5 MANUAL TRANSFER SWITCH SWITCH

- .1 Provide 3 way manual transfer switch (SOURCE 1, OFF, SOURCE 2): manually operated, double throw, to allow for connection to mobile temporary generator for maintenance of the generator. Install within Generator Package (building) and include installation of weatherproof external receptacle on outside of building to connect SOURCE 2 (portable unit).

2.6 EXHAUST SYSTEM

- .1 Heavy duty, residential type, horizontally mounted exhaust silencer with condensate drain, plug and flanged couplings.
- .2 Heavy duty flexible exhaust hose with flanged couplings as indicated.
- .3 Expansion joints, stainless steel, corrugated, of suitable length to absorb both vertical and horizontal expansion.

2.7 FUEL SYSTEM

- .1 Fuel storage tanks:
 - .1 Above ground exterior propane tank by others (Fuel Vendor).
- .2 Include gas detection system as part of Generator Package (building) and incorporate into monitoring system.
- .3 Regulator, venting, feed and return lines with flexible terminations at engine, shut-off and safety valves.
- .4 Include isolating valves on propane fuel lines serving auxiliaries (ie: building heater).
- .5 Remote fuel level switch to be incorporated into monitoring system.

2.8 COOLING AIR SYSTEM

- .1 Engine ventilating system:
 - .1 Recirculating damper assembly with modulating motor.
 - .2 Cold air inlet damper assembly with modulating motor.
 - .3 Air intake and discharge gooseneck weatherhoods.
 - .4 Modulating thermostat, and replaceable intake air filters.

2.9 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Controls: size 4 nameplates.
- .3 Meters, alarms, indicating lights: size 2 nameplates.

2.10 SOURCE QUALITY CONTROL

- .1 Complete generator set factory tested.
- .2 Tests:
 - .1 23 hours test at 100% rated load.
 - .2 1 hour test at 110% rated load.
 - .3 Automatic shutdown devices on trouble alarms.
 - .4 Automatic start-up, transfer to loads back to normal power and shutdown.
 - .5 Battery charger's ability to revert to high rate charge after cranking.
- .3 Submit certified copy of test results to Departmental Representative before shipment to site.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Position generating set and install as indicated.
- .2 Install fuel supply as indicated in accordance with CSA-B139.
- .3 Install ventilating air dampers, ducts, hoods, filters and fittings, exhaust system as indicated.
- .4 Complete wiring and interconnections as indicated.
- .5 Start generating set and test to ensure proper performance.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Basic Electrical Materials And Methods.
- .2 Notify Departmental Representative 10 working days in advance of test date.
- .3 Demonstrate:
 - .1 Automatic start, transfer to load, retransfer to normal power and unit shut down.
 - .2 Manual start, transfer, retransfer and shut down.
 - .3 Operation of automatic shut-down devices and alarms.
- .4 Run unit on load for 8 hours to show load carrying ability, stability of voltage and frequency and satisfactory performance of engine ventilation system to provide adequate engine cooling.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Divert unused metal and wiring materials from landfill to metal recycling facility.
 - .2 Divert unused batteries from landfill to battery recycling facility.
 - .3 Divert unused lubricating oil materials from landfill to oil recycling facility.
 - .4 Divert unused antifreeze from landfill to antifreeze recycling facility.

3.4 MAINTENANCE - CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer and National Fire Code of Canada, and CSA-B139.

END OF SECTION

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 26 32 13.02 Power Generation to 30 kW.
- .2 Appendix A: Generator Package for David Thompson Gate Rehabilitation

1.2 REFERENCES

- .1 CSA International
 - .1 CSA B139-09, Installation Code for Oil-Burning Equipment.
 - .2 CSA C282-09, Emergency Electrical Power Supply 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 generating equipment and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Submit verification of propane & electric technicians' qualifications.
- .4 Submit commissioning report.

1.4 QUALIFICATIONS

- .1 Generator Supplier shall have minimum 10 years experience with installation of generator systems in and construction of modular, skid mounted buildings (packages) housing generator systems as well as installation and commissioning of those generator skid packages at remote sites in Alberta and British Columbia.
- .2 Generator Supplier shall include qualifications as part of overall bid document submittal to demonstrates the required experience described in requirement 1.4.1.
- .3 Use qualified propane & electric technicians.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Include materials as follows:
 - .1 Conduits and boxes as required.
 - .2 Copper fuel lines and fittings as required.

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- .3 Primary fuel filter/water separator.
 - .4 Insulation for exhaust system.
 - .5 Electrical components as indicated.
 - .6 Wiring material.
 - .7 Antifreeze, propylene glycol.
 - .8 Propane fuel; participate in storage tank initial fill, plus top-up after testing.
 - .9 As part of Manual Transfer Switch, wiring and materials, including necessary steel conduits and fittings for making connections.
 - .10 The power circuit cables will be RW90 (-40 degrees C) cross link polyethylene.
 - .11 The control circuit cables will not be less than No. 14, RW90, copper conductors, colour or number coded.
 - .12 Electronic governor control cable shall be minimum size No. 18 stranded copper conductor, shielded complete with drain wire and overall PVC jacket.
 - .13 Battery cable shall be welding cable type, extra flexible, rope stranded copper conductor with neoprene oil-resistant insulation, sized to limit voltage drop to 5% at time of peak load.

2.2 INSULATION

- .1 Removable fibreglass jacket insulation rated for 650 degrees C minimum with stainless lacing hooks and wires.
 - .1 Enclose jacket on inside by stainless steel mesh with outside cover silicone coated or aluminized fibreglass cloth: to USCG approved Non-Combustible Materials No. 164.009.
- .2 Calcium Silicate removable insulation rated for 650 degrees C with exterior stainless steel protective cover and fastenings.

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

3.2 LOCATING AND MOUNTING

- .1 Locate unit within the Generator Package (AKA Generator Building or Skid Package) as indicated by Generator Package Vendor drawings.
- .2 Fit and adjust isolators in accordance with manufacturer's installation and adjustment instruction bulletin contained in unit manual.

- .3 Do not bolt housings to foundation if isolator housing feet are equipped with 6 mm rubber sound pads.

3.3 ALIGNMENT CHECK

- .1 Since Engine-generator shaft alignment is adjusted at factory, check to ensure that no change has occurred due to shipment and handling. Where engine and generator housings are close coupled and instruments at hand are not suitable for measuring alignment within confines of housings, just loosen engine and generator hold down bolts and ensure that each foot is carrying proportionate amount of weight and feet are level on base plate.

3.4 FUEL SUPPLY SYSTEM

- .1 Install fuel tank to CSA B139.
- .2 Inspect thoroughly fuel tank and lines to confirm they are clean and free of foreign material before connecting fuel system.
- .3 Install primary fuel filter/water separator and servicing shut-off valves as per Generator Package Vendor's design. Provide 3 spare filter elements.
- .4 Install ULC automatic fire shut-off valve. Locate upstream of any combustible fuel system component.
- .5 Install vents, regulator and isolations valves.
- .6 Install supply and return fuel lines between fuel tank and generator. Install flexible sections between the engine and fixed end of fuel lines from fuel tank, if required.
- .7 Neatly install fuel lines parallel or perpendicular to building lines with no kinks or dents.
- .8 Test fuel lines and report results to Parks Canada Inspector. Entirely replace fuel lines that may fail.

3.5 BATTERIES AND CHARGER

- .1 For dry charged batteries, activate in accordance with manufacturer's instructions manual prior to installation.
- .2 For wet batteries, inspect individually each battery cell and check electrolyte level.
 - .1 Check charge condition by measuring temperature and specific gravity of electrolyte.
 - .2 Consult manufacturer's instructions for recommended readings.
 - .3 If readings are lower, give batteries freshening charge until readings are reached.
- .3 Locate batteries as indicated and ensure batteries are accessible for service.
 - .1 Run and protect cables to starting motor using cables supplied with unit.
- .4 Install battery charger on wall, adjacent to batteries and make connection to batteries. Route circuit from Solar Power system panel to battery charger.

- .5 Clean connections and tighten securely.
- .6 Install removable plexiglass cover on batteries.

3.6 EXHAUST SYSTEM

- .1 Install exhaust pipe and silencer using material supplied with unit. Arrange silencer above and approximately in line with engine exhaust manifold with exhaust tail pipe protruding through thimble in wall.
- .2 Extend tail pipe 1 metre minimum beyond outside wall.
- .3 Support silencer with hangers so no weight or stress is applied to engine exhaust manifold or turbocharger.
- .4 Install flexible exhaust pipe between silencer and manifold.
- .5 Install exhaust system fireproof insulating material, after test run.
- .6 Route exhaust system in accordance with Generator Package design, ensuring exhaust tail pipe is installed in accordance with Code requirements and at an adequate distance from building openings.

3.7 COOLING AND VENTILATION

- .1 Install Generator Package air outlet and inlet automatic dampers (and controls) interior metal ducting and snow hoods in their respective building openings.
- .2 Install damper motors and linkages, adjust to ensure dampers are tight in closed position and give free damper movements from fully closed to fully open.
- .3 Where canvas boot is not provided, maintain 13 mm clearance between radiator and air outlet duct.
- .4 Mount thermostat within building in strategic position, away from inlet damper.
- .5 Install conduits and junction boxes and make connections from damper actuator motors to thermostat and to 120/24 V AC transformer.
- .6 Fill engine radiator with water/ethylene glycol antifreeze mix good for -40 degrees C.
- .7 Install remote radiator including piping, valves, fittings and pumps as indicated.

3.8 CONTROL AND TRANSFER PANELS

- .1 Locate panels as instructed by Generator Package Vendor in accordance with their design.
- .2 Make control and power circuit connections as indicated. Identify cables at both ends.
- .3 Tag with slip-on wire maker, each wire end with number corresponding to number in panel.

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- .4 Make terminations with self-insulated terminals of flanged fork or ring type.

3.9 ADDITIONAL WORKS

- .1 Complete any additional work as instructed by Departmental Representative to:
 - .1 Ensure equipment is safe to operate.
 - .2 Provide complete and operating system.

3.10 FIELD QUALITY CONTROL

- .1 Qualified propane and electric technicians to: inspect and verify that installation of interruptible power unit is acceptable and complete. Provide inspection report to the Departmental Representative.
- .2 Commissioning: do site commissioning of propane electric generator unit by qualified propane and electric technicians in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements.
- .3 Develop and submit commissioning report including time delay settings, operational set points and adjustment ranges.

3.11 SYSTEM STARTUP

- .1 Preparation: before starting unit, carry out thorough mechanical and electrical inspection of equipment, and perform following checks and adjustments:
 - .1 Disconnect battery cables from batteries to prevent accidental starting.
 - .2 Turn engine several revolutions by means of hand-barring devices to ensure parts are free and there are no obstructions to its running.
 - .3 Check engine/generator alignment readings to ensure they match readings attained at time of manufacture. Check fluid levels and top up as necessary. Pre-lubricate engine and turbochargers as recommended by engine manufacturer. Install drip pan beneath engine.
 - .4 Confirm cooling system antifreeze is effective to at least minus 40 degrees C.
 - .5 Check belts for correct tension and adjust as necessary.
 - .6 Check and grease points.
 - .7 Check and tighten properly nuts, bolts.
 - .8 Confirm safety guards are in place and properly secured.
 - .9 Check linkages for damage and freedom of movement.
 - .10 Check fuel supply system for leakage.
 - .11 Ensure fuel supply and fuel injection systems are properly primed.
 - .12 Check and tighten properly electrical connections.
 - .13 Check starting battery electrolyte level specific gravity and for proper installation.
 - .14 Check battery charger for proper operation and adjust as necessary.

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- .15 Carry out generator winding insulation resistance test. If reading is unacceptable, carry out recognized drying procedure. Do not start unit until satisfactory reading has been achieved.
 - .16 Check jacket coolant heater for proper operation.
 - .17 Complete additional preparations deemed necessary.
 - .2 Performance verification: on completion of start-up preparations, take following action:
 - .1 Have at hand, during initial start-up, means for choking off air supply to engine air induction manifold in event of engine run away or other emergency.
 - .2 Reconnect starting battery cables to starting battery.
 - .3 Start unit only in presence of the Departmental Representative and allow to warm up. Stop unit if abnormal conditions are encountered.
 - .4 Check for and correct leakage from exhaust system, fuel system, cooling system, and lubricating oil system.
 - .5 Adjust vibration isolators.
 - .6 Observe and confirm lubricating oil pressure and coolant temperature are within limits and no harmful vibration or sounds are evident.
 - .7 Ensure voltage is within operating parameters and automatic voltage regulator is operating correctly.
 - .8 Ensure manual voltage control is operating correctly.
 - .9 Ensure frequency is within operating parameters and electronic governor is operating correctly.
 - .10 Check engine air ventilation system for proper operation.
 - .11 Check operation of engine-mounted protective sensing devices and adjust as necessary.
 - .12 Check phase sequence of normal power supply and ensure emergency power supply are in same sequence.
 - .13 Check operation of electronic controller protection, transfer, timing, metering, and annunciator functions and adjust as necessary.
 - .14 Check operation and calibration of analog metering and adjust as necessary.
 - .15 Apply electrical load, read the metres, and correlate these readings.
 - .16 Demonstrate:
 - .1 SOURCE 1, transfer to OFF position, unit shutdown, transfer to SOURCE 2.
 - .2 Unit cranking, start, and shutdown by means of engine-mounted key switch.
 - .3 With doors closed, at Generator Package Vendor's construction site, supply load bank and run unit on full (nameplate) load for minimum period of 4 hours to show load-carrying capability, stability of voltage and frequency, and satisfactory performance of engine ventilating system and building damper system to provide adequate cooling, exhaust system.
 - .4 Every 1/2 hour carry out and record readings on Test Chart.
 - .17 Perform additional tests as required by Parks Canada Inspector to confirm unit is operating satisfactorily.

3.12 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.13 DEMONSTRATION AND TRAINING

- .1 As directed by Consultant and in accordance with Section 01 79 00 - Demonstration and Training carry out demonstrations of complete interruptible power unit for Project Acceptance Board. Deliver familiarization training of operating and maintenance staff.
 - .1 Include instruction to site operation and maintenance staff for proper care, operation, and maintenance of equipment.
 - .2 Maintain services for such period, and for as many visits as necessary to put equipment in operation, and confirm that operating personnel are conversant with aspects of its care and operation.
- .2 Include fuel required for performing propane-generator site test and top-up after acceptance test completion.

3.14 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Protect fuel lines from mechanical damage.
- .3 Repair damage to adjacent materials caused by electric power generating equipment installation.

END OF SECTION

PART 1 GENERAL

1.1 SUBMITTALS

- .1 Submit shop drawings for products specified in this Section.

PART 2 PRODUCTS

2.1 EMERGENCY LIGHTING UNITS

- .1 CSA approved, 120 VAC/12 VDC emergency lighting battery units. Units are complete with batteries, charger, dual lamp heads per unit (where shown); cabinet and 1.2 m (4') AC cord and plug set. Units to also be complete with automatic testing and self-diagnostic circuitry, and remote monitoring provisions. System to be designed to provide emergency lighting levels in accordance with local governing building requirements.
- .2 Chargers are fully automatic, solid-state type that automatically and instantaneously energizes lamp load upon failure of AC supply. Battery protection circuit automatically shuts down lamp load when battery reaches full discharge. Chargers to fully recharge battery in 12-24 hours and be current limited and short circuit proof.
- .3 Batteries to be long life sealed lead, maintenance free and have a capacity to supply sufficient output power to lamp loads and to exit sign emergency loads for a period of time in accordance with latest requirements of local governing building code but be a minimum of 30 minutes. Batteries to be designed for and guaranteed for at least 10 years of life expectancy.
- .4 Cabinets are constructed of No. 18 gauge steel, finished in white enamel. Front cover is removable to provide easy and full access to battery and charger connections. Knockouts are provided on top for lamp heads. Cabinet includes protective wire-guard, where required and/or where identified with "WG" designation on drawings.
- .5 Units include "PUSH-TO-TEST" switch, AC and high charge pilot lights and AC cordset.
- .6 Integral lampheads are 12V, 6 W MR16 LED lamps, decorative design, high impact plastic, adjustable heads.
- .7 Unless otherwise scheduled in Schedule of Luminaires, provide remote lamp heads as follows:
 - .1 remote surface mounted heads in climate controlled areas to be type EF40 series, vandal resistant heavy duty, clear, UV resistant polycarbonate lens type, die cast aluminum back plate, single and double adjustable head, 181 mm L x 117 mm W x 95 mm D (7-1/8" x 4-5/8" x 3-3/4"); complete with 12V, 6 W MR16 LED lamps;
 - .2 Remote surface mounted heads in climate controlled building maintenance/service areas to be No. EF9 series, single, double or triple adjustable swivel fire retardant thermoplastic heads with 12V, 6 W MR16 LED lamps; single unit approximately 114 mm L x 184 mm H x 89 mm D (4.5" x 7.25" x 3.5"); fixtures identified with "WG" to be complete with wire guard;

- .3 Remote in suspended ceiling type battery units to be provided as per Schedule of Luminaires; remote heads connected to these battery units to be provided as per drawing Schedule of Luminaires;
- .4 Remote heads to be of tamper proof construction;
- .5 Wire-guards where identified with "WG" designation on drawings.
- .8 Include for manufacturer's authorized representative to perform on-site after installation inspection, testing, adjusting, and verification of equipment. Such work to be performed during premium after hours' time. Refer to Part 3 for additional requirements.
- .9 Acceptable manufacturers are:
 - .1 Emergi-lite;
 - .2 Lumacell;
 - .3 Beghelli (supplied by Omnilumen);
 - .4 Readi-lite
 - .5 Aimlite.

PART 3 EXECUTION

3.1 INSTALLATION OF EMERGENCY LIGHTING UNITS

- .1 Provide emergency lighting battery units and lighting heads as specified herein and on Schedule of Luminaires, and mount where required. Connect battery units complete to dedicated emergency circuit of local power panels designated for this purpose or where identified on drawings, plug into designated adjacent receptacle. Provide wiring in conduit and connections to remote lamp heads and extend to central battery unit serving area.
- .2 Install units such that units to be automatically actuated upon failure of power supply to normal lighting in area covered by that unit equipment.
- .3 Connect exit signs to battery units circuits in applications where exit signs require backup DC supply.
- .4 Install combination units in locations and connect complete.
- .5 Obtain required training from manufacturer's representative on any special installation procedures. Install units in accordance with manufacturer's instructions to suit specific installation requirements.
- .6 Note that drawings identify location for battery units and generally identify circuiting of remote heads. In absence of direction of circuiting, provide wiring in conduit to feed remote heads and exit lights from nearest battery unit with sufficient capacity in area, in accordance with application requirements, manufacturer's requirements, and applicable codes. Multiple battery units may be required to accommodate connection of remote heads in some areas. Provide sufficient battery units to accommodate connected lamp loads and system design time of operation. Where more than one battery unit is installed in same immediate location, only one unit is required to be provided with integral lampheads.

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- .7 Where battery model number is noted, it is for general reference and exact capacity may be required to be increased to suit connected loads and required battery output time duration to suit local governing codes. Ensure that emergency lighting operates at lighting levels and for duration to meet local governing codes.
 - .8 For units serving genset room, provide SPD unit to line side of power supply to battery unit and install and connect in accordance with manufacturer's instructions.
 - .9 Provide remote mounting lamp heads as specified and refer to Schedule of Luminaires where additional requirements may be identified. Provide remote mounting lampheads in locations to provide system performance in compliance with requirements of Documents and where applicable, local governing building code. Connect complete to battery units. Be responsible for revisions to system, including relocations, aiming and additional remote heads as determined by testing results. Generally, provide wiring in accordance with manufacturer's requirements but be minimum No. 10 AWG, and increased to suit voltage drop requirements recommended by system manufacturer to comply with local electrical code requirements. Confirm finish requirements with Parks Canada Representative prior to ordering.
 - .10 Provide hazardous location type heads in areas to suit local governing authority hazardous classification requirements.
 - .11 Provide wiring in conduit and install devices in accordance to manufacturer's instructions. Comply with local governing codes and authority requirements with regards to providing fire rated conductors (MI) for life safety applications.
 - .12 When installation of emergency lighting equipment is complete, and in conjunction with manufacturer's authorized representative, inspect and test entire system, adjust as required, and certify in writing to Parks Canada Representative that system is complete, have been tested, adjusted, and are in proper operating condition. Also, be responsible for engaging emergency lighting manufacturer to perform an illumination level test in presence of Parks Canada Representative, throughout all areas of building. Manufacturer's technician to be responsible for properly aiming remote light heads, recording light level readings on a record set of floor plans and calculating light level readings. Co-ordinate and arrange for local authority building inspector approvals. Prepare and submit to Parks Canada Representative a letter on manufacturer's letterhead and signed by manufacturer's authorized technician, stating that emergency lighting levels meet requirements of local building code requirements and applicable CSA Standards. Notify Parks Canada Representative at least 10 days prior to propose testing date. Testing dates and times to be reviewed with Parks Canada Representative.
 - .13 Provide minimum one hard bound copy and electronic copy of signed test report.

3.2 TRAINING

- .1 Manufacturer's trained technician to perform onsite training of each user (including the provision of user guides) prior to project completion to ensure that users are properly trained in the operation and maintenances of system.
- .2 Refer to Instructions to Owner specified in Section entitled Electrical Work General Instructions.

END OF SECTION

PART 1 GENERAL

1.1 SUBMITTALS

- .1 Submit shop drawings for products of this Section, and on Schedule of Luminaires on drawings.
- .2 Include photometric data, lamp, and ballast information for each luminaire. Include ballast data identifying maximum circuit loading limitations.
- .3 Photometric data to include: total input watts, candlepower summary, candela distribution zonal lumen summary, luminaire efficiency, CIE type, coefficient of utilization, lamp type and lumen rating in accordance with IESNA testing procedures.
- .4 Include copy of certification that lenses and louvers comply with local governing building code requirements for flame spread ratings.
- .5 For poles, submit documentation that poles supplied are suitable for steady wind velocity and gust velocity of area of installation, and suitable for total effective projected area of mounted lighting equipment.
- .6 For exterior site areas or 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.

1.2 WARRANTY

- .1 Warranty requirements are as follows:
 - .1 unless otherwise noted, fluorescent and high intensity discharge (HID) lamps for a period of twelve (12) months from date of acceptance of Work by Parks Canada Representative for its intended use;
 - .2 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;
 - .3 unless otherwise noted, solid state ballasts for a period of five (5) years from date of acceptance of Work by Parks Canada Representative for its intended use;
 - .4 include costs for personnel, equipment and labour for replacing lamps and ballasts covered under warranty;
 - .5 re-lamp luminaires (except LED types) used during construction period before such date of acceptance of Work by Parks Canada Representative.

1.3 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.

PART 2 PRODUCTS

2.1 LUMINAIRES

- .1 Provide luminaires in accordance with Schedule of Luminaires found on drawings. Luminaires are to be CSA approved or have special local electrical authority approval.
- .2 Provide thickness of metal as indicated in Schedule of Luminaires and details, or as required so that luminaires are rigid, stable and resists deflection, twisting, warping or bending under normal installation procedures, re-lamping etc., or no less than requirements specified herein the specifications.
- .3 Unless otherwise noted, construct fluorescent luminaire bodies from minimum 20 gauge cold rolled prime steel and of rigid construction to permit any suspension method without sag. Unless otherwise noted, provide body finishes of corrosion resistant, chemically treated and electrostatically spray painted baked white enamel. Reflecting surfaces to be white with an average reflectance of not less than 85%. Provide adjustable mounting brackets for troffers mounted in ceilings.
- .4 Unless otherwise noted, linear and continuous linear architectural LED luminaires bodies to be constructed of extruded aluminum and of rigid construction. Unless otherwise noted, provide body finishes of corrosion resistant, chemically treated and electrostatically applied post powder coat finish. Efficiency not to be less than 69%.
- .5 Provide neoprene or silicone gasketing, barriers and stops where required to prevent light leaks or water/water vapour penetration.
- .6 Fabricate housings to allow for easy accessibility and replacement of parts.
- .7 Fabricate fixtures with a minimum number of joints. Make unexposed joints by acceptable method such as welding, brazing, screwing or bolting. Soldered joints are unacceptable. Do not use blind metal tapping methods or rivets for fastening parts which must be removed during service, or for fastening electrical components and supports. Cast parts, including die-cast members, to be of uniform quality, close grained, rigid, true to pattern, free from blow holes, pores, discoloration, hard spots, shrinkage defects, and cracks or other imperfections that affect strength and appearance or are indicative of inferior metals or alloys.
- .8 Reflectors and reflecting cones or baffles to be free of any tooling marks, spinning lines or marks by other assembly techniques. For fluorescent sources, iridescence to be low. Finishes to be equal to first quality polished, baffled, and anodized "Alzak".
- .9 Lamp sockets to be suitable for indicated lamps and be set so that lamps are positioned in optically correct relation to all luminaire components. Preset adjustable sockets at factory for lamp specified.
- .10 Lenses and louvres to comply with local governing building code and other local governing code flame spread rating requirements.
- .11 Unless otherwise noted, construct acrylic lens from 100% virgin acrylic and not less than 3.22 mm (0.125") thick. Fluorescent K12 acrylic lenses to have recessed prismatic pattern with no fade-outs or streaks and be of strain-free and uniform production. Glass lenses to be minimum 9.5 mm (0.375") thick.

- .12 Recessed luminaires with replaceable/serviceable parts such as ballasts, lamps, sockets, etc., must be accessible from lens side (ie. room side) of fixtures to allow for proper accessibility.
- .13 Luminaires to be factory assembled and tested prior to delivery on site.
- .14 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. Pole suppliers to ensure that poles supplied are suitable for steady wind velocity and gust velocity of area of installation, and suitable for total effective projected area of lighting equipment. Submit verification of this with shop drawings.
- .15 When requested, submit luminaire samples.
- .16 Dimensions for coves, valances, and strips as shown on drawings are for bidding purposes only. Job measure for exact dimensions of louvres, lenses and strips.
- .17 Dimensions for linear and continuous linear LED as shown on drawings are for bidding purposes only. Job measure for exact dimensions requirements to suit installation location.
- .18 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.
- .19 Coordinate with ballast manufacturers and dimmer/occupancy control manufacturers to ensure that components are compatible with each other and that interconnections do not affect performance, life or any warranties.
- .20 Products of same specified type to be of same manufacturer.

2.2 LAMPS

- .1 All luminaires shall be supplied with integrated LEDs. Lamp based luminaires will not be acceptable as alternates.

2.3 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 (outdoors): 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.
 - .5 Be 100% compatible with connected dimmer controls to provide dimming down to 5%.

- .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 6500 K; specific temperature requirements to be 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 (ballast) 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 manufacturers to be as recommended by luminaire manufacturers.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Provide luminaires as required. Obtain required training from manufacturer's representative on any special installation procedures. Install products in accordance with manufacturer's instructions to suit specific installation requirements.
- .2 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.
- .3 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.
- .4 Where outlet boxes locations are shown on drawings, they are diagrammatic only. Position outlet boxes to coincide with suspension hangers and knockouts.

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- .5 Install ceiling fixtures in centre of tiles unless dimensioned otherwise on Reflected Ceiling Plans. Locate hangers on tile centres or intersections. Mount recessed downlights, troffers, and surface mounted luminaires in or on full tiles. Install fixtures in and on acoustical tile ceilings in alignment with tile joints.
 - .6 Cut holes for recessed luminaires to exact size so that gaps are not visible or luminaire trims cover gaps.
 - .7 Mount surface ceiling luminaires perfectly level or plumb, tightly to ceiling without showing a space or light leak between frame and ceiling.
 - .8 Carefully align linear luminaires shown in continuous lines or rows, so that rows appear as straight lines. Variation in alignment not to exceed 6 mm (1/4") for any 5 m (16') run.
 - .9 Provide spacers for fixtures mounted on low density ceiling material.
 - .10 Provide plaster frames for recessed fixtures in plaster or gypsum board ceilings.
 - .11 Prepare fixtures, trim and poles and standards required to be painted.
 - .12 Wiring between fluorescent lamp holders and associated operating and starting equipment to be of similar or heavier gauge than leads furnished with approved types of ballasts with equal or better insulating and heat-resistant characteristics.
 - .13 Protect wiring with tape or tubing at all points where abrasion may occur. Conceal wiring within fixture construction except where design or mounting dictates otherwise.
 - .14 Splices:
 - .1 Minimize number of splices.
 - .2 Make with approved mechanical insulated steel spring type connectors, suitable for temperature and voltage conditions to which splices are to be subjected.
 - .3 Splices are not to be made unless properly terminated in accessible identified junction boxes.
 - .15 Support luminaires directly by ceiling slab structure and not to formed steel decking, ceiling hangers, ductwork, piping, cable trays, etc.
 - .16 Do not tighten wing nuts, bolts, or screws that allow fixture adjustment for recessed adjustable fixtures.
 - .17 Use cloth gloves when handling reflector cones, louvers, halogen lamps, glass, sconces and all exposed surfaces of fixtures.
 - .18 Co-ordinate luminaire installation with work of other trades to ensure that necessary recessing depths and mounting spaces are provided.
 - .19 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.
 - .20 Align and position all adjustable luminaires, and ensure that luminaires with adjustable lamp holders are properly positioned to correspond to lamps specified.
 - .21 Comply with requirements of local governing electrical code regarding support of luminaires in suspended ceilings.

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- .22 Independently suspend luminaires in suspended ceilings from ceiling slab. For each luminaire, provide minimum two (2) cable supports secured to ceiling slab and to luminaire. Confirm with local governing authorities and review with Parks Canada Representative if a variance to this requirement can be made for specific luminaires of low weight.
 - .23 Connect luminaires to power circuits and controls as required. Refer to drawings notes and schedules. Include for both normal and emergency power circuits as required.
 - .24 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.
 - .25 Generally, provide fluorescent luminaires with electronic type ballasts, unless within areas or rooms with electronically sensitive equipment, for which ballasts are to be electromagnetic types. Refer to luminaire schedules on drawings.
 - .26 Ground and bond luminaires as per local governing electrical code requirements.
 - .27 New fluorescent lamps to be operated for minimum 100 hours at full output prior to application for a Certificate of Substantial Performance of the Work.
 - .28 If requested, demonstrate operation of luminaires intended for special applications such as building floodlights and other decorative purposes. Adjust their locations within a reasonable distance to obtain effects desired.
 - .29 Test and adjust exterior luminaires at times after sunset, in presence of Parks Canada Representative and at times acceptable to Parks Canada Representative.
 - .30 Prior to turn over of Work to Parks Canada Representative, clean luminaires in manner recommended by manufacturer and to satisfaction of Parks Canada Representative.
 - .31 Lamps to be new and intact when project is complete and ready for acceptance.
 - .32 Include a full lamp listing in Operating and Maintenance Instruction Manuals.
 - .33 Additionally, refer to testing and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.2 No.141-02, Unit Equipment for Emergency Lighting.
 - .2 CSA C860-01(December 2002), Performance of Internally-Lighted Exit Signs.
- .2 National Fire Protection Association (NFPA)
 - .1 NFPA 101-2006, Life Safety Code.

1.2 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Section 01 00 50, paragraph 1.2.3 - Waste Management and Disposal.

PART 2 PRODUCTS

2.1 SELF-POWERED UNITS

- .1 Exit lights: to CSA C22.2 No.141 and CSA C860.
- .2 Housing, face plates, lamps: refer to Luminaire Schedule on drawing.
- .3 Face plate to remain captive for relamping.
- .4 Supply voltage: 120V, ac.
- .5 Output voltage: 6 V dc.
- .6 Operating time: 30 minimum.
- .7 Recharge time: twelve (12) hours
- .8 Battery: sealed, maintenance free.
- .9 Charger: solid state, voltage/current regulated, inverse temperature compensated, short circuit protected, with regulated output of plus or minus 0.01 V for plus or minus 10% V input variation.
- .10 Solid state transfer circuit.
- .11 Signal lights: solid state, for 'AC Power ON' and 'High Charge' condition.
- .12 Lamp heads: integral on unit, 345 degrees horizontal and 180 degrees vertical adjustment.
 - .1 Lamp type: LED

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- .13 Mounting: suitable for universal mounting directly on junction box and c/w knockouts for conduit.
 - .1 Removable or hinged front panel for easy access to batteries.
 - .14 Cabinet: finish: factory white.
 - .15 Auxiliary equipment:
 - .1 Ammeter.
 - .2 Voltmeter.
 - .3 Lamp disconnect switch.
 - .4 Test switch.
 - .5 AC/DC output terminal blocks inside cabinet.
 - .6 RFI suppressor.

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 exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.
- .2 Connect fixtures to exit light circuits.
- .3 Connect emergency lamp sockets to emergency circuits.
- .4 Ensure that exit light circuit breaker is locked in on position.

3.3 CLEANING

- .1 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 GENERAL REQUIREMENTS

- .1 A Stand Alone Off-Grid Solar power system is required to provide 120V electrical power for a standalone gate kiosk located on the David Thompson Highway. It shall be designed and installed to provide 1 KW of continuous electricity daily for a period of 8 hours per day, 365 days a year. The system must include battery storage to provide power to the 120V traffic beacons as well as security cameras and cellular communications at any time of the 24 hour period (daytime or night-time). The system will be required to accept power from a propane generator which will act as a backup charging source for the batteries during times when there is not enough solar energy available to charge the battery bank. Work shall be supervised by and fall under the responsibility of the General Contractor.
- .2 The Contractor must meet the Quality Assurance requirements defined herein in order for the Contractor's bid to be accepted. There will be no exceptions.
- .3 The Contractor shall carry all costs for the design, installation, commissioning, testing and training of the solar power system.

1.2 DESCRIPTION

- .1 This Section specifies the design, furnishing, installation, connection, testing, commissioning and training of solar energy electrical power generation systems.
- .2 All work shall meet the requirements specified in The Canadian Electrical Code 2015 (23rd edition).
- .3 All Portions of The Solar Installation shall meet the requirements specified in The Canadian Electrical Code 2015 (23rd edition) Section 64-Renewable Energy systems.
- .4 The General Contractor shall supply the Contractor with the project's structural and electrical drawings and specifications for the purpose of bidding the solar power system.
- .5 Coordinate all required planning and execution with the general contractor, electrical contractor and supplier of the pre-fab structure for the project.

1.3 SUBMITTALS

- .1 Power Output: Contractor shall submit calculated power output for the proposed solar photovoltaic system showing that it shall meet the parameters stated in the General Requirements. Provide independent calculations for each fixed, single-axis tracking, or double-axis tracking system.
- .2 Submit a PDF copy of the Shop Drawings, Product Data, and Samples, and with requirements in the individual specifications sections, to a Parks Canada Representative and Project Manager for the purpose of review by the structural engineer, electrical engineer and architect. The installation of a solar array on the Generator Package roof top shall be supervised and reviewed by the Structural Engineer (P. Eng.) hired by the Generator Package Vendor; ensure Shop drawings are received by all responsible parties.

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- .3 Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements.
 - .4 If equipment submitted differs in arrangement from that shown on the submittals, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract and acceptable to a Parks Canada Representative.
 - .5 Submittals and shop drawings for independent items, containing applicable descriptive information, shall be furnished together and complete in a group. Coordinate and properly integrate materials, and equipment in each group to provide a completely compatible and efficient installation. Final review and approvals will be made only by groups.
 - .6 Shop Drawings: Include photovoltaic module structural supports, solar module controls sequences, and instrument mounting and interconnections and all other components, part and pieces required to complete the function assembly. Where applicable, include pre-fabricated assemblies such as inverter skids or racking assemblies, and shop drawings for foundations or other support structures.
 - .7 Product Data: Include detailed information for components of the solar energy system.
 - .1 Wiring.
 - .2 Wiring Specialties.
 - .3 Off Grid Inverter/Charger
 - .4 Battery Bank
 - .5 Solar Modules.
 - .6 Collector Supports.
 - .7 Instrumentation.
 - .8 Switch gear.
 - .9 DC and AC disconnects, where applicable.
 - .10 Combiner boxes, where applicable.
 - .1 Rack system.
 - .2 Monitoring systems, including appropriate interfacing with existing facility data collection systems.
 - .8 Certification from the manufacturer that the system has been seismically tested to International Building Code requirements. Certification shall be based upon simulated seismic forces on a shake table or by analytical methods, but not by experience data or other methods.
 - .9 Certificates: Submit technical representative's certifications that the installation has been implanted as intended by the system designer and where applicable, recommended by the manufacturer.
 - .10 Manuals:
 - .1 Submit, simultaneously with the shop drawings, complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering replacement parts.

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- .1 Safety precautions.
 - .2 Operator restart.
 - .3 Startup, shutdown, and post-shutdown procedures.
 - .4 Normal operations.
 - .5 Emergency operations.
 - .6 Environmental conditions.
 - .7 Preventive maintenance plan and schedule.
 - .8 Troubleshooting guides and diagnostic techniques.
 - .9 Wiring and control diagrams.
 - .10 Maintenance and repair procedures.
 - .11 Removal and replacement instructions.
 - .12 Tracking systems (where applicable).
 - .13 Spare parts and supply list.
 - .14 Parts identification.
 - .15 Testing equipment and special tool information.
 - .16 Warranty information.
 - .17 Testing and performance data.
 - .18 Contractor information.
 - .2 If changes have been made to the maintenance and operating manuals originally submitted, then submit updated maintenance and operating manuals two weeks prior to the final inspection.
 - .3 Certifications: Two weeks prior to final inspection, submit the following:
 - .1 Certification by the Contractor that the solar energy electric generation system has been properly installed, adjusted, tested, commissioned, and warrantied. Contractor shall make all necessary field measurements and investigations to ensure that the equipment and assemblies meet contract requirements.
 - .11 Provide drawings that show the arrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract and acceptable to the Generator Package Vendor's Structural Engineer and the Electrical Engineer on Record.
 - .12 Provide sealed design of supports and racking design described in item 1.4.2 (sealed by the Generator Package Vendor's structural engineer) prior to commencement of work.

1.4 QUALITY ASSURANCE

- .1 Prior to the acceptance of a bid, Solar Energy Electrical Power Generation System Contractor(s) must demonstrate that they have successfully installed at least twenty projects within the past ten years that, in aggregate, equal or exceed the size of the proposed project. References shall be provided for five of the most recent qualified projects.
- .2 Acceptable Contractors (to supply and install) to complete this work are:
 - .1 Sentinel Solar located in Calgary, Alberta

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- .2 Skyfire Energy located in Calgary, Alberta
 - .4 Supports and racking for solar photovoltaic system designs shall be prepared under the seal of a licensed Professional Structural Engineer (PE) who shall be under contract of the Generator Package Vendor. Where applicable, such as roof top installations, the engineer shall also provide adequate review and structural analysis of the existing structure that will be supporting the proposed solar photovoltaic system. Among the documents that shall be submitted by the engineer are environmental loading analyses (including wind, snow, hail, and where applicable, seismic) and the rack and substrate's ability to withstand these environmental forces. In the instance where the rack is installed on the ground, adequate information shall be presented to demonstrate the earth's ability to support the proposed design.
 - .5 Investigate whether the local jurisdiction, or local environmental entities require environmental impact studies which may include, but are not limited to, effects upon wildlife. The Contractor shall determine which entity has jurisdiction over environmental matters and shall make appropriate inquiry and comply with all applicable regulations.
 - .6 Investigate any other local ordinances that may apply to installation of a solar energy electrical generating system in the proposed location. Bring any conflicts with the drawings and specifications to the attention of the Parks Canada Representative and Engineer of Record.
 - .7 Warranties: The warranty period shall be as noted for the items below:
 - .1 Solar photovoltaic modules and inverter: 10 year manufacturer's warranty against defects in materials and workmanship.
 - .2 Power output: 25 year manufacturer's power output warranty, with the first 10 years at 90% minimum rated power output and the balance of the 25 years at 80% minimum rated power output.
 - .3 Existing roof: Notify warrantor of existing roofing system on prior to beginning work and on completion of work, and obtain documentation verifying that existing roofing system has been inspected and warranty remains in effect. Submit documentation at project closeout.
 - .4 Storage Batteries: 5 year manufacturer's warranty against defects in materials and workmanship.

1.5 APPLICABLE PUBLICATIONS

- .1 Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- .2 Canadian Electrical Code 2015, 23rd Edition, Section 64 – Renewable Energy Systems
- .3 Natural Resources Canada, Photovoltaic Potential and Insolation Dataset.
www.nrcan.gc.ca/18366
- .4 National Renewable Energy Laboratory, PV WATTS Calculator. pvwatts.nrel.gov
- .5 American Society for Testing and Materials (ASTM):
- .6 E772-11 – Standard Terminology of Solar Energy Conversion

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- .7 Institutes of Electrical and Electronics Engineers (IEEE):
 - .1 937-07 – Recommended Practice for Installations and Maintenance of Lead-Acid Batteries for Photovoltaic (PV) Systems
 - .2 1361-03 – Guide for Selection, Charging, Test and Evaluation of Lead-Acid Batteries Used in Stand-Alone Photovoltaic (PV) Systems
 - .3 1526-03 – Recommended Practice for Testing the Performance of Stand-Alone Photovoltaic Systems
 - .4 1562-07 – Guide for Array and Battery Sizing in Stand-Alone Photovoltaic (PV) Systems
 - .5 1661-07 – Guide for Test and Evaluation of Lead-Acid Batteries Used in Photovoltaic (PV) Hybrid Power Systems
 - .8 International Electrotechnical Commission (IEC):
 - .1 61215-05 – Crystalline Silicon Terrestrial Photovoltaic (PV) Modules – Design Qualification and Type Approval
 - .2 61646-08 – Thin-Film Terrestrial Photovoltaic (PV) Modules – Design Qualification and Type Approval
 - .3 62446-09 – Grid-Connected Photovoltaic (PV) Systems – Minimum Requirements for System Documentation, Commissioning Tests and Inspection
 - .9 National Electrical Manufacturer’s Association (NEMA):
 - .1 250-08 – Enclosures for Electrical Equipment (1,000 Volts Maximum)

PART 2 PRODUCTS

2.1 GENERAL

- .1 Provide materials to fabricate Functioning Photovoltaic systems in accordance with this section and as shown on drawings. At the contractor’s option, provide factory-prefabricated solar equipment packages which include photovoltaic modules, batteries or other energy storage, inverters, and controls which meet the requirements of this section are acceptable.
- .2 Parks Canada or other Local Environmental Entity may require environmental impact studies which may include, for example, effects upon wildlife. The contractor shall determine which entity has jurisdiction over environmental matters and shall make appropriate inquiry and comply with all applicable regulations.
- .3 Acceptable Suppliers
 - .1 Sentinel Solar
 - .2 The Solar Wholesaler
 - .3 EECOL electric
- .4 **GROUNDING**
- .5 All applicable components of the solar energy electrical power generating system must be grounded as per latest CEC requirements.

- .6 A.C and D.C lightning arresters shall be provided at the inverter, solar array, and electrical distribution panels.
- .7 Shall ground according to manufacturer instructions per UL 1703.
- .8 DC Ground-Fault Protector:
 - .1 Shall be listed per UL 1703 CSA approved or equivalent.
 - .2 Shall comply with requirements of the CEC to reduce fire hazards.

2.2 PV ARRAY CIRCUIT COMBINER BOX

- .1 Shall include internal overcurrent protection devices with dead front.
- .2 Shall be contained in non-conductive NEMA Type 4X enclosure.
- .3 Up to 48 volts DC: Shall use DC breakers that meet CEC requirements for overcurrent protection, are ETL-tested, and UL-listed, CSA-listed.
- .4 Up to 600 volts DC paralleling system: Shall use fuses instead of breakers.
- .5 Shall be listed to UL 1741, and CSA approved or equivalent.
- .6 Ground and pole-mounted arrays shall have a separate combiner box mounted to the pole itself.
- .7 Where applicable, combiner box shall be a disconnecting combiner box.

2.3 SWITCHES /DISCONNECTING MEANS

- .1 Shall be in accordance with the CEC, as shown on the drawings, and as specified.
- .2 The following disconnect switches shall be provided to allow for certain components to be isolated for service as required
 - .1 Solar Array to Inverter Disconnect Switch
 - .2 Battery Bank to Inverter Disconnect Switch
 - .3 Generator to Inverter Disconnect Switch
- .3 Means of disconnect shall be UL-listed and CSA approved or equivalent.
- .4 Refer to Architect, Engineer, Owner for exact locations.
- .5 Utility External Disconnect Switch (UEDS): Refer to Architect, Engineer, Owner as several states do not require UEDS for small solar photovoltaic systems as the inverter shall provide the same function per NFPA 70 and CEC 690.61.
- .6 A Rapid Shutdown Device shall be provided and installed that will limit photovoltaic source or output circuits to not more than 30V and 240VA within 10s of rapid shutdown initiation.
- .7 Direct Current Conductor:
 - .1 If exposed: Shall use USE-2, UF inadequate at 60°C(140°F), or SE, 90°C (194°F) wet-rated and sunlight-resistant (usually for tracking modules).
 - .2 If in conduit: Shall use RHW-2, THWN-2, or XHHW-2 90°C (194°F), wet-location rated conductors.
- .8 Conduits and Raceways:

- .1 Shall use solid steel conduit (as appropriate) except for tracking modules. Weather tight EMT installations shall be allowed for DC wiring in weather protected areas.
- .2 Shall use expansion joints on long conduit runs.
- .3 Shall not be installed on photovoltaic modules.
- .9 Weather impacted enclosures shall be rated to NEMA 3R or better.
- .10 Cable Assemblies and Junction Boxes:
 - .1 Shall be UL-listed and CSA approved or equivalent.
 - .2 Shall be rated to 5VA flammability per UL 94.
- .11 Prohibited Wiring Materials: Not UL-listed, or listed materials used in unapproved environments outside those covered in their listing.

2.4 OFF GRID INVERTER / CHARGER COMBINATION UNIT

- .1 Shall be an off grid type inverter which allows for a generator backup, and combines an inverter, battery charger, and dual transfer switch in a single package.
- .2 Shall have an integral energy management system which will monitor the D.C output of the Solar Array, and when enough solar energy is not available utilize the backup generator as a charging source for the batteries.
- .3 Shall be fully programmable and incorporate a generator start module which can provide automatic control of the generator as a backup charging source as required.
- .4 Shall come complete with a communications adapter and control module which allows for remote connection, operation, and monitoring of the inverter / charger combination unit.
- .5 Shall meet the requirements as listed in The CEC 2015, Section 64 – Renewable Energy Systems
- .6 Shall be listed to UL 1741.
- .7 Shall be listed per FCC Part 15 Class A (commercial) or Class B (residential):
- .8 Shall include maximum power point tracking (MPPT) and temperature compensation features.
- .9 Shall include anti-islanding protection if paralleling arrangement is required.
- .10 Shall meet the requirements as listed in the CEC 2015, Section 64 (Storage Batteries)
- .11 The charge controller system shall be required for a stand-alone configuration with battery storage. The Inverter / Charge controller's adjusting mechanism shall be accessible only to qualified persons.
- .12 Shall be listed to UL 1741 and CSA approved or equivalent.
- .13 Shall be manufactured in a facility with ISO 9001 certification

2.5 SOLAR PHOTOVOLTAIC (PV) MODULES

- .1 Minimum Performance Parameters as per IBC 1509.7.4, IRC M2302.3, UL 1703.
- .2 Photovoltaic Panel Types:

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- .3 Monocrystalline: Listed to UL 1703.
 - .4 Polycrystalline: Listed to UL 1703.
 - .5 Module and System Identification
 - .6 Module or Panel:
 - .1 Listed to UL 969 for weather resistance.
 - .2 Listed to UL 1703 for marking contents and format.
 - .7 Main Service Disconnect: per CEC Requirements
 - .8 Identification Content and Format: per CEC.
 - .9 Identification for DC Conduit, Raceways, Enclosures, Cable Assemblies, and Junction Boxes: IFC 605.
 - .10 Identification for Inverter: per CEC Requirements
 - .11 Bypass diodes shall be built into each PV module either between each cell or each string of cells.
 - .12 Other Components: per UL 1703.
 - .13 Hail Protection: Compliant with testing procedure per ASTM E-1038.
 - .14 Lightning Protection: Shall ground according to manufacturer instructions per UL 1703.
 - .15 Access, Pathways, and Smoke Ventilation: Per IFC 605.3, access and spacing requirements must be observed in order to: ensure access to the roof, provide pathways to specific areas of the roof, provide for smoke ventilation opportunities area, and, where applicable, provide emergency access egress from the roof.

2.6 BATTERY BANK

- .1 General: Comply with CEC Requirements. Flooded lead-acid, captive electrolyte lead acid and nickel-cadmium are acceptable. Consider climate when selecting battery type.
- .2 Battery bank shall meet a minimum eight (8) hour, 1kW load run time at a temperature of -10 degrees Celcius.
- .3 An amp hour meter shall be provided that indicates the battery banks state of charge by measuring the current going in or out of the battery bank.
- .4 Off-Grid: Always use high-quality, industrial-grade, deep-cycle batteries.
- .5 Sizing: For stand-alone systems, size per IEEE 1013 and/or 1562.
- .6 Installation and Maintenance: Follow practices per IEEE 937.
- .7 Test and Evaluation:
 - .1 Stand-Alone System: Follow procedures per IEEE 1361.
- .8 Safety and Ventilation:
 - .1 Use protective enclosure and proper ventilation per The CEC Requirements.
 - .2 Exposed battery terminals and cable connections shall be protected, and live parts of batteries shall be guarded. Batteries should be accessible only to a qualified person via locked room, battery box, or other container.

- .3 Spacing around battery enclosures and boxes and other equipment shall be at least 915 mm (36 inches); batteries shall not be installed in living areas, or below enclosures, panelboards, or load centers.
- .4 Prohibited are conductive cases for flooded, lead-acid batteries operating above 48-volt nominal. Battery racks shall have no conductive parts within 155 mm (6 inches) of the tops of cases.
- .5 To reduce risk of electric shock, storage batteries in dwellings shall operate at less than 50 volts (48-volt nominal battery bank). Live parts of any battery bank shall be guarded.

.1 Interconnection:

- .6 Per CEC, battery cables shall be a standard building wire type conductor. Welding and automobile "battery" cables (listed and non-listed) are prohibited.
- .7 Flexible cables, listed for hard service use and moisture resistance, are permitted (not required) from battery terminals to nearby junction box and between battery cells. Flexible, highly-stranded building-wire type cables (USE/RHW and THW) are available. Battery terminals shall be compatible with flexible cables.

2.7 COLLECTOR SUPPORTS

- .1 Wind Resistance Requirement:
 - .1 For rack-mounted: per IBC 1509.7.1.
 - .2 For building-integrated photovoltaic and solar shingles: IBC 1507.17.3.
- .2 Mechanical Load Requirement: per UL 1703.
- .3 Ground and Pole Mount:
 - .1 Foundations shall be designed by a licensed Professional Structural Engineer (PE).
 - .2 Where possible, combiner boxes shall be mounted directly to the pole itself.

2.8 INSTRUMENTATION

- .1 Sensors:
 - .1 Temperature sensor shall be a component in the MPPT control system.
 - .2 May install additional data acquisition sensors to measure irradiance, wind speed, and ambient and PV module temperatures. Any additional sensors shall require a conduit separate from the current conductor conduit.
- .2 Datalogger/Monitoring System: Shall be a packaged system capable of string-level monitoring.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install the solar photovoltaic system in accordance with the Canadian Electrical Code 2015, 23rd Edition, Section 64-Renewable Energy systems, this section, and the printed instructions of the manufacturer.
- .2 Solar Generating System, battery system and generator backup charging shall be installed at Generator Package Vendor's construction yard and tested at the property prior to shipping Generator Package to the site. Testing shall be witnessed by Parks Canada hired Inspector and Electrical Engineer of Record.
- .3 All loose components shall be securely packaged and shipped within Generator Package for installation at the site.
- .4 Generator Package Vendor's Structural Engineer shall inspect installation prior to Generator Package is shipped to site.
- .5 Prior to system start-up, ensure no copper wire remains exposed with the exception of grounding wire as allowed in certain circumstances per manufacturer's instructions.
- .6 Systems shall be adequately anchored and braced per details on structural contract documents to withstand any specified seismic forces at the locations where installed.
- .7 Wiring Installation: Workers shall be made aware that photovoltaic modules will be live and generating electricity when there is any ambient light source and shall take appropriate precautions. Utilize on-site measurements in conjunction with engineering designs to accurately cut wires and layout before making permanent connections. Locate wires out of the way of windows, doors, openings, and other hazards. Ensure wires are free of snags and sharp edges that have the potential to compromise the wire insulation. All cabling shall be mechanically fastened.
- .8 Instrumentation: Install instruments as recommended by the manufacturer. Locate control panels inside a room accessible only to qualified persons.
- .9 Building-Integrated Photovoltaic Installations: Building-integrated photovoltaic modules/shingles shall be installed in accordance with the manufacturer's installation instructions.
- .10 Rack-Mounted Photovoltaic Installations: Rack-mounted photovoltaic modules shall be installed in accordance with the manufacturer's installation instructions.
- .11 Ground and Pole-Mounted Photovoltaic Installations: If structure is used as equipment grounding conductor, ensure compliance with CEC Requirements. Wiring shall not be readily accessible.
- .12 Tracking System Installations: Disconnect shall be within sight of the tracking motor.
- .13 Provide safety signage per CEC Requirements.
- .14 Remove, replace, patch, and repair existing roofing materials and surfaces cut or damaged during installation of the solar energy electrical power generation system, by methods and with materials so as not to void existing roofing system warranty. Notify roof warrantor before proceeding.

3.2 FIELD QUALITY CONTROL

- .1 Field Inspection: Perform in accordance with manufacturer's recommendations. Prior to initial operation, inspect the solar energy electrical power generation system for conformance to drawings, specifications, and CEC. In addition, include the following:
- .2 Visual Inspection and Tests:
 - .1 Compare equipment nameplate data with specifications and approved shop drawings.
 - .2 Inspect physical, electrical, and mechanical condition.
- .2 Verify required area clearances.
- .3 Verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey after energization.
- .4 Verify the correct operation of all sensing devices, alarms, and indicating devices.
- .5 Verify that all cable entries from top of junction boxes are sealed per junction box rating.
- .6 Verify all connections and integrity of printed circuit boards in all applicable junction boxes.
- .3 Tests: Provide equipment and apparatus required for performing tests. Correct defects disclosed by the tests and repeat tests. Conduct tests in the presence of a Parks Canada representative.
 - .1 Module String Voltage Test: Prior to connecting wiring to the combiner box, use a digital multi-meter to ensure each series string's polarity is correct.
 - .2 Operational Tests: Perform tests in accordance with the manufacturer's written recommendations. Tests for stand-alone systems shall be performed per IEEE 1526.

3.3 FOLLOW-UP VERIFICATION

- .1 Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that the solar photovoltaic electrical power generation system is in good operating condition and properly performing the intended function.

3.4 COMMISSIONING

- .1 Provide 8 hours of on-site Commissioning.
- .2 Connect the solar photovoltaic electrical power generation system to the serving electric utility grid only after receiving prior approval from the utility company.
- .3 Only qualified personnel shall connect the solar photovoltaic electrical power generation system to the serving electric utility grid.

3.5 INSTRUCTION AND TRAINING

- .1 Provide 6 hours of on-site training for the Parks Canada.
- .2 A complete set of operating instructions for the solar photovoltaic electrical power generation system shall be laminated or mounted under acrylic glass and installed in a frame near the equipment.

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- .3 Furnish the services of a factory-trained technician for one, 4-hour training period for instructing personnel in the maintenance and operation of the solar photovoltaic electrical power generation system, on the date requested by a Parks Canada representative.

END OF SECTION

PART 1 GENERAL

1.1 SUBMITTALS

- .1 Submit shop drawings for products specified in this Section.
- .2 Include data sheets for cabling, faceplates, terminal cabinets, racks, etc., and proposed cabling testing sheets.
- .3 Submit following:
 - .1 Samples of each type of data/voice jack complete with faceplate;
 - .2 Sample of proposed labelling of components and wiring;
 - .3 Sample of proposed test sheet;
 - .4 Copy of tester calibration certificate;
 - .5 written confirmation that telecommunication system vendor is manufacturer's valid certified system vendor for at least duration of contract work and is in good standing at time of Bid submission;
 - .6 Written evidence (copies of certificates) of vendor and technician qualifications;
 - .7 Copy of system manufacturer's warranty.

1.2 REFERENCE STANDARDS

- .1 Comply with latest editions of following, as applicable for project:
 - .1 ANSI/TIA-568-C, family of Telecommunications Standards, including:
 - .1 ANSI/TIA-568-C.0 - Generic Telecommunications Cabling for Customer Premises;
 - .2 ANSI/TIA-568-C.1 - Commercial Building Telecommunications Cabling Standard;
 - .3 ANSI/TIA-568-C.2 - Balanced Twisted-Pair Telecommunication Cabling and Components Standard;
 - .4 Issued addenda.
 - .2 ANSI/EIA/TIA 606-B (CSA T528) - Administration Standard for Telecommunications Infrastructure of Commercial Buildings;
 - .3 ANSI/EIA/ TIA-607-B (CSA T527) - Grounding and Bonding Requirements for Telecommunications in Commercial Buildings;
 - .4 ANSI/EIA/TIA-569-C (CSA T530) - Commercial Building Standards for Telecommunications Pathway and Spaces;
 - .5 Latest Building Industry Consulting Service International (BICSI) standards;
 - .6 Applicable local Building Codes.
- .2 Work to be installed by system manufacturers certified system installers/vendors who are certified and experienced in implementing selected data cabling system and to perform related testing programs.
 - .1 System final installation layout to be designed and/or reviewed by a RCDD. Submit shop drawings verifying this requirement.

1.3 WARRANTY

- .1 System manufacturers to provide a minimum twenty (20) year full parts, labour, and performance warranty on all passive components including structural cabling system. These warranties to be provided in written certificate form and that guarantee following:
 - .1 Passive system components, e.g. patch panels, UTP cable and outlet jacks, are free from manufacturing defects in material or workmanship;
 - .2 Approved cabling systems exceed specifications of TIA-EIA 568B.2.1 standards for specified category, in particular for attenuation and near-end cross-talk, loss and bandwidth requirements;
 - .3 installation supports applications for which it was originally designed as well as future versions of system performance specifications and any future applications using TIA/EIA 568B.2.1 component and cabling standards;
 - .4 Replacement or repair of any originally installed registered system component to be completed at no cost for parts and labour to during warranty period. Any components repaired or replaced to be warranted for remainder of warranty.
- .2 System manufacturers to provide in writing to Parks Canada Representative, that in event of demise or failure or change in approved status of installing certified system installer/vendor, manufacturer to be responsible for providing another certified system installer/vendor to fulfil remainder of warranty conditions.
- .3 Claim for repair procedure to comprise of contractor being notified of a problem and who will conduct necessary tests and repairs to correct problem. Should contractor be unable to resolve problem, contractor to contact system supplier who will take necessary action and provide any technical support to correct problem.
- .4 Initial response time to a repair claim for a registered system to be within 4 hours from time Contractor was notified of system fault.
- .5 Ensure that selected network cabling component manufacturer includes a system warranty that is a true "end-to-end" structured cabling system warranty from a single manufacturer, which includes data/voice communications outlet and patch cord at workstation, horizontal copper cabling, and patchpanel and patch cords at LAN room. In addition, this warranty is to be valid with selected fibre optic cabling solution.

1.4 SCOPE OF WORK

- .1 This Section provides minimum standards for provision of a structured cabling system to network computer systems for complex. Requirements for network electronics are responsibility of Parks Canada Representative's Network Integrator. Work includes but is not to be limited to following:
 - .1 provision of fibre optic cabling system; provision of fibre optic cabling for risers and intra-building backbone between LAN closets and for applications as noted on drawings; use of fibre optic backbone cabling to augment system if more than one network switch is used and distance between switches exceeds 90 m (295') and for applications for this project and as required by BICSI standards;
 - .2 Provision of category grade rating Category 5e cabling system for a complete networking within complex which can support use of intelligent network switches with Network Management capabilities;
 - .3 Organized wiring in a structured cabling system using point to point distribution system incorporating modular terminations;

- .4 Provision of data and voice cabling, data and voice communications outlets, patch panels and associated equipment;
 - .5 System testing and verification;
 - .6 Coordination of system requirements and integration requirements with integrated systems.
- .2 Local area network system must be "protocol neutral" and provide users access into a variety of resources from any location within the Complex. Ethernet backbone to be utilized for system with intelligent network switches coordinating and managing data flow. Wiring configuration is based on a "physical star" topology in which cabling runs emanate in radial pattern from data communications room in which intelligent switches are located.
- .3 Technical features of horizontal copper structural cabling plan include:
- .1 Use of Category 5e cabling to each data/voice outlet;
 - .2 Use of modular Category 5e jacks at workstation ends of data/voice cabling run;
 - .3 Backward compatibility to categories 5e, 5 and 3.
- .4 Network cabling system vendor to coordinate with Electrical Contractor to ensure that properly sized conduits, back boxes outlet boxes, junction boxes and floor boxes are provided of sufficient size as per EIA/TIA Standards to accommodate required Category rating system wiring and devices, with particular emphasis on bending radii of cabling. Replace to suit, conduit and boxes not meeting required Category rating requirements.
- .5 Design system to support minimum 802.11a/b/g/n/ac standards.

1.5 SYSTEM VENDOR QUALIFICATIONS

- .1 Vendor responsible for provision of system to have following qualifications:
- .1 Being established communications and electronics contractor that has and currently maintains a locally run and operated business for at least five years and holds applicable provincial and local licenses;
 - .2 be authorized Distributor or established franchisee for manufacturer of product/system proposed with full manufacturer's warranty privileges and be capable of providing post warranty service;
 - .3 Employ technicians who have attended and successfully completed manufacturer's technical certification classes for proposed system;
 - .4 Show satisfactory evidence, upon request, that they maintain a fully equipped service organization capable of furnishing adequate inspection and service to system on a 24-hour/7-day basis;
 - .5 Maintain at their facility necessary spare parts in proper proportion as recommended by manufacturer to maintain and service equipment being supplied.
- .2 Submit written evidence of qualifications with shop drawings submission.
- .3 Vendors not meeting any of above qualifications may be disqualified at Parks Canada Representative's discretion and be replaced with qualified vendor acceptable to Parks Canada Representative.

PART 2 PRODUCTS

2.1 HORIZONTAL CABLING

- .1 Horizontal cabling to data/voice outlets to be Belden "DataTwist 1200" series, ULC listed and labelled, unshielded twisted pair (UTP) cable and to comply with EIA/TIA TSB-36 requirements for Category 5e transmission. Cable minimum specifications to be:
 - .1 Conductors: 4 pair, 24 AWG. solid copper conductor, unshielded twisted pair;
 - .2 Cable grade: category 5e;
 - .3 Overall sheath: riser rated CMR / plenum rated CMP outer PVC jacket;
 - .4 Outer jacket colour to be of different colours to distinguish different systems as per Parks Canada Representative's direction; confirm colours with Parks Canada Representative prior to ordering.
- .2 Category 5e system to exceed ANSI/TIA/EIA 568-B.2 standard for a Category 5e 4-conductor channel. Demonstrate that proposed manufacturer's solution is guaranteed to exceed Category 5e requirements across entire swept frequency range of 1 – 100 MHz, by margin as per base specified product. Submit with shop drawings, ETL test reports to verify full channel performance of cable.
- .3 Provide plenum CMP rated cabling for applications as required by local authorities and codes.
- .4 Incoming copper cabling to be provided with suitable lightning protection devices. Refer to additional requirements later in this Section.

2.2 OUTLETS

- .1 Data/voice outlets to be based on Belden "CAT5E" series and meet following specifications:
 - .1 faceplates: flush wall mounting, to fit on single gang recessed outlet box, complete with device bracket or provisions that hold jacks securely in place; with top and bottom labelling windows; stainless steel or moulded PVC, of colour and finish reviewed with Parks Canada Representative, mounted to outlet box and bracket with matching screws;
 - .2 modules: Category 5e, eight-position, RJ-45 modular jacks, ISDN (T568A/B) pinned; KeyConnect modular or MDVO style jacks as approved by Parks Canada Representative and reviewed with Parks Canada Representative; icons with suitable identifications; constructed of high impact, flame retardant, thermoplastic; copper wires and connectors;
 - .3 Modules to be of specific colours to identify each system and of pin orientation reviewed with Parks Canada Representative and approved by Parks Canada Representative.
- .2 Wall mounted telephone outlets to include features as follows:
 - .1 Required Category rating modular RJ45 jack mounted securely into faceplate;
 - .2 Wall plate of stainless steel construction;
 - .3 Mounting studs on plate which are positioned to mount standard wall mount telephones with keystone adaptation flush to wall surface;
 - .4 Accept wall mountable phones with short patch cord connections to jack module.

- .3 Jacks colours and faceplate colours to be of variety to distinguish different systems as per Parks Canada Representative's requirements. Review exact colour finishes and T568 pinning arrangement with Parks Canada Representative prior to ordering.
- .4 Quantity of jacks and configuration of faceplates are as detailed on drawings.
- .5 Provide snap-in plastic dust covers on blank outlets and unused outlets.

2.3 PATCHPANELS

- .1 Belden "CAT5E" series, modular patch panels with features as follows:
- .2 Cat 5e certified, designed for 4-pair UTP cable; panel frames of black powder coated steel construction;
- .3 24 port and 48 port RJ45 jacks, as required; KeyConnect modular or MDVO style jacks as approved by and reviewed with Parks Canada Representative;
- .4 Circuit identification designation strip, snaps onto wiring block;
- .5 Distribution rings, rack mounting hardware and ancillary devices as required.

2.4 PATCHCORDS AND CABLES

- .1 Copper data patchcords to be based on Belden "CAT5E" series, modular, 24 AWG stranded copper, Category 6, ISDN wired.
- .2 Copper patchcords to be factory terminated and tested, and be provided in lengths from 600-2100 mm (2'-7') at patchpanel end to suit specific applications. Lengths to meet manufacturer's requirements to comply with required category grade performance standards. Provide patchcords in quantities to accommodate requirement that each port is active. Unless otherwise noted, patchcords at workstation ends are responsibility of others.
- .3 Include for provision of suitable patchcord extending to Parks Canada Representative's switch/server in room/rack. Confirm exact requirements with and review with Parks Canada Representative.
- .4 Where voice terminations are terminated onto wall mounted blocks, include for required patch cord to extend to rack voice patch panels and patchcords to further extend to Parks Canada Representative switch/server in room/rack. Confirm exact requirements with and review with Parks Canada Representative.
- .5 Fibre optic patch cords to match and be of same manufacturer as fibre optic cabling and be with required terminations. Patch cords to be provided to suit end to end structured cabling system and to accommodate network electronics as directed by and reviewed with Parks Canada Representative. Connector terminations to be SC or LC type, but confirm with and review with Parks Canada Representative prior to ordering.
- .6 Patchcords to be of different colours to distinguish different systems as per Parks Canada Representative's requirements. Review exact colour finishes with Parks Canada Representative prior to ordering.

2.5 PUNCHDOWN BLOCK TERMINATIONS

- .1 Incoming main telephone service cabling to typically be terminated on BIX or 110 mounts and connectors. Horizontal cabling as detailed on drawings to terminate on punchdown blocks.

- .2 Capacity of connectors to be to suit number of conductors. Confirm and coordinate exact type of termination means with local carrier/provider and review with Parks Canada Representative. Mounts to be suitable for wall mounting.
- .3 Category 3, BIX or 110 Series, 100 pair and 300 pair wiring blocks consisting of horizontal index strips with insulation displacement connectors for termination of 4 pair cables; wall mounting block with mounting legs to provide wiring space. Review exact type of terminations with Parks Canada Representative.
- .4 Category 6 or 5e, punchdown block bases for termination of UTP cabling and connecting blocks; finished in white; can be interlocked and stacked to accommodate system capacity; of types to be either rack mounted or panel mounted to suit application and room requirements.
- .5 Cross connect jumper wire, patch cords, cable HUB harness or pigtails as required to extend connections from blocks to patchpanels and to Parks Canada Representative's switches/servers.
- .6 Connecting tool, termination kits, designation strips, labels, and wiring distribution rings.

2.6 EQUIPMENT CABINETS

- .1 Enclosed type, equipment cabinets to be heavy duty type, complete with but not be limited to following requirements:
 - .1 Steel construction frame work with steel or aluminum construction sides, backs, tops and bottom panels;
 - .2 Ventilation fans and louvers;
 - .3 Minimum 1800 mm (70") in height;
 - .4 Polyurethane finish or enamel painted finish to Parks Canada Representative's approval;
 - .5 Double sided 12/24 tapped holes;
 - .6 Sized and spaced for standard EIA 19" racking;
 - .7 Heavy duty base with provision for bolting to floor;
 - .8 High capacity cable organizer channel with snap on cover;
 - .9 full height front and back hinged lockable doors with handle operators with locks and keys; keys to be keyed alike as per Parks Canada Representative's direction;
 - .10 Full height vertical cable channels 150 mm x 150 mm (6" x 6") on both sides of rack;
 - .11 Horizontal cable management channel – minimum one for each patch panel;
 - .12 Front and rear cable management provisions (typically only last 150 mm (6") of cabling to connector to be loose and not in channel);
 - .13 rack mounted multi- outlet power strips with surge protection, integral breaker, pilot light and power cord with twist lock type plug and receptacle provisions; number of outlets to be same as number of active devices housed in equipment enclosure;
 - .14 Required mounting hardware, label kits, Velcro style fasteners and ancillary devices.

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- .2 Include grounding provisions for each cabinet, to meet previously listed standards, which include but are not limited to following provisions:
 - .1 Copper ground strip mounted on side rail extending full height of rack;
 - .2 Equipment jumper kits, to bond network equipment to rack ground strip;
 - .3 Common bonding network to rack jumper kit, to bond rack to room common bonding network;
 - .4 Hardware including, copper compression HTAPS, paint piercing washer kits, bonding screws and electrostatic discharge port kits.
 - .3 Wall mounted equipment enclosures to be provided where required with similar applicable features as per specified floor mounted products, but sized to suit application and complete with wall mounting hardware and hinged feature to allow access to rear of cabinet.
 - .4 Cabinets to be of size and quantity to accommodate respective number of patch panel ports to suit number of required drops, quantity of network electronic components as directed by Parks Canada Representative's network integrator, uninterruptible power supply unit, and an additional 20% spare capacity for future expansion.
 - .5 Acceptable manufacturers are:
 - .1 Listed structured cabling system manufacturers;
 - .2 Devtek;
 - .3 Cable-Talk;
 - .4 Hoffman;
 - .5 Cannon.

2.7 LIGHTNING PROTECTION

- .1 Provide protection of communication lines, as recommended by referenced codes and standards including UL-497. Products to be equivalent to Porta Systems Corp series 606 "Protector Pack" blocks. Exact type of product to be confirmed with product manufacturer to accommodate number of incoming pairs and type of conductors. Generally, base design requirements on following:
 - .1 for voice/data communications: required category grade rating rated protector blocks with protection modules of ultra-low capacitance solid state technology to protect frequencies up to 250 MHz; blocks to include required solid state modules to suit conductor pair counts, mounting bracket and cover;
 - .2 Protection requirements at service entrance to also be confirmed with service provider;
 - .3 Protection blocks to be provided with mounting provisions to suit design application, i.e. wall mounting at conductor building entrance or rack mounting.
- .2 Contact manufacturer and review system requirements to determine exact product requirements for lightning protection. Ensure that main incoming lines and both ends of lines running between buildings are provided with adequate lightning protection to recommendations of system manufacturer.
- .3 Install devices in accordance with device manufacturer's instructions.

2.8 WIRELESS LAN INFRASTRUCTURE

- .1 Provisions for a wireless LAN infrastructure to be provided with 100% coverage of entire complex, utilizing structured network cabling system as a rough-in for future wireless access points (WAP) located in ceiling spaces. Generally, quantity of outlets to be identified on drawings, but Electrical Divisions Contractor to perform site signal survey/audit of coverage areas and confirm if additional rough-in jacks are required. Prepare audit immediately after structure of concrete and metal studs are in place. Submit copy of audit to Parks Canada Representative to review.
- .2 Locations may generally be shown on drawings, however, following criteria to be followed:
 - .1 Back-of-house above accessible ceiling tile or high up in open ceiling areas as reviewed with Parks Canada Representative;
 - .2 Public spaces priority;
 - .3 In service areas adjacent public areas;
 - .4 In light cove if WAP is hidden;
 - .5 With access panel (location identified).

2.9 ACCEPTABLE STRUCTURED CABLING SYSTEM MANUFACTURERS

- .1 Horizontal copper structured cabling infrastructure is to be end-to-end solution from a single manufacturer, which includes data communication outlets and patch cords at workstations, and patch panels and patch cords at LAN/Telecommunication rooms. To this horizontal network is integrated fibre optic cabling infrastructure from same manufacturer or approved listed herein, maintaining full warranty requirements for systems comprising this Section.
- .2 Acceptable structured cabling system manufacturers are:
 - .1 Belden;
 - .2 Commscope Systimax/Uniprise;
 - .3 Panduit;
 - .4 Hubbell;
 - .5 Leviton.

2.10 ACCEPTABLE CONTRACTORS

- .1 Contractor selected for installation of structured cabling system to provide confirmation of following:
 - .1 Detailed knowledge and experience in fibre optic cabling and category grade rating copper UTP wiring installations;
 - .2 Detailed knowledge and experience in installation of intelligent server/switches equipment;
 - .3 Experience in troubleshooting and problem solving in data communication networks.
 - .4 Ability to provide system manufacturer's certified warranties;
 - .5 Certified and valid proof of being system manufacturer's authorized vendor.
- .2 Refer also to supplier requirements specified in Part 1.

PART 3 EXECUTION

3.1 INSTALLATION OF STRUCTURED CABLING – GENERAL

- .1 Properly handle and install structured network cabling in accordance with manufacturer's specifications. Avoid undue pulling tension, abrasion, or rough handling to ensure that cables will permit transmission up to required category rating design speed for cables. Install cables without splices or cuts to ensure elimination of reflections, discontinuities, impedance mismatches, etc. maximum horizontal length of copper cabling from workstation to network switch is not to exceed 90 m (295') or less if recommended by system manufacturer to meet required category grade rating performance standards. Maximum length of patch cables (either cross connects or interconnecting with electronic equipment to connect devices at work area outlet), to be a total of 10 m (30'). Maintain system manufacturer's minimum channel lengths as confirmed with system manufacturer. Provide cable loops in accordance with manufacturer's instructions.
- .2 Unless otherwise noted or where cable tray is shown for such use, run cabling in conduit. Install pull cords for future use, in conduits extending between floors.
- .3 Generally, no more than two 90-degree changes in direction are recommended for cable installed in conduit without pullboxes and not more than 40% fill ratio. Confirm exact conduit bending radii restrictions and fill ratios with system manufacturer and comply with those standards.
- .4 With consideration in minimizing alien crosstalk to levels as per BICSI standards and manufacturer's standards, dress cables in a neat and orderly fashion from entrance of communications closet to relay racks using vertical and horizontal cable management trays and paths. Do not exceed manufacturer's distance limitations to maintain required category rating performance standards.
- .5 Care to be taken to ensure that during installation, nicks, abrasions, burning and scuffing of cable is prevented. Replace cables found to be damaged regardless of whether cable passes category grade rating or fibre performance testing standards.
- .6 Secure bundled cables transitioning between floors via ladder cable tray, to vertical ladder sections with Velcro wraps. Use waterfall (rounded transition) fittings for cable changing from a horizontal path to a vertical one. This is to maintain minimum bend radius for cabling system. Support cables running through risers between floors such that they are properly supported for their weight, especially in situations with high pair count cables and large bundles.
- .7 Electrical Contractor and telecommunication system vendor to provide coordination of structured cabling system with other building systems as required. Review data outlet and connection requirements with various system vendors and provide data drops to equipment as required. Size head end equipment to accommodate these additional outlets.
- .8 Required necessary drilling and anchoring components to be installed before any horizontal cable is installed.
- .9 Route horizontal cable into equipment racks/enclosures and neatly bundle with Velcro cable ties. Maximum number of cables per bundle to be 25.
- .10 Securely mount fire retardant plywood on wall in each telecommunications room or closet.
- .11 Cables wraps are to be Velcro type and are not to be over tightened.

- .12 Provide grounding and bonding requirements as specified in Section entitled Grounding and Bonding.

3.2 INSTALLATION OF PATCHPANELS AND ACCESSORIES

- .1 Provide patchpanels onto racks in locations. Provide terminating hardware and connectors to suit incoming and outgoing cabling. Clearly identify each port. Provide patch cords as required. Install devices in accordance with system manufacturer's requirements.
- .2 Terminate both data and voice horizontal cabling onto patchpanel punchdowns using manufacturer's recommended tools. Bundle cabling in neat configuration and secure to patchpanels and rack assemblies. Typically dedicated separate patch panels are required for data and voice.
- .3 Install rack enclosures on walls. Neatly bundle wiring within wiring management channels. Do not over tighten Velco straps. Ground racks as required.

3.3 INSTALLATION OF TERMINATION HARDWARE

- .1 For main telephone service incoming conductors to main communication closets and other conductors as detailed, provide required punchdown connectors and mounts on hardwood backboards on walls or on racks. Refer to drawing details. Design system layout to best suit incoming and outgoing cables. Properly punchdown cabling with manufacturer's required tool and label each connector as required.
- .2 Run interconnect cables neatly secured and bundled across connectors and between banks of mounts. Use D-rings to their full advantage. Neatly bundle pigtails and secure to IDC connectors.
- .3 Where wall mounted, align mounts in straight formations to provide a neat installation and to minimize interconnect wiring lengths.
- .4 Where horizontal cables are terminated to patchpanels, provide appropriate patch cords/jumper cables to interconnect patchpanel ports to respective wall mounted punchdown blocks.
- .5 Clearly and properly identify each cable and block terminations.
- .6 Co-ordinate with Parks Canada Representative's network integrator to determine exact requirements for telephone service interconnections.

3.4 COPPER CABLE INSTALLATION

- .1 Run horizontal, UTP cables continuous from end to end with no splices. Install horizontal cables in Star topology, emanating from rack mounted patchpanel(s) and terminating on data outlet faceplates in rooms or other workstation locations.
- .2 Install conductors in cable tray and conduit runs designated for data and voice conductors. Do not fasten conductors and conduit to suspended ceiling support systems. Support conduit to building structure slab independent of other support.
- .3 Terminations to involve as little outer jacket removal as possible and cable pairs "untwisting" is to not exceed 6 mm (1/4").
- .4 Provide slack cable to allow for minor workstation relocations. Provide a coil of slack cable of an approximate 2 m (6') length for each workstation outlet run.

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- .5 Where conduits and/or cable tray is not being provided, conductors within accessible ceiling spaces to be properly bundled using "Velcro" type wraps and supported with "J" hooks. Secure "J" hooks to ceiling slab structure. Install conductors following building lines. Do not fastened conductors to suspended ceiling support systems. Obtain Parks Canada Representative's approval in use of "J" hooks. Unless otherwise noted, drops down from ceiling spaces to consist of cabling installed in vertical conduits running down within walls to outlet boxes and terminating onto jacks.
 - .6 For main voice backbone cabling from main telecom room, provide 110 connectors and mounts on hardwood backboards on walls, as required. Design system layout to best suit incoming and outgoing cables. Properly punchdown cabling with manufacturer's required tool and label each connector as required.
 - .7 Run interconnect cables neatly secured and bundled across connectors and between banks of mounts. Use D-rings to their full advantage. Neatly bundle pigtails and secure to BIX/110 connectors.
 - .8 Align mounts in straight formations to provide a neat installation and to minimize interconnect wiring lengths.
 - .9 Coordinate with Parks Canada Representative's network integrator to determine exact requirements for telephone service interconnections.
 - .10 Provide jumpers/pigtails to interconnect backbone wiring to rack mounted voice patch panels where horizontal voice cabling is terminated.
 - .11 For horizontal copper backbone cabling, multi- pair conductor cabling is preferred. If available only in limited number of pair cabling, provide multiple runs to provide quantity as identified on drawings, and increase conduit diameters to suit exact number requirements, in accordance with of standards and codes.

3.5 PENETRATION THROUGH FIREWALLS

- .1 Provide a conduit sleeve where horizontal cables penetrate firewalls. Size conduit sleeve at 40% fill ratio with a plastic bushing at both ends.
- .2 After conduit sleeve is installed, fill opening around conduit with firestop and smoke seal materials.

3.6 INSTALLATION OF OUTLETS

- .1 Connect each outlet with a 4-pair, UTP cable. Test and identify each outlet and faceplate. Wire and connect jacks back to respective dedicated racks in LAN/TEL rooms. As detailed and as required to accommodate incoming telephone/voice lines, extend voice cabling from voice patch panels to wall mounted 110 connectors, providing patch cords, cross connects/jumpers, etc. as required.
- .2 Provide outlet jack/faceplate configuration as detailed on drawings.
- .3 Drawings identify data jacks for wireless access point receivers (antennae). These locations are approximate. Confirm exact locations during onsite radio frequency studies. Allow for jacks to be repositioned up to 4 m (15') to suit results of studies. Perform studies after completion of construction of interior structures. If studies are not performed at discretion of Parks Canada Representative, leave slack coiled length of cable on each run, allowing for repositioning and review with Parks Canada Representative.

3.7 SEPARATION OF DATA COMMUNICATION CABLES FROM SOURCES OF ELECTROMAGNETIC INTERFERENCE

- .1 Separate data communication cables from sources of electromagnetic radiation in accordance with standard ANSI/TIA/EIA-569 and following:
 - .1 FT-6 rated data cabling raceway and power conductors (2 KVA power circuits) raceway require 125 mm (5") clearance;
 - .2 For fluorescent luminaires, required clearance is 300 mm (12");
 - .3 Clearance increases up to 600 mm (24") for power circuits over 5 KVA;
 - .4 For large motor, transformers, power panels, etc., required clearance is 1m (39");
 - .5 Route cables to avoid direct contact with steam piping, hot water piping or other heat sources to avoid thermal degradation.

3.8 INSTALLATION OF RACKS

- .1 Provide racks and secure to floor with bolts and concrete anchors.
- .2 In locations where more than one rack is required, butt multiple racks together. Provide wiring channel interconnection such that wiring from rack to another is not exposed.
- .3 For open racks, provide metal raceway chimney channel for conductors extending down from ceiling, such that wiring is not exposed. Secure channel to rack and ceiling.
- .4 Run wiring neatly bundled within wiring management channels. Do not over tighten Velcro tie wraps such that they deform cable jacket. Velcro straps to easily slide along length of cable. Velcro tie wraps used in plenum spaces to be CMP/FT-6 rated.
- .5 Protect cable from any obstructions using appropriate grommeting in roof of rack.
- .6 Properly ground and bond rack and equipment to room ground bus as per specifications and to standards of TIA/EIA 607.

3.9 INSTALLATION OF EQUIPMENT ENCLOSURES

- .1 Provide equipment enclosures and secure to wall/floor/ceiling as required with suitable anchors.
- .2 In locations where more than one enclosure is required, butt multiple enclosures together. Provide wiring channel interconnection such that wiring from enclosure to another is not exposed.
- .3 Provide metal raceway chimney channel for conductors extending down from ceiling, such that wiring is not exposed. Secure channel to enclosure and ceiling.
- .4 Provide suitable power supply to cabinets having fans and other active components or designated as such.
- .5 Run wiring neatly bundled within wiring management channels. Do not over tighten Velcro tie wraps such that they deform cable jacket. Velcro straps to easily slide along length of cable. Velcro tie wraps used in plenum spaces to be CMP/FT-6 rated.
- .6 Protect cable from any obstructions using appropriate grommeting in roof of enclosure.
- .7 Properly ground and bond enclosure and equipment to room ground bus as per specifications and to standards of TIA/EIA 607.

3.10 SYSTEM IDENTIFICATION

- .1 Provide a complete identification system that clearly designates following:
 - .1 Horizontal cable;
 - .2 Workstation (or faceplate);
 - .3 Horizontal/passive patchpanel port;
 - .4 Switch/active patchpanel port;
 - .5 Patch cords;
 - .6 Switch rack.
- .2 Obtain Parks Canada Representative's approval of identification format, prior to start of work. Format to comply with Parks Canada Representative's standards. Submit proposed identification system and nomenclature with shop drawing submission.
- .3 Labels:
 - .1 Labels for outlet and patch panel identification to be typewritten/computer printed self-adhesive type with white printing area at outlet location and on face of patch panel; legible permanent marker on inside of outlet box cover; use minimum font size Arial 10 point.
 - .2 Number and identify each computer hub rack with a 20 mm x 50mm (¾" x 2") engraved lamacoid plate, with white letters on black background. For letters and numbers use Arial 24 font size. Fasten nameplates with minimum two metal screws.
 - .3 Cable Identification:
 - .1 Permanently identify horizontal UTP cables at both ends of cable, placed within 13 mm (½") at outlet location and 50 mm (2") at rack location and inside of outlet cover in following manner:

"CABLE # / RACK # / PATCH PANEL PORT # / OUTLET #"
 - .4 Faceplate:
 - .1 Label data ports: "Closet / Patch Panel/Port Number", where closets to be numerically assigned, patch panels to be sequentially alphabetically assigned beginning at top of rack and ports sequentially numerically assigned related to number of ports per patch panel.
 - .2 Label voice ports: "Port Number/Level/Closet", where ports are sequentially numerically assigned, level refers to floor level on which communication closet is located and closets to be numerically assigned as per data ports.
 - .5 Patchpanel And Patch Cord Identification:
 - .1 Identify patchpanel ports in simple numeric form approved by Parks Canada Representative.
 - .2 Identify patch cords at both ends in simple numeric form, not necessarily corresponding to port numbers and be approved by Parks Canada Representative.

- .4 Identification Log:
 - .1 Record cable and workstation identification in a hard copy "CABLE IDENTIFICATION LOG" which is to be handed over to Parks Canada Representative after cable testing and certification is complete. Forward duplicate copy to Parks Canada Representative.

3.11 CABLE TESTING AND SYSTEM CERTIFICATION

- .1 Testing and verification to be performed to standards listed herein this Section and in accordance with system manufacturer's testing and certification procedures.
- .2 Structured cabling system certification to include 100% cable testing and verification for an EIA/TIA required category grade rating solution.
- .3 Perform verification of each cable and document on a cable testing sheet forming part of hard and soft copy documentation supplied at end of installation. Testing sheets to list detailed performance test measurements as requested and as required to prove compliance with referenced standards. Also include summary sheet of passes, failures and rectified failures. Submit sample of test sheet with shop drawings.
- .4 Testing Procedures:
 - .1 Perform testing using Category 6 testers such as Fluke Networks Versiv family, or equivalent Microtest or Scope Communications. Tester to meet TIA/ISO certification standards for Levels IIe, III, IIIe, IV and V. Submit with shop drawings copy of calibration certificate issued by tester manufacturer's authorized technician identifying calibration within one year of use for testing on this project. Testing to include, but not be limited to following:
 - .1 Wire map;
 - .2 Cable length;
 - .3 Attenuation;
 - .4 Near end crosstalk (next);
 - .5 Power sum near end crosstalk (PSNEXT);
 - .6 Equal level far end crosstalk (ELFEXT);
 - .7 Power sum equal level far end crosstalk (PSELFEXT);
 - .8 Return loss;
 - .9 ACR;
 - .10 Power sum ACR;
 - .11 End to end continuity;
 - .12 Opens or shorts;
 - .13 Pair polarity.
 - .2 Field testing units for multimode fibre optic cabling to comply with ANSI/TIA-526-14-B. Field testing units for singlemode fibre optic cabling to comply with ANSI/TIA/EIA-526-7.

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- .3 Tester to include required modules for certification testing of fibre optic cabling. Perform fibre testing on each fibre in completed end-to-end system. Do not splice cables except where approved by Parks Canada Representative. Testing to consist of an end-to-end power meter test performed per TIA/EIA-455-53A and. Provide system loss measurements at 850 and/or 1300 nanometers for multi-mode fibres and 1310 and/or 1550 nanometers for single mode fibres. These tests also include continuity checking of each fibre.
 - .4 For horizontal cabling system using multi-mode optical fibre, measure attenuation in one direction at either 850 nanometer (nm) or 1300 nm.
 - .5 Test backbone multi-mode fibre cabling at both 850 nm and 1300 nm (or 1310 and 1550 nm for single mode) in at least one direction.
 - .6 Conduct test set-up and performance in accordance with ANSI/TIA/EIA-526-7 and/or ANSI/TIA/EIA-526-14 Standards, and to manufacturer's application guides.
 - .7 Perform attenuation testing with a stable launch condition using two-meter jumpers to attach test equipment to cable plant. Light source to be left in place after calibration and power meter moved to far end to take measurements.
 - .8 Acceptable loss measurements for 50 micron laser optimized solution at 850 nm wavelength is not to exceed 2.5 db.
 - .9 Since optical signal attenuation at one wavelength is independent of attenuation at a second wavelength, measure attenuation of channel at both standard wavelengths (850nm and 1300nm) for backbone links.
 - .10 Replace cable not passing testing procedure, in its entirety. No splicing is permitted.
 - .5 Reports:
 - .1 Submit test results to system manufacturer and obtain manufacturer's certificate of approval of system. Submit detailed indexed test report in a 3 - ring binder with manufacturer's certificate of approval of installation and testing of system and covering letter from company responsible for installation and testing of system stating accuracy of report. Letter to be signed by company's authorized testing technician. Document testing and reports with date and time of testing, testing technician's name and signature and specification Section number that test fulfilled.
 - .2 Submit minimum 2 hard copies of report and including digital format loaded on USB type memory flash drive.

3.12 SYSTEM TRAINING AND INSTRUCTIONS

- .1 Provide training of Parks Canada Representative's designated staff on principles of connections and operations to system. Clearly instruct on procedures of disconnections and reconnections to accommodate changes and relocations of connected equipment.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENT

- .1 Section 01 35 43 Environmental Procedures
- .2 Section 31 24 13 Roadway Embankments
- .3 Section 32 19 19.13 Topsoil Placement and Grading

1.2 MEASUREMENT PROCEDURES

- .1 Measure following items in hectares within limits as indicated:
 - .1 Clearing.
 - .2 Grubbing. .

1.3 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.

1.4 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 Grubbing consists of excavation and disposal of stumps and roots boulders and rock fragments of specified size to not less than specified depth below existing ground surface.
- .3 Merchantable timber is all timber with a butt diameter in excess of 150mm and top down to 100mm.

1.05 ACTION AND INFORMATIONAL 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 liter can with manufacturer's label.
 - .3 Herbicide: one liter 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. =

1.6 QUALITY ASSURANCE

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.7 STORAGE AND PROTECTION

- .1 Prevent damage to fencing trees landscaping natural features utility lines and root systems of trees which are to remain.
 - .1 Repair damaged items to approval of Departmental Representative,
 - .2 Remove trees designated to remain, if damaged, as directed by Departmental Representative.

1.8 WASTE MANAGEMENT AND DISPOSAL .

- .1 All merchantable timber is to be cut in 300mm lengths and stockpiled adjacent to site.

2 PRODUCTS

2.1 MATERIALS

- .1 Soil Material for Fill:
 - .1 Excavated soil material: free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, deleterious, or objectionable materials.
 - .2 Remove and store soil material for reused.

3 EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

3.2 PREPARATION

- .1 Inspect site and verify with Departmental Representative items designated to remain.
- .2 Locate and protect utility lines: preserve in operating condition active utilities traversing site.
 - .1 Notify 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 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.

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 indicated, by cutting at height of not more than 300 mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 1000 mm above ground surface.

- .3 Cut off branches and cut down trees overhanging area cleared as directed by Departmental Representative.
- .4 Cut off unsound branches on trees designated to remain as directed by Departmental Representative.

3.8 GRUBBING

- .1 Remove and dispose of roots larger than 7.5 cm in diameter, matted roots, and designated stumps from indicated grubbing areas.
- .2 Grub out stumps and roots to not less than 200 mm below ground surface.
- .3 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m².
- .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 to disposal area designated by Departmental Representative.
- .2 Do not dispose of materials by burning or burying.
- .3 Chip or mulch and stockpile or spread cleared and grubbed vegetative material on site as directed by Departmental Representative.
- .4 Remove diseased trees identified by Departmental Representative.] and dispose of this material to approval of Departmental Representative.

3.10 FINISHED SURFACE

- .1 Leave ground surface in condition suitable for immediate grading operations or if topsoil is present stripping of topsoil to approval of 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 Alberta Environmental Protection
 - .1 Storm Water Management Guidelines for the Province of Alberta, 1999.
- .2 National Parks Act, 2011.
- .3 Canadian Environmental Assessment Act, 2011.

1.2 EXISTING CONDITIONS

- .1 Refer to Geotechnical Report in Appendix “A” 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 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 STRIPPING OF TOPSOIL

- .1 Ensure that procedures are conducted in accordance with applicable Parks Canada, Municipal and other Federal requirements.
- .2 Remove topsoil before construction procedures commence to avoid compaction of topsoil.
- .3 Handle topsoil only when it is dry and warm.
- .4 Remove vegetation from targeted areas by non-chemical means and dispose of stripped vegetation outside the park.

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- .5 Remove brush from targeted area by non-chemical means and dispose outside the park.
 - .6 Strip topsoil to depths as directed by the Departmental Representative.
 - .1 Avoid mixing topsoil with subsoil.
 - .7 Pile topsoil in berms in locations as directed by the Departmental Representative.
 - .1 Stockpile height not to exceed 2.5 m.
 - .8 Stripped topsoil shall not be destroyed.
 - .9 All stockpiled soil must be salvaged for re-use.
 - .10 Dispose of unused topsoil off-site as directed by Departmental Representative.
 - .11 Protect stockpiles from contamination and compaction.
 - .12 Cover topsoil that has been piled for long term storage, with trefoil or grass to maintain agricultural potential of soil.
 - .13 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 Spread topsoil during dry conditions in uniform layers not exceeding 150mm, over unfrozen subgrade free of standing water.
- .3 Establish traffic patterns for equipment to prevent driving on topsoil after it has been spread to avoid compaction.
- .4 Cultivate soil following spreading procedures.

3.5 CLEANING

- .1 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 International (ASTM)
 - .1 ASTM C117-03, Standard Test Method for Material Finer Than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C136-01, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D422-632002, Standard Test Method for Particle Size Analysis of Soils.
 - .4 ASTM D698-00ae1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort 600 kN-m/m³.
 - .5 ASTM D1557-02e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort 2,700 kN-m/m³.
 - .6 ASTM D4318-00, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A3000-03, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.
 - .2 CAN/CSA-A23.1/A23.2-00 (August 2001), Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

1.2 DEFINITIONS

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
 - .1 Rock: any solid material in excess of 1.00 m³ and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m³ bucket. Frozen material not classified as rock.
 - .2 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
- .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.

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- .5 Recycled fill material: material, considered inert, obtained from alternate sources and approved by Parks Canada to meet requirements of fill areas. Submit material samples to Departmental Representative for testing and approval.
 - .6 Unsuitable materials:
 - .1 Weak, chemically unstable, and compressible materials.
 - .2 Frost susceptible materials.
 - .3 Unshrinkable fill: very weak mixture of Portland cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.3 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Preconstruction Submittals:
 - .1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.
 - .2 Submit records of underground utility locates, indicating: location plan of existing utilities as found in field clearance record from utility authority location plan of relocated and abandoned services, as required
- .3 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures
 - .2 Submit 70 kg samples of type of fill specified including representative samples of excavated material.
 - .3 Ship samples prepaid to testing firm selected by the Departmental Representative, in tightly closed containers to prevent contamination and exposure to elements.

1.4 QUALITY ASSURANCE

- .1 Qualification Statement: submit proof of insurance coverage for professional liability.
- .2 Where a qualified Professional Engineer is an employee of the Contractor, submit proof that Work by the Engineer is included in Contractor's insurance coverage.
- .3 Submit design and supporting data at least 2 weeks prior to beginning Work.
- .4 Design and supporting data submitted to bear stamp and signature of qualified Professional Engineer registered or licensed in Province of Alberta, Canada.
- .5 Keep design and supporting data on site.
- .6 Engage services of qualified Professional Engineer who is registered or licensed in Province of Alberta, Canada in which Work is to be carried out to design and inspect shoring, bracing and underpinning required for Work.

- .7 Do not use soil material until written report of soil test results are reviewed by Departmental Representative.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Storage and Protection:
 - .1 Protect existing features in accordance with Section 01 56 00 - Temporary Barriers and Enclosures and applicable local regulations.
 - .2 Existing buried utilities and structures:
 - .1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .2 Confirm locations of buried utilities by careful soil hydrovac methods.
 - .3 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered as indicated.
 - .4 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing.
 - .5 Record location of maintained, re-routed and abandoned underground lines.
 - .6 Confirm locations of recent excavations adjacent to area of excavation.
 - .3 Existing buildings and surface features:
 - .1 Conduct, with Departmental Representative, condition survey of existing buildings, plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.
 - .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative.
- .2 Construction/Demolition Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling.
 - .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 Place materials defined as hazardous or toxic in designated containers.
 - .4 Handle and dispose of hazardous materials in accordance with Regional and Municipal regulations.
 - .5 Ensure emptied containers are sealed and stored safely.

1.6 EXISTING CONDITIONS

- .1 Refer to Geotechnical Report in Appendix "B" for site details.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Type 1 and Type 2 fill: properties to the following requirements:
 - .1 Crushed, pit run or screened stone, gravel or sand.
 - .2 Gradations to be within the following limits:

Sieve Designation	% Passing		
	Type 1	Type 2	Type 4
75 mm	-	100	
50 mm	-	-	
37.5 mm	-	-	
25 mm	100	-	
19 mm	75-100	-	
12.5 mm	-	-	
9.5 mm	50-100	-	100
4.75 mm	30-70	22-85	90-100
2.00 mm	20-45	-	
0.425 mm	10-25	5-30	
0.180 mm	-	-	20
0.075 mm	3-8	0-10	

- .2 Type 3 fill: selected material from excavation or other sources, approved by Departmental Representative for use intended, unfrozen and free from rocks larger than 200 mm, cinders, ashes, sods, refuse or other deleterious materials.
- .3 Type 4 fill: clean sand, or free draining granular fill, free from clay, friable materials, and other deleterious materials.

PART 3 EXECUTION

3.1 SITE PREPARATION

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

3.2 SOIL STRIPPING AND STOCKPILING

- .1 Perform in accordance with Section 31 14 13 – Soil Stripping and Stockpiling.

3.3 SHORING AND BRACING

- .1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with the Health and Safety Act for the Province of Alberta.
- .2 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.

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- .3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at least 500 mm above toe of sheeting.
 - .3 When sheeting is required to remain in place, cut off tops at elevations as indicated by the Departmental Representative.
 - .4 Upon completion of substructure construction:
 - .1 Remove cofferdams, shoring and bracing.
 - .2 Remove excess materials from site and restore watercourses as indicated and as directed by Departmental Representative.

3.4 DEWATERING AND HEAVE PREVENTION

- .1 Keep excavations free of water while Work is in progress.
- .2 Submit for Departmental Representative's review details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.
- .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 accordance with Section 01 35 43 - Environmental Procedures to approved collection areas and in 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.

3.5 EXCAVATION

- .1 Advise Departmental Representative at least 7 days in advance of excavation operations for initial cross sections to be taken. Provide schedule of excavation to Departmental Representative.
- .2 Excavate to lines, grades, elevations and dimensions as indicated.
- .3 Excavation must not interfere with bearing capacity of adjacent foundations.
- .4 Dispose of surplus and unsuitable excavated material off site, as directed by the Departmental Representative.
- .5 Do not obstruct flow of surface drainage or natural watercourses.
- .6 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

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- .7 Notify Departmental Representative when bottom of excavation is reached.
 - .8 Obtain Departmental Representative approval of completed excavation.
 - .9 Correct unauthorized over excavation as follows:
 - .1 Fill under bearing surfaces and footings with concrete specified for footings.
 - .2 Fill under other areas with Type 2 fill compacted to not less than 98% of corrected Standard Proctor maximum dry density.
 - .10 Hand trim, make firm and remove loose material and debris from excavations.
 - .11 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
 - .12 Open trenches shall not be more than 30 m in length.
 - .1 Open trenches shall be fenced overnight for public and wildlife protection.

3.6 FILL TYPES AND COMPACTION

- .1 Use types of fill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D698.
- .2 Exterior side of pre-cast concrete storage tanks: use Type 4 fill within 450 mm from wall and Type 3 fill to sub-grade level. Do not compact soil adjacent to the pre-cast concrete storage tanks.
 - .1 Under exterior concrete slabs and aprons: provide 150mm compacted thickness base course of Type 1 fill topped with 50 mm Type 4 fill to underside of slab. Compact base course to 100%.
 - .2 Under exterior pre-cast concrete storage tank: provide 150mm compacted thickness base course of Type 1 fill.

3.7 BACKFILLING

- .1 Do not proceed with backfilling operations until completion of following:
 - .1 Departmental Representative has inspected and approved of construction below finish grade.
 - .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 250mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

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- .5 Install drainage system in backfill as indicated.

3.8 TESTING

- .1 The following shall be the minimum acceptable standard for backfill testing:
 - .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 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.
- .2 Trenches shall be tested from pipe zone to finished sub-grade.
- .3 Such tests are taken adjacent to the wet well, storage tanks, manholes and valves from pipe zone to finished sub-grade.

3.9 RESTORATION

- .1 Upon completion of Work, remove waste materials and debris, trim slopes, and correct defects as directed by Departmental Representative.
- .2 Replace topsoil as directed by Departmental Representative.
- .3 Reinstall lawns to elevation which existed before excavation.
- .4 Rebuild damaged road sections to drawing detail prior to execution of Work. Edges of asphalt on damaged roads are to be saw cut prior to remediation.
- .5 Clean and reinstall areas affected by Work as directed by Departmental Representative.

3.10 TRENCH SETTLEMENT DURING WARRANTY PERIOD

- .1 During the warranty period, the Contractor shall replace material and rectify all failures that occur as a result of settlement of trench backfill or collapse of trench walls.
- .2 Trenches in which backfill settles shall be refilled with the specified backfill material. Paved surfaces that are adjacent to trenches or on trench backfill, which fail during the period, shall be replaced or repaired in an approved manner.
- .3 Replacement of materials and rectification of failures that occur as a result of settlement of trench backfill or collapse of trench walls is entirely the responsibility of the Contractor and such repairs work shall be done at the Contractor's expense.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 31 11 00 Clearing and Grubbing
- .2 Section 32 91 19.13 Topsoil Placement and Grading
- .3 Section 02 41 13.14 Asphalt Pavement Removal
- .4 Section 32 11 16.01 Granular Sub-base
- .5 Section 32 11 23 Aggregate Base Course

1.2 MEASUREMENT PROCEDURES

- .1 **Common Excavation:** measure in cubic metres calculated from cross sections taken by Departmental Representative in areas of fill(material incorporated in embankment).
 - .1 Departmental Representative will take initial cross sections after clearing, grubbing and topsoil removal has been completed and immediately prior to excavation and embankment construction.
- .2 **Borrow:** measure in cubic metres calculated from cross sections after construction of embankment and measured in fill(material incorporated in embankment). Departmental Representative will take initial cross-section prior to embankment construction with borrow material.
 - .1 Departmental Representative will take initial cross sections after clearing, grubbing and topsoil removal has been completed and immediately prior to excavation and embankment construction.
- .3 **Prepare Subgrade Surface:** measured in square metres of 150 mm deep scarified layer(compacted to minimum of 98 % SPMDD) prepared for granular material.
- .4 **Waste Material**
 - .1 Measure in cubic metres calculated from cross sections taken by Departmental Representative in areas of excavation.
 - .2 Departmental Representative will take initial cross sections after clearing, grubbing and topsoil removal has been completed and immediately prior to excavation of material to be disposed.
- .5 No separate payment for:
 - .1 Excavating unnecessarily beyond lines established by Departmental Representative with exception of unavoidable slide material. Do not measure slide material, when such slides are attributable to negligence.
 - .2 Ripping and/or drilling and blasting of material.
 - .3 Scarifying or benching existing slopes or existing road surfaces.
 - .4 Removing and disposing of roots, stumps and other materials excavated during waste operation.
 - .5 Burying existing culverts from old road.
 - .6 Removing unsuitable material from embankment attributable to negligence.
 - .7 Shattering rock to 300 mm below subgrade elevation.
 - .8 Scaling and removing loose rock from rock face.
 - .9 Watering, drying and compacting.
 - .10 Finishing.
 - .11 Hauling of material.

1.3 REFERENCES

- .1 Definitions:
 - .1 Rock Excavation: excavation of:
 - .1 Material from solid masses of igneous, sedimentary or metamorphic rock which, prior to removal, was integral with parent mass. Material that cannot be ripped with reasonable effort with a Caterpillar D9 crawler bulldozer or equivalent to be considered integral with parent mass.
 - .2 Boulder or rock fragments measuring in volume 1 cubic metre or more.
 - .2 Common Excavation: excavation of materials that are not Rock Excavation obtained from within the project limits and within the right of way.
 - .3 Over Haul: No separate measurement for over haul. Hauling of material is included in the unit rates for common excavation, borrow and waste material.
 - .4 Embankment: material derived from usable common excavation and borrow material and placed above original ground or stripped surface up to top of subgrade.
 - .5 Waste Material: material unsuitable for embankment, embankment foundation or material surplus to requirements.
 - .6 Borrow Material: material obtained from areas outside right-of-way arranged and supplied by the contractor and required for construction of embankments or for other portions of work.
 - .7 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
 - .8 Preparing Subgrade Surface shall be the soil surface on which subsequent layer or layers of base course, gravel surfacing, surface treatment, pavement or other material is to be placed.
- .2 Reference Standards:
 - .1 ASTM International
 - .1 ASTM D 698-07ea1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft³) (600 kN-m/m³).

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit for approval and review blasting program including pre-shear details, powder factors fly-rock control, and vibration monitoring methods.

1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements:
 - .1 Adhere to regulations of authority having jurisdiction when blasting is required.
 - .2 Adhere to Provincial and National Environmental requirements when potentially toxic materials are involved.

2 PRODUCTS

2.1 MATERIALS

- .1 Embankment materials require approval by Departmental Representative.
- .2 Material used for embankment not to contain organic matter , frozen lumps, weeds, sod, roots, logs, stumps or other unsuitable material.
- .3 Borrow material:
 - .1 Obtain from sources arranged by the contractor such as quarry, or borrow pit as [approved by Departmental Representative].

- .1 Earth Embankment materials to consist of acceptable earth material and processed rock material free from objectionable quantities of organic matter, frozen soil, stumps, trees, moss, and other unsuitable materials.
- .2 Rock Embankments not acceptable for use on this project.

3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that condition of substrate is acceptable for roadway embankment Work:
 - .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.
 - .4 Topsoil and organic materials should not be present within the footprint of the proposed roadway.
 - .5 Granular material should not be placed on frozen subgrade.
 - .6 Any soft or incompetent soils identified during excavation or proof-rolling are to be sub-excavated and removed from the footprint of the proposed roadway.
 - .7 The subgrade condition should be approved by the Geotechnical engineer prior to placement of the granular sub-base materials.

3.2 COMPACTION EQUIPMENT

- .1 Compaction equipment: vibratory rollers or vibrating plate compactors capable of obtaining required density in materials on project.
 - .1 Demonstrate compaction equipment effectiveness on specified material and lift thickness by documented performance of test-strip before start of Work.
 - .2 Replace or supplement equipment that does not achieve specified densities.
- .2 Operate compaction equipment continuously in each embankment when placing material.

3.3 WATER DISTRIBUTORS

- .1 Apply water with equipment capable of uniform distribution.

3.4 STRIPPING OF TOPSOIL

- .1 Place top soil and finish grading in accordance with Section 32 91 19.13 - Topsoil Placement and Grading.
- .2 Commence topsoil stripping of areas as directed by Departmental Representative after brush weeds and grasses have been removed from these areas.
- .3 Do not mix topsoil with subsoil.
- .4 Stockpile stripped materials for later re-use within the limits of work.
- .5 Spread organic stripping, on completion of excavation and embankment construction, on slopes and trim or remove from site if quantity exceeds ability to grade on site.

3.5 EXCAVATING

- .1 General:
 - .1 Notify Departmental Representative when waste materials are encountered and remove to depth and extent directed.
 - .2 Sub-excavate 150 mm below subgrade in cut sections unless otherwise directed by Departmental

- Representative .
 - .1 Compact top 150 mm below sub-excavate to minimum 98% of SPMDD.
 - .2 Replace with approved embankment material and compact to specified embankment density.
- .4 Treat ground slopes, where subgrade is on transition from excavation to embankment, at grade points as directed by Department Representative.].
- .2 Drainage:
 - .1 Maintain profiles, crowns and cross slopes to provide good surface drainage.
 - .2 Provide ditches as work progresses to provide drainage.
 - .3 Construct interceptor ditches as indicated or as directed before excavating or placing embankment in adjacent area.
- .3 Rock excavation:
 - .1 No rock excavation is expected as part of this project
 - .2 Notify Departmental Representative [, when material appearing to conform to classification for rock is encountered, to enable measurements to be made to determine volume of rock. Provide 12 hour notification.
 - .2 Submit blasting program to Departmental Representative, for approval 48 hours minimum before start of Work.
 - .1 Do not proceed without written approval of blasting program from Departmental Representative .
 - .3 Shatter rock to 300 mm below subgrade elevation as indicated.
 - .4 Reduce overbreak and increase stability of rock faces by using smooth blasting techniques.
 - .5 Use smooth blast and excavate short sections in rock cuts to determine optimum spacing of holes when requested by Departmental Representative.
 - .6 Stem holes as necessary to contain blast.
 - .7 Do not use prilled type ammonium nitrate and fuel oil (ANFO) explosives within 4 m of final cut line.
 - .8 Form back wall by pre-splitting at least 10 m in advance of production blasting.
 - .1 Smooth wall blast just prior to or just after production blast as determined by approved blast program.
 - .9 Scale rock backslopes to achieve smooth, stable face, free of loose rock and overhangs to design backslope.
 - .10 Control blasting to minimize flying particles.
 - .11 Roadway excavation is to be executed so that no rock excavation or blasting is required beyond what cannot be ripped with reasonable effort with a Caterpillar D9 crawler bulldozer or equivalent.
- .4 Borrow Excavation:
 - 1 Completely use in embankments, suitable materials removed from right-of-way excavations before taking material from borrow areas.
 - .2 Contractor responsible for providing embankment materials, in excess of what is available from cut areas.
 - .3 Slope edges of borrow areas to minimum 4:1 and provide drainage.
- .5 Waste Material:
 - .1 Subgrade soil or previously existing, failing surface materials designated as undesirable by the Departmental Representative shall be excavated, removed and disposed.
 - .2 The contractor shall take ownership of the excavated material and shall remove it from the roadway to his own storage or disposal site.
 - .3 Material that is surplus to requirements on the project is considered as waste material.

3.6 EMBANKMENTS

- .1 Scarify or bench existing slopes in side hill or sloping sections to ensure proper bond between new materials and existing surfaces.
 - .1 Method used to be pre-approved in writing by [Departmental Representative] .
- .2 Break up or scarify existing road surface prior to placing embankment material.
- .3 Do not place material which is frozen nor place material on frozen surfaces except in areas authorized by Departmental Representative .
- .4 Maintain crowned surface during construction to ensure ready run-off of surface water.
- .5 Drain low areas before placing materials.
 - .1 Place and compact to full width in layers not exceeding 200 mm loose thickness. Departmental Representative may authorize thicker lifts if specified compaction can be achieved and if material contains more than 25% by volume stone and rock fragments larger than 100 mm.
- .6 Where material consists of rock:
 - .1 Place to full width in layers of sufficient depth to contain maximum sized rocks, but in no case is layer thickness to exceed 1 m.
 - .2 Distribute rock material to fill voids with smaller fragments to form compact mass.
 - .3 Fill surface voids at subgrade level with rock spalls or selected material to form earth-tight surface.
 - .4 Do not place boulders and rock fragments with dimensions exceeding 100 mm within 150 mm of pavement subgrade elevation.
- .7 Deductions from excavation will be made for overbuild of embankments.

3.7 COMPACTION

- .1 Break material down to sizes suitable for compaction and mix for uniform moisture to full depth of layer.
- .2 Deposit, spread, and level, embankment material in layers 200 mm maximum thickness before compaction.
 - .1 Compact each layer of embankment until compaction equipment achieves no further significant consolidation.
 - .2 Ensure required compaction for each layer before placing any material for next layer.
- .4 Obtain written approval from Departmental Representative before using specialized compaction equipment such as tamping rollers, vibratory rollers, or other alternate compaction equipment that produces the required results
 - .1 For tamping rollers, use equipment that exerts 1000 kPa minimum of pressure on tamping surface of each tamping foot in transverse row.
- .5 Compact each layer to a minimum of **98%** SPMDD,
- .6 Add water or dry as required to bring moisture content of materials to level required to achieve specified compaction.
- .7 Construction of subgrade should not be undertaken when the temperature is/or is projected to be below 0° C. Any frost present in constructed layer should be addressed by removal of the frost layer, heating to thaw frost, or waiting for the frost to naturally dissipate prior to placing subsequent layers.
- .8 Prior to the placement of granular materials, the prepared subgrade surface should be proof-rolled to identify any soft area. Any soft areas identified during proof roll should be reworked or sub-excavated to a minimum depth of 300 mm and backfilled with imported fill material and compacted to the specified compaction as discussed above.

3.8 FINISHING

- .1 The finished subgrade surface shall be firm and uniform, true to grade and cross-section of the roadway.
- .2 Remove rocks over 150 mm in dimension from slopes and ditch bottoms.
- .3 Trim between constructed slopes and edge of clearing to provide drainage and free of humps, sags and ruts.

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 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.10 PROTECTION

- .1 Maintain finished surfaces in condition conforming to cross-section and compaction requirements at top of subgrade.

END OF SECTION

PART 1 GENERAL

PART 2 WASTE MANAGEMENT AND DISPOSAL

- .1 Collect and separate plastic, paper packaging, and corrugated cardboard in accordance with Waste Management Plan.
- .2 Fold up metal banding, flatten and place in designated area for recycling.
- .3 Divert left over aggregate materials from landfill to local facility for reuse as approved by Department Representative.
- .4 Divert left over hardened cement materials from landfill to local facility for reuse as approved by Department Representative.

PART 3 PRODUCTS

3.1 STONE

- .1 A stone obtained from the face of the quarry after non-blasted or equal. The size depends on the depth of the bed and drilling pattern. Stone to closely match in colour, and come from same quarry as stone used on kiosk.
- .2 Stone should be stackable rundle boulders 500 mm to 600 mm height by 400 mm to 500 mm width by 1000 mm to 1200 mm length. Predominantly dark gray to brown in colour. Submit sample to Department Representative at least 2 weeks prior to delivery of material on site for approval.

PART 4 EXECUTION

4.1 PLACING

- .1 Fine grade area to be stone to uniform, even surface. Fill depressions with suitable material and compact to provide firm bed.
- .2 Place stone as indicated on drawing and details as indicated.
- .3 Place stones in manner approved by Department Representative to secure surface and create a stable mass.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 32 17 23 Pavement Markings

1.2 MEASUREMENT AND PAYMENT

- .1 Payment for this section is deemed incidental to the work and will not be paid separately.

1.3 REFERENCES

- .1 Canada Green Building Council (CaGBC)
 - .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package for New Construction and Major Renovations (including Addendum 2007).

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 abrasives and solvent used on project.
 - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety 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 Develop Construction Waste Management Plan related to Work of this Section.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 PRODUCTS

2.1 MATERIALS

- .1 Abrasives and solvents used for removal of paint, oil, grease, rubber deposits: proprietary products specially designed for pavement cleaning, subject to approval by Departmental Representative.

3 EXECUTION

3.1 REMOVING PAVEMENT MARKINGS

- .1 Remove rubber tire deposits and paint markings, in areas as directed by Departmental Representative , by blasting, rotary grinding, heater planing or other method approved in writing by Departmental Representative.

- .2 Exercise care to avoid dislodging of coarse aggregate particles, excessive removal of fines, damage to bituminous binder or damage to joint and crack sealers.
- .3 Do not heat pavement surfaces above 120 degrees C, when using heater planning equipment.

3.2 PAVEMENT SURFACE CLEANING

- .1 Remove sealing compound which has protruded excessively, where directed by Departmental Representative.
 - .1 Dispose of removed material as directed by Departmental Representative.
- .2 Remove dust, contaminants, loose and foreign materials, oil and grease, in areas as directed by and by method approved in writing by Departmental Representative.
- .3 Use rotary power brooms or vacuum sweepers supplemented by hand brooming.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 321723 – Pavement Markings
- .2 Section 321216 – Asphalt Paving.

1.2 MEASUREMENT AND PAYMENT

- .1 Payment for grooving of asphalt surfaces for centre line “rumble strips” will be paid per kilometer.
- .2 Payment for grooving transverse surfaces “rumble strips” will be paid per lump sum(LS) of all transvers grooving as shown on the drawings.

1.3 REFERENCES

- .1 Alberta Transportation Highways Geometric Design Guide
 - .1 Typical Layout for Milled Rumble Strips for Stop Conditions, CB6-3.52M3
 - .2 Typical Layout for Milled Rumble Strips for Centre Line, CB6-3.52M4

2 PRODUCTS

2.1 GROOVING EQUIPMENT

- .1 Use grooving equipment capable of producing clean cut grooves to dimension specified without damage to pavement surface between grooves.
- .2 For new equipment without proven field record, demonstrate performance to satisfaction of Departmental Representative prior to beginning Work.

3 EXECUTION

3.1 GROOVING CONFIGURATION

- .1 Cut grooves for centerline strips to be 150 - 200 mm wide by 6.0 mm deep by 300 mm long with centre to centre spacing of 700 mm.
- .2 Cut grooves for transverse strips to be 150 mm wide by 12.0 mm deep with centre to centre spacing of 900 mm.
- .2 Tolerances:
 - .1 Width and depth to +/-2 mm.
 - .2 Centre to centre spacing to +/-200 mm.
 - .3 Alignment deviation not to exceed 30 mm over 25 m length.

3.2 GROOVING

- .1 Cut grooves in locations and alignments as indicated.
- .2 Except where obstructions exist such as surface light fixtures cut grooves continuous through length of run, including through joints perpendicular to grooving alignment.

- .3 Do not cut through kerfs containing electrical cable.
- .4 Do not cut grooves closer than 75 mm to pavement joints running parallel to grooving alignment.
- .5 Do not cut grooves in newly placed surfaces until cured sufficiently to accommodate grooving without damage.
- .6 In transverse grooving of runway surfaces, terminate grooves 1 m from runway edge to permit maneuvering space for 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 Clean up continuously during grooving operation.
- .3 Remove loose material and thoroughly check grooving area for debris or tools prior to opening runway to traffic.
- .4 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Dispose of waste material resulting from grooving operation by flushing with water, sweeping or vacuuming.

END OF SECTION

1 GENERAL

1.01 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

- .1 Granular subbase material is supplied by Parks. The (Des.6 Class 80) granular material is from Pit 69 for Niblock (approximately 10km from Niblock gate) and from the David Thompson Pit for DTH gate (approximately 5km from the DTH gate)

1.02 RELATED REQUIREMENTS

- .1 Section 02 41 13.14 – Asphalt Pavement Removal
- .3 Section 32 11 23 – Aggregate Base Courses
- .4 Section 32 12 16 – Asphalt Paving
- .5 Section 32 12 13.16 – Asphalt Tack Coat
- .6 Section 32 12 13.23 – Asphalt Prime Coat
- .7 Section 32 16 15 – Concrete Walks, Curbs, and Gutters
- .8 Section 32 13 13 – Concrete Paving
- .9 Section 31 24 13 – Roadway Embankments

1.03 MEASUREMENT AND PAYMENT

- .1 Measure and payment for granular subbase will be in tonnes and will include full compensation for processing and compacting complete to the requirements of the Alberta Transportation Specifications for Highway Construction, Edition 15 (2013)
- .2 Measure and payment for hauling subbase material will be in cubic metre of material hauled in kilometer (m³.km) with the distance measured from the respective Pits to the site.
- .3 Bonuses and Penalties are not applicable under this part of the Work (No payment adjustment factor).

1.04 REFERENCES

- .1 Alberta Transportation Specifications for Highway Construction, Edition 15 (2013)
- .2 ASTM International
 - .1 ASTM C 117-04, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C 131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .3 ASTM C 136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D 422-63(2007), Standard Test Method for Particle-Size Analysis of Soils.
 - .5 ASTM D 698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft²) (600kN-m/m²).
 - .6 ASTM D 1557-09, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft²) (2,700kN-m/m²).
 - .7 ASTM D 1883-07e2, Standard Test Method for CBR (California Bearing Ratio) of Laboratory

- .8 Compacted Soils.
ASTM D 4318-10, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .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 U.S. Environmental Protection Agency (EPA) / Office of Water
 - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.05 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit all submittals and quality control requirements in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013) including all Quality Control testing results.

1.06 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013).].

2 PRODUCTS

2.01 MATERIALS

- .1 The Granular subbase material (Des 6 Class 80) as supplied by Parks from Pit 69 and the David Thompson Pit.

3 EXECUTION

3.01 EXAMINATION

- .1 Verification of Conditions in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013) Specifications 3.8.

3.02 PREPARATION

- .1 Temporary Erosion and Sedimentation Control in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013).

3.03 PLACING

- .1 Place granular sub-base after subgrade is inspected and approved by Departmental Representative.
- .2 Construct granular sub-base to depth and grade in areas as indicated.
- .3 Ensure no frozen material is placed.
- .4 Place material only on clean unfrozen surface, free from snow or ice.
- .5 Begin spreading sub-base material on crown line or high side of one-way slope.
- .6 Place granular subbase materials using methods which do not lead to segregation or degradation.

- .7 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
- .8 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Departmental Representative may authorize thicker lifts if specified compaction can be achieved.
- .9 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .10 Remove and replace portion of layer in which material has become segregated during spreading.
- .11 Construction of subbase should not be undertaken when the temperature is/or is projected to be below 0° C. Any frost present in constructed layer should be addressed by removal of the frost layer, heating to thaw frost, or waiting for the frost to naturally dissipate prior to placing subsequent layers.

3.04 COMPACTION

- .1 Compaction equipment to be capable of obtaining required material densities.
- .2 Compact to density of not less than 98% SPMDD.
- .3 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.
- .4 Apply water as necessary during compaction to obtain specified density.
- .5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.
- .6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.05 PROOF ROLLING

- .1 Proof rolling in accordance with Temporary Erosion and Sedimentation Control in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013).

3.06 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.07 SITE TOLERANCES

- .1 Finished sub-base surface to be within 30 mm of elevation as indicated but not uniformly high or low.

3.08 PROTECTION

- .1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by Departmental Representative.

END OF SECTION

1 GENERAL

1.01 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

- .1 Aggregate Base Course material for the Niblock and DTH gate will be supplied by Parks from Pit 69 (approximately 10km from Niblock site).

1.02 RELATED REQUIREMENTS

- .1 Section 02 41 13.14 – Asphalt Pavement Removal
- .2 Section 31 24 13 – Roadway Embankments
- .3 Section 32 11 16.01 – Granular Sub-base
- .4 Section 32 12 16 – Asphalt Paving
- .5 Section 32 12 13.16 – Asphalt Tack Coat
- .6 Section 32 12 13.23 – Asphalt Prime Coat
- .7 Section 32 16 15 – Concrete Walks, Curbs, and Gutters
- .8 Section 32 13 13 – Concrete Paving_R2

1.03 MEASUREMENT AND PAYMENT

- .1 Measurement will be in tonnes for material acceptably placed.
- .2 Measurement and Payment will be the unit price bid for Aggregate Base Course and will be full compensation for placing, processing, and compacting the material on the roadway (for Asphalt and Concrete Pavements) and approaches.
- .3 Measure and payment for hauling Base material will be in cubic metre of material hauled in kilometer (m3.km) with the distance measured from Pit 69 to the sites.
- .4 Bonuses and Penalties are not applicable under this part of the Work (No payment adjustment factor).
- .5 The payment for the supply and application of Prime Coat is included in the unit rate for Aggregate Base Course and no separate payment will be made for Prime Coat.

1.04 REFERENCES

1.05 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit all submittals and quality control testing requirements in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013) including all Quality Control Testing.

1.06 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013).

2 PRODUCTS

2.01 MATERIALS

- .1 The Aggregate Base Course material (Des.2 Class 25) is supplied by Parks.
- .2 The construction methods should meet the requirements of “Granular Base” as per Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013)

3 EXECUTION

3.01 PREPARATION

- .1 Temporary Erosion and Sedimentation Control to be in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013).

3.02 PLACEMENT

- .1 Place Aggregate Base Course after sub-base is inspected and approved by Departmental Representative.
- .2 Construct Aggregate Base Course to depth and grade in areas as indicated.
- .3 Ensure no frozen material is placed.
- .4 Place material only on clean unfrozen surface, free from snow or ice.
- .5 Begin spreading Aggregate Base Course material on crown line or high side of one-way slope.
- .6 Place Aggregate Base Course materials using methods which do not lead to segregation or degradation.
- .7 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
- .8 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Departmental Representative may authorize thicker lifts if specified compaction can be achieved.
- .9 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .10 Remove and replace portion of layer in which material has become segregated during spreading.
- .11 Construction of Aggregate Base Course should not be undertaken when the temperature is/or is projected to be below 0° C Any frost present in constructed layer should be addressed by removal of the frost layer, heating to thaw frost, or waiting for the frost to naturally dissipate prior to placing subsequent layers

3.03 COMPACTION

- .1 Compaction equipment to be capable of obtaining required material densities.
- .2 Compact to density of not less than 98% SPMDD.
- .3 Shape and roll alternately to obtain smooth, even and uniformly compacted Aggregate Base Course.
- .4 Apply water as necessary during compaction to obtain specified density.
- .5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.

- .6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
- .7 Place, compact, and proof roll Aggregate Base Course in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013)

3.04 SITE TOLERANCES

- .1 Finished base surface to be within plus or minus 10 mm of established depth and cross section but not uniformly high or low.

3.05 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
 - .2 Divert unused granular material from landfill to Contractor facility.

3.06 PROTECTION

- .1 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by Departmental Representative.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 02 41 13.14 – Asphalt Pavement Removal
- .2 Section 32 11 23 - Aggregate Base Course
- .2 Section 32 12 16 – Asphalt Paving
- .3 Section 32 12 13.23 – Asphalt Prime Coat
- .4 Section 32 16 15 – Concrete Walks, Curbs, and Gutters
- .8 Section 32 13 13 – Concrete Paving_R2

1.02 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

- .1 There are no items under this heading.

1.03 MEASUREMENT and PAYMENT PROCEDURES

- .1 All costs associated with the supply, application and maintenance of tack coat shall be included in the unit price bid per tonne for “Asphalt Concrete Pavement-EPS”, no separate or additional payment will be made.

1.04 REFERENCES

- .1 ASTM International
 - .1 ASTM D 140/D 140M-09, Standard Practice for Sampling Bituminous Materials.
- .2 Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013)
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-16.1-[M89], Cutback Asphalts for Road Purposes.
 - .2 CAN/CGSB-16.2-[M89], Emulsified Asphalts, Anionic Type, for Road Purposes.

1.05 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit all submittals and quality control testing requirements in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013)
- .2 Product Data:
 - .1 Submit in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013)
- .3 Samples:
 - .1 Submit in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013).

1.06 QUALITY ASSURANCE

- .1 Upon request from Departmental Representative, submit manufacturer's test data and certification that asphalt tack coat material meets requirements of this Section.

1.07 DELIVERY, STORAGE AND HANDLING

- .1 Delivery, storage, and handling in accordance with Submit in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013)

2 PRODUCTS

2.01 MATERIAL

- .1 In accordance with the Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013) Specification 3.19.2

2.02 EQUIPMENT

- .1 Equipment specifications in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013) Specification 3.19.3

3 EXECUTION

3.01 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for asphalt prime coat installation in accordance with manufacturer's written instructions.
 - .1 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.

3.02 APPLICATION

- .1 Application specifications in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013)

3.03 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 02 41 13.14 – Asphalt Pavement Removal
- .2 Section 32 11 23 – Aggregate Base Courses
- .2 Section 32 12 16 – Asphalt Paving
- .3 Section 32 12 13.16 – Asphalt Tack Coat
- .4 Section 32 16 15 – Concrete Walks, Curbs, and Gutters
- .8 Section 32 13 13 – Concrete Paving

1.02 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

- .1 There are no items under this heading.

1.03 MEASUREMENT and PAYMENT PROCEDURES

- .1 All costs associated with the supply, application and maintenance of prime coat shall be included in the unit price bid per tonne for “Aggregate Base Courses”, no separate or additional payment will be made

1.04 REFERENCES

- .1 ASTM International
 - .1 ASTM D 140/D 140M-09, Standard Practice for Sampling Bituminous Materials.
- .2 Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013)
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-16.1-[M89], Cutback Asphalts for Road Purposes.
 - .2 CAN/CGSB-16.2-[M89], Emulsified Asphalts, Anionic Type, for Road Purposes.

1.05 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit all submittal and quality control testing requirements in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013)
- .2 Product Data:
 - .1 Submit in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013)
- .3 Samples:
 - .1 Submit in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013).

1.06 QUALITY ASSURANCE

- .1 Upon request from Departmental Representative, submit manufacturer's test data and certification that asphalt prime material meets requirements of this Section.

1.07 DELIVERY, STORAGE AND HANDLING

- .1 Delivery, storage, and handling in accordance with Submit in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013)

2 PRODUCTS

2.01 MATERIAL

- .1 In accordance with Submit in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013) Specification 3.19.2

2.02 EQUIPMENT

- .1 Equipment specifications in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013) Specification 3.19.3

3 EXECUTION

3.01 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for asphalt prime coat installation in accordance with manufacturer's written instructions.
 - .1 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.

3.02 APPLICATION

- .1 Application specifications in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013) Specification 3.19.3.

3.03 USE OF SAND BLOTTER

- .1 If asphalt prime fails to penetrate, spread sand blotter material in amounts required to absorb excess material.
- .2 Allow sufficient time for excess prime to be absorbed.
- .3 Apply second application of sand blotter as required.
- .4 Do not roll blotter sand.
- .5 Sweep and remove excess blotter material.
- .6 Sand used for the blotting of excess asphalt due to prime shall be supplied by the Contractor.

3.04 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.

- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 02 41 13.14 – Asphalt Pavement Removal
- .2 Section 31 24 13 – Roadway Excavation
- .3 Section 32 11 16.01 – Granular Sub-base
- .4 Section 32 11 23 – Aggregate Base Courses
- .5 Section 32 12 13.16 – Asphalt Tack Coat
- .6 Section 32 12 13.23 – Asphalt Prime Coat
- .7 Section 32 16 15 – Concrete Walks, Curbs, and Gutters
- .8 Section 32 13 13 – Concrete Paving_R2
- .9 Section 31 22 13 – Roadway Embankment

1.02 PRODUCTS SUPPLIED BUT NOT INSTALLED UNDER THIS SECTION

- .1 There are no items under this heading

1.03 MEASUREMENT AND PAYMENT

- .1 Measurement and payment of Asphalt Concrete Pavement is in Tonnes and includes laying the asphalt mat and compaction to the required density and includes, Preliminary Leveling of Asphalt, Transverse Pavement Joints, and Fillets and Ramps.
- .2 Bonuses and Penalties are not applicable under this part of the Work(No payment adjustment factor).
- .3 Density, Smoothness, and Segregation, determined to be in penalty in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013) shall be identified for remediation or rejection at the discretion of the Department Representative.
- .4 Payment for the supply of liquid anti-strip additive where required based on the results of moisture susceptibility testing, will be made at the rate of \$9.00 per kg.
- .5 Haul of Asphalt from Pit 69 will be paid in cubic meter kilometer (m3.km) and measured from the Plant in Pit 69 to the site.
- .6 The supply and application of the Tack Coat is to be included in the Asphalt Paving rate and no separate payment will be made for Tack Coat on this project.

1.04 REFERENCES

- .1 American Association of State Highway and Transportation Officials (AASHTO)
 - .1 AASHTO M320-10, Standard Specification for Performance Graded Asphalt Binder.
 - .2 AASHTO R29-02, Standard Specification for Grading or Verifying the Performance Graded of an Asphalt Binder.
 - .3 AASHTO T245-97(2004), Standard Method of Test for Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus.

- .2 Asphalt Institute (AI)
 - .1 AI MS-2-1994 Sixth Edition, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.
- .3 ASTM International
 - .1 ASTM C 88-05, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
 - .2 ASTM C 117-04, Standard Test Method for Material Finer Than 0.075mm (No.200) Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C 123-04, Standard Test Method for Lightweight Particles in Aggregate.
 - .4 ASTM C 127-07, Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
 - .5 ASTM C 128-07a, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
 - .6 ASTM C 131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .7 ASTM C 136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .8 ASTM C 207-2006, Standard Specification for Hydrated Lime for Masonry Purposes.
 - .9 ASTM D 995--95b(2002), Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
 - .10 ASTM D 2419-09, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 - .11 ASTM D 3203-94(2005), Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
 - .12 ASTM D 4791-05e1, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- .4 Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013) and all amendments and design bulletins.
- .5 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.
- .6 U.S. Environmental Protection Agency (EPA) / Office of Water
 - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.05 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit all submittals and quality control testing requirements in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013).
- .2 Sampling, and Testing in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013) Specification 3.50.
- .3 Submit to Departmental Representative copies of freight and waybills for asphalt concrete pavement when delivered on site. Departmental Representative reserves right to check weights as material is received.

1.06 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013).

2 PRODUCTS

2.01 MATERIALS

- .1 Materials in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013). The Asphalt Mix shall be Type H1 with PG 58-34. Asphalt material will be supplied by Parks from Pit 69.

2.02 EQUIPMENT

- .1 Equipment in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013) Specification 3.50.5.1

2.03 MIX DESIGN

- .1 Asphalt will be supplied by Parks from Pit 69.

3 EXECUTION

3.01 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for asphalt paving in accordance with manufacturer's written instructions.
 - .1 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.

3.02 PLANT AND MIXING REQUIREMENTS

- .1 Asphalt will be supplied by Parks from Pit 69.

3.03 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 sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
 - .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 When paving over existing asphalt surface, clean pavement surface in accordance with Section 32 01 11.01 - Pavement Cleaning and Marking Removal.
 - .1 When levelling course is not required, patch and correct depressions and other irregularities to approval of Departmental Representative before beginning paving operations.
- .3 Apply prime coat and tack coat in accordance with Section 32 12 13.23 - Asphalt Prime Coats and Section 32 12 13.16 - Asphalt Tack Coats prior to paving.
- .4 Prior to laying mix, clean surfaces of loose and foreign material.

3.04 TRANSPORTATION OF MIX

- .1 Transport mix in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013) Specifications 3.50.5.3 and 4.5 Hauling.

3.05 TEST STRIP

- .1 Not required for project.

3.06 PLACING

- .1 Placing the mix in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013) 3.50.5.4 Placing the Mix.
- .2 Obtain Departmental Representative's approval of base and existing surface and tack coat and prime coat prior to placing asphalt.
- .3 Place asphalt concrete to thicknesses, grades and lines as indicated.
- .4 Placing conditions Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013).
 - .1 Place asphalt mixtures only when air temperature is 5 degrees C minimum.
 - .2 When temperature of surface on which material is to be placed falls below [10] degrees C, provide extra rollers as necessary to obtain required compaction before cooling.
- .5 Place asphalt concrete in compacted lifts in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013) 3.50.5.4
- .6 Any frost present in granular layers should be addressed by removal of the frost layer, heating to thaw frost, or waiting for the frost to naturally dissipate prior to placing of Asphalt.

3.07 COMPACTING

- .1 Compaction in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013) 3.50.5.6 Compacting the Mix.

3.08 JOINTS

- .1 Joints in accordance with Alberta Transportation Standard Specifications for Highway Construction, Edition 15 (2013) 3.50.5.2 Preparation of Existing Surface.
- .2 Longitudinal joints:
 - .1 Offset longitudinal joints in succeeding lifts by at least 150 mm.
 - .2 Cold joint is defined as joint where asphalt mix is placed, compacted and left to cool below 100 degrees C prior to paving of adjacent lane.
 - .1 If cold joint cannot be avoided, cut back by saw cutting previously laid lane, by at least 150 mm, to full depth vertical face, and tack face with thin coat of hot asphalt of adjacent lane.
 - .3 Overlap previously laid strip with spreader by 25 to 50 mm.
 - .4 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with lute or rake.
 - .5 Roll longitudinal joints directly behind paving operation.
 - .6 When rolling with static or vibratory rollers, have most of drum width ride on newly placed lane with remaining 150 mm extending onto previously placed and compacted lane.

3.09 FINISH TOLERANCES

- .1 Finished asphalt surface to be within [5] mm of design elevation but not uniformly high or low.
- .2 Finished asphalt surface not to have irregularities exceeding [5] mm when checked with [4.5] m straight edge placed in any direction.

3.10 DEFECTIVE WORK

- .1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required.
 - .1 If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form true and even surface and compact immediately to specified density.
- .2 Repair areas showing checking, rippling, or segregation.
- .3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement.

3.11 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Sections:
 - .1 01 33 00 - Submittal Procedures.
 - .2 01 35 29.06 - Health and Safety Requirements
 - .3 01 35 43 - Environmental Procedures.
 - .4 01 61 00 - Common Product Requirements
 - .5 01 74 11 - Cleaning.

1.2 REFERENCES

- .1 ASTM International
 - .1 ASTM A 775/A 775M-07b, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
 - .2 ASTM C 171-07, Standard Specification for Sheet Materials for Curing Concrete.
 - .3 ASTM C 260/C 260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .4 ASTM C 309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .5 ASTM C 494/C 494M-13, Standard Specification for Chemical Admixtures for Concrete.
 - .6 ASTM C 666/C 666M-03(2008), Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
 - .7 ASTM D 1752-04a(2013), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
 - .8 ASTM D 2628-91(2011), Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.
 - .9 ASTM D 3569-95(2000), Standard Specification for Joint Sealant, Hot-Applied, Elastomeric, Jet-Fuel-Resistant Type for Portland Cement Concrete Pavements.
 - .10 ASTM D 5329-09, Standard Test Methods for Sealants and Fillers, Hot-Applied, For Joints and Cracks in Asphaltic and Portland Cement Concrete Pavements.
 - .11 ASTM D 6297-13, Standard Specification for Asphaltic Plug Joints for Bridges.
 - .12 ASTM D 6690 -12, Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
- .2 CSA Group
 - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CSA-A3000-13, Cementitious Materials Compendium.
 - .3 CSA G30.18-09, Carbon Steel Bars for Concrete Reinforcement.

.3 Concrete Pad Specifications

- .1 Unless otherwise stated in these specifications all materials, testing, standard practices, and construction methodologies for the concrete pavement should be in accordance with the City of Calgary Specifications section "312.00.00 – Portland Cement Pavement".

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Product Data:
- .4 Submit manufacturer's instructions, printed product literature and data sheets for concrete paving material and include product characteristics, performance criteria, physical size, finish and limitations.
- .5 Submit following sampling and testing data:
- .1 Sieve analysis for gradation of bedding and joint material.
- .2 Evaluation of cleaning and sealing compound.
- .3 Sample Panels: 2 by 2 feet (610 by 610 mm), to demonstrate finish, color, and texture of decorative cement concrete pavement.
- .4 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements 01 35 43 - Environmental Procedures. Indicate VOC's:
- .1 For cleaning and sealing compounds.
- .2 Sealing and caulking compounds.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
- .1 Installer: Company or person specializing Portland cement concrete paving with 5 years' experience.
- .2 Certifications:
- .1 Submit to Departmental Representative manufacturer's test data and certification that following material meets criteria and requirements of this section prior to starting concrete work:
- .1 Submit certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA A23.1/A23.2, and that mix design is adjusted to prevent alkali aggregate reactivity problems.

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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .1 Unload cement and store in weathertight bins or silos that protect cement from dampness and contamination and provide easy access for inspection and identification of each shipment.
 - .2 Deliver and stockpile aggregates in accordance with Section 31 05 16 - Aggregate Materials. Stockpile minimum 50% of total required amount of each size of aggregate prior to commencing mixing operation.
 - .2 Replace defective or damaged materials with new.

PART 2 PRODUCTS

2.1 DESIGN REQUIREMENTS

- .1 Mix design requirements:
 - .1 Submit concrete mix design to Department Representative for review 4 weeks prior to commencing work.

2.2 MATERIALS

- .1 Portland cement: to CSA A3000.
- .2 Aggregates: to CSA A23.1/A23.2 and to following requirements:
 - .1 Coarse aggregate:
 - .1 Produce coarse aggregate in at least two separate sizes which, when combined, yields gradation specified. Each component size to form approximately equal percentage of total coarse aggregate.
 - .2 Gradation: to CSA A23.1/A23.2, table 5, nominal size 28-5.
 - .3 Flat and elongated particles: to CSA A23.1/A23.2 (13A) (length to width and width to thickness ratio greater than 3) not to exceed 0.5% by mass.
 - .2 Fine aggregate:
 - .1 Gradation: to CSA A23.1/A23.2, Table 1. Material passing 0.160 mm sieve: maximum 5%.
 - .2 Aggregates for use in concrete pavements shall not be susceptible to D-cracking. Unless field experience, aggregate history or prior laboratory testing have proven otherwise.
 - .3 Aggregates for use in concrete pavements shall be tested in accordance with ASTM C 666/C 666M. Test shall be in accordance with Procedure A for a period of 350 cycles.
- .3 Supplementary cementing materials: to CSA A3000.
- .4 Air entraining admixture: to ASTM C 260/C 260M.

- .5 Chemical admixtures: to ASTM C 494/C 494M. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .6 Curing compound: to ASTM C 309, Type 1-D or 2.
- .7 Joint sealant, hot poured. Bond breaker to Departmental Representative's approval.
- .8 Joint seal, preformed polychloroprene elastomeric: to ASTM D2628.
- .9 Preformed expansion joint filler: to ASTM D 1752.
- .10 Dowels and tie-bars: to CSA G30.18.
 - .1 Dowels: clean, straight and free from flattened or burred ends, plain round bars of grade 300 or better conforming to CSA G40.20/G40.21 and be epoxy-coated to ASTM A 775/A 775M.
 - .2 Tie-Bars: deformed steel bars in compliance with CSA G30.18 and be epoxy-coated to ASTM A 775/A 775M.
- .11 Protective covers and insulation for cold weather concreting: to CSA A23.1/A23.2.
- .12 Concrete Pad Materials
 - .1 The concrete should be a plain doweled 230 mm thick concrete pavement suitable for a Class C-1 exposure for all exterior flatwork, including pavement and exterior island slabs. The PCCP design is based on a 28-day flexural strength of 4.2 MPa. This typically requires a compressive strength of 35 MPa at 28 days. In the absence of a performance history, trial batching may be required to confirm flexural strength.
 - .2 The PCCP concrete should contain synthetic macro fibres for improved toughness and resistance to cracking. Design and construction should comply with CSA A23.1 and the General Notes on drawing number S-GN-01.

2.3 IMPRINTING TOOLS

- .1 Stamp Mats: Semi-rigid polyurethane mats with projected texture and ridged underside capable of imprinting texture and joint patterns to plastic concrete.
 - .1 Pattern: As indicated on the drawings.
- .2 Accessory Stamp Tools: Aluminum detailing tools capable of imprinting joints and dressing stamped joints of plastic concrete.

2.4 MIXES

- .1 Proposed changes in material source to be approved by Department Representative. New mix design will be provided by Department Representative.
- .2 Department Representative to carry out 7 day strength tests. If average strength at 7 days is less than 70% of specified minimum 28 day strength, check mix at once and adjust to ensure required strength is obtained.

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 concrete paving installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Department Representative.
 - .2 Inform Department Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Department Representative.

3.2 EQUIPMENT

- .1 Concrete plant: in accordance with CSA A23.1/A23.2.
- .2 Where fixed form paving is used provide equipment with following features:
 - .1 Mechanical self-propelled spreader capable of moving concrete forward and laterally.
 - .2 Vibrator locations and spacings whether surface or internal to be installed as per manufacturer's specifications or as directed by the Department Representative.
 - .3 Mechanical, self-propelled finisher with two independently operated transverse screeds.
 - .4 Float to be aluminum or magnesium, straight, smooth, sufficiently light to avoid sinking into concrete surface, operated mechanically or manually from edge to edge while advancing longitudinally.
- .3 Where slip form paving is used provide equipment with following features:
 - .1 Self-propelled slip form paver with crawler type tracks, designed to spread, consolidate, screed and float finish fresh concrete to required cross section, lines and grades. Paver to be approved by Department Representative.
 - .2 Pavement line and surface elevation to be automatically controlled from taut string or wire by laser equipment.
 - .3 Internal type vibrators: to be installed and arranged as per manufacturer's specifications.
 - .4 Use following equipment on approval of Departmental Representative:
 - .1 Hand operated transverse screeds spanning side forms.
 - .2 Mechanically powered vibrating beam spanning side forms.
 - .3 Hand operated floats and fluting tools used by skilled workers.
 - .4 Provide following miscellaneous equipment where required:
 - .1 Edging tool.
 - .2 Water truck equipped with pump, hose line and fine spray nozzle.
 - .3 Self-propelled automatic spray machine spanning fresh concrete, equipped with fine spray nozzles suitable for application of

membrane curing compound uniformly over surface and exposed edges, and with wind skirt to permit proper application during windy conditions.

3.3 FORMWORK

- .1 Install in accordance to following requirements:
 - .1 For fixed form paving:
 - .1 Provide steel forms of sufficient strength to support and keep alignment under weight of spreading and finishing machines.
 - .2 Use of wood forms for fillet areas to be approved by Department Representative.
 - .3 Set forms true to line and grade, join neatly and tightly and stake securely to resist concrete pressure and impact from tampers without springing.
 - .4 Clean and oil forms before each use.
 - .5 Obtain Departmental Representative's approval of forms before placing concrete.
 - .2 For slip form paving:
 - .1 Provide sufficient length of slip form trailing behind paver to prevent slumping at slab edge. Ensure rigid lateral support.
 - .2 Set grade and line for control string or wire from line and grade established by Departmental Representative.

3.4 SUBGRADE AND SUBBASE PREPARATION

- .1 Soft, yielding materials or other portions of subgrade that will not compact to specification shall be removed and replaced with suitable material. Subgrade to be brought to a firm unyielding condition with a uniform density. It shall be compacted at or above optimum moisture content to 98% Standard Proctor density.
- .2 When concrete is placed directly on subgrade, it will be checked for conformity with the cross-section tolerance. Finished surface shall not deviate more than 0 mm above and 20 mm below specified grade and cross-section, and the surface shall not deviate more than 10 mm at any place on a 3 mm template.
- .3 Subbase to consist of specified material and have a compacted thickness of not less than specified.
- .4 For slip-form paving, subbase travelled by tracks in paving machine shall be firm and have a smooth surface.
- .5 Subbase shall be compacted to specified density.
- .6 Prepared subbase shall be checked for conformity with the cross-section and grade tolerances. Finished surface of subbase shall not deviate more than 0 mm above and 20 mm below specified grade and cross-section, and surface shall not deviate more than 10 mm at any place on a 3 mm template.

- .7 Repair damage to subbase resulting from hauling or equipment operations.
- .8 Prior to placing concrete, subbase shall be thoroughly wetted. Wetting shall be carried out, such that standing water is not present on grade.
- .10 Surface condition of base to be approved by Departmental Representative before placing concrete.

3.5 PLANT AND MIXING REQUIREMENTS

- .1 If crusher screenings are approved as mixture component, proportion separately from sand.
- .2 If washing of aggregate required, allow aggregate to drain for 24 hours or longer as required to stabilize moisture content.
- .3 For truck mixers, mixing to be in accordance with CSA A23.1/A23.2.
- .4 Mix produced to be within following tolerances from mix design:
 - .1 Air content: as per CSA A23.1/A23.2, Table 10.

3.6 TRANSPORT AND DELIVERY OF MIX

- .1 Time from initial mixing to final placing to be not more than 120 minutes if mix is transported by agitating equipment (e.g. truck mixer) in accordance with CSA A23.1/A23.2, clause 18.4.2 - Delivery with Agitating Equipment.
- .2 Transport mix by non-agitating equipment only if;
 - .1 Time from addition of cement to time of placing not to exceed 45 minutes.
 - .2 Haul units to be of sufficient capacity to transport at least one regular size batch from mixer.
 - .3 Haul routes to be well maintained to prevent undue disturbance of concrete mix during transport.

3.7 PLACING

- .1 Place concrete to lines, grades and depths as indicated.
- .2 Discharge concrete into forms as soon as practical after mixing.
- .3 Construct pavement lanes in sequence approved by Department Representative.
- .4 Use hand placing where machine spreading is not feasible.
- .5 Spread uniformly with approved equipment to thickness sufficient to allow for proper consolidation and finishing. Do not apply external tractive force to paver.
- .6 Operate with continuous forward momentum. Schedule concrete supply to minimize interruptions.

- .7 Insert tie bars as indicated.
- .8 When completing concrete placement for day, carry placement through to scheduled control joint location.
- .9 Where concrete placement is stopped for more than 30 min due to breakdowns, weather or other reasons, construct extra bulkhead and construction joint as directed by Department Representative.
- .10 Do not place concrete on frozen surface.
- .11 No concrete shall be placed during rain.
- .12 When rain appears imminent paving operations should cease. Protect freshly laid concrete from rain damage and adverse weather condition and in accordance with CSA A23.1/A23.2. Extend protective covering over edges of concrete and arrange so as not to bear on unprotected edges.
- .13 Concrete placed when the ambient temperature is at or above 27 degrees C to be cured by continuous water curing from soaker hoses providing complete coverage of the pavement to minimize the temperature rise of the concrete.
- .14 When concrete has been placed in cold weather and the air temperature is expected to drop below 5 degrees C, insulating curing blankets or other suitable material shall be placed on the concrete pavement and weighted to prevent movement. Curing to continue until the cumulative number of days, or fraction thereof, during which the temperature of the concrete is above 10 degrees C, has totalled a minimum of 7 days. Alternatively, if compressive tests of cylinders cured under field conditions achieve at least 70% of the specified compressive strength, curing may be discontinued.
- .15 Concrete pavement placed in cool weather shall experience a minimum of 30 day air-drying period, following final curing, before first application of de-icing salts.

3.8 CONSOLIDATION

- .1 When internal vibrators are used:
 - .1 For slab depths up to 50 mm, mount vibrators parallel to base at mid depth. For slab depths greater than 50 mm, mount vibrators with tips minimum 50 mm above base and tips minimum 50 mm beneath pavement surface.
 - .2 Operate at manufacturer's recommended number of vibrations and specifications.
- .2 When surface vibrators are used:
 - .1 Synchronize units on each individual screed or pan.
 - .2 Operate at minimum of 3,500 vibrations per minute and minimum amplitude of 0.4 mm.
- .3 Stop vibrators when paver stops.

- .4 Use hand operated vibrator on odd shaped slabs inaccessible to frame mounted units. Do not operate vibrator in one location longer than 5 seconds.
- .5 Ensure concrete adjacent to edge forms or previously constructed slabs is thoroughly vibrated.

3.9 FINISHING

- .1 After consolidation by vibration, finish with equipment approved by Department Representative.
- .2 When striking off concrete surface, maintain uniform roll of concrete ahead of first screed for its full length when finishing machine is on first pass.
- .3 Make 2 passes with transverse finishing machine.
- .4 Where joints are formed rather than sawn, form longitudinal and transverse joints after final pass of finishing machine.
- .5 Hand finish areas inaccessible to finishing machines to same quality and surface characteristics as machine finished surfaces.
- .6 Finish concrete surface with approved float at proper time. Operate from edge to edge with wiping motion while advancing, with each succeeding pass overlapping previous one.
- .7 Check surface with approved 3.5 m long straightedge. Correct irregularities exceeding 5 mm before concrete takes initial set.
- .8 Finish edges of slabs with edging tool to form smooth squared surface. Do not patch with cement paste.

3.10 SURFACE TEXTURING

- .1 Commence texturing immediately after float finishing.
- .3 Use stiff bristled broom to produce nonslip concrete surface finish approved by Department Representative, with fine granular texture free from disfigurements.
- .5 Provide surface texture by transverse wire comb leaving grooves in surface of plastic concrete as per American Concrete Pavement Association publications.
- .6 Provide transverse surface texture by self-propelled machine specifically designed for purpose, automatically controlled from stringline reference used by paver, to produce an average surface texture as per American Concrete Pavement Association publication - Constructing Smooth Concrete Pavement.
- .7 Texturing to be straight, precise and not damaging to pavement edges.
- .8 Concrete Pad Surface Texturing and Finishing

- .1 After the concrete has been given a preliminary finish by means of floating with wood or magnesium tools, the surface of the fresh concrete shall be checked by the Contractor with a straightedge device not less than 3.0 m in length. High areas indicated by the straightedge device (± 3 mm) shall be removed by the hand-float method. Each successive check with the straightedge device shall lap the previous check path by at least $\frac{1}{2}$ of the length of the straightedge. The standard method of surface finish shall be transverse tining. In advance of curing operations, the pavement shall be given an initial and a final texturing. Initial texturing shall be performed with a burlap drag or broom device that will produce striations perpendicular with the centerline. Final texturing shall be performed with a wire comb tine device that will produce grooves perpendicular with the centerline. The wire comb tine device shall be operated within 150 mm, but not closer than 75 mm, of pavement edges.
- .2 Transverse tining shall be done by texturing with a wire comb perpendicular to the centerline of the pavement. The wire comb tines shall be rectangular in cross section, 3 mm wide, on 12.5 mm \pm 3 mm centers, and of sufficient length, thickness, and resilience to form grooves approximately 3 mm deep in the fresh concrete surface. Downward pressure on pavement surface shall be maintained at all times during texturing so as to achieve uniform texturing without measurable variations in pavement profile. Final texture shall be uniform in appearance with substantially all of the grooves having a depth between 2 to 5 mm. Finishing shall take place with the elements of the wire comb as nearly perpendicular to the concrete surface as is practical, to eliminate dragging the mortar.
- .3 If the tining equipment has not been previously approved, a test section shall be constructed prior to approval of the equipment.
- .4 A monomolecular evaporation retarder may be used to control surface evaporation between floating, finishing and texturing operations. Such materials shall be applied in accordance with manufacturer's directions and shall not be used as a finishing aid. A liquid membrane forming curing compound conforming to ASTM C309 shall be applied to the surface in two successive applications within 20 minutes of completion of tining operations.

3.11 STAMPING

- .1 Stamp concrete surfaces according to manufacturer's instructions.
- .2 Mat Stamping: While concrete is plastic, accurately align stamp mats in sequence and uniformly press into concrete to produce imprint pattern, texture, and depth of imprint, according to manufacturer's instructions. Remove stamps from concrete immediately.
 - .1 Stamp edges and surfaces unable to be imprinted with stamp mat with flexible stamping mats.
- .3 Remove unembedded pigmented powder release agent after interval recommended by manufacturer and according to manufacturer's instructions. Pressure wash surfaces according to manufacturer's instructions without damaging decorative concrete.

3.12 CURING

- .1 Cure for minimum 7 days by following method:

- .1 Curing compound:
 - .1 Apply in two coats with approved spray equipment to form complete and unbroken film on surface of concrete. Mechanically agitate compound before and during use.
 - .2 For hand application apply first coat immediately after texturing operations, second coat to be applied immediately after first coat in a perpendicular direction.
 - .3 For machine application curing compound to be applied in accordance with manufacturers' specifications.
 - .4 Apply second spray within 24 hours of first in accordance with manufacturer's instructions.
 - .5 Apply each spray at application rate recommended by manufacturer.
 - .6 Spray slab edges immediately after removal of forms.
 - .7 Protect formed or sawed joints from evaporation during curing period.
 - .8 Respray areas where membrane is damaged during curing period.

3.13 PROTECTION

- .1 Do not open concrete pavement to traffic or construction equipment until approved by Department Representative.
- .2 When placing concrete in lanes adjacent to existing concrete, operate placing equipment on rubber wheels or pads to prevent damage to existing surface.

3.14 TOLERANCES

- .1 Finished concrete surface to be within 5 mm of design grade but not uniformly high or low.
- .2 Finished concrete surface not to have irregularities exceeding 5 mm when checked with 4.5 m straight edge placed in any direction.
- .3 Horizontal deviations of slab edge from alignment of pavement not to exceed 10 mm.

3.15 JOINTS

- .1 General:
 - .1 Construct joints plumb, straight and square to details indicated.
 - .2 Transverse joints to coincide with those in adjacent pavement unless indicated or directed otherwise.
 - .3 Install preformed joint filler at locations and to details indicated.
 - .4 Install isolation joints around structures and features that project through, into or against pavement.
- .2 For sawn joints.
 - .1 Ensure joints are sawn straight. Install end stakes to ensure straight joint alignment across paved area. Mark joint alignment with chalk line or other suitable guide to approval of Department Representative.

- .2 Saw joints using approved equipment and methods to produce joint dimensions indicated.
- .3 Restrict speed of saw cutting to ensure proper joint alignment and to avoid damage to concrete.
- .4 Supply sufficient workers and equipment including standby equipment, to maintain satisfactory sawing schedule.
- .5 Schedule sawing operations on 24 hours basis and consistent with concrete placing.
- .6 Make initial saw cuts in progressive manner and as soon as concrete surface has hardened sufficiently to resist raveling as cut is made and before shrinkage cracks occurs.
- .7 If cracking occurs ahead of saw cut, stop sawing immediately. Move ahead several joints and cut one or more joints before returning to saw intermediate joints. Where cracking persists, make 1 m saw cut from one edge and complete sawing from opposite edge. Adjust sawing schedule accordingly.
- .8 If uncontrolled cracking or other surface damage results from inadequate or improper sawing techniques suspend further concrete operations until situation is corrected and immediately remove and replace damaged slabs.
- .9 Immediately on completion of sawing, flush joints with water to remove laitance.
- .3 Sealing:
 - .1 Seal joints before allowing vehicular traffic on new pavement.
 - .2 Provide Department Representative with copy of sealant manufacturer's instructions for application. Have sealant manufacturer's representative on site during initial 3 days of sealing operation.
 - .3 Just prior to sealing joint, clean with compressed air or flush with high pressure water to remove laitance, curing compound and protrusions of hardened concrete. Clean and dry by compressed air and vacuum to remove loose and foreign material.
 - .4 Do not apply joint sealant in rainy weather or when ambient temperature is less than 5 degrees C.
 - .5 Insert approved filler and bond breaking material in joint prior to applying sealant, then fill joint from bottom up with sealant to avoid trapping air.
 - .6 Prepare sealant for application using equipment and methods approved by Department Representative.
 - .7 Apply sealant strictly in accordance with manufacturer's recommendations with special attention to temperature ranges for safe heating and for application of hot poured sealants and cleanliness of concrete to be bonded.
 - .8 On completion of first application of sealant, return and top up any underfilled areas.
 - .9 Replace sealant which fails to bond to concrete or fails to cure properly, as directed by Department Representative.
- .4 Concrete Pad Joints

- .1 The pavement design should include transverse sawcut contraction joints spaced every 4.0 m.
- .2 Load transfer devices at all transverse joints is recommended to reduce faulting. Smooth epoxy coated steel dowels, 32 mm in diameter by 450 mm in length, spaced at 300 mm, placed at mid-depth within the slab are required. Dowels should be placed using a prefabricated dowel baskets to ensure they are oriented perpendicular to the joint and parallel to the pavement surface. Both ends of the PCCP should be thickened by 20% to provide increased strength at the free edges of the pavement.

3.16 DEFECTIVE CONCRETE

- .1 Concrete is defective when:
 - .1 It contains: honeycombing, embedded debris, uncontrolled shrinkage cracking, or other surface defects.
 - .2 It is damaged by freezing.
 - .3 It is placed at too high temperature.
- .2 Any 28 day strength test result is more than 3.5 MPa below the specified minimum 28 day strength.

3.17 REPAIR/RESTORATION

- .1 Repair of defective concrete work:
 - .1 Where defective concrete is identified by Department Representative during plastic condition, repair using methods approved by Department Representative.
 - .2 Grind off high surface variations where directed by Department Representative.
- .2 Remove and replace defective concrete where directed by Department Representative.
 - .1 Remove minimum 3 m of pavement by sawing through concrete across full lane width.
 - .2 Replace with new concrete to this specification.
 - .3 Construct contraction joint at boundary between sawn face of existing concrete and new concrete.
- .3 Install new reinforcement between old and new concrete as directed by Department Representative.

3.18 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.

3.19 PROTECTION

- .1 Keep vehicular traffic off newly paved areas until paving has properly cured and joints have been sealed.

END OF SECTION

1 GENERAL

1.01 RELATED REQUIREMENTS

- .1 Section 34 71 13.01 - Vehicle Concrete Barrier
- .2 Section 32 10 00 Concrete Forming and Accessories.
- .3 Section 01 45 00 Quality Control
- .4 Section 32 12 16.00 Asphalt Paving
- .5 Section 32 12 13.16 Asphalt Tack Coat
- .6 Section 32 12 13.23 Asphalt Prime Coat
- .7 Section 32 11 23 Aggregate Base Course
- .8 Section 32 11 16.01 Granular Subbase
- .9 Section 31 24 13 Roadway Embankment
- .10 Section 32 13 13 Concrete Paving_R2

1.02 REFERENCES

Perform cast-in-place concrete work for Wheelchair Ramps, Curb & Gutters.

Unless otherwise stated in these specifications all materials, testing, standard practices, and construction methodologies for the concrete curb and gutter should be in accordance with the City of Calgary Roads Construction 2015 Standard Specifications Section "311.00.00 – Concrete Sidewalk, Curb and Gutter". In this section replace the word "City" with "Parks Canada Agency"(PCA) and the word "Engineer" with "Departmental Representative"

- 1 CSA A3000-08. Cementitious Materials Compendium
- 2 CSA A23.1-09. Concrete Materials and Methods of Concrete Construction.
- 3 CSA A23.2-09. Test Methods and Standards Practices for Concrete
- 4 CSA A283-96. Qualification Code for Concrete Testing Laboratories

1.03 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals as per City of Calgary Roads Construction 2015 Standard Specifications, Section 310.03.00 - Submittals

1.04 DELIVERY, STORAGE AND HANDLING

- .1 Delivery, Storage and Handling as per City of Calgary Roads Construction 2015 Standard Specifications, Section 310.05.00 – Concrete Production and Delivery

2 PRODUCTS

- .1 The concrete for curb and gutter shall be **Class C-1** exposure for all exterior flatwork, including pavement. The PCCP design is based on a 28-day flexural strength of 4.2 MPa. This typically requires a compressive strength of **35 MPa** at 28 days. In the absence of a performance history, trial batching may be required to confirm flexural strength.
- .3 The Gravel Base material to be used shall be Designation 2 Class 25 Alberta Transportation Type material as specified under Aggregate Base Course.

3 EXECUTION

3.01 GRADE PREPARATION

- .1 The subgrade shall be true to cross-section and grade. Irregularities in the sub-grade may be adjusted by use of compacted crushed gravel. Prior to placing of concrete and base gravel fill, the sub-grade shall be compacted to a uniform density of not less than 98.0 percent of the design density.
- .2 The excavation and compaction of the sub-grade shall be deemed incidental to the Unit Rates of curb & gutter. Excavation includes the removal and disposition of all materials of whatever nature encountered within the boundaries necessary for the preparation of construction of curb and gutter, and other structures to the required cross-section, alignment and depth shown on the plans.

3.02 GRANULAR BASE

- .1 The Contractor shall supply approved base gravel material according to the Specifications and provide all material and labour to load, haul, transport, and compact said gravel on the finished grade as specified under Section Granular Base Course and the Standard Curb detail drawings. The compacted base shall be carried over the full extend of the excavation as indicated on the Standard Commercial Drawings and as noted above. The additional excavation, backfill, and compaction adjacent to the curb and gutter structure shall be deemed incidental to the Unit Rate for Curb and Gutter.
- .2 Where the width of the excavation does not permit the use of conventional compaction equipment to meet the Specifications, other means acceptable to roads construction shall be employed.
- .3 The Contractor shall place and compact a 50mm lift of 25 mm crushed gravel base prior to placing concrete. In areas, where islands and median concrete is placed above asphalt, the entire volume between the asphalt and the concrete shall be filled with compacted 25 mm crushed gravel. Placing and compaction of gravel shall be carried out in accordance with Section 32 11 23 "Aggregate Base Course".
- .4 The supply, placing, and compaction of the Granular Base material shall be deemed incidental to the Unit Rates of Curbs and Gutters.

3.03 CONCRETE

- .1 Concrete shall be type Class C-1 (35 MPa)
- .2 Form work as per City of Calgary Roads Construction 2015 Standard Specifications, Section 311.04.00 – Forms
- .3 Reinforcing as per City of Calgary Roads Construction 2015 Standard Specifications, Section 311.05.00 – Reinforcing
- .4 Concrete Placing as per City of Calgary Roads Construction 2015 Standard Specifications, Section 311.06.01 – General (Concrete Placing) to 311.06.04 – Air Adjustment on the Job Site. The Materials and

Research note under section 311.06.01 should be ignored for this contract.

- .5 Finishing as per City of Calgary Roads Construction 2015 Standard Specifications, Section 311.07.00 – Finishing
- .6 Wheelchair Ramps shall be constructed at locations as shown on the project drawings.

3.04 TOLERANCES

- .1 Tolerances as per City of Calgary Roads Construction 2015 Standard Specifications, Section 311.07.02 – Tolerances

3.05 EXPANSION AND CONTRACTION JOINTS

- .1 Expansion Joints as per City of Calgary Roads Construction 2015 Standard Specifications, Section 311.06.05 – Joints, 1) Expansion Joints and 2) Contraction Joints.
- .2 All joints on the curb and gutter shall be aligned with the joints on the Concrete Pavement Pad and the Concrete Medians. (No staggering of joints)

3.06 ISOLATION JOINTS

- .1 Isolation Joints as per City of Calgary Roads Construction 2015 Standard Specifications, Section 311.06.05 – Joints, 5) Isolation Joints.
- .2 All joints on the curb and gutter shall be aligned with the joints on the Concrete Pavement Pad and the Concrete Medians. (No staggering of joints)

3.07 CURING

- .1 Curing as per City of Calgary Roads Construction 2015 Standard Specifications, Section 311.08.00 – Curing

3.08 BACKFILL

- .1 Backfilling as per City of Calgary Roads Construction 2015 Standard Specifications, Section 311.12.02 – Backfilling and Backsloping.

3.09 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.

3.10 MEASUREMENT AND PAYMENT

- .1 Concrete Curbs and Gutters shall be measure per metre length along the face of the curb and will paid per metre complete as shown on the drawings.
- .2 Wheelchair ramps are not measured separately and will be included in the curb & gutter measurement. No additional payment will be made separately for construction of the wheelchair ramps and be seen incidental to curb & gutter construction.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 028101 – Hazardous Materials
- .2 Section 101453 – Traffic Signs
- .3 Section 347113 – Vehicle Post Delineators
- .4 Section 024113.14 – Asphalt Pavement Removal.**

1.2 MEASUREMENT FOR PAYMENT

- .1 Payment will be full compensation for inspecting the area to be painted, sweeping and cleaning the surfaces to be painted; supplying the paint and glass beads; traffic accommodation; labour; equipment; tools and incidentals necessary to complete the Work to the satisfaction of the Consultants. No additional payments will be made for temporary roadway line painting or removal of exiting painted lines and will be considered incidental to the work.

1.3 REFERENCES

- .1 Aspects of Pavement Marking addressed in other areas of the contract documents not addressed in this specification are still required.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.5-99, Low Flash Petroleum Spirits Thinner.
 - .2 CAN/CGSB 1.74-01, Alkyde Traffic Paint.
 - .3 CGSB1-GP-12c-68, Standard Paint Colours
 - .4 CGSB1-GP-71-83, Method of Testing Paints and Pigments.
- .3 Green Seal Environmental Standards (GS)
 - .1 GS-11-2008, 2nd Edition, Paints and Coatings.
- .4 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS)
- .5 Transportation Association of Canada:
 - .1 Manual of Uniform Traffic Control Devices for Canada 5th Edition.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's printed product literature and data sheets for pavement markings and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

- .3 Samples:
 - .1 Submit to Departmental Representative following material sample quantities at least 4 weeks prior to commencing work.
 - .1 Two 1 L samples of each type of paint.
 - .2 One 1 kg sample of glass beads.
 - .3 Sampling to CGSB1-GP-71
 - .2 Mark samples with name of project and its location, paint manufacturer's name and address, name of paint, CGSB specification number and formulation number and batch number.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Operations and Maintenance Data: submit information on materials relative to work of this Section for inclusion in operations and maintenance manual .

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 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and return of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 PRODUCTS

2.1 MATERIALS

- .1 Paint:
 - .1 To CGSB1-GP-74M, alkyd traffic paint
 - .3 Colour: to CGSB1-Gp-12C, yellow 505-308 and white 513-301
 - .4 Upon request, Departmental Representative will supply qualified product list of paints applicable to work. Qualified paints may be used but Departmental Representative. reserves the right to perform further tests.
- .2 Thinner: to CAN/CGSB-1.5.
- .3 Glass beads: overlay type: to CGSB1-GP-74M

3 EXECUTION

3.1 EXAMINATION

- .2 Pavement surface: dry, free from water, frost, ice, dust, oil, grease and other deleterious materials.
- .3 Proceed with Work only after unacceptable conditions have been rectified.

3.2 EQUIPMENT REQUIREMENTS

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

3.3 TRAFFIC CONTROL

- .1 See Section 01 35 00.06 Temporary Traffic Control.

3.4 APPLICATION

- .1 Pavement markings: laid out by Contractor.
- .2 Unless otherwise approved by Departmental Representative, apply paint only when air temperature is above 10 degrees C, wind speed is less than 60 km/h and no rain is forecast within next 4 hours.
- .3 Apply traffic paint evenly at rate of 3 m² /L.
- .4 Do not thin paint.
- .5 Symbols and letters to MUTCD.
- .6 Paint lines: of uniform colour and density with sharp edges.
- .7 Thoroughly clean distributor tank before refilling with paint of different colour.
- .8 Apply glass beads at rate of 0.6 kg/l of painted area immediately after application of paint.

3.5 TOLERANCE

- .1 Paint markings: within plus or minus 12 mm of dimensions indicated.
- .2 Remove incorrect markings in accordance with Section 32 01 11.01 - Pavement Cleaning and Marking Removal.

3.6 HIGHWAY OPERATION

- .1 Highway operation in accordance with the Traffic management plan and shall meet the following requirements
 - .1 Paint during hours of daylight between ½ hour after sunrise and ½ hour before sunset. Generally, the Contractor may paint lines during any day of the week but is cautioned that traffic volumes are usually higher on all highways on Friday, Saturday, and Sunday.
 - .2 Operation of the painting truck against the flow of traffic will not be permitted
 - .3 Loading glass beads or paint onto the painting track is not permitted on a roadway surface.
- .2 Remove incorrect markings in accordance with Section 32 01 11.01 - Pavement Cleaning and Marking Removal.
- .3 Loading glass beads of paint onto the painting truck is not permitted on a roadway service.

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 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.8 PROTECTION OF COMPLETED WORK

- .1 Protect pavement markings until dry.
- .2 Repair damage to adjacent materials caused by pavement marking application.

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 DEFINITIONS

- .1 Compost:
 - .1 Mixture of soil and decomposing organic matter used as fertilizer, mulch, or soil conditioner.
 - .2 Compost is processed organic matter containing 40% or more organic matter as determined by Walkley-Black or Loss On Ignition (LOI) test.
 - .3 Product must be sufficiently decomposed (i.e. stable) so that any further decomposition does not adversely affect plant growth (C:N ratio below (25) (50)), and contain no toxic or growth inhibiting contaminants.
 - .4 Composed bio-solids to: CCME Guidelines for Compost Quality, Category (A) (B).

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality control submittals:
 - .1 Soil testing: submit certified test reports showing compliance with specified performance characteristics and physical properties as described in PART 2 - SOURCE QUALITY CONTROL.
 - .2 Contractor to submit Certification that the soil is weed and invasive species free.
 - .3 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 Construction/Demolition Waste Management and Disposal.
- .2 Divert unused soil amendments from landfill to official hazardous material collections site approved by Departmental Representative.

- .3 Do not dispose of unused soil amendments into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

PART 2 PRODUCTS

2.1 TOPSOIL

- .1 Topsoil for seeded areas and planting beds: mixture of particulates, micro-organisms and organic matter which provides suitable medium for supporting intended plant growth.
 - .1 Soil texture based on The Canadian System of Soil Classification, to consist of 20 to consist of a fertile, friable, natural loam, containing not less than 4% organic matter for clay loams and not less than 2% organic matter for sandy loam to a maximum of 15%, and capable of sustaining vigorous plant growth, free of rocks of 50mm in diameter and over, subsoil contamination, roots and weeds (as determined by the Departmental Representative) and having a pH ranging from 7.0 to 8.5.
 - .2 Contain no toxic elements or growth inhibiting materials.
 - .3 Finished surface free from:
 - .1 Debris and stones over 50 mm diameter.
 - .2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
 - .4 Consistence: friable when moist.

2.2 TOP SOIL TESTING AND AMENDMENTS

- .1 Contractor will arrange and pay for services of accredited testing laboratory, approved by the Departmental Representative, to perform complete soil quality analysis on imported topsoil(s). Provide adequate tests from all sources of topsoil and submit copy of analysis to Departmental Representative.
- .2 Where stockpiled topsoil exists on site, Departmental Representative will perform soil tests.
- .3 Conduct soils test on three separate soil samples, taken as directed by Departmental Representative. Samples shall be taken from a minimum of three random locations and mixed to create a single uniform sample for testing.
- .4 Testing of soil shall be done within three weeks prior to soil placement.
- .5 Testing laboratory shall be approved by Departmental Representative prior to submitting samples.
- .6 Inform approved testing laboratory that soil tests are for growing native grasses and shrubs. Analysis and recommendations from laboratory should be specific for growing native grasses and shrubs.
- .7 Test specifically for the following: Nitrogen, Phosphorous, and Potassium. The analysis should also include measurement of percent sand, fines, (silt and clay), and organic matter to total 100%; soil pH; recommendation on quantity of lime required to achieve pH 6.5;

water soluble salts; total carbon to total nitrogen ratio; total nitrogen and available levels of calcium and magnesium; and herbicide content.

- .8 Submit to the Departmental Representative 1 copy of the soils test analysis report from the testing laboratory. Cost of initial analysis and subsequent tests to ensure compliance with specification shall be borne by the Contractor.
- .9 The analysis report shall include laboratory's recommendations for amendments, fertilizer and other required modifications to make the proposed growing medium meet the requirements of this specification and should clearly state the type, quantity and application procedure that is to be used.
- .10 At the discretion of the Departmental Representative, submit up to two additional soil samples for testing at intervals outlined by the Departmental Representative. Samples shall be taken from a minimum of three random locations and mixed to create a single uniform sample for testing. Results of these tests shall be presented to the Departmental Representative for review.
- .11 Failure to satisfy these contractual requirements could result in the Contractor being required to remove unacceptable growing medium at their expense.

2.3 SOURCE QUALITY CONTROL

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

PART 3 EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

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

3.2 STRIPPING OF TOPSOIL

- .1 Begin topsoil stripping of areas as indicated as directed by Departmental Representative after area has been cleared of brush, weeds and grasses and removed from site.
- .2 Strip topsoil to depths as indicated.
 - .1 Avoid mixing topsoil with subsoil where textural quality will be moved outside acceptable range of intended application.
- .3 Stockpile in locations as directed by Departmental Representative.
 - .1 Stockpile height not to exceed 3m.
- .4 Disposal of unused topsoil is to be in an environmentally responsible manner but not used as landfill as directed by Departmental Representative.
- .5 Protect stockpiles from contamination and compaction.

3.3 PREPARATION OF EXISTING GRADE

- .1 Verify that grades are correct.
 - .1 If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.
- .2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
- .3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.
 - .1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.
 - .2 Remove debris which protrudes more than 75 mm above surface.
 - .3 Dispose of removed material off site.
- .4 Cultivate entire area which is to receive topsoil to minimum depth of 125 mm.
 - .1 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

3.4 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL

- .1 Place topsoil after Departmental Representative has accepted subgrade.
- .2 Spread topsoil in uniform layers not exceeding 125 mm.
- ~~.3 For sodded areas keep topsoil 15 mm below finished grade.~~
- .4 Spread topsoil as indicated to following minimum depths after settlement.
 - .1 125 mm for seeded areas.
- .5 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

3.5 FINISH GRADING

- .1 Grade to eliminate rough spots and low areas and ensure positive drainage.
 - .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.

3.6 ACCEPTANCE

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

3.7 SURPLUS MATERIAL

- .1 Dispose of material except topsoil not required where Departmental Representative off site.

3.8 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

SPEC NOTE: Edit the following paragraphs to list documents or Sections with specific information that the reader might expect to find in this Section, but is specified elsewhere. Do not include Division 00 or Division 01 Sections in this listing.

- .1 Section [01 33 00 Submittal Procedures].
- .2 Section [01 74 19 - Construction/Demolition Waste Management And Disposal].
- .3 Section [31 22 13 - Rough Grading].
- .4 Section [32 91 19.13 - Topsoil Placement and Grading].

1.2 MEASUREMENT PROCEDURES

- .1 Measure hydraulic seeding in square metres for:
 - .1 Naturalized Seeding Areas.
- .2 Measure maintenance during establishment period and warranty period of areas seeded in square metres.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data.
 - .1 Submit product data in accordance with Section [01 33 00 - Submittal Procedures].
 - .2 Provide product data for:
 - .1 Seed mixture. Percentage of individual species with mixes. Certificates of Analysis must include both the common and include the scientific name following the CANADENSYS nomenclature system; indicate if the seed is a cultivar, ecovar, or wild native; geographic origin (seed source); date of collection; method of seed storage; germination, viability and vigour; and indicate all other species occurring including agronomic, weed, and native species; and date of the analysis. The contact information for the Seed Supplier will be included.
 - .2 Mulch (or equivalent).
 - .3 Submit in writing to Consultant 14 days prior to commencing work:
 - .1 Volume capacity of hydraulic seeder in litres.
 - .2 Amount of material to be used per tank based on volume.
 - .3 Number of tank loads required per hectare to apply specified slurry mixture per hectare.

1.5 SCHEDULING

- .1 Schedule hydraulic seeding to coincide with preparation of soil surface.
- .2

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .2 Divert unused fertilizer from landfill to official hazardous material collections site approved by Consultant.
- .3 Do not dispose of unused fertilizer into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

PART 2 - PRODUCTS

2.1 MATERIALS

SPEC NOTE: Consult landscape architect to determine specific application rates and requirements for seed selection and mixtures, mulch and fertilizer.

- .1 Seed: "Canada pedigreed grade" in accordance with Government of Canada Seeds Act and Regulations.
 - .1 Grass mixture: "ASPEN SHRUB COMMUNITY MIX" in accordance with Government of Canada "Seeds Act" and "Seeds Regulations".
 - .1 Mixture composition:
 - 1. 40% TICKLE GRASS
 - 2. 40% FOWL BLUEGRASS
 - 3. 20% AWNED WHEAT GRASS
- .2 Water: free of impurities that would inhibit germination and growth.
- .3 Fertilizer:
 - .1 To Canada "Fertilizers Act" and "Fertilizers Regulations".
 - .2 Complete synthetic, slow release with 35% of nitrogen content in water-insoluble form.

PART 3 - EXECUTION

3.1 WORKMANSHIP

SPEC NOTE: Hydraulic seeding is a two step process. The first step requires the application of seed and water with a small percentage of mulch to mark the applied area. The second step requires the application of the required amount of mulch.

- .1 Do not spray onto structures, signs, guide rails, fences, plant material, utilities and other than surfaces intended.
- .2 Clean-up immediately, any material sprayed where not intended, to satisfaction of Parks Representative, or Project Manager.
- .3 Do not perform work under adverse field conditions such as wind speeds over [10] km/h, frozen ground or ground covered with snow, ice or standing water.
- .4 Refer to drawings for application rates and areas.

3.2 PREPARATION OF SURFACES

- .1 Fine grade areas to be seeded free of humps and hollows. Ensure areas are free of deleterious and refuse materials.
- .3 Ensure areas to be seeded are moist to depth of 125 mm before seeding.
- .4 Obtain Consultant's approval of grade and topsoil depth before starting to seed.

3.6 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Perform following operations from time of seed application until acceptance by Consultant.
- .2 Grass Mixture:
 - .1 Repair and reseed dead or bare spots to allow establishment of seed prior to acceptance.
- .4 Control weeds by mechanical or chemical means utilizing acceptable integrated pest management practices.
- .5 Water seeded area to maintain optimum soil moisture level for germination and continued growth of grass. Control watering to prevent washouts.

3.7 ACCEPTANCE

- .1 Seeded areas will be accepted by Consultant provided that:
- .2 Plants are uniformly established. Seeded areas are free of rutted, eroded, bare or dead spots.
- .3 Areas have been mown at least twice.
- .4 Areas have been fertilized.
- .5 Areas seeded in fall will achieve final acceptance in following spring, one month after start of growing season provided acceptance conditions are fulfilled.

3.8 MAINTENANCE DURING WARRANTY PERIOD

SPEC NOTE: Edit the following paragraphs to specific requirements of lawn or legume mixtures seeded.

- .1 Perform following operations from time of acceptance until end of warranty period:
 - .1 Repair and reseed dead or bare spots to satisfaction of Parks Representative.

3.9 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Sections:
 - .1 01 33 00 - Submittal Procedures.
 - .2 01 35 30 - Health and Safety Requirements
 - .3 01 35 43 - Environmental Procedures
 - .4 01 61 00 - Common Product Requirements
 - .5 01 74 11 - Cleaning
 - .6 31 22 13 - Rough Grading
 - .7 32 91 19.13 - Topsoil Placement and Grading

1.2 REFERENCES

- .1 Definitions:
 - .1 Mycorrhiza: association between fungus and roots of plants. This symbiosis, enhances plant establishment in newly landscaped and imported soils.
- .2 Reference Standards:
 - .1 Agriculture and Agri-Food Canada (AAFC).
 - .1 Plant Hardiness Zones in Canada-2000.
 - .2 Canadian Nursery Landscape Association (CNLA)
 - .1 Canadian Standards for Nursery Stock-2006.
 - .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
 - .4 U.S. Environmental Protection Agency(EPA) / Office of Water
 - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Scheduling: obtain approval from Departmental Representative of schedule 7 days in advance of shipment of plant material.
- .2 Schedule to include:
 - .1 Quantity and type of plant material.
 - .2 Shipping dates.
 - .3 Arrival dates on site.
 - .4 Planting Dates.

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 trees, shrubs, ground cover, fertilizer, mycorrhiza, anti-desiccant, anchoring equipment, and mulch and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 30 - Health and Safety Requirements and 01 35 43 - Environmental Procedures.
- .3 Samples:
 - .1 Submit samples of mulch.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Landscape Contractor: to be a Member in Good Standing of Landscape Alberta Nursery Trades Association.
 - .2 Landscape Planting Supervisor: Landscape Industry Certified Technician with Softscape Installation designation.
 - .3 Landscape Maintenance Supervisor: Landscape Industry Certified Technician with Ornamental Maintenance designation.

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 Protect plant material from frost, excessive heat, wind and sun during delivery.
- .4 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.
- .5 Storage and Handling Requirements:
 - .1 Immediately store and protect plant material which will not be installed within 1 hours in accordance with supplier's written recommendations and after arrival at site in storage location approved by Departmental Representative.

- .6 Protect stored plant material from frost, wind and sun and as follows:
 - .1 For bare root plant material, preserve moisture around roots by heeling-in or burying roots in sand or topsoil and watering to full depth of root zone.
 - .2 For pots and containers, maintain moisture level in containers. Heel-in fibre pots.
 - .3 For balled and burlapped and wire basket root balls, place to protect branches from damage. Maintain moisture level in root zones.
- .7 Store and manage hazardous materials in accordance with manufacturer's written instructions.

1.7 WARRANTY

- .1 For plant material over 75 mm caliper plant material as itemized on plant list the 12 months warranty period is extended to 24 months.
- .2 End-of-warranty inspection will be conducted by Departmental Representative.
- .3 Departmental Representative reserves the right to extend Contractor's warranty responsibilities for an additional one year if, at end of initial warranty period, leaf development and growth is not sufficient to ensure future survival.

PART 2 PRODUCTS

2.1 PLANT MATERIAL

- .1 Type of root preparation, sizing, grading and quality: comply to Canadian Standards for Nursery Stock.
 - .1 Source of plant material: grown in Zone 2b in accordance with Plant Hardiness Zones in Canada.
 - .2 Plant material must be planted in zone specified as appropriate for its species.
 - .3 Plant material in location appropriate for its species.
- .2 Plant material: free of disease, insects, defects or injuries and structurally sound with strong fibrous root system.
- .3 Trees: with straight trunks, well and characteristically branched for species.
- .4 Trees larger than 200 mm in caliper: half root pruned during each of two successive growing seasons, the latter at least one growing season before arrival on site.
- .5 Bare root stock: nursery grown, in dormant stage, not balled and burlapped or container grown.

2.2 WATER

- .1 Free of impurities that would inhibit plant growth.

2.3 STAKES

- .1 T-bar, steel, 40 x 40 x 5 x 2440 mm.

2.4 WIRE TIGHTENER

- .1 Type 1: galvanized steel, rod.

2.5 GUYING WIRE

- .1 Type 1: steel, 3 mm wire.

2.6 CLAMPS

- .1 U-bolt: galvanized, 13 mm diameter, c/w curved retaining bar and hex nuts.

2.7 GUYING COLLAR

- .1 Tube: plastic, 13 mm diameter, nylon reinforced.

2.8 TRUNK PROTECTION

- .1 Wire mesh: galvanized, electrically welded 1.4 mm wire with 25 x 25 mm mesh and fastener.
- .2 Plastic: perforated spiralled strip.
- .3 Burlap: clean 2.5 kg/m² minimum mass and 150 mm minimum wide, and twine fastener.
- .4 Tar impregnated crepe paper and twine fastener.

2.9 MULCH

- .1 Shredded wood: varying in size from 25 to 125 mm in length, from coniferous trees.

2.10 FERTILIZER

- .1 Synthetic commercial type as recommended by soil test report manufacturer.
 - .1 Ensure new root growth is in contact with mycorrhiza.
 - .2 Use mycorrhiza as recommended by manufacturer's written recommendations.

- .2 ANTI-DESICCANT

- .1 Wax-like emulsion.

2.11 FLAGGING TAPE

- .1 Fluorescent, orange colour.

2.12 SOURCE QUALITY CONTROL

- .1 Obtain approval from Departmental Representative of plant material prior to planting.

- .2 Imported plant material must be accompanied with necessary permits and import licenses. Conform to Federal, Provincial or Territorial regulations.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts 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 and after receipt of written approval to proceed from Departmental Representative.

3.2 PRE-PLANTING PREPARATION

- .1 Proceed only after receipt of written acceptability of plant material from Departmental Representative.
- .2 Remove damaged roots and branches from plant material.
- .3 Apply anti-desiccant to conifers and deciduous trees in leaf in accordance with manufacturer's instructions.
- .4 Locate and protect utility lines.
- .5 Notify and acquire written acknowledgment from utility authorities before beginning excavation of planting pits for trees and shrubs.
- .6 Temporary Erosion and Sedimentation Control:
- .7 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 sediment and erosion control drawings sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
 - .1 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - .2 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 EXCAVATION AND PREPARATION OF PLANTING BEDS

- .1 Establishment of sub-grade for planting beds in accordance with Section 31 22 13 - Rough Grading.
- .2 Preparation of planting beds in accordance with Section 32 91 19.13 - Topsoil Placement and Grading.
- .3 For individual planting holes:
 - .1 Stake out location and obtain approval from Departmental Representative prior to excavating.
 - .2 Excavate to depth and width as indicated.
 - .3 Remove subsoil, 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.
 - .4 Scarify sides of planting hole.
 - .5 Remove water which enters excavations prior to planting. Notify Departmental Representative if water source is ground water.

3.4 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 For container stock or root balls in non-degradable wrapping, remove entire container or wrapping without damaging rootball.
 - .1 Plant vertically in locations as indicated.
 - .2 Orient plant material to give best appearance in relation to structure, roads and walks.
- .3 For trees and shrubs:
 - .1 Backfill soil in 150 mm lifts.
 - .1 Tamp each lift to eliminate air pockets.
 - .2 When two thirds of depth of planting pit has been backfilled, fill remaining space with water.
 - .3 After water has penetrated into soil, backfill to finish grade.
 - .2 Form watering saucer as indicated.
- .4 For ground covers, backfill soil evenly to finish grade and tamp to eliminate air pockets.
- .5 Water plant material thoroughly.
- .6 After soil settlement has occurred, fill with soil to finish grade.

3.5 TRUNK PROTECTION

- .1 Install trunk protection on deciduous trees as indicated.
- .2 Install trunk protection before installation of tree supports.

3.6 TREE SUPPORTS

- .1 Install tree supports as indicated.
- .2 Use single stake tree support for deciduous trees less than 3 m in height and evergreens less than 2 m in height.
 - .1 Place stake on prevailing wind side and 150 mm minimum from trunk.
 - .2 Drive stake 150 mm minimum into undisturbed soil beneath roots.
 - .1 Ensure stake is secure, vertical and unsplit.
- .3 Install 150 mm long guying collar 1500mm above grade.
 - .1 Thread Type 1 guying wire through guying collar tube.
 - .2 Twist wire to form collar and secure firmly to stake. Cut off excess wire.
 - .3 Use 3 guy wires and anchors for deciduous trees greater than 3 m in height and evergreens greater than 2 m in height.
 - .4 Use Type 2 guying wire with clamps for trees less than 75 mm in diameter and Type 3 guying wire with clamps for trees greater than 75 mm in diameter.
 - .5 Use Type 1 anchors for trees less than 75 mm in diameter and Type 2 anchors for trees greater than 75 mm in diameter.
 - .6 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.
 - .7 Guying collars to be of sufficient length to encircle tree plus 50 mm space for trunk clearance. 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 at 120 degrees.
 - .8 Install anchors at equal intervals about tree and away from trunk so guy wire will form 45 30 degree angle with ground. Install anchor at angle to achieve maximum resistance for guy wire.
 - .9 Attach guy wire to anchors. Tension wire and secure by multi-wraps installing clamps.
 - .10 Install wire tightener ensuring that guys are secure and leave room for slight movement of tree.
 - .11 Saw tops off wooden anchors which extend in excess of 100 mm above grade or as directed by Departmental Representative DCC Representative Consultant.
 - .12 Install flagging tape to guys as indicated.
- .4 After tree supports have been installed, remove broken branches with clean, sharp tools.

3.7 MULCHING

- .1 Ensure soil settlement has been corrected prior to mulching.
- .2 Spread mulch as indicated.

3.8 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Perform following maintenance operations from time of planting to acceptance by Departmental Representative.
 - .1 Water to maintain soil moisture conditions for optimum establishment, growth and health of plant material without causing erosion.
 - .1 For evergreen plant material, water thoroughly in late fall prior to freeze-up to saturate soil around root system.
 - .2 Remove weeds monthly.
 - .3 Replace or respread damaged, missing or disturbed mulch.
 - .4 For non-mulched areas, cultivate as required to keep top layer of soil friable.
 - .5 If required to control insects, fungus and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations. Obtain product approval from Departmental Representative prior to application.
 - .6 Remove dead or broken branches from plant material.
 - .7 Keep trunk protection and guy wires in proper repair and adjustment.
 - .8 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.

3.9 MAINTENANCE DURING WARRANTY PERIOD

- .1 From time of acceptance by Departmental Representative to end of warranty period, perform following maintenance operations.
 - .1 Water to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion.
 - .2 Reform damaged watering saucers.
 - .3 Remove weeds monthly.
 - .4 Replace or respread damaged, missing or disturbed mulch.
 - .5 For non-mulched areas, cultivate monthly to keep top layer of soil friable.
 - .6 If required to control insects, fungus and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations. Obtain product approval from Departmental Representative prior to application.
 - .7 Apply fertilizer in early spring as indicated by soil test.
 - .8 Remove dead, broken or hazardous branches from plant material.
 - .9 Keep trunk protection and tree supports in proper repair and adjustment.

- .10 Remove trunk protection, tree supports and level watering saucers at end of warranty period.
- .11 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.
- .12 Submit monthly written reports to Departmental Representative identifying:
 - .1 Maintenance work carried out.
 - .2 Development and condition of plant material.
 - .3 Preventative or corrective measures required which are outside Contractor's responsibility.

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 reuse and recycling in accordance with requirements below:
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.
 - .2 Divert discarded burlap, wire and plastic plant containers materials from landfill to plastic recycling facility approved by Departmental Representative.
 - .3 Dispose of unused fertilizer at official hazardous material collection site approved by Departmental Representative.
 - .4 Dispose of unused anti-desiccant at official hazardous material collection site approved by Departmental Representative.
 - .5 Divert unused wood and mulch materials from landfill to recycling composting facility approved by Departmental Representative.

3.11 CLOSEOUT ACTIVITIES

- .1 Submit maintenance reports for trees, shrubs, and other plantings.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM A53/A53M-10, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A105/A105M-10, Specification for Carbon Steel Forgings, for Piping Applications.

1.2 PRODUCT DATA

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's catalog data, descriptive literature, and assembly drawings. Show manufacturer's model or figure number for each type of coupling or joint for each type of pipe material for which couplings are used.
- .3 Indicate for item(s) as applicable:
 - .1 Manufacturer, model number, materials of construction by specification reference, line contents, pressure and temperature rating.
 - .2 Movement handled; axial, lateral, angular and the amounts of each.
 - .3 Nominal size and dimensions including details of construction and assembly.
- .4 Submit manufacturer's recommended torques to which the coupling bolts shall be tightened.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit maintenance data in accordance with Section 01 78 00 - Closeout Submittals.

1.4 WASTE MANAGEMENT AND DISPOSAL

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

PART 2 PRODUCTS

2.1 FLEXIBLE PIPE COUPLING

- .1 Coupling System Design And Component Unit Responsibility

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- .1 Gaskets, bolts, nuts, glands, end rings, and hardware for pipe couplings of all types shall be furnished by the manufacturer of the pipe coupling and shall be designed as an integral system by the pipe coupling manufacturer.
 - .2 Gaskets shall be designed for the coupling and appropriately sized to provide a watertight seal at the design pressure and temperature.
 - .3 Gaskets, bolts, nuts, glands, end rings, and hardware for pipe couplings shall be shipped with the pipe coupling and shall be clearly labeled indicating the origin of the material, including place and date of manufacture.
 - .4 Manufacturer's printed installation instructions shall be packaged with each pipe coupling.
- .2 Flexible Pipe Couplings For Plain End Ductile Iron Pipe, PVC Pressure Pipe, Or PVC Distribution Pipe
- .1 Couplings shall be PVC or ductile iron, Dresser Style 153, Smith-Blair Type 441, Baker Series 228, or approved equal.
 - .3 Minimum length to be in accordance with manufacturer's recommendations.
 - .4 Inner hose: PVC corrugated.
 - .5 Diameter and type of end connection: as indicated.
 - .6 Operating conditions:
 - .1 Working pressure: 1034 kPa.
 - .2 Working temperature: 60°C.
 - .3 To match system requirements.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Clean oil, grease, scale, and dirt from pipe ends. Repair any damage or holidays in the shop applied coating before installing couplings or adapters. Clean gaskets in flexible pipe couplings, transition couplings, and flanged coupling adapters before installing.
- .2 Clean sleeve bolts and nuts by wire brushing before installing in end rings. Lubricate threads of bolts and nuts with oil or graphite prior to installation. Tighten nuts uniformly and in a progressive diametrically opposite sequence, and torque with a calibrated torque wrench.
- .3 Pressure Testing: Test couplings and adapters at the same time that the connecting pipelines are pressure tested. See Specification Section 33 31 13 for pressure testing requirements. Repair leaks in piping and retest.

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- .4 If couplings or adapters leak under pressure testing, loosen or remove the nuts and sleeve bolts, reset or replace the gaskets, reinstall or retighten the bolts and nuts, and retest the coupling or adapter. Couplings and adapters shall be watertight.

3.2 CLEANING

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

END OF SECTION

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
 - .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 33.01 - Excavating, Trenching and Backfilling.
- .2 Trench depth to provide minimum cover over water service pipe of 2.75 m from finished grade.
- .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 300 mm separation between pipes.
- .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 **Engineer** 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.

END OF SECTION

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 C117-95, Standard Test Method for Material Finer Than 75 MU m (No. 200) Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C136-01, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM D698-00a, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft⁴-lbf/ft³ (600 kN-m/m³)).
 - .5 ASTM D3034-00, 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.
- .4 Canadian Standards Association (CSA International)
 - .1 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).
- .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 in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .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.

1.8 MEASUREMENT PROCEDURES

- .1 Measure supply and installation of sanitary mains including excavating and backfilling, granular bedding and surround, surface restoration and filter fabric in lineal metres including all incidentals of each type and size of pipe installed. Measurement will be along slope length of actual length of pipe in place, through valves and fittings, after work has been completed.

PART 2 PRODUCTS

2.1 PIPE, JOINTS AND FITTINGS

- .1 Type PSM Polyvinyl Chloride (PVC):to CSA-B182.2.
- .1 Standard Dimensional Ratio (SDR):35.
 - .2 Separate gasket and integral bell system.
 - .3 Nominal lengths:6 m.
 - .4 Size: as indicated on drawings.

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 or gravel consisting of hard, durable particles.
 - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.2.
- .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 required for bedding cradles, encasement, supports, thrust blocks and plugs: to Section 03 30 00 - Cast-in-Place Concrete.

2.3 BACKFILL MATERIAL

- .1 Type 3, in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.

2.4 FLOW MEASURING SYSTEM - MANHOLE G5

- .1 Flow Module:
 - .1 Portable, permanent-site Area Velocity Module type flow meter
 - .2 Ultrasonic Doppler Technology to measure mean velocity
 - .3 Materials: High-impact polystyrene, stainless steel
 - .4 Enclosure: NEMA 4X, 6P (IP68)
 - .5 Serial Communication Speed: 38,400 bps
 - .6 Temperature Range: -40° to 60°C operating and storage
 - .7 Built-in Flow Rate Conversions:
 - .1 Level-to-Area Conversions
 - .2 Level-to-Flow Conversions
 - .8 Data Storage:
 - .1 Non-volatile flash; retains stored data during program updates.
 - .2 Capacity 395,000 bytes (up to 79,000 readings, equal to over 270 days of level and velocity readings at 15-minute intervals, plus total flow and input voltage readings at 24-hour intervals)
- .2 Area Velocity Sensor
 - .1 Materials: Sensor - Epoxy, chlorinated polyvinyl chloride (CPVC), stainless steel
 - .2 Cable - Polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC)
 - .3 Operating Temperature: 30° to 60° C
 - .4 Level Measurement: Submerged pressure transducer mounted in the flow stream
 - .5 Transducer Type - Differential linear integrated circuit pressure transducer
 - .6 Range (standard): 0.010 to 3.05 m
 - .7 Maximum Allowable Level: 10.5 m
 - .8 Accuracy: ± 0.003 m from 0.01 to 3.05 m
 - .9 Long-Term Stability: ± 0.007 m/yr
 - .10 Compensated Range: 0° to 50°C
 - .11 Velocity Measurement:
 - .1 Typical Minimum Depth: 25 mm
 - .2 Range: -1.5 to +6.1 m/s
 - .3 Accuracy (in water with uniform velocity profile):

- .4 Speed of sound: 4850 ft/s, for indicated velocity range
- .5 ± 0.03 m/s from -1.5 to +1.5 m/s,
- .6 $\pm 2\%$ of reading from 1.5 to 6.1 m/s

PART 3 EXECUTION

3.1 PREPARATION

- .1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation.
 - .1 Inspect materials for defects to approval of the Departmental Representative.
 - .2 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

- .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.

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- .7 Minimize joint deflection after joint has been made to avoid joint damage.
 - .8 At rigid structures, install pipe joints not more than 1.2m 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 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 150mm 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.

3.7 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.

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- .3 Compact backfill to at least 98 % corrected maximum dry density.

3.8 TESTING

- .3 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.
- .4 Trenches shall be tested from pipe zone to finished sub-grade.
- .5 Such tests are taken adjacent to all manholes and valves from pipe zone to finished sub-grade.

3.9 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.

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- .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.

3.10 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 REFERENCES

- .1 ANSI/AWWA D120-09: Thermosetting Fibreglass-Reinforced Plastic Tanks.
- .2 Tank manufacturer shall be recognized by Underwriters Laboratories of Canada (ULC) as a manufacturer of tanks listed to the ULC-S615 standard.
- .3 American Concrete Institute (ACI) standard ACI 318-11, Building Code Requirements for Structural Concrete.

1.2 DESIGN REQUIREMENTS

- .1 Design a single-wall or double-wall, fibreglass reinforced plastic (FRP) water storage tank as shown on the drawings. The water tank shall be manufactured according to applicable American National Standards Institute (ANSI) and American Water Works Association (AWWA) standards

1.3 SUBMITTALS

- .1 Submit shop drawings, product brochures and manufacturers Installation Manual and Operation Guidelines in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings to indicate:
 - .1 Design calculations for items designed by manufacturer.
 - .2 Tables and bending diagrams of reinforcing steel.
 - .3 Camber.
 - .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.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .2 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

PART 2 PRODUCTS

2.1 SINGLE WALL AND DOUBLE WALL FIBREGLASS REINFORCED PLASTIC (FRP) UNDERGROUND WATER TANKS

- .1 Internal Load — Tank shall be designed to withstand a 5-psig air-pressure test with a 5:1 safety factor.
- .2 Surface Loads — Tank shall be designed to withstand surface H-20 and HS-20 axle loads when properly installed according to manufacturer's current Installation Manual and Operating Guidelines.
- .3 External Hydrostatic Pressure for Underground Water Tank — Tank shall be designed for 7 feet of overburden over the top of the tank, the hole fully flooded, and a safety factor of 5:1 against general buckling.

2.2 PRODUCT STORAGE

- .1 Tank shall be vented to atmospheric pressure.
- .2 Tank shall be capable of handling liquids with specific gravity up to 1.1.
- .3 Tank shall be compatible with liquids identified in the manufacturer's standard limited warranty.

2.3 MATERIALS

- .1 Tank shall be manufactured with a laminate consisting of resin and glass fiber reinforcement only. No sand/silica fillers or resin extenders shall be used.
- .2 All internal mounting hardware shall be manufactured of rustproof materials.

2.4 DESIGN

- .1 The tank shall be designed as a single-wall or double-wall vessel as specified and shown in the drawings.
- .2 Tank shall be manufactured with structural ribs which are fabricated as in integral part of the tank wall.

2.5 CAPACITY AND DIMENSIONS

- .1 Tank shall have nominal capacity of 20,000 Litres.
- .2 Tank shall have nominal outside diameter of 2.49 metres

2.6 INTERSTITIAL SPACE (DOUBLE WALL TANKS ONLY)

- .1 The interstitial space between the primary and secondary walls shall be constructed with a glass reinforcement material, which provides a structural bond between the two tank walls, while creating a defined interstice that allows for free flow of liquid.
- .2 A tank top fitting shall be provided to allow for a monitoring sensor to be installed at the bottom of the interstice.
- .3 The interstice of the tank shall be designed to withstand 20 psig pressure.

2.7 ACCESS OPENINGS

- .1 All access openings shall have a diameter of 24 inches or 30 inches, complete with riser, lid and necessary hardware.
- .2 Size and location(s) as shown on tank drawing.

2.8 PIPING AND FITTINGS

- .1 Tank shall be equipped with factory-installed threaded fittings, or pipe stubs.
- .2 PVC piping shall at a minimum meet the requirements of ANSI Schedule 40.
- .3 All flanged nozzles shall be flanged and flat-faced, and conform to Class 150 bolting patterns as specified in ANSI/ASME/ B16.5-2009.
- .4 Steel NPT fittings shall withstand a minimum of 150 foot-pounds of torque and 1,000 foot-pounds of bending, both with a 2:1 safety factor.
- .5 Location of fittings and piping shall be as shown on tank drawings.

2.9 ATTACHED ACCESS RISERS

- .1 Attached access risers shall be PVC or FRP as supplied by tank manufacturer.
- .2 Attached access risers shall be 24-inch or 30-inch-diameter
- .3 Access risers shall be attached to access openings during installation utilizing adhesive or FRP bonding kits as supplied by the tank manufacturer.

2.10 MANWAY OPENINGS (OPTIONAL)

- .1 Manway openings shall be flanged, 22" I.D. and complete with gaskets, bolts and steel cover as shown on tank drawings.
- .2 Manway openings shall be designed to withstand 5 psig test pressure with a 5:1 safety factor.

2.11 LADDERS (OPTIONAL)

- .1 Ladders shall be the standard FRP ladder as supplied by tank manufacturer.

2.12 ANCHORING (OPTIONAL)

- .1 Anchor straps shall be FRP anchor straps as supplied by tank manufacturer.
- .2 Number and location of straps shall be as shown on drawings.
- .3 Prefabricated concrete deadmen, which are designed to ACI Standard 318-11, shall be supplied by tank manufacturer.

PART 3 TESTING AND INSTALLATION

3.1 TESTING

- .1 Tank shall be tested according to manufacturer's Installation Manual and Operating Guidelines for Fibreglass Underground Storage Tanks in effect at time of installation.

3.2 INSTALLATION

- .1 Tank shall be installed according to the manufacturer's Installation Manual and Operating Guidelines in effect at time of installation.

PART 4 LIMITED WARRANTY

- .1 Warranty shall be the manufacturer's limited warranty in effect at the time of purchase.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 32 17 23 – Pavement Markings.
- .2 Section 10 14 53 – Traffic Signs

1.2 PRICE AND PAYMENT PROCEDURES

- .1 Measurement procedures:
 - .1 Payment measured per unit and payment will be for the supply and installation completely as indicated.

1.3 REFERENCES

- .1 Alberta Transportation
 - .1 Standard Specifications for Highway Construction (SSHC), Edition 15 (2013)
- .2 Canadian General Standards Board (CGSB)
 - .1 CGSB 62-GP-11M-[78(R1987)], Marking Material, Retroreflective, Enclosed Lens, Adhesive Backing.
- .3 Manual of Uniform Traffic Control Devices for Canada [2014].

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 and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples
 - .1 Submit to Departmental Representative at least 4 weeks prior to commencing work, following samples of materials proposed for use:
 - .1 Reflective markers.

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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect vehicle post delineators 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 of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 PRODUCTS

2.1 FLEXIBLE GUIDE POST TRAFFIC DELINEATORS

- .1 Round Plastic Posts
 - 1. The flexible guide posts shall return to upright positions following repeated impacts and passages of vehicles over them. Such collisions shall not cause serious damage to the post or vehicle. Failure to conform to the requirements specified herein shall be cause for rejection.
- .2 General
 - .1 the posts shall be of uniform quality and workmanship and be free from defects
 - .2 The Design-Builder shall provide a complete report of the physical properties of the post to PCA. This report shall include properties such as low temperature impact resistance, after-impact recoverability and weather resistance
- .3 Specifications – Dimensions, Colour and Construction
 - .1 Round posts shall have a minimum outer diameter of 90mm and an overall length of 1.67m.
 - .2 The top 250mm of the post length shall be black and the remainder shall be white
 - .3 The post shall be straight. Straight is defined as having no point along the length of the post any more than 6 mm removed from a perfectly straight edge placed parallel to any side of the post
 - 4. Round posts shall be open at the top and bottom
 - .5 the surface of the post shall be smooth and free from irregularities or defects. The surface of the post shall not be affected by cleaning using scrapers, detergent and water, or solvent.
 - .6 The black portion of the post shall accept and hold securely high-intensity reflectorized sheeting applied to its surface area with heavy-duty stainless steel staples, glue or other adhesives deemed suitable by the manufacturer.
 - .7 If one piece construction is not used, then the connections between the pieces shall be at least as strong as if constructed of a single piece. The strength shall exist at temperatures ranging from -50degrees C to 50 degrees C
 - .8 the reflective portion of round posts shall be visible from all directions and shall be of sufficient size so as to be recognizable in the dark as a guide post reflector. The reflective portion of semi-flat posts shall be visible to traffic.
- .4 Weather Resistance and Durability
 - .1 The post shall not be seriously affected by ozone, exhaust fumes, asphalt or road oils, dirt, vegetation, deicing alts or any other types of air contamination or materials likely to be encountered after installation.
 - .2 the post shall withstand without serious damage all elements likely to be encountered after installation including hot (50 degrees C) or cold (-50 degrees C) temperatures, rain snow, hail, abrasion and physical abuse.
- .5 Strength and Flexibility
 - .1 the posts shall resist, without breaking, tearing, shattering, or other serious damage, one highway vehicle impact at a speed of 100 km/h at a test temperature of -33 degrees C.
 - .2 the post shall not bend, warp, or distort, when installed at temperatures up to 50 degrees C or installed in wind velocities up to 120km/h.
- .6 High intensity Reflectorized Sheeting
 - .1 Each post shall have a 50mm wide reflective sheeting material fastened between 100mm and 150mm from the top of the post. The reflective sheeting shall be green when the guidepost is used to mark the edges of approaches located on curves, and white in all other instances.
 - .2 The reflective sheeting material shall be high-intensity encapsulated glass bead reflective sheeting

meeting or exceeding the minimum requirements as specified in ASTM-D4956, performance requirement Type III and Class I pressure sensitive adhesive backing requirements.

3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for vehicle post delineators installation in accordance with manufacturer's written instructions.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 INSTALLATION

- .1 Do work in accordance with Manual of Uniform Traffic Control Devices for Canada (MUTCDC) except where specified otherwise.
- .2 Install posts vertically and 0.6 m beyond shoulder of road.
- .3 Locate center of reflective marker 1.2 m above elevation of outside edge of adjacent lane in accordance with MUTCDC and at right angles to road centerline.
- .4 Install delineators as indicated on plans.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 32 10 00 Concrete Forming and Accessories.
- .2 Section 01 45 00 Quality Control
- .3 Section 32 12 16.00 Asphalt Paving
- .4 Section 32 12 13.16 Asphalt Tack Coat
- .5 Section 32 12 13.23 Asphalt Prime Coat
- .6 Section 32 11 23 Aggregate Base Course
- .7 Section 32 11 16.01 Granular Subbase
- .8 Section 31 24 13 Roadway Embankment
- .9 Section 32 13 13 Concrete Paving_P2

1.2 MEASUREMENT AND PAYMENT

- .1 Measurement for the supply and installation of 810 mm concrete barrier is in metres along its centreline; include transition sections at terminals of installation. No separate payment is made for transition sections and is included in the 810 mm concrete barrier unit rate.
- .2 Measurement for the, supply and installation of 690 mm concrete barrier is in metres along its centerline; include transition sections at terminals of installation. No separate payment is made for transition sections and is included in the 690 mm concrete barrier unit rate.

1.3 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.2-98, Boiled Linseed Oil.
 - .2 CAN/CGSB-3.3-07, Kerosene.
 - .3 CAN/CGSB-1-GP-181M, Coating, Zinc-Rich
- .2 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction
 - .2 CAN/CSA-A-A23.4, Precast Concrete – Materials and Construction
 - .3 CAN/CSA-G40.21-98, Structural Quality Steel

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 concrete mixes, reinforcement, connectors, granular, and kerosene and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with authorities having jurisdiction and Section 01 35 21 - LEED Requirements.
 - .3 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.
- .4 Recycled Content:
 - .1 Submit listing of recycled content products used, including details of required percentages or recycled content materials and products, showing their costs and percentages of [post-consumer] [and] [post-industrial] content, and total cost of materials for project.
 - .2 Submit evidence, when Supplementary Cementing Materials (SCMs) are used, to certify [reduction in cement from Base Mix to Actual SCMs Mix, as percentage].

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 accordance with manufacturer's recommendations.
 - .2 Store and protect concrete barriers from nicks, scratches, and blemishes.
 - .3 Store precast concrete units in single layer.
 - .4 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 by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

2 PRODUCTS

2.1 MATERIALS

- .1 Supply Precast Concrete barrier as per British Columbia 2009 Standard Specifications for Highway construction, Section 941 – Precast Reinforced concrete barriers, 690 mm and 810mm high. In addition all end faces to have 25mm chamfered edges.
- .2 Concrete Median Barrier to have drainage slot as per SP941-02.01.01 of the British Columbia 2009 Standard Specifications for Highway Construction. Drainage slot is not required on curves.
- .3 Precast Concrete Barrier
 - .1 To CAN/CSA-A23.1 except where amended below.
 - .2 Compressive Strength: Compressive strength test result is equal to or exceeds 30 MPa and no individual cylinder strength is less than 27 MPa.
 - .3 Calcium chloride or admixtures containing calcium chloride are not to be used in concrete.
 - .4 Cement Content: minimum of 3210 kg/m³.
 - .5 Water/Cement Ratio: maximum of 0.45.
 - .6 Course Aggregate: nominal maximum size not exceeding 28mm.
 - .7 Slump: 50 mm plus or minus 20mm.
 - .8 Entrained Air: 5 to 8%.
- .4 Secondary reinforcement

- .1 Secondary reinforcement in the form of synthetic fibres reinforcement shall be added to all concrete barriers. The fibres shall be added to wet concrete prior to placement at the rate recommended by the fiber manufacturer. Synthetic fibres shall conform to ASTM C1116 "Specifications for Fiber Reinforced Concrete and Shotcrete" Type III and shall be 50mm fibrillated polypropylene fibres added at a rate of 0.9kg/m³.
- .5 Concrete Placing and Consolidation
 - 1. To CAN/CSA-A23.4, Clause 19.
- .6 Concrete Curing and Protection
 - . Strictly to CAN/CSA-A23.4, Clause 21.
 - .2 During curing period temperature differential between concrete surface and ambient air not to exceed 20 degrees C.
- .7 Exposed Concrete Surfaces
 - .1 Uniform in texture and colour as produced from well-maintained steel form surfaces and proper vibration methods without excessive surface fines or laitance.
 - .2 Surface defects will normally be cause of rejection of any unit except where such are within following permissible limits or are subject to making good within following permissible limits:
 - .1 Unobtrusive defects of any kind where their total area is not in excess of 2% of exposed surface area of unit.
 - .2 Air holes not greater than 3mm in diameter and not more than 20 in any isolated 300mm x 300mm area
 - .3 Sharp ridges at edges of exposed concrete surfaces softened where necessary by careful rubbing and grinding.
 - .4 Patching of isolated small holes, cavities, and similar self-confining defects.
- .8 Patching, if authorized, to be completed as follows:
 - .1 Defective area saturated with water and defect prepared with cement paste and filled with mortar.
 - .2 Mortar to be properly proportioned to same sand and cement as original concrete and reasonably colour-matched to cured dry unit with addition of white cement where necessary, to be pre-shrunk for about one hour before re-tempering and use.
 - .3 Patching mortar to be well tooled in, finished flush and smooth and area covered to cure adequately.
- .9 Surface tolerance to be +3mm unless otherwise indicated on drawings.
- .10 Finished Product
 - .1 Notify Department Representative in advance of manufacturing of schedule so that inspection can be carried out. All processes are subject to inspection by the Department Representative.
 - .2 Identification indicated by embedding manufacturer's name or trademark, year of manufacture, and form number on end of each unit in manner, size and depth that will be permanently legible.
 - 3. Authorized patching or making good shall be completed before shipment or upon delivery and rejected units replaced at no cost.
- .11 Welded Steel Wire Mesh reinforcement
 - 1. Welded wire mesh reinforcement not to be used. Fibrillated fibre strand reinforced concrete to be used for production of barriers.
- .12 reinforcing Steel for Bent and Hooked Connections
 - .1 To CAN/CSA-G40.21-M, Grade 260W.
 - .2 Carefully bend reinforcing steel to radii detailed and install as shown on drawings.
 - .3 Inspect reinforcing steel after bending for evidence of fracture. Fractured pieces to be replaced.
 - .4 Surface treatment: Treatment of exposed surfaces not required.
- .13 Pick-up points
 - .1 Form with accurately placed rigid P.V.C. pipe recessed 15mm from both finished surfaces as shown on drawings.

- .14 Drainage Slots: Cast-in as shown on drawings.

3 EXECUTION

3.1 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Do excavation and placing of granular base in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling and as indicated.

3.2 INSTALLATION

- .1 Precast Concrete Barriers shall be installed permanently on asphalt concrete pavement in accordance with Drawings and these Specifications.
- .2 Precast Concrete Barriers will also be installed temporarily for traffic protection as verified by the department representative. When no longer needed the barriers will be re-installed elsewhere or stored in a Department Representative approved location.
- .3 Layout of barriers to be done by contractor.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION