



**Public Works and  
Government Services Canada**

Requisition No. **R.112456.001** EZ899-220930/A

DRAWINGS & SPECIFICATIONS  
for

**New Residence**

**New Aiyansh B.C.**

**Issued for Tender 2021-07-12**

Issued for Tender

**APPROVED BY:**

**Fung, Philip**

Digitally signed by: Fung, Philip  
DN: CN = Fung, Philip C = CA O = GC OU = PWGSC-TPSGC  
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Regional Manager, AES

Date

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Project Manager  
Philip Fung

Date

**DISCIPLINE**

**SEAL**

<p>Prime Consultant / Architect:</p> <p>Barry Cosgrave, AIBC, MRAIC Number Ten Architectural Group</p>	
<p>Structural Engineer:</p> <p>Chelsea Paton, P. Eng. WSP Canada Inc.</p>	
<p>Mechanical Engineer:</p> <p>Craig Harrison, P.Eng. WSP Canada Inc.</p>	

<p>Electrical Engineer:</p> <p>Gardiner MacNeill, P.Eng. WSP Canada Inc.</p>	 <p>A circular professional seal for G. A. MacNeill, a Professional Engineer in the Province of British Columbia. The seal features a signature over the name 'G. A. MACNEILL' and the registration number '# 53555'. The date '2021-06-29' is stamped at the bottom.</p>
<p>Civil Engineer:</p> <p>Simon Kras, P.Eng. WSP Canada Inc.</p>	 <p>A circular professional seal for S. M. Kras, a Professional Engineer in the Province of British Columbia. The seal features a signature over the name 'S. M. KRAS' and the registration number '# 40183'. The date '2021-06-23' is stamped at the bottom.</p>

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SU.1 SURVEY

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**Part 1            General**

**1.1                WORK COVERED BY CONTRACT DOCUMENTS**

- .1            Work of this Contract comprises the construction of new employee housing in New Aiyansh B.C.

**1.2                DESCRIPTION OF WORK**

- .1            Construction of residential two story wood framed structure on a concrete foundation. The residence will contain 3 bedrooms on the upper floor. The residence also contains a garage and a basement suite. Exterior cladding is cement board, roof is fiberglass asphalt shingle. Site work includes clearing selected trees, grading, drainage, and providing driveway connections to the adjacent roadway.

**1.3                CONTRACT DOCUMENTS**

- .1            The Contract documents, drawings and specifications are intended to complement each other, and to provide for and include everything necessary for the completion of the work.
- .2            Drawings are, in general, diagrammatic and are intended to indicate the scope and general arrangement of the work.

**1.4                DIVISION OF SPECIFICATIONS**

- .1            The specifications are subdivided in accordance with the current 6-digit National Master Specifications System.
- .2            A division may consist of the work of more than 1 subcontractor. Responsibility for determining which subcontractor provides the labour, material, equipment and services required to complete the work rests solely with the Contractor.
- .3            In the event of discrepancies or conflicts when interpreting the drawings and specifications, the specifications govern.

**1.5                TIME OF COMPLETION**

- .1            Complete all work associated with the project and have the facility ready for use within 36 weeks after Contract Award.
- .2            The contractor to work full 8.5 hour shifts, 5 days a week in order to complete the project within the allotted time.
- .3            Time is of the essence. Completion of the work on schedule is of the utmost importance to the Departmental Representative.

**1.6                HOURS OF WORK**

- .1            Construction work will occur Monday to Saturday from 8:00 am to 5:00 pm. Permission must be given by the Departmental Representative prior to working after 5:00 pm or on holidays.

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**1.7 SITE MEETINGS**

- .1 Site meetings between PWGSC Departmental Representatives and the Contractor will be arranged on a bi weekly basis to review project progress and upcoming work.
- .2 Contractor to arrange project meetings and to be responsible for arranging times and location.
  - .1 Departmental Representative will be responsible for recording and distributing meeting minutes.

**1.8 COST BREAKDOWN**

- .1 Before submitting the first progress claim, submit a breakdown of the Contract lump sum prices in detail as directed by the Departmental Representative and aggregating Contract price.

**1.9 CONTRACTORS USE OF PREMISES**

- .1 Ensure construction site is safe, secure and properly separated from areas accessible to the public.
- .2 Minimize service disruptions. Coordinate any required service shutdowns to occur outside occupied/operational hours.
- .3 Contractor to take possession of the site within one week of the contract award date.

**1.10 OWNER OCCUPANCY**

- .1 Co-operate with Departmental Representative in scheduling operations to minimize conflict with existing facility.

**1.11 EXISTING SERVICES**

- .1 Notify, Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative 72 hours notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to tenant operations.
- .3 Submit schedule to and obtain approval from Departmental Representative for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .4 Provide temporary services as directed, to maintain critical existing systems.
- .5 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .6 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .7 Record locations of maintained, re-routed and abandoned service lines.

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**1.12 DOCUMENTS REQUIRED**

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

**1.13 AS-BUILT DOCUMENTS**

- .1 The Departmental Representative will provide 2 sets of drawings, 2 sets of specifications, and 2 copies of the original AutoCAD files for “as-built” purposes.
- .2 As work progresses, maintain accurate records to show all deviations from the Contract documents. Note on as-built specifications, drawings and shop drawings as changes occur.
- .3 Refer to Section 01 78 00 Closeout Procedures.

**1.14 ADDITIONAL DRAWINGS**

- .1 The Departmental Representative may furnish additional drawings for clarification. These additional drawings have the same meaning and intent as if they were included with plans referred to in the Contract documents.

**1.15 SUBMISSION OF TENDER**

- .1 Submission of a tender is deemed to be confirmation of the fact that the Tenderer has analyzed the Contract documents and is fully conversant with all conditions.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.

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**Part 3            Execution**

**3.1                NOT USED**

.1            Not used.

**END OF SECTION**

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**Part 1            General**

**1.1                SCHEDULES REQUIRED**

- .1            Construction Schedule

**1.2                SCHEDULE FORMAT**

- .1            Prepare schedule in form of a horizontal bar chart. (Gantt)
- .2            Provide a separate bar for each major operation
- .3            Provide horizontal time scale identifying first Working Day of each week.
- .4            Identification of listings
- .5            By specific task
- .6            Identify work by phase
- .7            Include all milestones and identify critical paths

**1.3                SCHEDULE SUBMISSION.**

- .1            Submit initial schedule within seven working days after award of Contract.
- .2            Submit schedules in electronic format, forward through e-mail - .pdf files.
- .3            Departmental Representative will review schedule and return review copy within three days after receipt.
- .4            Resubmit finalized schedule within three days after return of review copy.
- .5            Submit revised progress schedule with each application for payment.
- .6            Distribute copies of revised schedule to:
  - .1            Subcontractors.
  - .2            Other concerned parties.
- .7            Instruct recipients to report to Contractor within five working days, any problems anticipated by timetable shown in schedule.

**1.4                SCHEDULING**

- .1            Show complete sequence of construction by activity, identifying Work of separate stages and final completion of the entire project within the time period required by the Contract documents. The schedule must clearly show completion of each phase. Indicate the following:
  - .1            Submission of Shop Drawings, product data, MSDS sheets and samples
  - .2            Indicate estimated percentage of completion for each item of Work at each submission.
  - .3            Indicate the anticipated date of substantial completion.
  - .4            Indicate final completion date within the time period required by the contract documents.

- .5 Indicate projected percentage of completion of each item as of first day of the week.
- .6 Indicate progress of each activity to date of submission schedule.
- .7 Indicate changes occurring since previous submission of schedule:

**1.5 PROGRESS REPORTS**

- .1 Maintain an accurate record of the Construction work. Submit progress report when requested by the Departmental Representative and with each Request for Progress Payment.
- .2 Include in reports, the dates of commencement and percentage of work completed for different aspects of the work.

**1.6 CHANGES IN THE SCHEDULE**

- .1 Whenever proposing a change in the construction schedule, submit proposed revised schedule to the Departmental Representative, together with such analyses thereof as are required to clearly indicate the purpose and anticipated results of such changes.
- .2 If, in the opinion of the Departmental Representative, any proposed change in construction scheduled is inadequate to secure completion of the Work within the specified time, or is otherwise not in accordance with the specifications, or if the Work is not being adequately or properly prosecuted in any respect, the Departmental Representative reserves the right to require a revised schedule together with such analyses thereof as are required to indicate the anticipated results of such revision.
- .3 Claims for additional compensation or extension of Contract Time on account of such requirements will not be considered.

**END OF SECTION**

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**Part 1            General**

**1.1                ADMINISTRATIVE**

- .1        Submit to Departmental Representative submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2        Do not proceed with Work affected by submittal until review is complete.
- .3        Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4        Where items or information is not produced in SI Metric units converted values are acceptable.
- .5        Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6        Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7        Verify field measurements and affected adjacent Work are co-ordinated.
- .8        Contractor's responsibility for errors and omissions in submission is not relieved by Departmental Representative's review of submittals.
- .9        Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.
- .10      Keep one reviewed copy of each submission on site.

**1.2                HEALTH AND SAFETY PLAN**

- .1        Submit site specific Health and Safety Plan, MSDS and WHMIS documents requested in Section 01 35 30 - Health and Safety Requirements

**1.3                SHOP DRAWINGS AND PRODUCT DATA**

- .1        The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2        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.
- .3        Allow 5 days for Departmental Representative's review of each submission.



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- .4 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
  - .5 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.
  - .6 Accompany submissions with electronic transmittal, containing:
    - .1 Date.
    - .2 Project title and number.
    - .3 Contractor's name and address.
    - .4 Indicate the specification section and paragraph number that applies to the shop drawing that is being submitted.
      - .1 Ensure that each shop drawing clearly refers to the requirements of the stated specification section.
    - .5 Identification and quantity of each shop drawing, product data and sample.
    - .6 Other pertinent data.
  - .7 Submissions include:
    - .1 Date and revision dates.
    - .2 Project title, number and applicable specification section.
    - .3 Name and address of:
      - .1 Subcontractor.
      - .2 Supplier.
      - .3 Manufacturer.
    - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
    - .5 Details of appropriate portions of Work as applicable:
      - .1 Fabrication.
      - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
      - .3 Setting or erection details.
      - .4 Capacities.
      - .5 Performance characteristics.
      - .6 Standards.
      - .7 Operating weight.
      - .8 Wiring diagrams.
      - .9 Single line and schematic diagrams.
      - .10 Relationship to adjacent work.
  - .8 After Departmental Representative's review, distribute copies.
  - .9 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

- .10 Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.
  - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
  - .2 Testing must have been within 3 years of date of contract award for project.
- .11 Submit electronic copies of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.
  - .1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.
- .12 Submit electronic copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative
- .13 Submit 2 hard copies and electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.
- .14 Delete information not applicable to project.
- .15 Supplement standard information to provide details applicable to project.
- .16 If upon review by Departmental Representative no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .17 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.
  - .1 This review shall not mean that PWGSC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
  - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

#### **1.4 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, one of each sample to Departmental Representatives office.
- .3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.
- .4 Where colour, pattern or texture is criterion, submit full range of samples.

- .5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.
- .6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.
- .7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

**1.5 PHOTOGRAPHIC DOCUMENTATION**

- .1 Submit electronic copy of digital photography in jpg format, standard resolution as directed by Departmental Representative.
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Number of viewpoints: 4 locations.
  - .1 Viewpoints and their location as determined by Departmental Representative.
- .4 Frequency of photographic documentation: weekly and as follows
  - .1 Upon completion of: excavation, foundation, framing and services before concealment.

**1.6 CERTIFICATES AND TRANSCRIPTS**

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

## 1 GENERAL

### PWGSC Update on Asbestos Use

**Effective April 1, 2016, all Public Works and Government Services of Canada (PWGSC) contracts for new construction and major rehabilitation will prohibit use of asbestos-containing materials.**

### COVID 19

**All contractors shall follow Canadian Construction Association COVID-19 - Standardized Protocols for All Canadian Construction Sites.**

## 1.1 REFERENCES

- .1 Government of Canada.
  - .1 Canada Labour Code - Part II (as amended)
  - .2 Canada Occupational Health and Safety Regulations. (as amended)
- .2 National Building Code of Canada (NBC): (as amended)
  - .1 Part 8, Safety Measures at Construction and Demolition Sites.
- .3 The Canadian Electrical Code (as amended)
- .4 Canadian Standards Association (CSA) as amended:
  - .1 CSA Z797-2018 Code of Practice for Access Scaffold.
  - .2 CSA S269.1-2016 Falsework for Construction Purposes.
  - .3 CSA S350-M1980 (R2003) Code of Practice for Safety in Demolition of Structures.
  - .4 CSA Z1006-10 Management of Work in Confined Spaces.
  - .5 CSA Z462-18 Workplace Electrical Safety Standard
- .5 National Fire Code of Canada 2015 (as amended)
  - .1 Part 5 – Hazardous Processes and Operations and Division B as applicable and required.
- .6 American National Standards Institute (ANSI): (as amended)
  - .1 ANSI/ASSP A10.3-2013, Operations – Safety Requirements for Powder-Actuated Fastening Systems.

.7 Province of British Columbia:

.1 Workers Compensation Act Part 3-Occupational Health and Safety. (as amended)

.2 Occupational Health and Safety Regulation (as amended)

## 1.2 RELATED SECTIONS

.1 Refer to the following current NMS sections as required:

.1 Section 01 11 00 – Summary of Work.

.2 Section 01 74 19 – Construction Waste and Disposal.

## 1.3 WORKERS' COMPENSATION BOARD COVERAGE

.1 Comply fully with the Workers' Compensation Act, regulations and orders made pursuant thereto, and any amendments up to the completion of the work.

.2 Maintain Workers' Compensation Board coverage during the term of the Contract, until and including the date that the Certificate of Final Completion is issued.

## 1.4 COMPLIANCE WITH REGULATIONS

.1 PWGSC may terminate the Contract without liability to PWGSC where the Contractor, in the opinion of PWGSC, refuses to comply with a requirement of the Workers' Compensation Act or the Occupational Health and Safety Regulations.

.2 It is the Contractor's responsibility to ensure that all workers are qualified, competent and certified to perform the work as required by the Workers' Compensation Act or the Occupational Health and Safety Regulations.

## 1.5 SUBMITTALS

.1 Submit to Departmental Representative submittals listed for review in accordance with Section 01 33 00 Submittal Procedures.

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

.3 Submit the following:

.1 Organizations Health and Safety Plan.

.2 Site Specific Safety Plan or Health and Safety Plan (SSSP or HASP).

.3 Copies of reports or directions issued by Federal and Provincial health and safety inspectors.

- .4 Copies of incident and accident reports.
- .5 Complete set of Material Safety Data Sheets (SDS), and all other documentation required by Workplace Hazardous Materials Information System (WHMIS) requirements.
- .6 Emergency Response Procedures.
- .4 The Departmental Representative will review the Contractor's Site Specific Safety Plan or Health and Safety Plan (SSSP/HASP) and emergency response procedures and provide comments to the Contractor within 5 days after receipt of the plan. Revise the plan as appropriate and resubmit to Departmental Representative.
- .5 Medical surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of work, and submit additional certifications for any new site personnel to Departmental Representative.
- .6 Submission of the Site Specific Safety Plan or Health and Safety Plan, and any revised version, to the Departmental Representative is for information and reference purposes only. It shall not:
  - .1 Be construed to imply approval by the Departmental Representative.
  - .2 Be interpreted as a warranty of being complete, accurate and legislatively compliant.
  - .3 Relieve the Contractor of his legal obligations for the provision of health and safety on the project.

## **1.6 RESPONSIBILITY**

- .1 Assume responsibility as the Prime Contractor for work under this contract.
- .2 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .3 Comply with and enforce compliance by employees with safety requirements of Contract documents, applicable Federal, Provincial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

## **1.7 HEALTH AND SAFETY COORDINATOR**

- .1 Assign a competent and qualified Health and Safety Coordinator who shall:
  - .1 Be responsible for completing all health and safety training, and ensuring that personnel that do not successfully complete the required training are not permitted to enter the site to perform work.

- .2 Be responsible for implementing, daily enforcing, and monitoring the Site Specific Safety Plan (SSSP) or Health and Safety Plan (HASP).
- .3 Be on site during execution of work.
- .4 Have minimum two (2) years' site-related working experience.
- .5 Have working knowledge of the applicable occupational safety and health regulations.

## **1.8 GENERAL CONDITIONS**

- .1 Provide safety barricades and lights around work site as required to provide a safe working environment for workers and protection for pedestrian and vehicular traffic.
- .2 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the work site.
  - .1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.
  - .2 Secure site at night time or provide security guard as deemed necessary to protect site against entry.

## **1.9 PROJECT/SITE CONDITIONS**

- .1 Work at site will involve contact with:
  - .1 Multi-employer work site.
  - .2 Federal employees and general public.
  - .3 Energized electrical services.
  - .4 Working from heights.

## **1.10 UTILITY CLEARANCES**

- .1 The Contractor is solely responsible for all utility detection and clearances prior to starting the work.
- .2 The Contractor will not rely solely upon the Reference Drawings or other information provided for Utility locations.

### **1.11 REGULATORY REQUIREMENTS**

- .1 Comply with specified codes, acts, bylaws, standards and regulations to ensure safe operations at site.
- .2 In event of conflict between any provision of the above authorities, the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, the Departmental Representative will advise on the course of action to be followed.

### **1.12 WORK PERMITS**

- .1 Obtain specialty permit(s) related to project before start of work.

### **1.13 FILING OF NOTICE**

- .1 The General Contractor is to file Notice of Project with Provincial authorities prior to commencement of work. (All construction projects require a Notice of Work)
- .2 Provide copies of all notices to the Departmental Representative.

### **1.14 SITE SPECIFIC HEALTH AND SAFETY PLAN**

- .1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risks and safety hazards.
- .2 Prepare and comply with the Site Specific Safety Plan (SSSP) or Health and Safety Plan (HASP) based on the required hazard assessment, including, but not limited to, the following:
  - .1 Primary requirements:
    - .1 Contractor's safety policy.
    - .2 Identification of applicable compliance obligations.
    - .3 Definition of responsibilities for project safety/organization chart for project.
    - .4 General safety rules for project.
    - .5 Job-specific safe work, procedures.
    - .6 Inspection policy and procedures.
    - .7 Incident reporting and investigation policy and procedures.



- .8 Occupational Health and Safety Committee/Representative procedures.
- .9 Occupational Health and Safety meetings.
- .10 Occupational Health and Safety communications and record keeping procedures.
- .11 COVID 19 Protocols and Procedures
- .2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.
- .3 List hazardous materials to be brought on site as required by work. SDS required for all products.
- .4 Indicate Engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.
- .5 Identify personal protective equipment (PPE) to be used by workers.
- .6 Identify personnel and alternates responsible for site safety and health.
- .7 Identify personnel training requirements and training plan, including site orientation for new workers.
- .3 Develop the plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.
- .4 Revise and update Site Specific Safety Plan (SSSP) and/or Health and Safety Plan (HASP) as required, and re-submit to the Departmental Representative.
- .5 Departmental Representative's review: the review of Site Specific Safety Plan and/or Health and Safety Plan by Public Works and Government Services Canada (PWGSC) shall not relieve the Contractor of responsibility for errors or omissions in final Site Specific Safety Plan and/or Health and Safety Plan of responsibility for meeting all requirements of construction and Contract documents and legislated requirements.

### **1.15 EMERGENCY PROCEDURES**

- .1 List standard operating procedures and measures to be taken in emergency situations. Include an emergency response and emergency evacuation plan and emergency contacts (i.e. names/telephone numbers) of:
  - .1 Designated personnel from own company.
  - .2 Regulatory agencies applicable to work and as per legislated regulations.

- 
- .3 Local emergency resources.
  - .4 Departmental Representative.
  - .5 A route map with written directions to the nearest hospital or medical clinic.
  - .2 Include the following provisions in the emergency procedures:
    - .1 Notify workers and the first-aid attendant, of the nature and location of the emergency.
    - .2 Evacuate all workers safely.
    - .3 Check and confirm the safe evacuation of all workers.
    - .4 Notify the fire department or other emergency responders.
    - .5 Notify adjacent workplaces or residences which may be affected if the risk extends beyond the workplace.
    - .6 Notify Departmental Representative.
  - .3 Provide written rescue/evacuation procedures as required for, but not limited to:
    - .1 Work at high angles.
    - .2 Work in confined spaces or where there is a risk of entrapment.
    - .3 Work with hazardous substances.
    - .4 Underground work.
    - .5 Work on, over, under and adjacent to water.
    - .6 Workplaces where there are persons who require physical assistance to be moved.
  - .4 Design and mark emergency exit routes to provide quick and unimpeded exit.
  - .5 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.
  - .6 Contractors must not rely solely upon 911 for emergency rescue in a confined space, working at heights, etc.

### **1.16 HAZARDOUS PRODUCTS**

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS 2015) regarding use, handling, storage and disposal of hazardous materials, and regarding labelling and provision of Safety Data Sheets (SDS) acceptable to the Departmental Representative and in accordance with the Canada Labour Code.
- .2 Where use of hazardous and toxic products cannot be avoided:
  - .1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable SDS and WHMIS 2015 documents as per Section 01 33 00 Submittal Procedures.
  - .2 In conjunction with Departmental Representative schedule to carry out work during "off hours" when tenants have left the building.
  - .3 Provide adequate means of ventilation in accordance with Section 01 51 00.
  - .4 The contractor shall ensure that the product is applied as per manufacturers recommendations.
  - .5 The contractor shall ensure that only pre-approved products are bought onto the work site in an adequate quantity to complete the work.

### **1.17 ASBESTOS HAZARD**

- .1 Carry out any activities involving asbestos in accordance with current applicable Federal and Provincial Regulations.
- .2 Removal and handling of asbestos will be in accordance with current applicable Provincial / Federal Regulations.

### **1.18 PCB REMOVALS**

- .1 Mercury-containing fluorescent tubes and ballasts which contain polychlorinated biphenyls (PCBs) are classified as hazardous waste.
- .2 Remove, handle, transport and dispose of as indicated in Division 2 specifications.

### **1.19 REMOVAL OF LEAD-CONTAINING PAINT**

- .1 All paint containing TCLP lead concentrations above 5 ppm are classified as hazardous.
- .2 Carry out demolition and/or remediation activities involving lead-containing paints in accordance with current applicable Provincial / Territorial Regulations.

- .3 Work with lead-containing paint shall be completed as per Provincial and Federal regulations.
- .4 Dry Scraping/Sanding of any materials containing lead is strictly prohibited.
- .5 The use of Methylene Chloride based paint removal products is strictly prohibited.

**1.20 ELECTRICAL SAFETY REQUIREMENTS**  
**(Reference: Worksafe BC OHS Regulation Part 19 – Electrical Safety)**

- .1 Comply with authorities and ensure that, when installing new facilities or modifying existing facilities, all electrical personnel are completely familiar with existing and new electrical circuits and equipment and their operation.
  - .1 Before undertaking any work, coordinate arc flash protection, required energizing and de-energizing of new and existing circuits with Departmental Representative.
  - .2 Maintain electrical safety procedures and take necessary precautions to ensure safety of all personnel working under this Contract, as well as safety of other personnel on site.

**1.21 ELECTRICAL LOCKOUT**

- .1 Develop, implement and enforce use of established procedures to provide electrical lockout and to ensure the health and safety of workers for every event where work must be done on any electrical circuit or facility.
- .2 Prepare the lockout procedures in writing, listing step-by-step processes to be followed by workers, including how to prepare and issue the request/authorization form. Have procedures available for review upon request by the Departmental Representative.
- .3 Keep the documents and lockout tags at the site and list in a log book for the full duration of the Contract. Upon request, make such data available for viewing by Departmental Representative or by any authorized safety representative.

**1.22 OVERLOADING**

- .1 Ensure no part of work is subjected to a load which will endanger its safety or will cause permanent deformation.

**1.23 FALSEWORK**

- .1 Design and construct falsework in accordance with CSA S269.1-1975 (R2003) (as amended)

#### **1.24 SCAFFOLDING**

- .1 Design, construct and maintain scaffolding in a rigid, secure and safe manner, in accordance with CSA Z797-2009 (as amended) and B.C. Occupational Health and Safety Regulations. (as amended)

#### **1.25 CONFINED SPACES**

- .1 Carry out work in compliance with current Provincial / Territorial regulations.

#### **1.26 POWDER-ACTUATED DEVICES**

- .1 Use powder-actuated devices in accordance with ANSI A10.3 (as amended) only after receipt of written permission from the Departmental Representative.

#### **1.27 FIRE SAFETY REQUIREMENTS**

- .1 Refer to Section 01 35 35 - Fire Safety Requirements.

#### **1.28 UNFORESEEN HAZARDS**

- .1 Should any unforeseen or peculiar safety-related factor, hazard or condition become evident during performance of the work, immediately stop work and immediately advise the Departmental Representative verbally and in writing.

#### **1.29 POSTED DOCUMENTS**

- .1 Post legible versions of the following documents on site:
  - .1 Site Specific Safety Plan (SSSP) or Health and Safety Plan (HASP)
  - .2 Sequence of work.
  - .3 Emergency procedures.
  - .4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.
  - .5 Notice of Project.
  - .6 Floor plans or site plans. Must be posted in a secure area and locked up when not being used.
  - .7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.

- .8 Workplace Hazardous Materials Information System (WHMIS 2015) documents.
  - .9 Material Safety Data Sheets (SDS).
  - .10 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.
  - .11 All Hazardous Material and Substance Reports including Lab Analysis
- .2 Post all Material Safety Data Sheets (MSDS) on site, in a common area, visible to all workers and in locations accessible to tenants when work of this Contract includes construction activities adjacent to occupied areas.
  - .3 Postings should be protected from the weather, and visible from the street or the exterior of the principal construction site shelter provided for workers and equipment, or as approved by the Departmental Representative.

### **1.30 MEETINGS**

- .1 Attend health and safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.

### **1.31 CORRECTION OF NON-COMPLIANCE**

- .1 Immediately address health and safety non-compliance issues identified by the Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance with health and safety issues identified.
- .3 The Departmental Representative may issue a "stop work order" if noncompliance of health and safety regulations is not corrected immediately or within posted time. The General Contractor/subcontractors will be responsible for any costs arising from such a "stop work order".

## **2 PRODUCTS**

- .1 Not used.

## **3 EXECUTION**

- .1 Not used.

**END OF SECTION**

**Part 1            General**

**1.1                CONSTRUCTION FIRE SAFETY**

- .1        The Contractor shall provide construction fire safety in accordance with the National Fire Code of Canada.

**1.2                REPORTING FIRES**

- .1        The Contractor shall inform the Departmental Representative and the Fire Chief of all fire incidents at the construction site, regardless of size.
- .2        Know location of nearest fire alarm pull station and telephone, including emergency phone number.
- .3        Report immediately fire incidents to Fire Department as follows:
  - .1        Telephone, by calling **911**
- .4        When reporting fire by telephone, give location of fire, name or number of building and be prepared to verify location.

**1.3                FIRE SAFETY PLAN**

- .1        Submit a fire safety plan for the construction site prior to commencement of construction work. The fire safety plan shall conform to the National Fire Code of Canada.
- .2        The fire safety plan shall be submitted to the Departmental Representative for review by local fire department. Any comments by local fire department shall be implemented by the Contractor.
- .3        The fire safety plan shall be limited to the area of construction only. Contractor is not responsible for amending fire safety plans in existing buildings.
- .4        Post the fire safety plan at the entrance to the construction site or near the construction site's health and safety board.
- .5        The fire safety plan shall conform to the National Fire Code of Canada, and shall contain, at minimum:
  - .1        Emergency procedures to be used in case of fire, including
    - .1        Sounding the fire alarm;
    - .2        Notifying the fire department;
    - .3        Instructing occupants on procedures to be followed when the fire alarm sounds;
    - .4        Evacuating occupants, including special provisions for persons requiring assistance; and
    - .5        Confining, controlling and extinguishing fires.
  - .2        The appointment and organization of designated supervisory staff to carry out fire safety duties.
  - .3        The training of supervisory staff and other occupants in their responsibilities for fire safety.
  - .4        The holding of fire drills (where applicable).
  - .5        The control of fire hazards in the building.

- .6 The inspection and maintenance of building facilities provided for the safety of occupants.

#### **1.4 FIRE WARNING SYSTEM**

- .1 A fire warning shall be provided to notify construction personnel of a fire emergency in the construction area.
- .2 The system used shall be capable of being heard throughout the building.

#### **1.5 EXTERIOR FIRE PROTECTION SYSTEMS**

- .1 Do not use Fire hydrants, standpipes or hose systems for other than fire-fighting purposes unless authorized by the Supervisor, Surface and Mobile.

#### **1.6 FIRE PROTECTION SYSTEM IMPAIRMENT**

- .1 Notify the Departmental Representative and the Fire Chief 48 hours prior to shutting down any active fire protection system, including water supply, fire suppression, fire detection and life safety systems.
- .2 Implement all fire protection system impairments in accordance with the National Fire Code of Canada. Fire Orders will be provided at the Pre-Commencement Meeting.

#### **1.7 FIRE EXTINGUISHERS**

- .1 In addition to other requirements of this specification, supply fire extinguishers, as scaled by the Fire Chief, necessary to protect work in progress and contractor's physical plant on site.
- .2 Fire extinguishers may be required in the following areas as directed by the Fire Chief
  - .1 Adjacent to hot works;
  - .2 In areas where combustibles are stored;
  - .3 Near or on any internal combustion engines;
  - .4 Adjacent to areas where flammable liquids or gases are stored or handled;
  - .5 Adjacent to temporary oil fired or gas fired equipment; and
  - .6 Adjacent to bitumen heating equipment.
- .3 Extinguishers shall be sized as 4-A:40-B:C (20 lbs) unless otherwise directed by the Fire Chief.
- .4 Extinguishers shall be of the dry chemical type unless otherwise required by the hazard being protected.
- .5 The Contractor may assume the quantity of extinguishers based on a maximum travel distance between extinguishers of 75 feet.

#### **1.8 ACCESS FOR FIRE FIGHTING**

- .1 Access for firefighting shall be provided in accordance with the National Fire Code of Canada.
- .2 Advise the Fire Chief of work that would impede fire apparatus response. This includes violation of minimum horizontal and overhead clearance, as prescribed by the Fire Chief, erecting of barricades and digging of trenches.
- .3 Minimum horizontal clearance: clear width of not less than 5m, or as defined by the Chief.



- .4 Minimum vertical clearance: overhead height of not less than 6m, or as defined by the Fire Chief.

### **1.9 SMOKING PRECAUTIONS**

- .1 Smoking is prohibited in all buildings. Observe posted smoking restrictions on entire site. Smoking only in designated areas. Contractor to provide designated area for job.

### **1.10 RUBBISH AND WASTE MATERIALS**

- .1 Keep rubbish and waste materials at minimum quantities.
- .2 Burning of rubbish is prohibited.
- .3 Remove rubbish from work site at end of work day or shift or as directed.
- .4 Storage:
  - .1 Store oily waste in approved receptacles to ensure maximum cleanliness and safety.
  - .2 Deposit greasy or oily rags and materials subject to spontaneous combustion in approved receptacles and remove specified.

### **1.11 FLAMMABLE AND COMBUSTIBLE LIQUIDS**

- .1 Handle, store and use of flammable and combustible liquids in accordance with the National Fire Code of Canada.
- .2 Keep flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use in quantities not exceeding 45 litres provided they are stored in approved safety cans bearing Underwriters' Laboratory of Canada or Factory Mutual seal of approval. Obtain written authorization from Fire Chief for storage of quantities of flammable and combustible liquids exceeding 45 litres.
- .3 Do not transfer flammable or combustible liquids inside buildings or on jetties.
- .4 Do not transfer flammable or combustible liquids in vicinity of open flames or any type of heat-producing devices.
- .5 Do not use flammable liquids having flash point below 38 degrees C such as naphtha or gasoline as solvents or cleaning agents.
- .6 Store flammable and combustible waste liquids, for disposal, in approved containers located in safe ventilated area. Keep quantities to a minimum and notify Fire Chief when disposal is required.

### **1.12 HOT WORKS**

- .1 The Contractor shall implement a hot works program in accordance with the National Fire Code of Canada and NFPA 51 Standard for Fire Prevention during Welding, Cutting and Other Hot Work.
- .2 The Contractor shall obtain from the Fire Chief a "Hot Work" permit for all hot works in the construction area. Frequency of renewal for hot works permits is at the discretion of the Fire Chief.
- .3 When Work is carried out in dangerous or hazardous areas involving use of heat; provide fire watchers equipped with sufficient fire extinguishers. Determination of dangerous or hazardous areas along with level of protection necessary for Fire Watch is at discretion of the Fire Chief.

- .4 Area of hot works
  - .1 Hot works shall be carried out in an area free of combustible and flammable content.
  - .2 Where 1.14.5.1 is not possible,
    - .1 All flammable and combustible materials within 15m of the hot works shall be protected in accordance with the National Fire Code of Canada;
    - .2 A fire watch shall be provided during the hot work and for a period of not less than 60 minutes unless otherwise directed.
    - .3 A final inspection of the hot work area shall be conducted not less than 4 hours after the completion of hot works unless otherwise directed by the Fire Chief.
  - .3 Where there is a possibility of sparks leaking onto combustible materials in areas adjacent to the areas where the hot work is carried out
    - .1 Openings in walls, floors or ceilings shall be covered or closed to prevent the passage of sparks to such adjacent areas, or
    - .2 Sentence 1.14.5.2 shall apply for those areas.
- .5 Protection of flammable and combustible materials
  - .1 Any combustible or flammable material, dust or residue shall be
    - .1 Removed from the area where hot works is carried out; or
    - .2 Protected from ignition by non combustible materials.
- .6 Fire extinguisher
  - .1 A fire extinguisher shall be provided within 3 m of all hot works. Minimum size shall be 20lbs ABC unless otherwise directed by the Fire Chief.

### **1.13 HAZARDOUS SUBSTANCES**

- .1 Work entailing use of toxic or hazardous materials, chemicals and/or explosives, or otherwise creating hazard to life, safety or health, shall be in accordance with National Fire Code of Canada.
- .2 Provide ventilation where flammable liquids, such as lacquers or urethanes are used. Eliminate all sources of ignition.

### **1.14 QUESTIONS AND/OR CLARIFICATION**

- .1 Direct questions or clarification on Fire Safety in addition to above requirements to the Departmental Representative.
- .2 Departmental Representative is responsible to obtain clarifications from the Fire Chief. The Contractor is not to liaise directly with the Fire Chief for notification, authorization or any requests unless the situation constitutes an immediate emergency.

### **1.15 FIRE INSPECTION**

- .1 Co-ordinate site inspections by the Fire Chief through Departmental Representative.
- .2 Allow the Fire Chief unrestricted access to work site.
- .3 Co-operate with the Fire Chief during routine fire safety inspection of work site.
- .4 Immediately remedy unsafe fire situations observed by the Fire Chief.

**Part 2            Products**

**2.1                NOT USED**

.1            Not Used.

**Part 3            Execution**

**3.1                NOT USED**

.1            Not Used.

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 01 74 19 Construction Waste and Disposal.
- .2 Section 31 23 33.01 Excavating, Trenching and Backfilling.

**1.2 REFERENCES**

- .1 Definitions:
  - .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.
  - .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.
- .2 Reference Standards:
  - .1 U.S. Environmental Protection Agency (EPA)/Office of Water
    - a) EPA 832/R-92-005-92, Storm Water Management for Construction Activities, Chapter 3.
    - b) EPA General Construction Permit (GCP) 2012.
  - .2 City of Vancouver Construction Site and Erosion Sediment Control Guide.

**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 any stormwater rehabilitation unit and associated flocculants, including product characteristics, performance criteria, environmental data including toxicity, physical size, and limitations.
  - .2 Submit WHMIS MSDS in accordance with Section 01 35 30 - Health and Safety Requirements.
- .3 Before commencing construction activities or delivery of materials to site, submit Construction Activity Pollution Prevention Plan for review and approval by Departmental Representative.
- .4 Construction Activity Pollution Prevention Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction.
- .5 Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .6 Include in Construction Activity Pollution Prevention Plan:
  - .1 Names of persons responsible for ensuring adherence to Construction Activity Pollution Prevention Plan.

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- .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 for construction activities associated with the project. The plan must incorporate practices such as phasing, seeding, grading, mulching, filter socks, stabilized site entrances, preservation of existing vegetation, and other best management practices (BMPs) to control erosion and sedimentation in runoff from the entire project site during construction. The plan must list the BMPs employed and describe how they accomplish the following objectives:
    - a) Prevent loss of soil during construction by stormwater runoff and/or wind erosion, including but not limited to stockpiling of topsoil for reuse.
    - b) Prevent sedimentation of any affected stormwater conveyance systems or receiving streams.
    - c) Prevent polluting the air with dust and particulate matter.
  - .6 The BMPs to be selected from the Greater Vancouver Sewerage and Drainage District's Best Management Practices Guide for Stormwater, Appendix H, Construction Site Erosion and Sediment Control Guide, dated October 1999 or a locally approved equivalent, whichever is more stringent. BMPs must comply with all federal, provincial/territorial and local erosion and sedimentation control regulations
  - .7 The Erosion and Sediment Control Plan must describe how the project team will do the following:
    - a) Preserve vegetation and mark clearing limits.
    - b) Establish and delineate construction access.
    - c) Control flow rates.
    - d) Install sediment controls.
    - e) Stabilize soils.
    - f) Protect slopes.
    - g) Protect drain inlets.
    - h) Stabilize channels and outlets.
    - i) Control pollutants.
    - j) Control dewatering.
    - k) Maintain the BMPs.
    - l) Manage the erosion and sedimentation control plan.
  - .8 Drawings indicating locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
  - .9 Traffic Control Plans including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather.
    - a) Plans to include details and measures to minimize amount of material transported onto paved public roads by vehicles or runoff.

- .10 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.
  - a) Plan to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.
- .11 Spill Control Plan to include procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.
- .12 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.
- .13 Waste Source Separation Program (WSSP) to ensure that materials that can be recycled are sorted into pre- defined categories for recycling and re- use.
  - a) Target is 100% diversion of cardboard, plastic packaging, ferrous and non-ferrous metals and uncontaminated wood.
  - b) Recycling facilities are limited in New Aiyansh, but a depot is situated in the Terrace area. Contractor is to strive to recycle as much material produced by construction activities as possible.
  - c) As part of the WSSP, Contractor to provide a post - construction record of diverted materials including volume in cubic meters or weight in Kg as appropriate.
  - d) Refer also to Section 01 74 19 Construction Waste and Disposal.
- .14 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.
- .15 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.
- .16 Waste Water Management Plan identifying methods and procedures for management and discharge of waste waters which are directly derived from construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water used in flushing of lines.

#### **1.4 FIRES**

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

#### **1.5 DRAINAGE**

- .1 Provide temporary drainage and pumping required to keep excavations and site free from water.
- .2 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.
- .3 Contractor shall install, monitor and maintain catch basin sediment traps in the catch basins indicated on the plan. Installation, maintenance and removal of the catch basin sediment trap is to be in accordance with the manufacturers specifications. Install sediment trap until unit is removed as part of excavation and service is abandoned. Records of inspection and maintenance to be completed by the Contractor.

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- .4 Sediment control structures to be installed in accordance with details on the Contract Drawing prior to commencement of construction activity.
  - .5 Pumped water discharged to municipal storm drain must meet max 50 NTU turbidity. Contractor may utilize methods/technologies as part of a stormwater rehabilitation unit (SWRU) including & in addition to those listed below:
    - .1 settling pond
    - .2 settling tankage
    - .3 filtration units
    - .4 flocculants (product must be in conformance with Ministry of Environment, federal fisheries and the requirements of municipal bylaws)
    - .5 centrifugal-action separator
    - .6 filter bags
    - .7 dewatering bags
    - .8 vector trucks (material removed from site must be disposed of in accordance with applicable regulations)
    - .9 bark mulch (hog fuel)
  - .6 Provide a water supply complete with approved reduced pressure backflow assembly (RPBA) to facilitate washing truck wheels to prevent the migration of silt onto adjacent streets. All wash activities are to be contained within the site.
  - .7 Contractor shall provide personnel as required to sample and test site runoff. Samples to be collected and submitted to an approved testing facility. Cost of collection and testing to be at Contractors expense.
  - .8 Contractor to cover erodible stockpiled material or exposed cut slopes with anchored polyethylene sheeting to prevent displacement by wind or rainwater runoff.
  - .9 Contractor is responsible to take measures onsite to minimize tracking of sediment onto existing roads and road cleaning as required or as recommended by the Departmental Representative.
  - .10 A supply of erosion and sediment control materials shall be kept on construction site at all times to provide for minor unexpected erosion or sediment control needs, routine control replacements, and/or sediments emergencies.
  - .11 Install sediment control structures at times and locations noted or as directed by Departmental Representative.
  - .12 Contractor shall ensure that all excavation and construction procedures are undertaken in such a manner as to prevent sediment-laden runoff from site entering the municipal storm drainage system.
  - .13 During periods of heavy rain, all works associated with large machine traffic (e.g. hauling) should be stopped to minimize tracking of debris offsite.
  - .14 During the construction period the erosion prevention and sediment control facilities shown on the Contract Drawings are the minimum requirements for anticipated site conditions. These structures shall be upgraded as needed for unexpected storm events or site conditions, and to ensure that sediment and sediment-laden water do not leave the site. Contractor to notify Departmental Representative of revisions to the approved plan.

- .15 All control measures are to be restored at the end of the day everyday, in the event of a rainfall while the site is not supervised.
- .16 Design Criteria:
  - .1 Water quality test parameters:
  - .2 Turbidity - 50 NTU (max)
  - .3 Oil and grease - 15.0 mg/l (max)
  - .4 Total phosphorus - 1.0 mg/l (max)
  - .5 75 mg/l - suspended solids
- .17 Reporting and documentation
  - .1 Contractor to provide water quality samples every 2 weeks for turbidity and total suspended solids at stormwater discharge points of active work areas.
  - .2 Additional samples to be taken after significant rainfall events with intensities greater than 30 mm in a 24 hour period.
  - .3 Contractor to provide monthly reports on sediment and erosion control measures including any modifications to structures, maintenance provided, observations, and performance information. The report is to include photographs of the facilities.

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

- .1 Protect trees and plants on site and adjacent properties by erecting snow fence around the drip zone.
- .2 Protect trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework.
- .3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage.
  - .1 Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.
- .5 Some existing trees are to be removed under the work of this contract.
- .6 Refer to Civil drawings for locations of trees designated for removal, instructions for documentation of trees removed, and estimates of number of trees to be removed.
- .7 Replacement trees to be planted at a ratio of 2 replacement trees for each tree removed.
  - .1 Trees will be a mix of Cedar, Spruce, Balsam and Poplar.
  - .2 Locations of replacement trees to be determined by the Departmental Representative.

## **1.7 POLLUTION CONTROL**

- .1 Maintain temporary erosion and pollution control features installed under this Contract.
- .2 Control emissions from equipment in accordance with local authorities' emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area.



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

## **1.8 NOTIFICATION**

- .1 Departmental Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Construction Activity Pollution Prevention Plan.
- .2 Contractor: after receipt of such notice, inform Departmental Representative of proposed corrective action and take such action.
  - .1 Take action only after receipt of written approval by Departmental Representative.
- .3 Departmental Representative may 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.

## **1.9 HISTORICAL/ARCHAEOLOGICAL CONTROLS**

- .1 Immediately cease work and report to Departmental Representative if any historical or archaeological items or midden containing soils are uncovered during works.
- .2 Midden containing material
  - .1 If encountered, Contractor is to take appropriate measures per this Section for excavation work if contaminated soil is encountered.
  - .2 Midden material removal/excavation to be performed as directed by the Departmental Representative.

## **Part 2 Products**

### **2.1 NOT USED**

- .1 Not Used.

## **Part 3 Execution**

### **3.1 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .4 Waste Management: separate waste materials for in accordance with Section 01 74 19 – Construction Waste and Disposal.

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

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES AND CODES**

- .1 Perform Work in accordance with National Building Code of Canada (NBC) 2015 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 Comply with applicable local bylaws rules and regulations enforced at the location concerned.
- .3 Provide inspection authorities having jurisdiction with plans and information required for issue of acceptance certificates
- .4 Pay fees and obtain certificates and permits required
- .5 Furnish inspection certificates in evidence that the work installed conforms to the requirements of the authority having jurisdiction
- .6 Conform to the Canada Labour Code II, Canada Occupational Safety and Health regulations.
- .7 FCC, Fire Commissioner of Canada.
  - .1 Standard No. 301, "Construction Operations" , June 1982.
- .8 WCB, Worker's Compensation Act, B.C.,Reg. 185/99
- .9 Meet or exceed requirements of:
  - .1 Contract documents.
  - .2 Specified standards, codes and referenced documents.

**1.2 BUILDING SMOKING ENVIRONMENT**

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

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

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**Part 1            General**

**1.1                INSPECTION**

- .1    Allow Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2    Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Departmental Representative or law of Place of Work.
- .3    If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

**1.2                PROCEDURES**

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

**1.3                REJECTED WORK**

- .1    Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2    Make good other Contractor's work damaged by such removals or replacements promptly.
- .3    If in opinion of Departmental Representative, it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents. Departmental Representative will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents.
- .4    In case of dispute, decisions as to standard or quality of work rests solely with the Departmental Representative.

**1.4                INDEPENDENT INSPECTION AGENCIES**

- .1    Independent Inspection/Testing Agencies are to be engaged by the contractor to inspect portions of the work, as indicated in individual specification sections.
- .2    Contractor is to allow for the costs of these inspections
- .3    Provide equipment required for executing inspection and testing by appointed agencies.

- .4 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.
- .5 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to Departmental Representative. Pay costs for retesting and reinspection.

**1.5 TESTS AND MIX DESIGNS**

- .1 Furnish test results and mix designs as requested.

**1.6 EQUIPMENT AND SYSTEMS**

- .1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.
- .2 Refer to individual specification sections for definitive requirements.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

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**Part 1            General**

**1.1                INSTALLATION AND REMOVAL**

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

**1.2                WATER SUPPLY**

- .1    Departmental Representative will provide continuous supply of potable water for construction use.
  - .1        Water to be provided from adjacent properties until new water service is completed.
- .2    Exercise conservation. Turn off water when not in use.
- .3    Provide all equipment and temporary hoses to bring water supply to site, at no additional cost to the contract.

**1.3                TEMPORARY POWER AND LIGHT**

- .1    Electrical power is available for construction purposes at no cost.
  - .1        Power will be provided from adjacent properties until power pole and temporary construction service is installed under the work of this contract.
- .2    Departmental Representative will determine delivery points and quantitative limits. Departmental Representative written permission is required before any connection is made. Connect to existing power supply in accordance with Canadian Electrical Code.
- .3    Provide all equipment and temporary lines to bring these services to the work, at no additional cost to the contract.
- .4    Exercise conservation whenever using temporary electrical power supply.

**1.4                TEMPORARY HEATING AND VENTILATION**

- .1    Provide temporary heating required during construction period, including attendance, maintenance and fuel.
- .2    Construction heaters used inside building must be vented to outside or be flameless type. Solid fuel salamanders are not permitted.
- .3    Provide temporary heat and ventilation in enclosed areas as required to:
  - .1        Facilitate progress of Work.
  - .2        Protect Work and products against dampness and cold.
  - .3        Prevent moisture condensation on surfaces.
  - .4        Provide ambient temperatures and humidity levels for storage, installation and curing of materials.

- .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .4 Maintain temperatures of minimum 10 degrees C in areas where construction is in progress.
- .5 Ventilating:
  - .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
  - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
  - .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
  - .4 Ventilate storage spaces containing hazardous or volatile materials.
  - .5 Ventilate temporary sanitary facilities.
  - .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .6 Permanent heating system of building, not to be used for construction heating.
- .7 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
  - .1 Conform with applicable codes and standards.
  - .2 Enforce safe practices.
  - .3 Prevent abuse of services.
  - .4 Prevent damage to finishes.
  - .5 Vent direct-fired combustion units to outside.
- .8 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

**1.5 FIRE PROTECTION**

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

**Part 2 Products**

- 2.1 NOT USED

**Part 3 EXECUTION**

- .1 NOT USED

**END OF SECTION**

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**Part 1            General**

**1.1                INSTALLATION AND REMOVAL**

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

**1.2                SCAFFOLDING**

- .1    Scaffolding in accordance with CAN/CSA-S269.2.
- .2    Provide and maintain scaffolding ladders and platforms necessary for the performance of the work.

**1.3                HOISTING**

- .1    Provide, operate and maintain hoists required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.
- .2    Hoists to be operated by B.C. certified personnel.

**1.4                SITE STORAGE/LOADING**

- .1    Confine work and operations of employees to areas as directed by Departmental Representative unless otherwise identified in 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.

**1.5                CONSTRUCTION PARKING**

- .1    Parking is permitted on site in areas directed by Departmental Representative.
- .2    Existing roads may be used for access to project site. Maintain construction parking area clean and free of construction-related debris, spillage and soiling.
- .3    Make good damage resulting from Contractor use of parking areas and roads, at no additional cost to the Contract.

**1.6                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 where directed by Departmental Representative.

**1.7                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.

**1.8 CONSTRUCTION SIGNAGE**

- .1 No project identification signage allowed
- .2 No other signs or advertisements, other than warning signs, are permitted on site.
- .3 Signs and notices for safety and instruction in both official languages. Graphic symbols to CAN/CSA-Z321.
- .4 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Departmental Representative.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 Not Used**

- .1 Not Used

**END OF SECTION**

**General**

**1.1 INSTALLATION AND REMOVAL**

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

**1.2 HOARDING and BARRIERS**

- .1 Provide minimum 1,828.8mm high construction fencing around perimeter of the area of work.

**1.3 ACCESS TO SITE**

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

**1.4 FIRE ROUTES**

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

**1.5 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY**

- .1 Protect surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred.
- .3 Be responsible for damage incurred due to lack of or improper protection.

**END OF SECTION**

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**Part 1            General**

**1.1                QUALITY**

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

**1.2                STORAGE, HANDLING AND PROTECTION**

- .1        Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2        Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.
- .3        Store products subject to damage from weather in weatherproof enclosures.
- .4        Store cementitious products clear of earth or concrete floors, and away from walls.
- .5        Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6        Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7        Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8        Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.

- .9 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

### **1.3 TRANSPORTATION**

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

### **1.4 MANUFACTURER'S INSTRUCTIONS**

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Notify Departmental Representative in writing, of conflicts between specifications and manufacturer's instructions. Departmental Representative will establish course of action.
- .3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

### **1.5 QUALITY OF WORK**

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed.
- .2 Do not employ anyone unskilled in their required duties.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative whose decision is final.

### **1.6 CO-ORDINATION**

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

### **1.7 CONCEALMENT**

- .1 In finished areas conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- .2 Before installation inform Departmental Representative if there is interference. Install as directed by Departmental Representative.

### **1.8 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.

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**1.9 LOCATION OF FIXTURES**

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

**1.10 FASTENINGS**

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

**1.11 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.

**1.12 PROTECTION OF WORK IN PROGRESS**

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

**1.13 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.
- .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.

**Part 2            Products**

**2.1                NOT USED**

.1                Not Used.

**Part 3            Execution**

**3.1                NOT USED**

.1                Not Used.

**END OF SECTION**

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**Part 1            General**

**1.1                PROJECT CLEANLINESS**

- .1    Maintain Work in tidy condition, free from accumulation of waste products and debris.
- .2    Maintain public areas adjacent to the worksite in a tidy condition.
- .3    Remove waste materials from site at daily and as directed by the Departmental Representative.
- .4    Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5    Provide and use marked separate bins for recycling. Refer to Section 01 74 19 – Construction Waste and Disposal.
- .6    Provide on-site dump containers for collection of waste materials and debris.
- .7    Dispose of waste materials and debris.
  - .1    Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.
  - .2    Send hazardous wastes to authorized hazardous waste disposal or treatment facilities.
  - .3    Remove hazardous materials away from public areas as they are exposed.
- .8    Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.
- .9    Clean interior areas prior to start of finishing work. Maintain areas free of dust and other contaminants during finishing operations.

**1.2                FINAL CLEANING**

- .1    When all of the Work has been 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. 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.
- .5    Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .6    Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .7    Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .8    Remove dirt and other disfiguration from exterior surfaces.

- .9 Clean and sweep roofs, gutters, areaways, and sunken wells.
- .10 Sweep and wash clean paved areas.
- .11 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.
- .12 Clean roofs, downspouts, and drainage systems.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**



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**Part 1            General**

**1.1                DEFINITIONS**

- .1        Waste Source Separation Program (WSSP): implementation and co-ordination of ongoing activities to ensure designated waste materials will be sorted into pre-defined categories and sent for recycling and reuse, maximizing diversion and potential to reduce disposal costs.
- .2        Separate Condition: refers to waste sorted into individual types.
- .3        Source Separation: act of keeping different types of waste materials separate beginning from the point they became waste.
- .4        Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials generated by project. Specifies diversion goals, implementation and reporting procedures, anticipated results and responsibilities.

**1.2                DOCUMENTS**

- .1        Post and maintain in visible and accessible area at job site, one copy of following documents:
  - .1        Waste Reduction Workplan.
  - .2        Waste Source Separation Plan.

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Prepare and submit following prior to project start-up:
  - .1        Completed Waste Reduction Workplan (WRW).
  - .2        Completed Waste Source Separation Program (WSSP) description.
- .3        Prepare and submit at intervals agreed to by Departmental Representative the following:
  - .1        Bills of lading and destination receipts for all waste removed from the site.

**1.4                WASTE REDUCTION WORKPLAN (WRW)**

- .1        Prepare and submit WRW prior to project start-up.
- .2        WRW identifies strategies to optimize diversion through reduction, reuse, and recycling of materials and comply with applicable regulations, based on information acquired from WA.
- .3        Recycling capacity in New Aiyansh is limited. The nearest municipal landfill and recycling depot is located in Terrace B.C. approximately 80km away. Contractor is to strive to recycle as many materials as possible.

- .4 The target for waste diversion is 100% diversion of cardboard, plastic packaging, steel and non-ferrous metals, and uncontaminated wood. The Contractor shall provide a postconstruction record of diverted materials including approximate quantities (volume in m<sup>3</sup> or weight in Kg, as appropriate)
  - .1 Destination of materials identified.
  - .2 Deconstruction/disassembly techniques and sequencing where required.
  - .3 Schedule for deconstruction/disassembly where required.
  - .4 Details on materials handling and removal procedures.
  - .5 Quantities of materials to be salvaged for reuse or recycled and materials sent to landfill.
  - .6 Names and addresses of proposed recycling and landfill sites
- .5 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.
- .6 Set realistic goals for waste reduction, recognize existing barriers and develop strategies to overcome these barriers.
- .7 Post WRW or summary where workers at site are able to review content.
- .8 Monitor and report on waste reduction by documenting total volume (in tonnes) and cost of actual waste removed from project.
- .9 Outline procedures to be put in place to handle, store and dispose of identified hazardous wastes.

#### **1.5 WASTE SOURCE SEPARATION PROGRAM (WSSP)**

- .1 As part of Waste Reduction Workplan, prepare WSSP prior to project start-up.
- .2 WSSP will detail methodology and planned on-site activities for separation of reusable and recyclable materials from waste intended for landfill. Contractor to provide list indicating material types to be diverted from landfill. This list to contain, but is not limited to, the following: metals, glass, concrete, clean untreated wood, plastics, paper.
- .3 Provide sufficient on-site facilities and containers for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
- .4 Provide containers for the deposit of
  - .1 Reuseable and recycleable materials
  - .2 Materials to be sent to landfill
- .5 Collect handle and store on-site and transport off-site recycleable materials in separated condition.
- .6 Locate separated materials in areas which minimizes material damage and with the least interference with day to day activities. Location to be approved by Departmental Representative
- .7 Clearly and securely label containers to identify types/conditions of materials accepted.
- .8 On-site sale of salvaged materials is not permitted.

**1.6 USE OF SITE AND FACILITIES**

- .1 Execute Work with minimal interference and disturbance to normal use of adjacent facility.

**1.7 DISPOSAL OF WASTES**

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of waste into waterways, storm, or sanitary sewers.
- .3 Remove materials on-site as Work progresses.
- .4 Transportation and disposal of hazardous waste must be in accordance with applicable legislation.
- .5 The Contractor shall provide a postconstruction record of diverted materials including approximate quantities (volume in m3 or weight in Kg, as appropriate).

**1.8 HAZARDOUS AND TOXIC WASTES**

- .1 If suspected unidentified Hazardous Materials are discovered, stop work in the area immediately and inform the Departmental Representative.

**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 ADMINISTRATIVE REQUIREMENTS**

- .1 Acceptance of Work Procedures:
  - .1 Contractor's Inspection: Contractor and all subcontractors to conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
    - .1 Notify Departmental Representative in writing of satisfactory completion of inspection and submit verification that corrections have been made.
    - .2 Request Departmental Representative's inspection.
  - .2 Departmental Representative's Inspection:
    - .1 Departmental Representative and Contractor to inspect Work and identify defects and deficiencies.
    - .2 Contractor to correct Work as directed.
  - .3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:
    - .1 Work: completed and inspected for compliance with Contract Documents.
    - .2 Defects: corrected and deficiencies completed.
    - .3 Certificates required by authorities having jurisdiction have been submitted.
    - .4 Operation of systems have been demonstrated to the Departmental Representative and designated airport staff.
    - .5 Work is complete and ready for final inspection.
  - .4 Declaration of Substantial Performance: When Departmental Representative considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.
  - .5 Commencement of warranty period: Date of Departmental Representatives acceptance of substantial performance to be the date for commencement for warranty period.
  - .6 Payment of Holdback: after issuance of Substantial Performance of work, submit application for payment of holdback amount in accordance with contractual agreement.
  - .7 Final Inspection:
    - .1 When completion tasks are done, request final inspection of Work by Departmental Representative.
    - .2 If work is deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection.

- .8 Final Payment
  - .1 When Departmental Representative considers final deficiencies and defects corrected and requirements of contract met, make application for final payment.
  - .2 When work deemed incomplete by Departmental Representative complete outstanding items and request re-inspection.

**1.2 FINAL CLEANING**

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

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

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**Part 1            General**

**1.1                SECTION INCLUDES**

- .1    Closeout submittals
- .2    Operation and maintenance manual format.
- .3    Contents each volume.
- .4    Recording actual site conditions.
- .5    Record (as-built) documents and samples.
- .6    Record documents.
- .7    Final survey.
- .8    Warranties and bonds.

**1.2                RELATED SECTIONS**

- .1    Section 01 33 00 - Submittal Procedures.

**1.3                CLOSEOUT SUBMITTALS**

- .1    Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .2    Copy will be returned with Departmental Representative's comments.
- .3    Revise content of documents as required prior to final submittal.
- .4    Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, one final copy of operating and maintenance manuals in Canadian English.
  - .1    One copy of the manual to be provided in digital form on a USB drive, in Canadian English.
- .5    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.
- .6    If requested, furnish evidence as to type, source and quality of products provided.
- .7    Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .8    Pay costs of transportation.

**1.4                OPERATION AND MAINTENANCE MANUAL FORMAT**

- .1    Organize data in the form of an instructional manual.
- .2    Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3    When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.

- .4 Cover: Identify each binder with type or printed title "MAINTENANCE MANUAL"; list title of project and identify subject matter of contents.
- .5 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: Manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .9 Provide both .PDF electronic copy and hard copy submissions
- .10 Coordinate with commissioning specification to include all related close out documentation, warranty and test reports.

### **1.5 CONTENTS - EACH VOLUME**

- .1 Table of Contents: provide title of project;
  - .1 date of submission;
  - .2 names, addresses, and telephone numbers of Contractor and Subcontractors with name of responsible parties; and
  - .3 schedule of products and systems, indexed to content of volume.
- .2 For each product or system, list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
- .4 Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

### **1.6 RECORDING ACTUAL SITE CONDITIONS**

- .1 Record information on set of black line opaque drawings, and within the Project Manual, provided by Departmental Representative.
- .2 Annotate with coloured felt tip marking pens, maintaining separate colours for each major system, for recording changed information.
- .3 Record information concurrently with construction progress. Do not conceal Work of the Project until required information is accurately recorded.
- .4 Contract drawings and shop drawings: legibly 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: legibly 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 inspection certifications, field test records, required by individual specifications sections.

## **1.7 RECORD DOCUMENTS AND SAMPLES**

- .1 In addition to requirements in General Conditions, maintain at the site for Departmental Representative, one record copy of:
  - .1 Contract Drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Change Orders and other modifications to the Contract.
  - .5 Reviewed shop drawings, product data, and samples.
  - .6 Field test records.
  - .7 Inspection certificates.
  - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with section number listings in List of Contents of the Project Manual. Label each document "RECORD DOCUMENTS" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative's.

**END OF SECTION**



**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Not used

**1.2 REFERENCES**

- .1 CSA International
  - .1 CSA S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.
- .2 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.
  - .2 Canadian Environmental Protection Act (CEPA), 1993, C.33.

**1.3 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.

**1.4 SITE CONDITIONS**

- .1 This specification refers only to civil-related demolition works outside the building envelope.
- .2 Take precautions to protect environment and undertake works in conformance with Contract Documents for siltation control and pollution prevention.
- .3 Although there is no reason to suspect that designated substances will be encountered during excavation, if any material should be encountered that, in the Contractor's opinion, appears to be a designated substance, for example hydrocarbons or asbestos, then stop work, take preventative measures, and notify Departmental Representative immediately.
  - .1 Proceed only after receipt of written instructions have been received from Departmental Representative.
- .4 Notify Departmental Representative before disrupting building access or services.

**1.5 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 and at no cost.
  - .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.

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**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.

**Part 3 Execution**

**3.1 EXAMINATION**

- .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.

**3.2 PREPARATION**

- .1 Locate and protect utilities. Preserve active utilities traversing site in operating condition.
- .2 Temporary Erosion and Sedimentation Control:
  - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to: requirements of authorities having jurisdiction.
  - .2 Inspect, repair, and maintain erosion and sedimentation control measures during demolition.
  - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal after completion of demolition work.
- .3 Protection of In-Place Conditions:
  - .1 Prevent movement, settlement, or damage to adjacent structures, utilities, and landscaping features and parts of building to remain in place. Provide bracing and shoring required.
  - .2 Keep noise, dust, and inconvenience to occupants to minimum.
  - .3 Protect building systems, services and equipment.
  - .4 Provide temporary dust screens, covers, railings, supports and other protection as required.
  - .5 Do Work in accordance with Section 01 35 30 - Health and Safety Requirements.

**3.3 REMOVAL OF HAZARDOUS WASTES**

- .4 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.

**3.4 DEMOLITION/REMOVAL:**

- .1 Remove items as indicated.
- .2 Disconnect, cap, plug or divert, as required, existing utilities within the property where they interfere with the execution of the work, in conformity with the requirements of the authorities having jurisdiction. Mark the location of these and previously capped or

plugged services on the site and indicate location (horizontal and vertical) on the record drawings. Support, shore up and maintain pipes and conduits encountered.

- .1 Coordinate any service disruptions with Departmental Representative for hours of work, duration of shutdown, and emergency procedures in case of prolonged outage.
  - .2 Immediately notify Departmental Representative and utility company concerned in case of damage to any utility or service, designated to remain in place.
  - .3 Immediately notify the Departmental Representative should uncharted utility or service be encountered and await instruction in writing regarding remedial action.
- .3 Excavate at least 200mm below pipe invert, when removing pipes under existing or future pavement area.
  - .4 Removal of Pavements, Concrete Slabs, 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 Use cold milling, planning or grinding equipment with automatic grade controls capable of operating from stringline, and capable of removing part of pavement surface to depths or grades indicated.
  - .5 Expose, cut, remove, and dispose of any asbestos cement pipe in accordance with all applicable WorkSafeBC guidelines and regulations.

### **3.5 STOCKPILING**

- .1 Proper stockpiling will help maintain the value of salvaged materials.
- .2 Label stockpiles, indicating material type and quantity.
- .3 Designate appropriate security resources/measures to prevent vandalism, damage and theft.
- .4 Locate stockpiled materials convenient for use in new construction to eliminate double handling wherever possible.
- .5 Stockpile in locations as directed by Departmental Representative.
  - .1 Stockpile height not to exceed 2 m and should be protected from erosion.
- .6 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.

### **3.6 RESTORATION AND CLEANING**

- .1 Restore areas and existing works outside areas of demolition to match condition of adjacent, undisturbed areas or to conditions that existed prior to beginning of Work.
- .2 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
- .3 .1 Leave Work areas clean at end of each day.
- .4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .5 Refer to demolition drawings and specifications for items to be salvaged for reuse.

- .6 Waste Management: separate waste materials for reuse recycling in accordance with Section 01 74 19 - Construction Waste 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        Section 03 20 00 – Concrete Reinforcing
- .2        Section 03 30 00 – Cast-in-Place Concrete

**1.2                REFERENCE STANDARDS**

- .1        Editions of all Referenced Standards to be the ones designated by the applicable Building Code in force at the time of building permit application, as indicated on Structural Drawings. For Standards not referenced by the Building Code, use the latest editions.
- .2        CSA Group (CSA)
  - .1        CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2        CAN/CSA O86, Engineering Design in Wood.
  - .3        CSA O121, Douglas Fir Plywood.
  - .4        CSA O141, Softwood Lumber.
  - .5        CSA O151, Canadian Softwood Plywood.
  - .6        CSA O153, Poplar Plywood.
  - .7        CAN/CSA O325.0, Construction Sheathing.
  - .8        CSA S269.1, Falsework and Formwork.
- .3        Underwriters' Laboratories of Canada (ULC)
  - .1        CAN/ULC-S701, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

**1.3                ADMINISTRATIVE REQUIREMENTS**

- .1        Pre-installation Meetings: convene pre-installation meeting two weeks prior to beginning concrete works. Ensure key personnel attend.

**1.4                ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Product Data:
  - .1        Submit manufacturer's instructions, printed product literature and data sheets for proprietary materials used in formwork and coatings and include product characteristics, performance criteria, physical size, finish, and limitations.
  - .2        Submit digital copies of WHMIS SDS in accordance with Section 01 35 43 - Environmental Procedures and 01 35 30 - Health and Safety Requirements.
- .3        Submit shop drawings for formwork.
  - .1        Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia.

- .2 Prepare Shop Drawings in accordance with CSA S269.1 for formwork.
  - .3 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.
  - .4 Indicate sequence of erection and removal of formwork.
  - .5 Indicate method and schedule of construction, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts.
  - .6 Indicate sequence of erection and removal of formwork.
- .4 Sustainable Design Submittals:
- .1 Construction Waste Management:
    - .1 Submit project Waste Management Plan and Waste Reduction Workplan highlighting recycling and salvage requirements Section 01 74 19 – Construction Waste and Disposal.
  - .2 Low-Emitting Materials:
    - .1 Submit listing of release agents used in building, comply with VOC and chemical component limits or restriction requirements.

## **1.5 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Concrete supplier to be certified by the BC ready mixed concrete association.
- .3 Provide written report to Departmental Representative verifying compliance concrete in place meets performance requirements.
- .4 Retain a professional engineer registered or licensed in British Columbia, with experience in formwork design of comparable complexity and scope, to perform following services as part of Work of this Section:
  - .1 Design of formwork.
  - .2 Review, stamp, and sign fabrication and erection Shop Drawings, design calculations and amendments.
  - .3 Conduct on-site inspections and prepare and submit inspection reports verifying this part of Work is in accordance with Contract Documents and reviewed Shop Drawings.

## **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 and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect formwork from damage.
  - .3 Replace defective or damaged materials with new.

- .4 Develop Waste Reduction Workplan and Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse by manufacturer of pallets, crates, padding, packaging materials as specified in Waste Reduction Workplan and Construction Waste Management Plan in accordance with Section 01 74 19 – Construction Waste and Disposal.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Formwork materials:
  - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA O121, CSA O141, CSA O151, and CSA O153.
  - .2 For concrete with special architectural features, use formwork materials to CSA A23.1/A23.2.
  - .3 Rigid insulation board: to CAN/ULC-S701.
- .2 Tubular column forms: round, spirally wound, polyethylene impregnated virgin kraft interior layer and a waxed exterior, internally treated with release material.
  - .1 Spiral pattern not to show in hardened concrete.
- .3 Form ties:
  - .1 For concrete not designated 'Architectural': removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes minimum 25 mm diameter in concrete surface.
  - .2 For Architectural concrete; snap ties complete with plastic cones and light grey concrete plugs.
- .4 Form liner:
  - .1 Plywood: medium density overlay Douglas Fir plywood to CSA O121, or other special materials to achieve the required concrete finish.
- .5 Form release agent: Proprietary, non-volatile material not to stain concrete or impair subsequent application of finishes or coatings to surface of concrete, derived from agricultural sources, non petroleum containing, non-toxic, low VOC, and biodegradable.
- .6 Sealant: to Section 07 92 00 - Joint Sealants.

## **Part 3 Execution**

### **3.1 FABRICATION AND ERECTION**

- .1 Verify lines, levels, and centres before proceeding with formwork and ensure dimensions agree with drawings.
- .2 Obtain Departmental Representative's approval for use of earth forms framing openings not indicated on drawings.

- .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .4 Refer to architectural drawings for concrete members requiring architectural exposed finishes.
- .5 Fabricate and erect formwork in accordance with CAN/CSA S269.1 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA A23.1/A23.2.
- .6 Align form joints and make watertight.
  - .1 Keep form joints to minimum.
- .7 Use 25mm chamfer strips on external corners and 25mm fillets at interior corners, joints, unless specified otherwise.
- .8 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .9 Construct forms for architectural concrete, and place ties as directed.
  - .1 Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
- .10 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.
  - .1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .11 Clean formwork in accordance with CSA A23.1/A23.2, before placing concrete.
- .12 Obtain Departmental Representative's approval for formed openings, slots and chases not indicated on Structural Drawings.
- .13 Do not close wall forms before reinforcing steel has been reviewed by Departmental Representative.
- .14 Provide lateral bracing as required to keep walls stable after formwork removal.

### **3.2 CONCRETE EXPOSED TO VIEW**

- .1 Minimize formwork joints. Locate joints and ties in a uniform pattern with no ties within 300mm of an edge or joint.
- .2 Make panels forming wall faces as large as possible, and arrange symmetrically.
- .3 Seal all joints in formwork and between formwork and concrete.
- .4 Place chamfers at member corners unless architectural details show an alternative profile.
- .5 Do not reuse formwork if there is any evidence of surface damage or wear, which could impair the visual quality of the concrete surface.
- .6 Reuse forms only on identical sections, using the original tie holes. Clean forms and fill nail holes before reuse.
- .7 Use only galvanized nails.
- .8 Where removable tie rods are used for form ties, remove tie cones and plug holes with precast concrete plugs bonded to concrete using a pre-approved adhesive.



**3.3 FORMWORK REMOVAL**

- .1 Leave formwork in place for following minimum periods of time after placing concrete.
  - .1 3 days for walls.
  - .2 2 days for footings and foundation piers.
- .2 For walls, remove formwork when concrete has reached 60% of its 28-day design strength or minimum period noted above, whichever comes later.
- .3 Re-use formwork subject to requirements of CSA A23.1/A23.2.

**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 19 – Construction Waste 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      Section 03 10 00 – Concrete Forming and Accessories
- .2      Section 03 30 00 – Cast-in-Place Concrete

**1.2            REFERENCE STANDARDS**

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

**1.3            ADMINISTRATIVE REQUIREMENTS**

- .1      Pre-installation Meetings: convene pre-installation meeting two weeks prior to beginning concrete works. Ensure key personnel attend.

**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 proprietary materials used in concrete reinforcing and include product characteristics, performance criteria, physical size, finish, and limitations.
  - .2      Submit digital copies of WHMIS Safety Data Sheet (SDS) in accordance with Section 01 35 43 - Environmental Procedures and Section 01 35 30 - Health and Safety Requirements.

- .3 Shop Drawings:
  - .1 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice.
  - .2 Indicate placing of reinforcement and:
    - .1 Bar bending details.
    - .2 Lists.
    - .3 Quantities of reinforcement.
    - .4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings.
      - .1 Indicate sizes, spacings and locations of chairs, spacers and hangers.
    - .5 Detail lap lengths and bar development lengths to CAN/CSA A23.3, unless otherwise indicated.
      - .1 Provide type B, unless otherwise indicated.
    - .6 Indicate position and size of openings in walls. Coordinate with trades requiring openings.
- .4 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Reduction Workplan and Waste Management Plan highlighting recycling and salvage requirements.
- .5 Quality Assurance Submittals:
  - .1 Submit in accordance with Section 01 45 00 - Quality Control and as described in PART 2 - SOURCE QUALITY CONTROL.
  - .2 Mill Test Report: upon request, submit to Departmental Representative certified copy of mill test report of reinforcing steel, minimum 4 weeks prior to beginning reinforcing work.
  - .3 Upon request submit in writing to Departmental Representative proposed source of reinforcement material.
- .6 Quality Assurance
  - .1 Welding of reinforcing steel to be performed by welders certified under CSA W186.

## **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 off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

- .2 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan and Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 74 19 – Construction Waste and Disposal.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Substitute different size bars only if permitted in writing by Departmental Representative.
- .2 Reinforcing steel: billet steel, grade 400, deformed bars to CSA G30.18, unless indicated otherwise.
- .3 Weldable Reinforcing steel: weldable low alloy steel deformed bars to CSA G30.18.
- .4 Cold-drawn annealed steel wire ties: to ASTM A1064/A1064M.
- .5 Deformed steel wire for concrete reinforcement: to ASTM A1064/A1064M.
- .6 Chairs, bolsters, bar supports, spacers: to CSA A23.1/A23.2.
- .7 Tie wire: 1.5 mm diameter annealed wire.
- .8 Where rebar dowel anchors (RDA) are noted on drawings, provide adhesive anchoring system. Approved RDA are as follows:
  - .1 Hilti HIT-HY200,
  - .2 Simpson Strong-Tie Set-XP,
  - .3 Red Head A7+, or
  - .4 Approved equivalent.
- .9 For rebar dowel anchors (RDA) see drawings for embedment lengths.
- .10 Mechanical splices: subject to approval of Departmental Representative.
- .11 Plain round bars: to CSA G40.20/G40.21.

### **2.2 FABRICATION**

- .1 Fabricate reinforcing steel in accordance with CSA A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Obtain Departmental Representative's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Departmental Representative, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.
- .5 Provide standard hooks at ends of all hooked bars.
- .6 Substitute different size bars only if permitted in writing by Departmental Representative.

### **2.3 SOURCE QUALITY CONTROL**

- .1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.
- .2 Upon request, inform Departmental Representative of proposed source of supplied material.

### **Part 3 Execution**

#### **3.1 FIELD BENDING**

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Departmental Representative.
- .2 When field bending authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars, which develop cracks or splits.

#### **3.2 PLACING REINFORCEMENT**

- .1 Cutting or puncturing vapour retarder is not permitted; repair damage and reseal vapour retarder before placing concrete.
- .2 Place reinforcing steel as indicated on placing drawings and in accordance with CSA A23.1/A23.2.
- .3 Use plain round bars as slip dowels in concrete.
  - .1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.
  - .2 Apply thick even film of mineral lubricating grease when paint is dry.
- .4 Prior to placing concrete, obtain Departmental Representative's written approval of reinforcing material and placement.
- .5 Maintain cover to reinforcement during concrete pour.
- .6 Remove all loose scale, dirt, oil or other coatings which would reduce bond.
- .7 Do not cut reinforcement without Departmental Representative's written approval.

#### **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 19 – Construction Waste 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     Section 03 10 00 – Concrete Forming and Accessories
- .2     Section 03 30 00 – Concrete Reinforcing

**1.2                REFERENCE STANDARDS**

- .1     Editions of all Referenced Standards to be the ones designated by the applicable Building Code in force at the time of building permit application, as indicated on Structural Drawings. For Standards not referenced by the Building Code, use the latest editions.
- .2     ASTM International (ASTM)
  - .1     ASTM C260/C260M, Standard Specification for Air-Entraining Admixtures for Concrete.
  - .2     ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - .3     ASTM C494/C494M, Standard Specification for Chemical Admixtures for Concrete.
  - .4     ASTM C920 Standard Specification for Elastomeric Joint Sealants.
  - .5     ASTM C1017/C1017M, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
  - .6     ASTM D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
  - .7     ASTM D624, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
  - .8     ASTM D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
  - .9     ASTM D1752, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .3     Canadian General Standards Board (CGSB)
  - .1     CAN/CGSB-51.34, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .4     CSA Group (CSA)
  - .1     CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2     CSA A283, Qualification Code for Concrete Testing Laboratories.
  - .3     CSA A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005),

### **1.3 ABBREVIATIONS AND ACRONYMS**

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

### **1.4 ADMINISTRATIVE REQUIREMENTS**

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

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

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for proprietary materials used in Cast-In-Place Concrete and additives and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit digital copies of WHMIS SDS in accordance with Section 01 35 30 - Health and Safety Requirements and Section 01 35 43 - Environmental Procedures.
- .3 Site Quality Control Submittals:
  - .1 Provide testing reports for review by Departmental Representative and do not proceed without written approval when deviations from mix design or parameters found.
  - .2 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.

- .3 Concrete hauling time: provide for review by Departmental Representative deviations exceeding maximum allowable time of 120 minutes for concrete delivered to site of Work and discharged after batching.
- .4 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Management Plan and Waste Reduction Workplan highlighting recycling and salvage requirements.

## **1.6 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Provide Departmental Representative, minimum 4 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.
  - .1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture meet specified requirements.
- .3 At least 4 weeks prior to beginning Work, inform Departmental Representative of source of fly ash.
  - .1 Changing source of fly ash without written approval of Departmental Representative is prohibited.
- .4 Minimum 4 weeks prior to starting concrete work, provide proposed quality control procedures for review by Departmental Representative on following items:
  - .1 Hot weather concrete.
  - .2 Cold weather concrete.
  - .3 Curing.
  - .4 Finishes.
  - .5 Formwork removal.
  - .6 Joints.
- .5 Quality Control Plan: provide written report to Departmental Representative verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

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

- .1 Delivery and Acceptance Requirements:
  - .1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.
  - .2 Modifying maximum time limit without receipt of prior written agreement from Departmental Representative and concrete producer as described in CSA A23.1/A23.2. is prohibited.
  - .3 Deviations submitted for review by Departmental Representative.
  - .4 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.



- .2 Packaging Waste Management: remove for reuse of padding, pallets, crates, packaging materials in accordance with Section 01 74 19 – Construction Waste and Disposal.

## **1.8 SITE CONDITIONS**

- .1 Placing concrete during rain or weather events that could damage concrete is prohibited.
- .2 Protect newly placed concrete from rain or weather events in accordance with CSA A23.1/A23.2.
- .3 Cold weather protection:
  - .1 Protect concrete from freezing. Do not place concrete against frozen ground. Use cold weather concreting methods in accordance with CSA-A23.1.
  - .2 Maintain protection equipment, in readiness on Site.
  - .3 Use such equipment when ambient temperature below 5°C, or when temperature may fall below 5°C before concrete cured.
  - .4 Placing concrete upon or against surface at temperature below 5°C is prohibited.
- .4 Hot weather protection:
  - .1 Protect concrete from excessive heat and drying. Use hot weather concreting methods in accordance with CSA-A23.1.
  - .2 Protect concrete from direct sunlight when ambient temperature above 27°C.
  - .3 Prevent forms of getting too hot before concrete placed. Apply accepted methods of cooling not to affect concrete adversely.
- .5 Protect from drying.

## **Part 2 Products**

### **2.1 DESIGN CRITERIA**

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

### **2.2 PERFORMANCE CRITERIA**

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

### **2.3 MATERIALS**

- .1 Portland Cement: Type GU to CSA A3001.
- .2 Blended hydraulic cement: Type GUb to CSA A3001.
- .3 Portland-limestone cement: Type GUL to CSA A23.1.
- .4 Concrete to be normal density (min. 2300 kg/m<sup>3</sup>) unless noted otherwise.
- .5 Supplementary cementing materials: with maximum 20% fly ash replacement, by mass of total cementitious materials to CSA A3001
- .6 Water: to CSA A23.1.
- .7 Aggregates: to CSA A23.1/A23.2.

- .8 Admixtures:
  - .1 Air entraining admixture: to ASTM C260.
  - .2 Chemical admixture: to ASTM C1017 and ASTM C494. Departmental Representative to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .9 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.
  - .1 Compressive strength: 50 MPa at 28 days.
- .10 Non premixed dry pack grout: composition of non metallic aggregate Portland cement with sufficient water for mixture to retain its shape when made into ball by hand and capable of developing compressive strength of 50 MPa at 28 days.
- .11 Curing compound: to CSA A23.1/A23.2 and ASTM C309, Type 1-chlorinated rubber.
- .12 Mechanical waterstops: ribbed extruded PVC of sizes indicated with shop welded corner and intersecting pieces with legs minimum 600 mm long:
  - .1 Tensile strength: to ASTM D412, method [A], Die "C", minimum 48 MPa.
  - .2 Elongation: to ASTM D412, method [A], Die "C", minimum 275%.
  - .3 Tear resistance: to ASTM D624, method [A], Die "B", minimum 30 kN/m.
- .13 Premoulded joint fillers:
  - .1 Bituminous impregnated fibre board: to ASTM D1751.
  - .2 Sponge rubber: to ASTM D1752, Type I, flexible grade.
- .14 Epoxy joint fillers:
  - .1 Semi-rigid, two-component, epoxy polyurethane, 100% solids content, Shore A Hardness.
- .15 Weep hole tubes: plastic.
- .16 Dampproofing:
  - .1 In accordance with Section 07 11 13 - Bituminous Dampproofing.
- .17 Dampproof membrane:
  - .1 Polyethylene film: 0.25 mm thickness to CAN/CGSB-51.34 and in accordance with Section 07 28 00 Air and Vapour Barriers.
- .18 Plastic T crack control joint: 38 mm deep strip with removable cap.
- .19 Where rebar dowel anchors (RDA) are noted on drawings, provide adhesive anchoring system. Approved RDA are as follows:
  - .1 Hilti HIT-HY200,
  - .2 Simpson Strong-Tie Set-XP,
  - .3 Red Head A7+, or
  - .4 Approved equivalent.
- .20 For rebar dowel anchors (RDA) see drawings for embedment lengths.

- .21 Where adhesive concrete anchors (ACA) are noted on drawings, provide adhesive anchoring system. Approved ACA are as follows:
  - .1 Hilti HIT-HY200 with Hilti HAS threaded rod,
  - .2 Simpson Strong-Tie Set-XP with ASTM F1554 grade 36 threaded rod,
  - .3 Red Head A7+ with ASTM F1554 grade 36 threaded rod, or
  - .4 Approved equivalent.
- .22 For adhesive concrete anchors (ACA) approximate minimum embedment lengths are noted below. Actual embedment lengths to be in accordance with manufacturer product data.
  - .1 12mm (1/2") diameter – 114mm (4-1/2") embedment
  - .2 16mm (5/8") diameter – 143mm (5-5/8") embedment
  - .3 19mm (3/4") diameter – 171mm (6-3/4") embedment
- .23 Where drilled concrete anchors (DCA) are noted on drawings, provide expansion anchors. Approved DCA are as follows:
  - .1 Hilti Kwik Bolt 3,
  - .2 Simpson Strong-Tie Wedge-all,
  - .3 Red Head Trubolt, or
  - .4 Approved equivalent.
- .24 For drilled concrete anchors (DCA) approximate minimum embedment lengths are noted below. Actual embedment lengths to be in accordance with manufacturer product data.
  - .1 12mm (1/2") diameter – 89mm (3-1/2") embedment
  - .2 16mm (5/8") diameter – 102mm (4") embedment
  - .3 19mm (3/4") diameter – 121mm (4-3/4") embedment
- .25 Anchors located outside the building envelope's vapour barrier to be hot dip galvanized or stainless steel.
- .26 Concrete to be minimum 28 days old at the time of anchor installation.
- .27 Use drilling and installation tools and procedures per manufacturers' recommendations.
- .28 Do not cut reinforcement to accommodate drilled anchors and dowels.
- .29 When obstructions prevent drilling holes in specified locations to the required depth, relocate at no extra cost to the contract. Obtain departmental representative approval of new locations before drilling holes. Fill all abandoned holes with min. 30mpa grout. Do not tighten anchors until grout in adjacent abandoned holes reaches 75% fc'.

## 2.4 MIXES

- .1 Alternative 1 - Performance Method for specifying concrete: to meet Departmental Representative performance criteria to CSA A23.1/A23.2.
  - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.
  - .2 Provide concrete mix to meet following plastic state requirements:
    - .1 Uniformity: uniform density, air content, and slump.

- .2 Workability: free of loss of mortar, colour variations, surface blemishes, and segregation.
- .3 Finishability: to CSA A23.1/A23.2.
- .3 Provide concrete mix to meet following hard state requirements:
  - .1 Mix: Type 1
    - .1 Durability and class of exposure: N.
    - .2 Compressive strength at 28-day age: 25 MPa minimum.
    - .3 Intended application: Interior applications, basement slab on grade.
    - .4 Aggregate size: 20mm maximum
  - .2 Mix: Type 2
    - .1 Durability and class of exposure: F-2.
    - .2 Compressive strength at 28-day age: 25 MPa minimum.
    - .3 Intended application: Footings, basement walls, and foundation walls and piers.
    - .4 Aggregate size: 20mm maximum
  - .3 Mix: Type 3
    - .1 Durability and class of exposure: C-2.
    - .2 Compressive strength at 28-day age: 32 MPa minimum.
    - .3 Intended application: Garage slab on grade, exterior slabs on grade, ramps, and stairs.
    - .4 Aggregate size: 20mm maximum
  - .4 Mix: Type 4
    - .1 Durability and class of exposure: N.
    - .2 Compressive strength at 28-day age: 10 MPa minimum.
    - .3 Intended application: Lean concrete, mudslabs.
    - .4 Aggregate size: 10mm maximum
- .4 Do not use admixtures containing chlorides.

### **Part 3 Execution**

#### **3.1 PREPARATION**

- .1 Obtain Departmental Representative's written approval before placing concrete.
  - .1 Provide 12 business days minimum notice prior to placing of concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.

- .3 During concreting operations:
  - .1 Development of cold joints not allowed.
  - .2 Ensure concrete delivery and handling facilitate placing with minimum of re-handling, and without damage to existing structure or Work.
  - .3 Convey concrete from truck to final location by methods which will prevent separation or loss of material. Maximum free fall not to exceed 1.5m. Consolidate concrete using mechanical vibrators.
  - .4 Do not add water to concrete on site.
- .4 Pumping of concrete permitted only after approval of equipment and mix.
- .5 Disturbing reinforcement and inserts during concrete placement is prohibited.
- .6 Prior to placing of concrete obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .7 Protect previous Work from staining.
- .8 Clean and remove stains prior to application for concrete finishes.
- .9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, workability, air content, temperature and test samples taken.
- .10 Do not place load upon new concrete until authorized by Departmental Representative.

### 3.2 **INSTALLATION/APPLICATION**

- .1 Do cast-in-place concrete work to CSA A23.1/A23.2.
- .2 Sleeves and inserts:
  - .1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through concrete members, except where indicated or approved by Departmental Representative.
  - .2 Where approved by Departmental Representative, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.
  - .3 Sleeves and openings greater than 100 x 100 mm not indicated reviewed by Departmental Representative.
  - .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain written approval of modifications from Departmental Representative before placing of concrete.
  - .5 Confirm locations and sizes of sleeves and openings shown on drawings.
  - .6 For slabs-on-grade, locate all conduits, pipes, or heating cables embedded in concrete clear of the top one third of the slab thickness to avoid damage during sawcutting.
- .3 Anchor bolts and rebar dowels:
  - .1 Set anchor bolts to templates in coordination with appropriate trade prior to placing concrete.

- .2 Install rebar dowel anchors (RDA), adhesive concrete anchors (ACA), and drilled concrete anchors (DCA) in holes drilled after concrete has set only after receipt of written approval from Departmental Representative.
  - .1 Drilled holes: to manufacturers' recommendations.
- .3 Protect anchor bolt and dowel holes from water accumulations, snow and ice build-ups.
- .4 Set RDA and ACA with adhesive.
- .4 Drainage holes and weep holes:
  - .1 Form weep holes and drainage holes in accordance with Section 03 10 00 - Concrete Forming and Accessories. If wood forms used, remove them after concrete has set.
  - .2 Install weep hole tubes and drains as indicated.
- .5 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.
- .6 Waterstops:
  - .1 Install waterstops to provide continuous water seal.
  - .2 Do not distort or pierce waterstop in way as to hamper performance.
  - .3 Do not displace reinforcement when installing waterstops.
  - .4 Use equipment to manufacturer's requirements to field splice waterstops.
  - .5 Tie waterstops rigidly in place.
  - .6 Use only straight heat sealed butt joints in field.
  - .7 Use factory welded corners and intersections unless otherwise approved by Departmental Representative.
- .7 Joint fillers:
  - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative.
  - .2 When more than one piece required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
  - .3 Locate and form isolation and construction joints as indicated.
  - .4 Install joint filler.
  - .5 Use 12mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12mm of finished slab surface unless indicated otherwise.
- .8 Dampproof membrane:
  - .1 Install dampproof membrane under concrete slabs-on-grade inside building.
  - .2 Lap dampproof membrane minimum 150 mm at joints and seal.
  - .3 Seal punctures in dampproof membrane before placing concrete.
  - .4 Use patching material minimum 150 mm larger than puncture and seal.

### **3.3 FINISHING AND CURING**

- .1 Finish concrete to CSA A23.1/A23.2.

- .2 Use procedures noted in CSA A23.1/A23.2 to remove excess bleed water. Ensure surface not damaged.
- .3 Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration of compatibility of compounds used.
- .4 Formed surfaces exposed to view: sack rubbed finish in accordance with CSA A23.1/A23.2.
- .5 Interior floor slabs to be left exposed: initial finishing operations followed by final finishing comprising mechanical floating and steel trowelling in accordance with CSA A23.1/A23.2 Table 21 to produce hard, smooth, dense steel trowelled surface free from blemishes; finish classification Class B. Do not trowel air entrained concrete. Steel trowel exposed interior concrete floors at least twice. Provide final spin troweling when non-slip finish is required.
- .6 Equipment pads: provide smooth trowelled surface.
- .7 Pavements, walks, curbs and exposed site concrete:
  - .1 Screed to plane surfaces and use wood floats.
  - .2 Provide round edges and joint spacings using standard tools.
  - .3 Trowel smooth and provide lightly brushed non-slip finish.
- .8 Rub exposed sharp edges of concrete with carborundum to produce 3 mm minimum radius edges unless otherwise indicated.

### **3.4 SURFACE TOLERANCE**

- .1 Concrete tolerance to CSA A23.1 Depressions in floors between high spots not greater than 6 mm below a 3 m straight edge and in accordance with CSA A23.1/A23.2, Clause 7.6.1.2 and Table 21, finish classification Class B.

### **3.5 CONSTRUCTION AND CONTROL JOINTS**

- .1 Cut control joints in slabs on grade at locations indicated, to CSA A23.1/A23.2 and install specified joint sealer/filler.
- .2 Horizontal construction joints in concrete walls are not permitted, except where shown on the Drawings.
- .3 Slabs on grade: unless noted otherwise, provide control joints in between at 25 times the slab thickness, but not more than 5m. Longer dimension of any slab on grade segment created by construction and control joints not to exceed 1.25 times the shorter dimension of the segment. Consider slab depressions and pits when proposing layout. Complete sawcutting within 6 to 18 hours of placing concrete.

### **3.6 SEALING APPLICATION**

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

- .6 Cure concrete surfaces in accordance with CSA A23.1/A23.2, Clause 7.7 Table 19, type 2-Additional, and Appendix D.

### **3.7 FIELD QUALITY CONTROL**

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

### **3.8 CLEANING**

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 – Construction Waste and Disposal.
  - .1 Divert unused concrete materials from landfill to local facility after receipt of written approval from Departmental Representative.
  - .2 Provide appropriate area on job site where concrete trucks and be safely washed.
  - .3 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by Departmental Representative.
  - .4 Disposal of unused admixtures and additive materials into sewer systems, into lakes, streams, onto ground or in other location to pose health or environmental hazard is prohibited.
  - .5 Prevent admixtures and additive materials from entering drinking water supplies or streams.
  - .6 Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal.
  - .7 Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

**END OF SECTION**



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**Part 1      General**

**1.1          SECTION INCLUDES**

- .1      Finishing slabs-on-grade.
- .2      Surface treatment with sealer.

**1.2          RELATED SECTIONS**

- .1      Section 03 00 00 - Cast-in-Place Concrete: prepared concrete floors ready to receive finish.
- .2      Section 09 90 00 - Painting: painted floor finishes.

**1.3          REFERENCES**

- .1      Health Canada/Workplace Hazardous Materials Information System, (WHMIS).
  - .1      Material Safety Data Sheets (MSDS).

**1.3          QUALITY ASSURANCE**

- .1      Applicator: company specializing in commercial concrete floor finishing.

**1.4          SUBMITTALS**

- .1      Make submissions in accordance with procedures described in Section 01 33 00 - Submittal Procedures.
- .2      Product data:
  - .1      Provide data on finishing compounds, product characteristics, compatibility and limitations.
  - .2      Submit Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).
    - .1      Indicate precautions for workers during handling and application of floor sealers.
- .3      Manufacturer instructions:
  - .1      Submit instructions to include installation instructions for each floor hardener product used.

**1.6          WHMIS**

- .1      Comply with WHMIS requirements regarding use of floor sealers.

**Part 2      Products**

**2.1            COMPOUNDS - HARDENERS AND SEALERS**

- .1      Sealer: sodium silicate composition, clear, colourless, to provide lasting stain resistant/dustproof concrete floor finish.

**Part 3      Execution**

**3.1            FLOOR FINISHING**

- .1      Steel trowel surfaces scheduled to remain exposed.

**3.2            FLOOR SURFACE TREATMENT**

- .1      Apply sealer in accordance with manufacturer instructions.

**END OF SECTION**

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**Part 1      General**

**1.1          SECTION INCLUDES**

- .1      Manufactured stone masonry applied to wood and to concrete substrates.

**1.2          RELATED SECTIONS**

- .1      Section 06 10 00 - Wood Framing: wood strapping.
- .2      Section 06 20 00 - Finish Carpentry: wood capping.
- .3      Section 07 28 00 – Air and Vapour Barriers: building/sheathing paper installations.

**1.3          REFERENCES**

- .1      American Society for Testing and Materials (ASTM International).
  - .1      ASTM C39/C39M-10, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
  - .2      ASTM C67-09, Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
  - .3      ASTM C144-04, Standard Specification for Aggregate for Masonry Mortar.
  - .4      ASTM C192/C192M-07, Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
  - .5      ASTM C207-06, Standard Specification for Hydrated Lime for Masonry Purposes.
- .2      Canadian Standards Association (CSA International).
  - .1      CAN/CSA-A3000-03, Cementitious Materials Compendium.

**1.4          SUBMITTALS**

- .1      Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2      Product data:
  - .1      Submit manufacturer printed product literature, specifications and data sheets for manufactured stone.
- .3      Samples:
  - .1      Submit range of stone colour and size samples representative of stone to be installed for Departmental Representative's selection and confirmation prior to ordering Project material.

**1.5          SITE MOCK-UPS**

- .1      Prepare in accordance with Section 01 45 00 - Quality Control.
- .2      Construct mock-up of stone veneer in locations directed by Departmental Representative to indicate installation techniques, workmanship and colour blend.

- .3 Notify Departmental Representative at least 2 working days in advance to for review of mock-ups.
- .4 Approved mock-ups will establish minimum acceptable standard for remaining work.
- .5 Approved mock-ups may remain part of Work.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Manufactured stone: cast light weight concrete rounded river stone, integral colour blend selected by Departmental Representative.
  - .1 Physical properties: not less than following.
    - .1 Compressive strength (ASTM C192/C192M, ASTM C39/C39M): 12.4 Mpa for 5 specimen average; 10.3 MPa for individual unit.
    - .2 Freeze/thaw performance (ASTM C67): no disintegration; less 3% percent weight loss.
  - .2 Mortar:
    - .1 Portland cement: to CAN/CSA-A3000.
    - .2 Sand: to ASTM C144, passing 16 mesh.
    - .3 Hydrated lime: to ASTM C207, Type S.
    - .4 Latex additive: formulated for use in Portland cement mortar and thin set bond coat.
    - .5 Water: potable.
  - .3 Metal lath: 1.3 mm gauge woven wire self-furring mesh.
  - .4 Breather board: asphaltic board made up of button-punched fibreglass sheet coated with high melt asphalt and faced both sides with asphalt kraft building paper.
  - .5 Mechanical fasteners:
    - .1 Breather board fasteners: minimum 3 mm dia. shank hot dip galvanized steel roofing nails of sufficient length to penetrate not less than 25 mm into strapping.
    - .2 Metal lath fasteners: minimum 3 mm dia. shank hot dip galvanized steel roofing nails of sufficient length to pass through breather board, strapping and wall sheathing and penetrate not less than 35 mm into wood studs behind wall sheathing.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 For wood substrate applications:
  - .1 Install breather board to strapping to back up lath and provide rain screen space.
  - .2 Install metal lath nailed through into wood studs behind wall sheathing.

- .2 For concrete substrate applications:
  - .1 Clean concrete to remove forming compounds and loose particles which would impair mortar bond.

### **3.2 INSTALLATION**

- .1 Install in accordance with stone manufacturer recommendations and to match approved mock-ups, whichever more stringent.
- .2 Set stone plumb, true, level in full bed of mortar.
  - .1 Install on metal lath for wood substrate applications.
  - .2 Install direct to concrete for concrete substrate applications.
- .3 Use soaked softwood wedges where required to support stone in proper alignment until mortar has set. Remove wedges when dry and without breaking them off. Fill voids with pointing mortar.
- .4 Tool joints after initial set has occurred.
- .5 Pointing: remove dirt and loose mortar from joints by using pressure air stream.
  - .1 Wet joints for mortar pointing.
  - .2 Point joints with pointing mortar in 2 or 3 stages. Rub smooth with plastic tool to slightly concave joint.
  - .3 Point to match approved mock-ups.

### **3.3 ERECTION TOLERANCES**

- .1 To match approved mock-ups.

### **3.4 CLEANING**

- .1 Clean stone surfaces of excess mortar without damaging stone faces and colours.

**END OF SECTION**

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**Part 1      General**

**1.1          SECTION INCLUDES**

- .1      Shop fabricated ferrous metal items.

**1.2          RELATED SECTIONS**

- .1      Section 09 90 00 - Painting: site-applied paint finishes.

**1.3          REFERENCES**

- .1      American Society for Testing and Materials (ASTM International).
  - .1      ASTM A53/A53M-10, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  - .2      ASTM A307-07b, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .3      ASTM A500/A500M-10a, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
  - .4      ASTM A501-07, Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
  - .5      ASTM F593-02(2008), Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs.
- .2      Canadian General Standards Board (CGSB).
  - .1      CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.
- .3      Canadian Standards Association (CSA International).
  - .1      CSA G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2      CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3      CSA W47.1-09, Certification of Companies for Fusion Welding of Steel.
  - .4      CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding.
  - .5      CSA W55.3-08, Certification of Companies for Resistance Welding of Steel and Aluminum.
  - .6      CSA W59-03(R2008), Welded Steel Construction (Metal Arc Welding).
- .4      SSPC Manual, Structural Steel Painting Council (SSPC) Standards.
- .5      National Building Code of Canada (NBC) - 2005.

**1.4          QUALITY ASSURANCE**

- .1      Fabricator: company specializing in welded structural building components and approved under CSA W47.1 and CSA W55.3.

## **1.5 SUBMITTALS**

- .1 Make submissions in accordance with procedures described in Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings:
  - .1 Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners and accessories.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Steel sections and plates: CAN/CSA G40.20/G40.21, Grade 300W or 350W.
- .2 Steel pipe: ASTM A53/A53M, Grade B Schedule 40, standard weight.
  - .1 Handrails, guardrails: black finish.
  - .2 Clothes line posts: nominal 100 mm size pipe with 6 mm wall thickness, galvanized finish.
- .3 Steel tubing: ASTM A500, Grade B and ASTM A501.
- .4 Bolts, nuts, washers:
  - .1 Interior applications: ASTM A307.
  - .2 Exterior applications: ASTM F593 stainless steel alloy.
- .5 Welding materials: CSA W59; type required for materials being welded.
- .6 Shop and touch-up primer: CAN/CGSB-1.40.
- .7 Clotheslines:
  - .1 Lines: clear vinyl coated multi-strand galvanized steel cable, tested to hold 770 kg of weight.
  - .2 Pulleys: 165 mm dia. ball-bearing mounted cast zinc assembly manufactured for clothesline use.
  - .3 Eyes: galvanized steel hooks.
    - .1 Post hooks: threaded, complete with galvanized nuts and washers.
    - .2 House hooks: threaded for use in wood construction.
  - .4 Turnbuckles: aluminum alloy turnbuckles each fitted with threaded galvanized hooks, for tensioning of clothesline.
  - .5 Clothesline ends: corrosion-resistant metal ratchet devices to join clotheslines.
- .8 Concrete: minimum 25 Mpa compressive strength at 28 days, slump suitable for footing use and ground moisture conditions.

### **2.2 FABRICATION**

- .1 Fit and shop assemble in largest practical sections, for delivery to site.

- .2 Full weld all joints and joining sections. Make welds continuous for length of each joint; spot welding is not acceptable.
- .3 Grind exposed welds flush and smooth with adjacent finish surface.
- .4 Make exposed joints butt tight, flush and hairline.
- .5 Supply components required for anchorage of metal fabrications.

### **2.3 FINISHES**

- .1 Clean metal surfaces prior to application of shop primer and finish paint system using following 2 cleaning procedures, in accordance with SSPC Manual. Clean metal surfaces to be galvanized in accordance with galvanizing plant and CAN/CSA-G164 requirements.
  - .1 SSPC-SP1 - Solvent Cleaning, followed by
  - .2 SSPC-SP6 - Commercial Blast Cleaning.
- .2 Prime painting:
  - .1 Apply primer to obtain full and even coverage at rates recommended by primer manufacturer.
  - .2 Use primer unadulterated, as prepared by manufacturer. Do not paint when temperature is lower than 7 degrees C. Paint on dry clean surfaces only.
  - .3 Do not prime surfaces in direct contact bond with concrete or where field welding is required.
- .3 Galvanizing:
  - .1 Hot dip galvanize black finish items after fabrication to CAN/CSA-G164.
  - .2 Provide minimum not less than 600 g/m<sup>2</sup> of zinc coating.
- .4 Powder coating:
  - .1 Have all visible surfaces of metal fabrications listed under **SCHEDULE** powder coated by commercial power coating plant prior to delivery to site, in colours and gloss levels selected by Departmental Representative.
  - .2 Protective wrap items to protect powder coating from damage during delivery and installation.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

### **3.2 INSTALLATION**

- .1 Install items plumb and level, accurately fitted, free from distortion or defects.



- .2 Install balustrades, railings and guards including connections in accordance with NBC vertical and horizontal live load requirements. Fix interior items through wall finishes into wall framing/wood blocking. Direct fastening to gypsum board alone not acceptable.
- .3 Perform field welding to CSA requirements.
- .4 After installation, touch-up scratched and damaged shop primer with touch-up primer.

### **3.3 SCHEDULE**

- .1 The following Schedule is a list of principal items only. Refer to drawing details for items not specifically scheduled.
  - .1 Interior handrails, guardrails: prime painted after fabrication ready for site finish painting.
  - .2 Exterior guardrails: galvanized after fabrication followed by powder coating finish.
  - .3 Clotheslines: galvanized pipe.
    - .1 Shop fit post tops with permanent galvanized plates to exclude water. Fit clothesline hooks to posts before erecting.
    - .2 Excavate plumb post holes at accurate locations. Make holes not less than 915 mm deep.
    - .3 Install posts plumb. Orient clothesline hooks towards house mounted clothesline hook locations.
    - .4 Centre posts in concrete footings.
    - .5 Set concrete footing tops at or no more than 100 mm below the finished grade.
    - .6 Crown or dome tops of concrete footings to shed water away from post surfaces.
    - .7 Install house mounted clothesline hooks screwed through siding/trim into wall framing/blocking. Fixing to siding/trim alone not acceptable.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            Section 06 17 53 – Shop-Fabricated Wood Trusses.

**1.2                REFERENCE STANDARDS**

- .1            Editions of all Referenced Standards to be the ones designated by the applicable Building Code in force at the time of building permit application, as indicated on Structural Drawings. For Standards not referenced by the Building Code, use the latest editions.
- .2            ASTM International (ASTM)
  - .1            ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .2            ASTM A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - .3            ASTM A307, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength.
  - .4            ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .5            ASTM D 5456, Standard Specification for Evaluation of Structural Composite Lumber Products.
  - .6            ASTM F1667, Standard Specification for Driven Fasteners: Nails, Spikes and Staples.
- .3            Canadian General Standards Board (CGSB)
  - .1            CAN/CGSB-71.26, Adhesive for Field-Gluing Plywood to Lumber Framing for Floor Systems.
- .4            Canadian Wood Council
  - .1            Wood Design Manual Edition
  - .2            Engineering Guide for Wood Frame Construction
- .5            CSA Group (CSA)
  - .1            CSA G40.20 /G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2            CSA S16, Design of Steel Structures.
  - .3            CSA W48, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
  - .4            CSA W59, Welded Steel Construction (Metal Arc Welding) Metric
  - .5            CSA B111, Wire Nails, Spikes and Staples.
  - .6            CSA O80 Series, Wood Preservation.
  - .7            CSA O86, Engineered Design in Wood
  - .8            CSA O112.9, Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).

- .9 CSA O121, Douglas Fir Plywood.
- .10 CSA O141, Softwood Lumber.
- .11 CSA O151, Canadian Softwood Plywood.
- .12 CSA O153, Poplar Plywood.
- .13 CSA O325, Construction Sheathing.
  
- .6 National Research Council Canada (NRC)
  - .1 National Building Code of Canada (NBC).
- .7 Forest Stewardship Council (FSC)
  - .1 FSC-STD-01-001, FSC Principle and Criteria for Forest Stewardship.
- .8 Green Seal Environmental Standards (GS)
  - .1 GS-11, Paints and Coatings.
- .9 National Lumber Grades Authority (NLGA)
  - .1 Standard Grading Rules for Canadian Lumber.
- .10 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1113, Architectural Coatings.
- .11 Sustainable Forestry Initiative (SFI)
  - .1 SFI Standard.

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

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for wood products and accessories and include product design data, characteristics, performance criteria, physical size, finish and limitations.
  - .2 Include manufacturer's design data and installation details for engineered wood structural members (PSL and LVL).
  - .3 Submit certified test reports for engineered wood structural members from approved independent laboratory indicating compliance with specifications for specified performance characteristics and physical properties.
  - .4 Submit CCMC Product Evaluation Report for engineered wood products.
  - .5 Submit manufacturer's installation instructions.
- .3 Shop Drawings:
  - .1 Submit drawings for fabricated steel components for review.
  - .2 Indicate materials, thicknesses, dimensions, holes, welds, and finishes.

## **1.4 QUALITY ASSURANCE**

- .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.
- .3 Plywood, OSB and wood based composite panel construction sheathing identification: by grade mark in accordance with applicable CSA standards.

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

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground, in dry location, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store materials off ground with moisture barrier at both ground level and as a cover forming a well-ventilated enclosure, with drainage to prevent standing water.
  - .3 Stack, lift, brace, cut and notch engineered lumber products in strict accordance with manufacturer's instructions and recommendations.
  - .4 Store and protect architecturally exposed lumber from nicks, scratches, and blemishes.
  - .5 Replace defective or damaged materials with new.
  - .6 Store separated reusable wood waste convenient to cutting station and work areas.
- .4 Packaging Waste Management: remove for reuse and return of packaging materials as specified in accordance with Section 01 74 19 – Construction Waste and Disposal.

## **Part 2 Products**

### **2.1 STRUCTURAL FRAMING**

- .1 Conform to CSA O86 Engineering Design in Wood and in accordance with Part 9 of the NBC 2015.
- .2 Framing and board lumber: in accordance with NBC, except as follows:
  - .1 Softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:
  - .2 NLGA Standard Grading Rules for Canadian Lumber.
  - .3 Typical unless noted otherwise: CSA O141, SPF No. 2 or better grade, kiln dried.
  - .4 Patio canopy joists: CSA O141, SPF No. 2 or better grade, kiln dried.
  - .5 Patio canopy beam: CSA O141, D-Fir No. 1 or better grade, kiln dried.
- .3 Posts and columns: CSA O141, D-Fir No. 1 or better grade, kiln dried.

- .4 Glued end-jointed (finger-jointed) lumber NLGA Special Products Standard, are acceptable for interior partition wall studs.
- .5 Structural Composite Lumber (SCL) in accordance with ASTM D 5456, for following uses:
  - .1 Laminated veneer lumber (LVL): beams, headers, hip and valley rafters as indicated on structural drawings. Minimum grade 2.0E, 2500Fb (Fb=31.9MPa) or better.
  - .2 Parallel strand lumber (PSL): beams and headers as indicated on structural
- .6 Framing and board lumber: in accordance with NBC, except as follows:
  - .1 Architecturally Exposed Lumber: D-Fir species, NLGA Select grade.

## **2.2 PANEL MATERIALS AND APPLICATION**

- .1 Roof sheathing:
  - .1 Plywood, DFP or CSP sheathing grade or PP standard sheathing grade, square edge, thickness as indicated on structural drawings.
  - .2 OSB, grade O-1 or O-2, thickness as indicated on structural drawings.
  - .3 Construction sheathing product: end use mark 1R24.
- .2 Exterior wall sheathing:
  - .1 Plywood, DFP or CSP sheathing grade or PP standard sheathing grade, square edge, thickness as indicated on structural drawings.
  - .2 OSB, grade O-1 or O-2, thickness as indicated on structural drawings.
  - .3 Construction sheathing product: end use mark W16.
- .3 Subflooring:
  - .1 Plywood, DFP or CSP sheathing grade or PP standard sheathing grade, T&G edge, thickness as indicated on structural drawings.

## **2.3 ACCESSORIES**

- .1 Subflooring adhesive: to CAN/CGSB-71.26, cartridge loaded.
- .2 General purpose adhesive: to CSA O112.9.
- .3 Nails, spikes and staples: to CSA B111, common round steel wire nails.
- .4 Bolts: to ASTM A307, 12.5mm diameter unless indicated otherwise, complete with nuts and washers.
- .5 Structural screws: By Simpson Strong-Tie, Mitek, or approved equivalent, as indicated on structural drawings.
- .6 Lag screws: To ANSI/ASME B18.12.1 machine threaded
- .7 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.

- .8 Joist hangers, connectors and fasteners By Simpson Strong-Tie, Mitek, or approved equivalent, as indicated on structural drawings.
  - .1 Galvanized to minimum G90 coating designation, interior locations.
  - .2 Galvanized to minimum G185 coating designation, exterior locations.
  - .3 Stainless steel to 316L, preservative treated wood.
- .9 Fabricated steel connections as indicated on drawings
  - .1 Steel plates: to CSA G40.20/G40.21, Grade 300W.
  - .2 Welding materials: to CSA W59.
  - .3 Welding electrodes: to CSA W48 Series.
  - .4 Shop paint primer: to CISC/CPMA 2-75 solvent reducible alkyd, red oxide.
  - .5 Assembly galvanizing: to ASTM A153/A153M, exterior locations.
- .10 Roof sheathing H-Clips: formed "H" shape, thickness to suit panel material, extruded 6063-T6 aluminum alloy type approved by Departmental Representative.
- .11 Fastener Finishes:
  - .1 Galvanizing: to ASTM A153/A153M, use galvanized nails, screws, lag bolts, and bolts for exterior work.
  - .2 Galvanizing: to ASTM A153/A153M, use galvanized lag bolts and bolts for in contact with preservative treated wood.
  - .3 Stainless steel: use stainless steel 316 alloy for nails and screws in contact with preservative treated wood.
  - .4 Proprietary corrosion resistant fasteners for preservative treated wood: as recommended by manufacturer for material and service conditions.
- .12 Wood Preservative:
  - .1 Pressure treated wood preservative: alkaline copper quaternary (ACQ), copper azole (CA), or micronized copper azole (MCA).
  - .2 Surface-applied wood preservative: limited to field treatment of cut ends, notches, and holes. To match pressure treated wood preservative.
  - .3 Wood in contact with ground: ensure preservative retention levels are adequate.
  - .4 Structures built with wood treated with preservative treated wood must not be used for storing food nor should the wood come in contact with drinking water.
- .13 Sill Plate Gasket: Closed cell polyethylene foam gasket in width to match sill plate width, 6 mm thick.

## **2.4 FABRICATION**

- .1 Fabricate structural steel in accordance with CAN/CSA-S16 and in accordance with reviewed shop drawings.
- .2 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

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**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for rough carpentry 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 SYSTEMS INTEGRATION**

- .1 Install sill plate gasket in continuous lengths between concrete surfaces and wood framing. Untreated wood not to be in direct contact with concrete, provide sill plate gasket between wood and concrete.

**3.3 FABRICATED STEEL COMPONENTS**

- .1 Structural steel work: in accordance with CAN/CSA-S16.
- .2 Welding: in accordance with CSA W59.

**3.4 FRAMING INSTALLATION**

- .1 Install engineered framing and plant fabricated structural wood components, including all hangers, connectors and fasteners, in accordance with accepted shop drawings and manufacturers' instructions.
- .2 Install members true to line, levels and elevations, square and plumb.
- .3 Construct continuous members from pieces of longest practical length.
- .4 Install spanning members with "crown-edge" up.
- .5 Provide all erection bracing required to keep the structure stable and in alignment during construction.
- .6 Substitution of common nails with power-driven nails of the same length and diameter is acceptable. Substitution of power-driven nails of smaller diameter must be approved in writing by Departmental Representative prior to use. Power driven nails not to be over-driven into wood or sheathing.
- .7 Proposed notching and drilling of framing members must be submitted to the Departmental Representative for review. Significant notches conforming to part 9 may be rejected if they compromise the structural integrity.
- .8 All components of built up members to be continuous for full span. Do not splice or use butt joints.
- .9 Carry all posts down to foundation. Provide solid vertical blocking of matching size or larger and in line with posts at floor levels.

- .10 Use joists hangers where joists frame into sides of supports.
- .11 Provide solid blocking between joists at interior supports and provide cross-bridging between joists at maximum 2100mm on centre along length of span, unless noted otherwise.
- .12 For sawn lumber floor systems, all rim board and blocking material to be minimum 38mm thick unless, noted otherwise on drawings.
- .13 Select exposed framing for appearance. Install lumber materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.
- .14 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .15 Countersink bolts where necessary to provide clearance for other work.
- .16 Install specified panel product for each application.
- .17 Install with panel end-joints located on solid bearing, staggered at least 800mm.
  - .1 In addition to mechanical fasteners, floor panels secure floor subflooring to floor joists using glue. Place continuous adhesive bead in accordance with manufacturer's instructions, single-bead on each joist and double-bead on joists
- .18 Install wall sheathing in accordance with requirements of NBC and as indicated on structural drawings.
- .19 Install roof sheathing in accordance with requirements of NBC and as indicated on structural drawings.
- .20 Field treat surfaces of preservative treated lumber exposed by cutting, trimming or boring with liberal brush application of preservative before installation in accordance with manufacturer's requirements.

### **3.5 FURRING AND BLOCKING**

- .1 Comply with requirements of National Building Code of Canada (NBC), supplemented by the following paragraphs.
- .2 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.
- .3 Align and plumb faces of furring and blocking to tolerance of 1:600.
- .4 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .5 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized steel fasteners.
- .6 Install wood backing, dressed, tapered and recessed slightly below top surface of roof insulation for roof hopper.
- .7 Install sleepers as indicated.
- .8 Use caution when working with particle board. Use dust collectors and high-quality respirator masks.
- .9 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.



- .10 Countersink bolts where necessary to provide clearance for other work.

### **3.6 PROTECTION**

- .1 Protect all wood products from the elements as required to maintain their integrity.
- .2 Protect installed products and components from damage during construction.
- .3 Repair damage to adjacent materials caused by rough carpentry installation.

### **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.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 06 10 00 – Rough Carpentry

**1.2 REFERENCE STANDARDS**

- .1 Editions of all Referenced Standards to be the ones designated by the applicable Building Code in force at the time of building permit application, as indicated on Structural Drawings. For Standards not referenced by the Building Code, use the latest editions.
- .2 CSA Group (CSA)
  - .1 CAN/CSA O80 Series, Wood Preservation.
  - .2 CSA O86, Engineering Design in Wood.
  - .3 CSA O141, Softwood Lumber.
  - .4 CSA S307, Load Test Procedure for Wood Roof Trusses for Houses and Small Buildings.
  - .5 CSA S347, Method of Test for Evaluation of Truss Plates Used in Lumber Joints.
  - .6 CSA W47.1, Certification of Companies for Fusion Welding of Steel.
- .3 National Lumber Grades Authority (NLGA)
  - .1 Standard Grading Rules for Canadian Lumber.
- .4 National Research Council Canada (NRC)
  - .1 British Columbia Building Code (BCBC – 2018).
  - .2 National Building Code of Canada (NBC - 2015).
  - .3 Canadian Construction Materials Centre (CCMC), Registry of Product Evaluations.
- .5 Truss Plate Institute of Canada (TPIC)
  - .1 TPIC, Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses (Limit States Design).

**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 wood trusses and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia, Canada.

- .2 Include on drawings:
  - .1 Each shop drawing submission showing connection details.
  - .2 Indicate special structural application and specification as according to local authorities having jurisdiction.
  - .3 Indicate TPIC Truss Design Procedure and CSA O86 Engineering Design in Wood and specific CCMC Product Registry number of the truss plates
  - .4 Indicate species, sizes, and stress grades of lumber used as truss members. Show pitch, span, camber, configuration and spacing of trusses. Indicate connector types, thicknesses, sizes, locations and design value. Show bearing details. Indicate design load for members.
  - .5 Submit stress diagram or print-out of computer design indicating design load for truss members. Indicate allowable load and stress increase.
  - .6 Provide certification that trusses meet requirements of CSA S307 and CSA S347.
  - .7 Indicate arrangement of webs or other members to accommodate ducts and other specialties.
  - .8 Show location of lateral bracing for compression members.
  - .9 Show temporary and permanent bracing and bridging details affecting the structural capacity of the trusses.
  - .10 Test reports: submit certified test reports for prefabricated wood trusses from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
  - .11 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .12 Instructions: submit manufacturer's installation instructions.
- .4 Sustainable Design Submittals:
  - .1 Construction Waste Management:
    - .1 Submit project Waste Reduction Workplan and Waste Management Plan highlighting recycling and salvage requirements.

#### **1.4 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Fabricator to be a member of the Canadian Wood Truss Association.
  - .2 Fabricator for trusses to show evidence of quality control program such as provided by regional wood truss associations, or equivalent.
  - .3 Fabricator for welded steel connections to be certified in accordance with CSA W47.1.

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

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions and Section 01 61 00 - Common Product Requirements.

- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect wood trusses from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
  - .4 Provide bearing supports and bracings. Prevent bending, warping and overturning of trusses.
- .4 Develop Waste Reduction Workplan and Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse by manufacturer of pallets, packaging materials, crates, padding, as specified in Waste Reduction Workplan and Construction Waste Management Plan in accordance with Section 01 74 19 – Construction Waste and Disposal.

## **Part 2 Products**

### **2.1 DESIGN REQUIREMENTS**

- .1 Design light metal plate connected wood trusses in accordance with Truss Plate Institute of Canada (TPIC) truss design procedures for wood truss chords and webs in accordance with engineering properties in CSA O86.
- .2 Design light metal plate connected wood trusses in accordance with TPIC truss design procedures for truss joint designs to test engineering properties in accordance with CSA S347 and listed in CCMC Registry of Product Evaluations.
- .3 Design trusses, bridging and bracing in accordance with Part 9 of the NBC, for loads indicated on structural drawings, and minimum uniform and minimum concentrated loadings stipulated in NBC commentary.
- .4 Design trusses to support all overbuild framing required for roof geometry, do not interrupt roof sheathing to accommodate overbuild framing.
- .5 Vaulted trusses not to rely on supporting structure to resist horizontal spreading of truss.
- .6 Design trusses, bracing, and bridging for a specified wind uplift of 1.0 kPa.
- .7 Limit live load deflections to 1/360th of span unless otherwise specified or indicated.

### **2.2 MATERIALS**

- .1 Lumber: Douglas-Fir or Spruce-Pine-Fir species, No. 1/No. 2 grade, S4S, with maximum moisture content of 19% at time of fabrication and to following standards:
  - .1 CSA O141.
  - .2 NLGA (National Lumber Grading Association), Standard Grading Rules for Canadian Lumber.
- .2 Fastenings: to CSA O86.

### **2.3 FABRICATION**

- .1 Fabricate wood trusses in accordance with reviewed shop drawings.
- .2 Provide for design camber and roof slopes when positioning truss members.
- .3 Connect members using metal connector plates.

### **2.4 SOURCE QUALITY CONTROL**

- .1 Identify lumber by grade stamp of an agency certified by Canadian Lumber Standards Administration Board.

## **Part 3 Execution**

### **3.1 EXAMINATION**

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

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

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

### **3.3 ERECTION**

- .1 Erect wood trusses in accordance with reviewed shop drawings.
- .2 Handling, installation, erection, bracing and lifting in accordance with manufacturers instructions.
- .3 Make adequate provisions for handling and erection stresses.
- .4 Exercise care to prevent out-of-plane bending of trusses.
- .5 Install temporary horizontal and cross bracing to hold trusses plumb and in safe condition until permanent bracing and decking are installed.
- .6 Install permanent bracing in accordance with reviewed shop drawings, prior to application of loads to trusses.
- .7 Do not cut or remove any truss material without approval of Departmental Representative.

### **3.4 FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
  - .1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, protection and cleaning of its products, and submit written reports, in acceptable format, to verify compliance of work with Contract.
  - .2 Manufacturer's field services: provide manufacturer's field services, consisting of product use recommendations and periodic site visits for inspection of product installation, in accordance with manufacturer's instructions.
  - .3 Perform field review of the work for conformance with the shop drawings, manufacturer's instructions, and contract documents.
- .2 Obtain reports within five days of review and submit immediately to Departmental Representative.
- .3 Upon completion of the work, submit Letter of Assurance Schedule S, stamped and signed by professional engineer from Clause 1.3.3.1.

### **3.5 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 19 – Construction Waste and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**END OF SECTION**

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**Part 1      General**

**1.1      SECTION INCLUDES**

- .1 Interior finish carpentry items other than shop prefabricated casework including but not limited to:
  - .1 Standing/running trim.
  - .2 Wood handrails.
  - .3 Wood door frames.
  - .4 Linen shelves.
  - .5 Wire shelves.
  
- .2 Exterior finish carpentry items including but not limited to:
  - .1 Wood battens and wood trim.
  - .2 Window trim and sills.
  - .3 Door trim.
  - .4 Wood capping for stone masonry.
  - .5 Wood fascia.
  - .6 Wood brackets.
  - .7 Wood posts and beams.
  - .8 Mail boxes.
  - .9 House numbers.

**1.2      RELATED SECTIONS**

- .1 Section 04 73 00 - Manufactured Stone Masonry: stone cladding.
- .2 Section 06 10 00 – Rough Carpentry: wall framing, wood blocking.
- .3 Section 07 44 56 - Fiber Reinforced Cementitious Siding: fibre cement siding and panels.
- .5 Section 08 14 16 – Interior Doors.
- .7 Section 09 90 00- Painting: painting and finishing of finish carpentry items.

**1.3      REFERENCES**

- .1 American National Standards Institute (ANSI).
  - .1 ANSI 208.1-2009, Particleboard Standard.
  
- .2 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI).
  - .1 AWS Manual, Architectural Woodwork Quality Standards Illustrated - 1st edition, October 1, 2009.

- .3 Canadian Standards Association (CSA International).
  - .1 CSA O121-M1978(R2003), Douglas Fir Plywood.
  - .2 CSA O151-04, Canadian Softwood Plywood.
- .4 National Lumber Grades Authority, (NLGA).
  - .1 Standard Grading Rules for Canadian Lumber 2005.

#### **1.4 QUALITY ASSURANCE**

- .1 Fabricator: company specializing in custom carpentry work with not less than 3 years of experience. Provide proof of experience if requested by Departmental Representative.
- .2 Perform work to AWMAC/AWI Custom Grade requirements

#### **1.5 SUBMITTALS**

- .1 Make submissions in accordance with procedures described in Section 01 33 00 - Submittal Procedures.
- .2 Samples:
  - .1 Submit wood samples if requested by Departmental Representative to indicate quality of wood proposed for use in Work.
  - .2 Submit wood bracket sample to indicate quality of wood and fabrication proposed for use in Work. Accepted sample may form part of Work.
  - .3 Submit mail box sample to indicate item proposed for use in Work. Accepted sample may form part of Work.
  - .4 Submit house number samples to indicate item proposed for use in Work. Accepted sample may form part of Work.

#### **1.6 SITE MOCK-UPS**

- .1 Prepare in accordance with Section 01 45 00 - Quality Assurance.
- .2 Install following in locations directed by Departmental Representative to indicate installation techniques and workmanship.
  - .1 Interior items:
    - .1 Wood door frames.
    - .2 Linen shelves.
  - .2 Exterior items:
    - .1 Wood battens and wood trim.
    - .2 Window trim and sills.
    - .3 Door trim.
    - .4 Wood capping for stone masonry.
    - .5 Wood fascia.
    - .6 Wood brackets.
    - .7 Wood posts and beams
- .3 Notify Departmental Representative at least 2 weeks in advance to review mock-ups.



- .4 Approved mock-ups will establish minimum acceptable standard for remaining work.
- .5 Approved mock-ups may remain part of Work.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Interior finish carpentry:
  - .1 Softwood lumber: AWMAC/AWI Custom Grade, S4S, kiln dried solid stock, Douglas fir species, selected for painted finish.
  - .2 Medium Density Fibreboard (MDF): NPA A208.2; composed of wood fibres, medium density, of grade to suit application.
  - .3 Plywood: to CSA O121 or CSA O151, DFP material "G1S" grade, CSP material "S1S" grade.
  - .4 Wood handrails, balusters: Red Oak species, selected for transparent finish.
  - .5 Wire shelves: white vinyl coated purpose-made wire fabrications complete with white painted wall brackets, 380 mm deep unless detailed/indicated otherwise..
- .2 Exterior finish carpentry:
  - .1 Wood battens, trim, fascia: S4S material, SPF species, 2 Common grade to NLGA para. 113b.
  - .2 Door and window trim Lumber: softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:
    - .1 CSA O141.
    - .2 NLGA Standard Grading Rules for Canadian Lumber.
    - .3 Tight grain, appearance grade, SPF.
    - .4 Comb face appearance.
    - .5 Factory pre primed on all 4 sides.
    - .6 Refer to details for dimensions and profiles.
  - .3 Wood capping, wood posts and beams: S4S material, D Fir species, "C" Industrial Clear grade to NLGA No. 1.
    - .1 Material to be kiln dried.

### **2.2 ACCESSORIES**

- .1 Nails: sizes and types to suit application.
  - .1 Interior applications: plain finish.
  - .2 Exterior applications: hot dip galvanized finish.
- .2 Bolts, nuts, washers, blind fasteners, lags, screws: sizes and type to suit application.
  - .1 Interior applications: plain finish.
  - .2 Exterior applications: hot dip galvanized finish.
- .3 Wood filler: permanent non-shrinking formulation, interior and exterior grades to suit applications.

- .4 Mail boxes: horizontal form heavy-duty weatherproof black plastic construction with embossed wood grain texture, hinged mansard shaped lid, approx. 460 mm wide x 200 mm high x 125 mm deep (projecting from wall).
- .5 Residential unit numbers: 125 mm high individual cast aluminum with black powder coat finish numbers, complete with black finished mounting screws.
- .6 Brackets for wood handrails: purpose-made solid brass fabrications, bright polished finish, curved brass rod supporting brass cradle pre-drilled to accept 3 countersink head wood screws to receive wood handrail, approx. 60 mm dia. brass wall plate pre-drilled to accept 3 countersink head wood screws, complete with brass wood screws.

### **Part 3 Execution**

#### **3.1 INSTALLATION - INTERIOR FINISH CARPENTRY**

- .1 Install items in accordance with AWMAC/AWI Custom Grade requirements and to match accepted site mock-ups.
- .2 Set and secure materials and components in place, plumb and level.
- .3 Standing and running trim:
  - .1 Co-ordinate finishing of items prior to installation wherever practical.
  - .2 Install items in accordance with details.
  - .3 Countersink all fixings and fill flush with wood filler.
  - .4 Site measure, cut and install items using longest practical length pieces to avoid splice joints.
  - .5 Use full length door frames and door trim to avoid splice joints.
  - .6 Where splice joints cannot be avoided due to distances exceeding length of production mouldings/stock make splice joints tight and fine, invisible under painted and clear finishes by cutting splice joints at 45 deg. and fixing splice joints to prevent opening.
- .4 Wood handrails:
  - .1 Co-ordinate finishing of items prior to installation wherever practical.
  - .2 Install items in accordance with details.
  - .3 Fix through wall finishes into wall framing to withstand not less than 2.2 kN force without pulling away and loosening for life of installations.
  - .4 Fixing to gypsum board alone not acceptable.
- .5 Door frames:
  - .1 Single rabbet jamb design wood, paint grade.
  - .2 Fix securely into wall framing to resist displacement.
  - .3 Countersink all fixings and fill flush with wood filler.

- .6 Linen shelves:
  - .1 Melamine laminations, provide melamine resin impregnated decorative sheet fused thermally to all edges (edge banding) exposed in final assembly.
  - .2 Fix through wall finishes into wall framing.
  - .3 Fixing to gypsum board alone not acceptable.
  
- .7 Surface-mounted equipment backboards (for electrical panels):
  - .1 Fix backboards to walls using drywall screws through wall finishes into wall framing. Space screws not more than 400 mm o.c. along wall framing. Set screw heads flush with plywood face without tearing face veneers.
  - .2 Fixing to gypsum board alone not acceptable.
  - .3 Have painted backboards back-primed prior to installing. Co-ordinate with painting trade.
  
- .8 Wire shelves:
  - .1 Fix through wall finishes into wall framing.
  - .2 Fixing to gypsum board alone not acceptable.
  - .3 Provide 2 levels of wire shelves over each sink in each basement, unless detailed/indicated otherwise.

### **3.2 INSTALLATION - EXTERIOR FINISH CARPENTRY**

- .1 Install items to match accepted site mock-ups.
- .2 Set and secure materials and components in place, plumb and level.
- .3 Wood battens, trim, fascia, capping:
  - .1 Use longest available lengths of wood stock to avoid splice joints.
  - .2 Cut ends accurately.
  - .3 Where splice joints cannot be avoided due to distances exceeding available length:
    - .1 Scarfe cut splice joints at 45 deg. to overlap and minimize appearance.
    - .2 Dry fit splice joints to determine final appearance.
    - .3 Caulk splice joints with sealant.
    - .4 Nail fix splice joints to maintain fine tight appearance and to prevent future opening.
  - .4 Co-ordinate application of primer plus 1st coat of colour finish to all surfaces of battens and trim prior to installation.
  - .5 Set nails flush with trim and batten surfaces.
- .4 Door/window trim, window sills:
  - .1 Use continuous length stock for each piece.
  - .2 Cut and fit ends accurately.
  - .3 Co-ordinate application of primer plus 1st coat of colour finish to all surfaces of trim and sills prior to installation.
  - .4 Countersink all fixings and fill flush with wood filler.
- .5 Wood brackets, posts and beams:
  - .1 Cut and fit ends accurately.
  - .2 Co-ordinate application of primer plus 1st coat of colour finish to all surfaces of

- 
- trim and sills prior to installation.
  - .3 Countersink all fixings and fill flush with wood filler.
  
  - .6 Mail boxes:
    - .1 Install using companion screws.
    - .2 Fix in place to resist loosening for life of installations.
    - .3 Install after all painting/staining has been completed and dried.
    - .4 Install to locations detailed/indicated, level and straight.
    - .5 Allow one mail box per residential unit. Final locations directed by Departmental Representative.
  
  - .7 House numbers:
    - .1 Install using companion screws.
    - .2 Fix in place to resist loosening for life of installations.
    - .3 Install after all painting/staining has been completed and dried.
    - .4 Install to locations detailed/indicated with each set of numbers even spaced, level and straight.
    - .5 Allow 4 digits per residential unit. Final numbering and locations directed by Departmental Representative.

**END OF SECTION**

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**Part 1            General**

**1.1                SECTION INCLUDES**

- .1      Custom shop fabricated cabinet units.
- .2      Countertops.
- .3      Cabinet hardware.
- .4      Closet shelf-with-rod units.

**1.2                RELATED SECTIONS**

- .1      Section 06 20 00 - Finish Carpentry
- .2      Section 09 90 00 - Painting.

**1.3                REFERENCES**

- .1      BHMA A156.9-2010 - Cabinet Hardware.
- .2      NPA A208.2-2009 - Medium Density Fibreboard (MDF) for Interior Applications.
- .3      AWMAC - Architectural Woodwork Standards (AWS) – 1st Edition, 2009.
- .4      CAN/CSA O141-91(R1999), Softwood Lumber.
- .5      NLGA (National Lumber Grades Authority) - Standard Grading Rules for Canadian Lumber.
- .6      NEMA LD3-2005 - High Pressure Decorative Laminates (HPDL).
- .7      Green Seal Environmental Standards
  - .1      Standard GC-03-97, Anti-Corrosive Paints.
  - .2      Standard GS-11-93, Architectural Paints.
  - .3      Standard GS-36-00, Commercial Adhesives
- .8      South Coast Air Quality Management District (SCAQMD), California State
  - .1      SCAQMD Rule 1113-04, Architectural Coatings.
  - .2      SCAQMD Rule 1168-05, Adhesives and Sealants Applications

**1.4                SUBMITTALS**

- .1      Section 01 33 00: Submission procedures.
- .2      Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.
- .3      Product Data: Provide data for hardware accessories.

**1.5                QUALITY ASSURANCE**

- .1      Perform cabinet construction to AWMAC Custom quality.

**1.6 DELIVERY, STORAGE, AND PROTECTION**

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

**1.7 ENVIRONMENTAL REQUIREMENTS**

- .1 During and after installation of work of this section, maintain the same temperature and humidity conditions in building spaces as will occur after occupancy.

**Part 2 Products**

**2.1 LUMBER MATERIALS**

- .1 Lumber: To the requirements of AWMAC, Custom grade.
- .2 Hardwood Lumber: plain sawn, maximum moisture content of 6%; with plain sawn grain, of quality suitable for transparent finish.
  - .1 Oak trim, Oak wood:
    - .1 Quality: to AWMAC/AWI Custom Grade, moisture content 10% or less.
    - .2 Type: solid wood, Red Oak species, to match adjacent doors and drawer fronts.
    - .3 Applications:
      - .1 Oak trim: plain profile stock and machine profiled moulding stock trim pieces to fit cabinetwork tight to walls and where required to join/trim installed cabinets to make installations continuous.
      - .2 Oak wood: widths required, 19 mm thick unless detailed/indicated otherwise.
  - .3 Oak wood veneer:
    - .1 Quality: to AWMAC/AWI Custom Grade.
    - .2 Type: Red Oak species, flat slice cut, to match adjacent casework doors and drawer fronts.
  - .4 Softwood Lumber
    - .1 Kiln dried

**2.2 SHEET MATERIALS**

- .1 Sheet Materials: To the requirements of AWMAC custom grade.
- .2 Softwood Plywood:
  - .1 Veneer core
  - .2 Clear, sanded
- .3 Medium Density Fibreboard (MDF): NPA A208.2; composed of wood fibres, medium density, of grade to suit application.

### **2.3 LAMINATE MATERIALS**

- .1 High Pressure Laminate: NEMA LD3, high pressure laminate, solid chosen from manufacturers standard colour range, satin finish.

### **2.4 ACCESSORIES**

- .1 Adhesive: Type recommended by laminate manufacturer to suit application.
  - .1 Adhesives to SCAQMD Rule 1168-05
- .2 Plastic Edge Trim (PVC): Extruded flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness; colour as selected. Minimum 3 mm thickness.

### **2.5 HARDWARE**

- .1 Hardware: BHMA A156.9
- .2 Shelf Standards and Rests: Formed steel channels and rests, cut for fitted rests spaced at 25 mm centres; satin finish.
- .3 Shelf Brackets: Formed steel brackets, formed for attachment with lugs; satin finish.
- .4 Drawer and Door Pulls: Extruded aluminum pull, U-shaped satin finish; 100 mm centres..
- .5 Catches: Magnetic.
- .6 Drawer slides: steel construction with metal ball bearing retainers/rollers, side mounting unless detailed/indicated otherwise, full extension style, automatic stops to prevent accidental dropping of drawers when pulled out, each with 25 kg capacity, bright zinc finish.
- .7 Hinges: European type, satin finish.
- .8 Lazy Susan shelves: adjustable height spin around shelves on central chrome plated steel shaft for use in kitchen lower cabinets to improve storage and access, shelves to be lipped design chrome plated wire construction or painted sheet steel construction, one unit per kitchen.

### **2.6 PLASTIC LAMINATE CASEWORK**

- .1 Cabinet Construction: Flush overlay, adjustable shelving.
- .2 Exposed Surfaces:
  - .1 Casework doors: stile and rail construction enclosing recessed flat panel, solid wood, Red Oak species, architectural clear grade, flat slice cut, 19 mm thick.
  - .2 Drawer fronts: stile and rail raised panel construction, solid wood, Red Oak species, architectural clear grade, flat slice cut, 19 mm thick.

- .3 Semi-exposed Surfaces:
  - .1 Surfaces (other than drawer bodies) Thermofused melamine.
  - .2 Shelves: High pressure laminate.
  - .3 Edges: PVC.
  - .4 Drawer Sides and Backs: Edgebanded.
  - .5 Drawer Bottoms: Melamine.
  
- .4 Cabinets over toilets:
  - .1 Bodies (tops, sides, bottoms): Oak wood.
  - .2 Backs: melamine laminations.
  - .3 Shelves:
    - .4 Melamine laminations.
    - .5 Provide melamine resin impregnated decorative sheet fused thermally to shelf edges exposed in final assembly.
  - .6 Doors: stile and rail construction enclosing recessed flat panel, solid wood, Red Oak species, architectural clear grade, flat slice cut, 19 mm thick.
  
- .5 Closet shelf-with-rod units:
  - .1 Shelf: melamine laminations, provide melamine resin impregnated decorative sheet fused thermally to all edges (edge banding) exposed in final assembly.
  - .2 Rod: chrome plated 33 mm o.d x minimum 1.9 mm wall thickness seamless steel tubing, with chrome plated steel round "captured" flanges to prevent unauthorized rod removal, complete with chromed plated mounting screws.

## **2.7 PLASTIC LAMINATE COUNTERTOPS**

- .1 Comply with AWMAC Quality Standards, Custom grade requirements for counter construction supplemented as follows:
- .2 High Pressure Laminate: high pressure laminate, solid from standard colour range, with matte finish.
- .3 Postformed style countertops.
- .4 Core Material: Plywood.

## **2.8 FABRICATION**

- .1 Shop prepare and identify components for matching during site assembly.
- .2 Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.
- .3 When necessary to cut and fit on site, provide materials with ample allowance for site cutting and scribing.



- .4 Apply plastic laminate finish in full, uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises.

## **2.9 WOOD FINISHES**

- .1 Factory Finishing:
  - .1 Finishing System: AWMAC, Custom grade, acrylic lacquer finish system.
  - .2 Sheen: Satin.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install Work to AWMAC Custom Grade.
- .2 Set and secure casework in place; rigid, plumb, and level.
- .3 Use fixture attachments in concealed locations for wall mounted components.
- .4 Use concealed joint fasteners to align and secure adjoining counter tops.
- .5 Secure cabinet to floor using appropriate angles and anchorages.

### **3.2 ADJUSTING**

- .1 Test installed work for rigidity and ability to support loads.
- .2 Adjust moving or operating parts to function smoothly and correctly.

### **3.3 CLEANING**

- .1 Do cleaning in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

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**Part 1      General**

**1.1          SECTION INCLUDES**

- .1      Sheet waterproofing.

**1.2          RELATED SECTIONS**

- .1      Section 07 21 05 - Insulation: board insulation.

**1.3          SUBMITTALS**

- .1      Make submissions in accordance with procedures described in Section 01 33 00 - Submittal Procedures.
- .2      Product data:
  - .1      Submit manufacturer printed product literature, specifications and data sheets requested by Departmental Representative.

**1.4          SITE MOCK-UPS**

- .1      Prepare in accordance with Section 01 45 00 - Quality Assurance.
- .2      Install sheet waterproofing in locations directed by Departmental Representative to indicate installation techniques, laps, seaming and workmanship.
- .3      Include sheet waterproofing connections to items penetrating waterproofing installations.
- .5      Approved mock-ups will establish minimum acceptable standard for remaining work.
- .6      Approved mock-ups may remain part of Work.

**Part 2      Products**

**2.1          MATERIALS**

- .1      Sheet waterproofing: self-adhesive purpose-made waterproofing membrane, minimum 1.5 mm thick total thickness, comprised of 1.4 mm thick SBS rubberized asphalt integrally bonded to 0.1 mm thick cross-laminated polyethylene film, peel-off film protecting self-adhering backing.
- .2      Primers, mastics: types recommended by respective membrane manufacturer for conditions, applications and substrates applicable.

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**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verify existing conditions before starting work.
- .2 Verify condition of substrate and adjacent materials.

**3.2 PREPARATION**

- .1 Prepare surfaces in accordance with respective waterproofing sheet manufacturer requirements.
- .2 Clean surfaces of forming oils, grease, paints, dust and other contaminants.
- .3 Fill concrete joints and cracks; remove and grind smooth sharp concrete edges and fins.
- .4 Apply primers in accordance with sheet waterproofing manufacturer's directions for substrates and temperatures applicable.

**3.3 INSTALLATION**

- .1 Install to match accepted site mock-ups.
- .2 Apply in accordance with manufacturer's directions and requirements to achieve permanent watertight installations.
- .3 Apply waterproofing from finished grade elevations down foundation walls onto tops of footings, out across tops of footings to seal footing-to-foundation wall joints and down footing faces to bearing elevations.
- .4 Apply compatible mastic to seal all penetrations occurring within waterproof zone.

**3.4 INSPECTION**

- .1 Notify Departmental Representative at least 2 working days in advance for inspection of completed installations.
- .2 Do not permit installations to be concealed or enclosed without inspection.

**END OF SECTION**

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**Part 1      General**

**1.1          SECTION INCLUDES**

- .1      Thermal batt insulation in exterior wall and ceiling construction.
- .2      Board insulation over substrate.
- .3      Board Insulation under perimeter of concrete slab.
- .4      Blown insulation at attic: loose insulation pneumatically placed.
- .5      Foamed-in-place insulation at junctions and joints of wall and roof materials to achieve thermal and air/vapour seal.

**1.2          RELATED SECTIONS**

- .1      Section 07 13 52 - Modified Bituminous Sheet Waterproofing.
- .2      Section 07 26 00 - Vapour Retarders.

**1.3          REFERENCES**

- .1      American Society for Testing and Materials (ASTM International).
  - .1      ASTM C665-12 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
- .2      Underwriters' Laboratories of Canada (ULC).
  - .1      CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.
  - .2      CAN/ULC-S702-1997, Standard for Mineral Fibre Insulation.

**1.4          SYSTEM DESCRIPTION**

- .1      Provide continuity of wall/roof thermal enclosure from the exterior environment.

**Part 2      Products**

**2.1          INSULATION MATERIALS**

- .1      Pre formed semi rigid Mineral Wool insulation in batt form, unfaced, friction fit, to ASTM C665.
  - .1      Thermal resistance and sizes as indicated.
  - .2      Sound Batt insulation in interior wall assemblies where indicated.

- .2 Board insulation: CAN/ULC-S701, Type4, extruded cellular polystyrene.
  - .1 Plain: ship lap edges; minimum 210 kPa compressive strength; minimum 5 year "aged" thermal resistance value of RSI 0.87 per 25 mm thickness; thicknesses or total RSI/R-values detailed/indicated.
  - .2 Under slab insulation:
    - .1 Insulation Board: Extruded polystyrene (XPS) insulation to ASTM C578 – 15b and CAN/ULC-S701, Type VI, thickness as indicated, square edges.
  - .3 Concrete topped: tongue and groove edges, minimum 240 kPa compressive strength; minimum 5 year "aged" thermal resistance value of RSI 0.87 per 25 mm insulation thickness; with 10 mm thick factory-applied latex modified 32 Mpa at 28 days strength concrete topping, middle scored, with impact resistance equal to standard 200 mm concrete block per ASTM G14 test method; thicknesses or total RSI/R-values detailed/indicated.
    - .1 Companion accessories: purpose-made concealed fasteners, clips and devices recommended by insulation manufacturer for securing insulation permanently in place; all galvanized to resist rusting.
- .3 Blown insulation: CAN/ULC-S702 Type 5, mineral fibre (rock wool) with zero flame spread and smoke development in accordance with CAN/ULC S102.2, thicknesses or total RSI/R-values detailed/indicated.
- .4 Foamed insulation:
  - .1 CAN/ULC-S705.1, low rise expanding polyurethane type.
  - .2 Flame spread and smoke developed rating: CAN/ULC-S102.

## **2.2 ACCESSORIES**

- .1 Board insulation adhesive: type recommended by insulation manufacturer for substrates encountered, compatible with sheet waterproofing.
- .2 Drain mat: purpose-made filter mat drain board product comprised of dimpled plastic drainage sheeting layer bonded to non-woven geotextile filter fabric, capable of permitting free water passage while preventing fines from entering drainage plane, directing groundwater downwards by gravity.

## **Part 3 Execution**

### **3.1 INSTALLATION - BATT INSULATION**

- .1 Install batt insulation, in exterior walls and between ceiling framing spaces without gaps or voids.
  - .1 Keep insulation minimum 75 mm from heat emitting devices and recessed light fixtures not marked suitable for contact with insulation.
  - .2 Keep insulation minimum 50 mm from sidewalls of chimneys and Types B and L vents.

- .2 Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation. Leave no gaps or voids.
- .3 Install sound batt insulation in interior walls where indicated.

### **3.2 INSTALLATION - BOARD INSULATION AT FOUNDATION PERIMETER**

- .1 Install boards on foundation wall perimeter over sheet waterproofing.
  - .1 Plain boards: place boards in a method to maximize contact bedding; stagger joints; butt edges and ends tight to adjacent board and to protrusions.
  - .2 Concrete topped boards: install using companion accessories; mitre cut outside corners to conceal insulation under concrete topping; fill joints with continuous bead of flexible exterior grade caulking in colour grey to match cement face; tool caulking to produce smooth and uniform surface and to ensure that caulking will adhere to joint.

### **3.3 INSTALLATION - DRAIN MAT AT FOUNDATION PERIMETER**

- .1 Install boards over inspected perimeter insulation.
- .2 Co-ordinate and schedule installation of perimeter insulation with timely installation of drain mat to limit exposure of unprotected insulation to sunlight and construction damage. Provide temporary protective coverings where installation of drain mat is delayed.
- .3 Install drain mat to provide drainage way for ground water by relieving hydrostatic pressure and leading groundwater down to footing drains. Install full size panels.
- .3 Join adjacent panels together with lateral edge of connecting panel placed over flanged edge of previous panel. Seal top/terminal edge of panel installations to prevent soil from intruding into or behind panels.
- .4 Fix panels in place with adhesive to resist displacement during backfilling operations. Adhesive to be compatible with insulation and drain mat.
- .5 Protect installed drain mat from damage and displacement until backfilled.

### **3.4 INSTALLATION - BLOWN INSULATION**

- .1 Install insulation and ventilation baffles to manufacturer instructions.
  - .1 Provide and install baffles to prevent insulation from spilling over top of exterior wall and causing blockage of soffit vents and to prevent displacement of insulation by wind entering vents.
- .2 Place insulation in attic spaces.
  - .1 Keep insulation minimum 75 mm from heat emitting devices and recessed light fixtures not marked suitable for contact with insulation.
  - .2 Keep insulation minimum 50 mm from sidewalls of chimneys and Types B and L vents.

- .3 Place insulation against baffles. Do not impede natural attic ventilation to soffit.
- .4 Place tight to and behind mechanical and electrical services within the plane of insulation.
- .5 Completely fill intended spaces. Leave no gaps or voids.

**3.5 FOAMED INSULATION - APPLICATION**

- .1 Apply insulation by froth method, to uniform monolithic density without voids.
- .2 Apply in all spaces and crevices in exterior wall and roof construction in order to maintain continuity of air seal and vapour retarder.
- .3 Apply to achieve continuity of enclosure thermal resistance.

**3.6 INSPECTION**

- .1 Notify Departmental Representative at least 2 working days in advance for inspection of completed installations.
- .2 Do not permit installations to be concealed or enclosed without inspection.

**END OF SECTION**

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**Part 1      General**

**1.1      SECTION INCLUDES**

- .1      Sheet and sealant materials for controlling vapour diffusion.

**1.2      RELATED SECTIONS**

- .1      Section 07 21 05 - Insulation: batt insulation.

**1.3      REFERENCES**

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

**1.4      DEFINITION**

- .1      Vapour retarder: material or assembly of materials that resists water vapour diffusion through it.

**1.5      SYSTEM DESCRIPTION**

- .1      Materials and installation methods to provide continuity of vapour retarder:
  - .1      In conjunction with materials described in Section 07 21 05 - Insulation and Section 07 92 12 - Interior Sealants.
  - .2      To seal gaps between enclosure components and opening frames.
  - .3      To seal miscellaneous penetrations.

**1.6      PERFORMANCE REQUIREMENTS**

- .1      Maximum vapour permeability (perm): 1 ng/S/m/pa measured in accordance with ASTM E96 Method E.

**1.7      ADMINISTRATIVE REQUIREMENTS**

- .1      Co-ordinate with other work having a direct bearing on work of this section.
- .3      Sequencing:
  - .1      Sequence Work to permit installation of materials in conjunction with other retardant materials and seals.
  - .2      Do not install vapour retarder until items penetrating it are in place.

**1.8      SITE MOCK-UPS**

- .1      Prepare in accordance with Section 01 45 00 - Quality Assurance.



- .2 Install vapour retarder in locations directed by Departmental Representative to indicate installation techniques, laps, seaming and workmanship.
- .3 Include vapour retarder connections around perimeter of each of the following conditions to indicate connection techniques.
  - .1 Each type of exterior door frame.
  - .2 Each type of window frame.
  - .3 Each type of ventilation grille, exhaust outlet and other exterior wall penetration.
- .4 Notify Departmental Representative at least 2 weeks in advance to review mock-ups.
- .5 Approved mock-ups will establish minimum acceptable standard for remaining work.
- .6 Approved mock-ups may remain part of Work.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Polyethylene film: to CAN/CGSB-51.34, with maximum 0.01 perms vapour transmission.
  - .1 Thicknesses: 0.15 mm (6 mils).
  - .2 Under Slab
    - .1 Purpose made reinforced polyethylene vapour barrier manufactured from virgin materials with a permeance of less than 0.01 perms.
    - .2 Permeance tested in accordance with ASTM E1745.
    - .3 Strength to ASTM E1745 Class A.
    - .4 Thickness:.381mm (15 mils) minimum.
- .2 Joint sealing tape: moisture resistant pressure sensitive adhesive tape, minimum 50 mm wide.
  - .1 Proprietary moisture resistant pressure sensitive adhesive tape as recommended for use on underslab vapour barrier.
- .3 Sealant: non-hardening formulation, compatible with polyethylene film.
  - .1 VOC limit: maximum 250 g/L.
- .4 Staples: minimum 6 mm leg.
- .5 Moulded box vapour barriers: factory-moulded polyethylene box for use with recessed electric switch and outlet device boxes.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verify existing conditions before starting work.
- .2 Verify condition of substrate and adjacent materials.

### 3.2 PREPARATION

- .1 Remove loose or foreign matter which might impair adhesion.
- .2 Clean and prime substrate surfaces to receive sealants in accordance with manufacturer written instructions.

### 3.3 INSTALLATION

- .1 Install to match accepted site mock-ups.
- .2 Typical applications:
  - .1 Use 0.15 mm (6 mils) thick sheets of largest practical size to minimize joints. Arrange all joints to occur on solid bearing.
  - .2 Cut and tailor sheet to form openings and ensure material is lapped and sealed to frames.
  - .3 Cut and tailor sheet to form openings and ensure material is lapped and sealed to frames.
  - .4 Inspect sheets for continuity. Repair punctures and tears with sealing tape before installations are concealed.
  - .5 Seal perimeter of installations as follows:
    - .1 Apply continuous bead of sealant to substrate at perimeter of sheets.
    - .2 Lap sheet over sealant and press into sealant bead.
    - .3 Install staples through lapped sheets at sealant bead into wood substrates, where applicable. Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.
  - .6 Seal lap joints in sheets as follows:
    - .1 Attach 1st sheet to substrate.
    - .2 Apply continuous bead of sealant over solid backing at joint.
    - .3 Lap adjoining sheet minimum 150 mm and press into sealant bead.
    - .4 Install staples through lapped sheets at sealant bead into wood substrate, where applicable.
    - .5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.
  - .7 Seal electrical switch and outlet device boxes that penetrate sheet as follows:
    - .1 Moulded vapour barrier shells.
    - .2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through shell back and sides.
  - .8 Seal door and window frames that penetrate sheet as follows:
    - .1 Perform all sealing in locations which will remain hidden from view in final construction.
    - .2 Apply continuous bead of sealant to door and window frames for connection of sheets.
    - .3 Lap sheet over sealant and press into sealant bead.
    - .4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

- .3 Underslab applications:
- .1 Install the barrier in accordance with this section and Manufacturer's instructions.
  - .2 Install vapour barrier as a continuous, airtight floor moisture barrier system under the entire concrete slab. The barrier shall be sealed with manufacturers flexible sealant at all edges, seams and penetrations to provide a water and air tight seal.
  - .3 Lap seams a minimum of 150 mm sealed in the overlapping areas sealed manufacturers proprietary polyethylene tape.
  - .4 Continue the barrier vertically up all columns, pipes and interior concrete grade beams for a distance of at least 200 mm.
  - .5 Tape and seal the floor barrier around columns and pipes
  - .6 Tape and seal at all perforations, penetrations and at structural elements.

### **3.4 INSPECTION**

- .1 Notify Departmental Representative at least 2 weeks days in advance for inspection of completed installations.
- .2 Do not permit installations to be concealed or enclosed without inspection.

**END OF SECTION**

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**Part 1      General**

**1.1          SECTION INCLUDES**

- .1      Building/sheathing paper.
- .2      Materials to connect and seal openings, joints and junctions between building/sheathing paper and other materials and assemblies.
- .3      Metal flashings lapped under building/sheathing paper installations.

**1.2          REFERENCES**

- .1      Canadian General Standards Board (CGSB).
  - .1      CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.

**1.3          SITE MOCK-UPS**

- .1      Prepare in accordance with Section 01 45 00 - Quality Assurance.
- .2      Install air barrier in locations directed by Departmental Representative to indicate installation techniques, laps, seaming and workmanship.
- .3      Include air barrier connections (SAM) around perimeter of each of the following conditions to indicate connection techniques.
  - .1      Each type of exterior door frame.
  - .2      Each type of window frame.
  - .3      Each type of ventilation grille, exhaust outlet and other exterior wall penetration.
- .4      Notify Departmental Representative at least 2 weeks in advance to review mock-ups.
- .5      Approved mock-ups will establish minimum acceptable standard for remaining work.
- .6      Approved mock-ups may remain part of Work.

**Part 2      Products**

**2.1          MATERIALS**

- .1      Building/sheathing paper: CAN/CGSB-51.32 asphalt saturated kraft paper permitting passage of water vapour; conforming to U.S. Standard UUB-790A for 30 minute water resistance.
- .2      Staples: corrosion-resistant alloy or plated, lengths required to penetrate sheathing for secure attachment of building/sheathing paper.
- .3      Tape: proprietary moisture-resistant pressure-sensitive adhesive tape.

- .4 Caulking: gun grade asphaltic compound recommended by building/sheathing paper manufacturer for use sealing lap joints.
- .5 Self-adhesive membrane (SAM): minimum 1 mm thick self-adhering composite sheet membrane comprised of 0.9 mm thick rubberized asphalt integrally bonded to 0.1 mm thick reinforced high density polyethylene film, with peel-off protective paper covering self-adhesive surface, with companion surface primer for attachment to substrates.
- .6 Metal flashings: 0.56 mm thick (26 ga.) pre-painted Z275 (G90) designation zinc coated sheet metal.
  - .1 Finish: not less than 22 micrometres of high molecular weight polyester (hmp) gloss paint on epoxy primer prior to profile fabrication; include permanent-type treatment to reverse side of coil stock to prevent corrosion of backside surfaces; colours selected by Departmental Representative.
- .7 Nails: galvanized steel roofing nails, length to penetrate minimum 19 mm into sheathing.

## **2.2 FLASHING FABRICATION**

- .1 Use commercial sheet metal forming equipment to fabricate accurate flashings with true crisp lines and quality metalwork joinery suitable for exposed installation.
- .2 Hem exposed edges of flashings.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Be responsible for installation and proper placement of SAM and building/sheathing paper starter strips prior to installation of wall penetration items to ensure weather sealed junctions between wall penetration items and building/sheathing paper application.
  - .1 All wall openings.
  - .2 All wall penetrations.
  - .3 Locations detailed/indicted on drawings.
- .2 Provide and install metal flashings detailed/indicated tied into building/sheathing paper installations to shed moisture to exterior of building. Fix in place with roofing nails.

### **3.2 INSTALLATION**

- .1 Install to match accepted site mock-ups.
- .2 Install 2 layers of building/sheathing paper to produce both continuous water shedding barrier over wall sheathing. Install in 2 separate applications with joints staggered/offset by at least 300 mm between 2nd application and 1st application to ensure continuous water shedding function.

- .3 Install building/sheathing paper horizontally, starting from bottom of wall with each subsequent course shingle lapped over previous course to shed moisture down building/sheathing paper surface.
- .4 Integrate building/sheathing paper installation with building/sheathing paper starter strips and SAM stripping installed around rough openings.
- .5 Overlap subsequent courses minimum 50 mm over previous courses and provide minimum 100 mm overlaps at course ends laps.
- .6 Cut and tailor fit building/sheathing paper neatly around openings and projections. Seal to openings in walls using SAM.
- .7 Attach building/sheathing paper to sheathing using sufficient quantities of staples to hold paper in place until covered by subsequent construction.
- .8 Seal vertical lap joints of each layer using continuous applications of tape or caulking.
- .9 Repair rips and tears in building/sheathing paper using continuous strips of tape. Repair large holes using patches of building/sheathing paper stapled in place with all edges tape sealed.

**END OF SECTION**

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**Part 1            General**

**1.1                SECTION INCLUDES**

- .1        Moisture shedding underlayment, eave, valley and ridge protection.
- .2        Granular surfaced asphalt shingle roofing.
- .4        Attic/roof vents.
- .5        Vent pipe flashings/roof jacks.

**1.2                RELATED REQUIREMENTS**

- .1        Section 07 62 00 – Sheet Metal Flashing and Trim.

**1.3                REFERENCES**

- .1        Canadian General Standards Board (CGSB)
  - .1        CAN/CGSB-37.4-M89, Fibrated, Cutback Asphalt, Lap Cement for Asphalt Roofing.
  - .2        CAN/CGSB-37.5-M89, Cutback Asphalt Plastic Cement.
  - .3        CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
  - .4        CAN/CGSB-51.34-M86 Vapour Barrier Polyethylene Sheet, for Use in Building Construction.
- .2        Roofing Contractors' Association of British Columbia (RCABC)
  - .1        RCABC Roofing Practices Manual - 2016.
- .3        American Society for Testing and Materials (ASTM):
  - .1        ASTM D1970 / D1970M - 20 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
- .4        CSA International
  - .1        CAN/CSA-A123.1/A123.5, Asphalt Shingles Made From Organic Felt and Surfaced With Mineral Granules/Asphalt Shingles Made From Glass Felt and Surfaced With Mineral Granules.
  - .2        CAN/CSA-A123.2-03(R2008), Asphalt-Coated Roofing Sheets.
  - .3        CSA A123.3-05(2010), Asphalt Saturated Organic Roofing Felt.
  - .4        CAN3-A123.51-M85(R2006), Asphalt Shingle Application on Roof Slopes 1:3 and Steeper.
  - .5        CAN3-A123.52-M85(R2006), Asphalt Shingle Application on Roof Slopes 1:6 to Less Than 1:3.
  - .6        CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .6 National Research Council Canada (NRC)/Institute for Research in Construction (IRC) - Canadian Construction Materials Centre (CCMC)
  - .1 CCMC-2011, Registry of Product Evaluations.

#### **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 asphalt shingles and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
  - .1 Submit duplicate samples of full size specified shingles.

#### **1.5 QUALITY ASSURANCE**

- .1 Perform all installations in accordance with RCABC requirements.

#### **1.6 WARRANTY**

- .1 Provide manufacturer's standard warranty for asphalt shingle installations.

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

- .1 Deliver, store and handle materials in accordance with manufacturers requirements.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Remove only in quantities required for same day use.
  - .3 Replace defective or damaged materials with new.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Asphalt shingles: to ASTM D3018 Type 1, ASTM D3462 and CAN/CSA-A123.1/A123.5.
  - .1 Description: styrene butadiene styrene (SBS) coated glass fibre mat, traditional 3-tab design, with heat-activated self-sealing and algae-block coating.
  - .2 Exposure: 140 mm to 145 mm.
  - .3 Fire resistance (ASTM E108): Class A.
  - .4 Wind resistance (ASTM D3161 Type 1 Class F): passes 161 km/h (100 mph) test.



- .5 Impact resistance (UL2218): Class 4.
- .6 Colours: selected by Departmental Representative.
- .2 Sheathing paper: to CAN/CGSB-51.32.
- .3 Eave protection to ASTM D1970 / D1970M – 20.
  - .1 Self-adhering.
  - .2 Sanded top surface.
  - .3 Minimum 1.4 mm thickness.
- .4 Roofing felt: to CSA A123.3 (organic felt No. 15).
- .5 Asphaltic Cement:
  - .1 Plastic cement: to CAN/CGSB-37.5.
  - .2 Lap cement: to CAN/CGSB-37.4.
- .6 Sheet Metal: minimum 0.56 mm (26 ga) galvanized iron or 0.80 (.032") aluminum.
- .7 Nails: to CSA B111, of galvanized steel, sufficient length to penetrate 19 mm into deck.
- .8 Staples: chisel point galvanized steel 25 mm crown 1.5 mm thick, sufficient length to penetrate 20 mm into deck.

## 2.2 ACCESSORIES

- .1 Attic/roof) vents:
  - .1 Description: purpose-made proprietary units designed for use on sloped roofs, with integral mounting flange, fitted with insect screen and water shedding caps.
  - .2 Sizes: approx. 38,800 mm<sup>2</sup> of free air flow per vent.
  - .3 Material: pre-painted aluminum sheet construction.
  - .4 Colour: selected by Departmental Representative.
  - .5 Fasteners: galvanized steel roofing nails, length to penetrate minimum 19 mm into sheathing.
  - .6 Quantity: to meet code requirements.
- .2 Vent pipe flashings/roof jacks:
  - .1 Description: purpose-made proprietary units, sized to suit plumbing vent stacks, with integral mounting flange, c/w companion vent caps to ensure permanent watertight installations with shingle roofing.
  - .2 Material: 12.2 kg/m<sup>2</sup> sheet lead.
  - .3 Fasteners: galvanized steel roofing nails, length to penetrate minimum 19 mm into sheathing.

## Part 3 Execution

### 3.1 APPLICATION

- .1 Do asphalt shingle work to RCABC standards except where specified otherwise.

- .2 Install self-adhesive eave protection at perimeter of roof.
  - .1 Extend up roof slope minimum 915mm from fascia.
  - .2 Overhang fascia by 25mm.
- .3 Install underlayment over roof deck, lap over eave protection.
- .4 Install sheet metal drip edge along eaves, overhanging 50 mm with minimum 50 mm flange extending onto roof decking. Nail to deck at 300 mm o.c..
- .5 Install bottom step flashing (soaker base flashing) interleaved between shingles at vertical junctions.
- .6 Install shingles in accordance with manufacture's recommendations or RCABC standards. Whichever is more stringent.

### **3.3 ROOF VENTS**

- .1 Cut neat accurate holes in roof sheathing without damaging roof framing.
- .2 Install vents square, true and uniformly spaced to line of each roof slope.
- .3 Install with shingle installations.
- .4 Make installations waterproof.

### **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 in accordance with Section 01 74 19 - Construction Waste and Disposal.

### **3.3 PROTECTION**

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

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED SECTIONS**

- .1    Section 07 62 00 – Sheet Metal Flashings and Trims: wall flashings.
- .2    Section 08 11 00 – Exterior Doors.
- .3    Section 08 36 13- Sectional Doors.

**1.2                REFERENCES**

- .1    American Society for Testing and Materials International, (ASTM).
  - .1    ASTM C1186-08, Standard Specification for Flat Fiber-Cement Sheets.
- .2    Canadian General Standards Board (CGSB).
  - .1    CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
  - .2    CAN/CGSB-19.17-M90, One-component, Acrylic Emulsion Base Sealing Compound.
- .3    Health Canada/Workplace Hazardous Materials Information System (WHMIS).
- .4    Material Safety Data Sheets (MSDS).

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Product Data:
  - .1    Submit manufacturer installation instruction sheets indicating nailing and cutting requirements.
  - .2    Submit manufacturer MSDS for siding and panels.
    - .1    Indicate precautions for workers when cutting siding.
- .3    Samples:
  - .1    Submit 300 long samples of siding proposed for use in Work, if requested by Departmental Representative.
  - .2    Submit full range pre-finish colour charts for Departmental Representative colour selection use.
- .4    Manufacturer's instructions:
  - .1    Submit manufacturers installation instructions

**1.4                QUALITY ASSURANCE**

- .1    Mock ups
  - .1    Install at least 10 m<sup>2</sup> area of siding in location directed by Departmental Representative to indicate installation techniques and workmanship. Include application of sealant in mock-ups.

- .2 Notify Departmental Representative at least 1 week in advance to review mock-ups.
- .3 Allow 2 working days for Departmental Representative to inspect mock-ups.
- .4 Approved mock-ups will establish minimum acceptable standard for remaining work.
- .5 Approved mock-ups may form part of Work.

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

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

## **1.6 ENVIRONMENTAL REQUIREMENTS**

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

## **1.7 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 Construction Waste and Disposal.

## **1.8 WARRANTY**

- .1 For Work of this Section, 12 months warranty period is extended as follows:
  - .1 360 months that siding and panels will be free from defects in materials and workmanship.
  - .2 180 months that pre-finish applied to siding and to panels will be free from paint peeling, cracking and chipping.
  - .3 Warranties to be in form acceptable to Departmental Representative.

## **1.9 CLOSEOUT SUBMITTALS**

- .1 Provide warranty certificates for inclusion in O&M manual.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Siding: to ASTM C1186, asbestos-free composite product intended for exterior use, insect resistant, fire resistant and non-combustible.
  - .1 Lap siding.
    - .1 Thickness: 8 mm.
    - .2 Exposed face: embossed woodgrain texture.

- .2 Panels
  - .1 Dimensions: 1220 mm wide x 2438 mm long.
  - .2 Thickness: 8mm
  - .3 Exposed Face: Smooth
- .2 Soffit board: to ASTM C1186, asbestos-free composite product intended for exterior use, insect resistant, fire resistant and non-combustible.
  - .1 Pre drilled for venting.
  - .2 Manufactured specifically for soffit applications.
- .3 Finish
  - .1 Pre-finished factory-applied 3 coat baked on paint system in standard available colour to be approved by Departmental Representative. Each board factory protected with plastic film prior to shipping.
    - .1 Pre finished siding colour to be chosen by Departmental Representative from submitted samples.
- .4 Trim materials
  - .1 Lumber: softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:
    - .1 CSA O141.
    - .2 NLGA Standard Grading Rules for Canadian Lumber.
    - .3 Tight grain, appearance grade, SPF.
    - .4 Comb face appearance.
    - .5 Factory pre primed on all 4 sides.
    - .6 Refer to details for dimensions and profiles.
- .5 Nails:
  - .1 Stainless steel alloy or hot dip galvanized steel; style, type, head and lengths recommended by siding/panel manufacturer for permanent attachment of siding/panels to substrates applicable.
  - .2 Style and head of nails acceptable to Departmental Representative to minimize nail appearance where nails cannot be concealed.
- .6 Screws:
  - .1 Ceramic coated steel alloy socket drive (Robertson) flat head deck screws of lengths recommended by panel manufacturer for permanent attachment of trims to substrates.
- .7 Sealants:
  - .1 Paintable: acrylic latex to CAN/CGSB-19.17, colours capable of being concealed by paint.
  - .2 Non-paintable: polyurethane to CAN/CGSB-19.13, colours to match siding/panel paint colours.
- .8 Touch-up paint: siding/panel manufacturer formulation for exact touch-up/repair of pre-finished siding/panels.

- .9 Accessories: Aluminum bug screen closure custom fabricated for soffit venting assembly.

### **Part 3 Execution**

#### **3.1 MANUFACTURERS INSTRUCTIONS**

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

#### **3.2 INSTALLATION**

- .1 Coordinate siding installation with the installation of flashing and doors.
- .2 Use maximum size material at each location to prevent or minimize joints.
- .3 Cut material using sharp shears, saws and tools recommended by siding/panel manufacturer. Make cuts that will produce true even joints free of chips and splinters.
- .4 Remove factory protective film immediately after installation of each board to ensure full protection of pre-finish coating during siding/panel handling and installation.
- .5 Strapping:
- .1 Install over inspected building/sheathing paper installations to support siding.
- .2 Shim and adjust as necessary to ensure continuous flat planes were wall sheathing is irregular.
- .3 Drive nails flush with strapping face.
- .6 Siding:
- .1 Planks
- .1 Install on previously installed strapping.
- .2 Install to match approved site mock-ups.
- .3 Blind nail in place.
- .4 Stagger end joints in adjacent coursing so as not to be apparent in finished installation.
- .5 Provide and install siding starter strips required for start of siding installations.
- .6 Install horizontal and true to line of building with even aligned coursing across all wall planes.
- .7 Install lap siding with 6" exposure.
- .2 Panels:
- .1 Use largest production sheets to reduce or eliminate panel joints. Make panel joints tight fitted, flush and symmetrical where panel joints cannot be avoided.
- .2 Install panels using combination of construction adhesive and nails. Limit use of face nailing in order not to blemish panel faces.
- .3 Install battens as detailed.

- .7 Soffits
  - .1 Install soffit venting panels as detailed.
- .8 Trim:
  - .1 Nail and screw in place as detailed.
- .9 Caulking:
  - .1 Install to match accepted mock-ups.
  - .2 Install sealants to produce weathertight and fine-finished installations.
  - .3 Apply sealant in continuous beads, using caulking gun and proper size nozzle.
  - .4 Use sufficient pressure to fill voids and joints solid.
  - .5 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
  - .6 Tool exposed surfaces before skinning begins.
    - .1 Siding/panel butt joints: finish sealant flush and smooth to minimize joint appearance.
    - .2 All other joints: finish sealant to give slightly concave shape.
  - .7 Wipe off excess sealant without damaging siding/panel pre-finish paint coating.

### **3.3 CLEANING**

- .1 Progress Cleaning:
  - .1 Remove dirt and marks caused by installation.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for recycling.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.4 PROTECTION**

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

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1        Section 07 31 13 - Asphalt Shingles.
- .2        Section 07 44 56 - Fiber Reinforced Cementitious Siding.

**1.2                REFERENCES**

- .1        American Society for Testing and Materials International (ASTM)
  - .1        ASTM A240/A240M-07e1, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
  - .2        ASTM A653/A653M-07, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated Galvannealed by the Hot-Dip Process.
  - .3        ASTM D523-89(1999), Standard Test Method for Specular Gloss.
  - .4        ASTM D822-01(2006), Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
  - .5        ASTM C920-08, Standard Specification for Elastomeric Joint Sealants.
- .2        Aluminum Association (AA)
  - .1        AA DAF 45-03(R2009), Designation System for Aluminum Finishes.
- .3        American Architectural Manufacturers Association (AAMA)
  - .1        AAMA 611-98, Voluntary Specifications for Anodized Finishes Architectural Aluminum.
- .4        Roofing Contractors Association of B.C. (RCABC)
  - .1        RGC, RCABC Guarantee Corporation
  - .2        RGC Manual, RGC Roofing Practices Manual published by RCABC.
- .5        NBC, National Building Code of Canada (issue date listed in Section 01 41 00 Regulatory Requirements)

**1.3                SUBMITTALS**

- .1        Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Product Data:
  - .1        Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3        Samples:
  - .1        Submit duplicate samples of each type of sheet metal material, finishes and colours for Departmental Representative colour selection.



#### **1.4 QUALITY CONTROL**

- .1 Do Work in accordance with latest standards published in RGC Manual for 5 Year Guarantee.

#### **1.5 PERFORMANCE REQUIREMENTS**

- .1 Provide metal flashings that will withstand wind uplift conditions listed in NBC for building location, unless more stringent values are identified on drawings.

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

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements unless more stringent care is required by respective material manufacturer.
- .2 Protect pre finished materials from scratching
- .3 Stack pre-formed materials in manner to prevent twisting, bending and rubbing.

#### **1.7 WASTE MANAGEMENT AND DISPOSAL:**

- .1 Separate waste materials for recycling in accordance with Section 01 74 19 - Construction Waste and Disposal.

### **Part 2 Products**

- .1 Zinc coated sheet steel: to ASTM A653/A653M, commercial quality, Grade 33, with not less than Z275 designation zinc coating, pre-finished.
  - .1 Pre-finish: coil stock finished with polyvinylidene fluoride gloss paint on epoxy primer prior to profile fabrication, with colour coat containing not less than 70% pvdf resin. Include permanent-type treatment to reverse side of coil stock to prevent corrosion of backside surfaces.
    - .1 Specular gloss: 30 units +/- in accordance with ASTM D523.
    - .2 Coating thickness: not less than 22 micrometres
    - .3 Resistance to accelerated weathering for chalk rating of 8, colour fade 5units or less and erosion rate less than 20% to ASTM D822 as follows:
      - .1 Outdoor exposure period 2500 hours
      - .2 Humidity resistance exposure period 5000 hours
    - .4 Colours: As selected by Departmental Representative. Colours to match building
  - .2 Sheet steel to be produced by North American mills to ensure compliance with above-referenced standards. Submit evidence of North American mill source upon Departmental Representative request.
- .2 Touch-up paint: type compatible with and matching pre-finish paint/colour.
- .3 Flashing nails: annular ringed, with integral rubber sealing washers.
  - .1 Stainless steel alloy where used at pressure treated wood.
  - .2 Hot dip galvanized steel where used in untreated wood

- .4 Sealants: non-sag polyurethane, one part formulation, to ASTM C 920 Type S, Grade NS, Class 35, Use NT, M, A and O; colours selected by DCC Representative where exposed to view.
- .5 Self-adhesive SBS membrane: minimum 1 mm thick self-adhering composite sheet membrane comprised of 0.8 mm thick rubberized asphalt integrally bonded to 0.1 mm thick film of polyethylene, bottom surface protected with silicone release sheet.

## 2.2 FABRICATION OF FLASHING

- .1 Fabricate in accordance with detail drawings and to RGC requirements.
- .2 Fabricate typical flashings using not less than 0.61 mm thick pre-finished zinc coated sheet steel, unless detailed/indicated otherwise. Use greater metal thickness at locations of wider span to prevent "oil-canning" and deformation of flashings.
- .3 Fabricate flashings accurately with true crisp lines and quality metalwork joinery suitable for exposed installation.
- .4 Pre-fabricate corners with mitred joints. Form watertight lock-seams set in sealant for all mitred corner joints.
- .5 Maintain 1:6 minimum slope on horizontal surfaces.
- .6 Hem exposed edges. Fold under minimum 10 mm.
- .7 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
- .8 Refer to drawings for self-adhesive SBS membrane locations under metal flashings.
- .9 Fabricate specialized flashings including but not limited to hot pipe flashings, storm collars, pressure rings and flue caps using not less than 0.38 mm (AISI 28 gauge) metal thickness stainless steel sheet. Use greater metal thickness at locations of wider span to prevent "oil-canning" and deformation of flashings.
  - .1 Colour match welding material to parent metal in stainless steel fabrications.
  - .2 Use welding material with same corrosion resistance properties as parent metal.
  - .3 Grind and polish welds to match parent metal.

## 2.3 RAINWARE

- .1 Gutters: continuous die formed pre-finished aluminum sheet fabrications, not less than 0.80 mm metal thickness. Dimensions; 100 mm width x 100 mm depth.
- .2 Downspouts: pre-finished aluminum sheet fabrications, profiles and sizes detailed/indicated, not less than 0.48 mm metal thickness. 4" diameter, round profile. Complete with flanged gutter output tube.
- .3 End caps, downspout outlets, straps, support brackets, downspout strainers: pre-finished aluminum sheet profiles to suit gutters and downspouts.
- .4 Anchorage devices: hot dip galvanized steel or stainless steel alloy screws and washers.
- .5 Gutter supports: designed to fit into, engage and support gutters; non-corroding plated finish stamped metal or aluminum alloy casting fabrications.
- .6 Downspout supports: stamped pre-finished aluminum sheet straps.

- .7 Rain chains: general utility chain, 6 mm dia., Grade 30, welded link, hot dip galvanized finish steel.
- .8 Finishes: aluminum sheet coil stock finished with high molecular weight polyester (hmp) gloss paint on epoxy primer prior to profile fabrication, colours selected by Departmental Representative.

## Execution

### 2.4 INSTALLATION

- .1 Metal Flashings
  - .1 Install in accordance with detail drawings.
  - .2 Fit flashings together so that one end of each section is free to move in joint.
  - .3 Fit flashings secure in place. Make corners square, surfaces true and straight in all planes, and all lines accurate to profiles.
- .2 Metal storm collars: Install plumbing vents as detailed.
- .3 Gutter: install with flashings, as detailed.
- .4 Rainware:
  - .1 Install gutters, rainwater leaders and accessories.
  - .2 Provide gutter supports at intervals required to prevent gutter deformation caused by ladder loads against any point along gutters.
  - .3 Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts and accessories.
  - .4 Slope gutters 5 mm/1000 mm minimum.
  - .5 Seal metal joints watertight.
  - .6 Install rainwater leaders plumb and tight to building face.
    - .1 Fix in place to resist loosening and pulling away using round-headed screws through washers through straps at top, bottom and at 915 mm intervals in between.
    - .2 Fix downspouts and elbow connections using round-headed screws. Make all connections secure and watertight without damaging pre-finished surfaces.
    - .3 Arrange downspouts to drain into concrete anchor blocks.
    - .4 Install rain chains where indicated.

### 2.5 CLEANING

- .1 Clean flashings to remove handling marks and smudges.

- .2 Proceed in accordance with Section 01 74 11 - Cleaning.
  - .1 Progress cleaning: leave Work area clean at end of each day.
  - .2 Final cleaning: on completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools, equipment and barriers.

**END OF SECTION**

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**Part 1      General**

**1.1          REFERENCES**

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .2 Underwriter's Laboratories of Canada (ULC)
  - .1 ULC-S115-1995, Fire Tests of Fire stop Systems.
- .3 Green Seal Environmental Standards
  - .1 Standard GS-36-00, Commercial Adhesives
- .4 South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

**1.2          DEFINITIONS**

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

**1.3          SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit product manufacturer's ULC result cut sheets for each fire stopping condition.

- .3 Submit electronic copies of WHMIS MSDS - Material Safety Data Sheets (MSDS)
  - .1 Indicate precautions for workers using fire stopping products.
- .3 Shop Drawings:
  - .1 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation.
  - .2 Construction details should accurately reflect actual job conditions.
- .4 Samples:
  - .1 Submit samples showing actual fire stop material proposed for project on Departmental Representative's request.
  - .2 Submit manufacturer installation instructions and special handling criteria, installation sequence, cleaning procedures.

#### **1.4 QUALITY ASSURANCE**

- .1 Qualifications:
  - .1 Installer: company specializing in fire stopping installations with 5 years documented experience.
  - .2 Overall Project quality control:
    - .1 Employ one applicator firm to install all firestopping throughout project, using personnel that meet installer qualifications stated above.
    - .2 Do not permit separate trades to firestop their own service penetrations.
  - .3 Health and safety requirements: do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

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

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
  - .3 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, ULC markings.
- .2 Storage and Protection:
  - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.
- .3 Waste Management and Disposal:
  - .1 Separate waste materials for recycling in accordance with Section 01 74 19 - Construction Waste and Disposal.

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**Part 2 Products**

**2.1 MATERIALS**

- .1 Fire stopping and smoke seal systems: in accordance with CAN-ULC-S115.
  - .1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN-ULC-S115 and not to exceed opening sizes for which they are intended.
  - .2 Fire stop system rating: Refer to drawings for assembly ratings.
- .2 Service penetration assemblies: systems tested to CAN-ULC-S115.
- .3 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115.
- .4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.
- .5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .6 Fire stopping materials to conform to the requirements of :
  - .1 Green Seal Environmental Standards:
    - .1 Standard GS-36-00, Commercial Adhesives.
  - .2 South Coast Air Quality Management District (SCAQMD), California State:
    - .1 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.
- .7 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .8 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .9 Sealants for vertical joints: non-sagging.

**Part 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

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

**3.2 PREPARATION**

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials.
  - .1 Ensure that substrates and surfaces are clean, dry and frost free.
- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

- .3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

### **3.3 INSTALLATION**

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

### **3.4 FIELD QUALITY CONTROL**

- .1 Inspections: notify Departmental Representative when ready for inspection and prior to concealing or enclosing fire stopping materials and service penetration assemblies.
- .2 Installed firestopping will be examined to determine if assemblies have been installed in accordance with respective ULC listings.
  - .1 Allow for destructive testing of installed firestopping during examination including re-instatement of damaged firestopping during inspection, at no additional cost to Contract.
  - .2 Deviation from ULC listed systems will be considered grounds for rejection and will require replacement of firestopping to conform with respective ULC listings, at no additional cost to Contract.

### **3.5 CLEANING**

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

**END OF SECTION**



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**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1    Section 07 26 00 Vapour Retarders.
- .2    Section 07 62 00 Sheet Metal Flashing and Trim.
- .3    Section 09 90 00 Painting.

**1.2                REFERENCES**

- .1    ASTM International
  - .1    ASTM C919-08, Standard Practice for Use of Sealants in Acoustical Applications.
- .2    Canadian General Standards Board (CGSB)
  - .1    CGSB 19-GP-5M-1984, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).
  - .2    CAN/CGSB-19.13- M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
  - .3    CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.
  - .4    CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.
- .3    General Services Administration (GSA) - Federal Specifications (FS)
  - .1    FS-SS-S-200-E(2)1993, Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement.
- .4    Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1    Material Safety Data Sheets (MSDS).
- .5    Green Seal Environmental Standards
  - .1    Standard GS-36-00, Commercial Adhesives
- .6    South Coast Air Quality Management District (SCAQMD), California State, Regulation XI. Source Specific Standards
  - .1    SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.

**1.3                SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2    Product Data:
  - .1    Submit manufacturer's instructions, printed product literature and data sheets for joint sealants and include product characteristics, performance criteria, physical size, finish and limitations.

- .2 Manufacturer's product to describe:
  - .1 Caulking compound.
  - .2 Primers.
  - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
- .3 Samples:
  - .1 Submit samples of each type of material and colour.
  - .2 Cured samples of exposed sealants for each colour where required to match adjacent material.
- .4 Manufacturer's Instructions:
  - .1 Submit instructions to include installation instructions for each product used.

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

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

#### **1.5 WHMIS**

- .1 Submit copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOCs during application.

#### **1.6 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction Waste and Disposal.

#### **1.7 SITE CONDITIONS**

- .1 Environmental Conditions:
  - .1 Proceed with installation of joint sealants only when:
    - .1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4 degrees C.
    - .2 Joint substrates are dry.
    - .3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
- .2 Joint-Width Conditions:
  - .1 Proceed with installation of joint sealants only where joint widths are more than those allowed by joint sealant manufacturer for applications indicated.

- .3 Joint-Substrate Conditions:
  - .1 Proceed with installation of joint sealants only after contaminants capable of impairing product adhesion have been removed.
- .4 Where sealants are qualified with primers use only these primers.

## **Part 2 Products**

### **2.1 SEALANT MATERIALS**

- .1 Sealant materials to conform to the requirements of :
  - .1 Green Seal Environmental Standards
    - .1 Standard GS-36-00, Commercial Adhesives
  - .2 South Coast Air Quality Management District (SCAQMD), California State
    - .1 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.
- .2 VOC limit maximum 250 g/L for sealers used within the building envelope.
- .3 Where sealants are qualified with primers, use only these primers

### **2.2 SEALANT MATERIAL DESIGNATIONS**

- .1 Polyurethanes: colours selected by Departmental Representative.
  - .1 Non-sag formulation: 1-part, to CAN/CGSB-19.13, Type 2, MCG-2-25, MCG-2-40.
  - .2 Self-levelling formulation:
    - .1 1-part: to CAN/CGSB-19.13, Type 1.
    - .2 2-part: to CAN/CGSB-19.24, Type 1, Class B.
- .2 Silicones one part: to CAN/CGSB-19.13.
- .3 Acrylics one part: to CGSB 19-GP-5M.
- .4 Acrylic latex: one part, non sag siliconized acrylic polymer to CAN/CGSB-19.17. Paintable when cured
- .5 Acoustical sealant: to ASTM C919.
- .6 Preformed compressible and non-compressible back-up materials:
  - .1 Polyethylene, urethane, neoprene or vinyl foam:
    - .1 Extruded closed cell foam backer rod.
    - .2 Sized as required.
  - .2 Neoprene or butyl rubber:
    - .1 Round solid rod, Shore A hardness 70.
  - .3 High density foam:
    - .1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m<sup>3</sup> density, or neoprene foam backer, size as recommended by manufacturer.

- .4 Bond breaker tape:
  - .1 Polyethylene bond breaker tape which will not bond to sealant.

### **2.3 SEALANT SELECTION**

- .1 Junctions between floor edges and foundation walls to produce permanent sealed vapour-resistant joints, junctions between new floor edges and existing floor edges to produce permanent sealed joints.
  - .1 Polyurethane, self-levelling.
- .2 Penetrations in exterior walls to fill joints watertight including but not limited to exterior perimeters of door frames, window frames, curtain wall frames; exterior perimeters of wall vents; exterior perimeters of all other wall penetrations.
  - .1 Polyurethane, non-sag.
- .3 Interior perimeters of door frames and trims, window and curtain wall frames to make junctions filled, smooth and invisible suitable for subsequent "painting out" with interior wall finishes.
  - .1 Acrylic latex.
- .4 Junctions between counter tops and walls to produce permanent sanitary and watertight seal; junctions between plumbing fixtures and walls, floors and counter tops/vanities to produce permanent sanitary and watertight seal. Co-ordinate with plumbing trade to avoid omission/duplication.
  - .1 Mildew-resistant silicone.
- .5 Lap joint and perimeter sealant for polyethylene vapour barriers
  - .1 Acoustical sealant.

### **2.4 JOINT CLEANER**

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

## **Part 3 Execution**

### **3.1 SURFACE PREPARATION**

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

- .5 Prepare surfaces in accordance with manufacturer's directions.

### **3.2 PRIMING**

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

### **3.3 BACKUP MATERIAL**

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

### **3.4 MIXING**

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

### **3.5 APPLICATION**

- .1 Sealant:
- .1 Apply sealant in accordance with manufacturer's written instructions.
  - .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
  - .3 Apply sealant in continuous beads.
  - .4 Apply sealant using gun with proper size nozzle.
  - .5 Use sufficient pressure to fill voids and joints solid.
  - .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
  - .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
  - .8 Remove excess compound promptly as work progresses and upon completion.
- .2 Curing:
- .1 Cure sealants in accordance with sealant manufacturer's instructions.
  - .2 Do not cover up sealants until proper curing has taken place.

### **3.6 CLEANING**

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

**END OF SECTION**

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**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Interior panel doors.

**1.2 RELATED SECTIONS**

- .1 Section 08 71 00 - Door Hardware.
- .2 Section 08 80 50 - Glazing.
- .3 Section 09 90 00 - Painting: Site finishing of doors.

**1.3 REFERENCES**

- .1 AWI/AWMAC - Quality Standards Illustrated (QSI), current edition.
- .2 CSA O115-M1982, Hardwood and Decorative Plywood.
- .3 CAN/CSA O132.2 Series-90, Wood Flush Doors.
- .4 UL 10B - Fire Tests of Door Assemblies.

**1.4 SUBMITTALS**

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Indicate door core materials and construction.
- .3 Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, and undercuts required,

**1.5 QUALITY ASSURANCE**

- .1 Perform work in accordance with AWI/AWMAC QSI, Custom Finish doors in accordance with AWI/AWMAC QSI Quality Standard.
- .2 Health and safety requirements: do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

**1.6 DELIVERY, STORAGE, AND PROTECTION**

- .1 Package, deliver and store doors in accordance with AWI/AWMAC QSI.
- .2 Protect doors from dampness. Arrange for delivery after work causing abnormal humidity has been completed.
- .3 Store doors in well ventilated room, off floor, in accordance with manufacturer's recommendations.

- .4 Protect doors with resilient packaging. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges [with tinted sealer] if stored more than one week.

## **1.7 WASTE MANAGEMENT AND DISPOSAL**

- .1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- .2 Dispose of all packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

## **PART 2 PRODUCTS**

### **2.1 DOOR TYPES**

- .1 Interior Doors: Solid core: to CAN/CSA-O132.2.1.

### **2.2 DOOR CONSTRUCTION**

- .1 Doors are to be solid core construction.
- .2 Moulded single panel design consisting of wood stiles, MDF rails and engineered low density composite core. Door facings to be applied to stiles, rails and core forming a 3-ply structural attachment.
- .3 Doors are to be factory pre hung in solid wood jambs where required.
- .4 Particleboard core must not contain added urea-formaldehyde.

### **2.3 FABRICATION**

- .1 Fabricate non-rated doors in accordance with QSI Custom Grade Quality Standards requirements.
- .2 Provide lock blocks at lock edge and top of door for closer for hardware reinforcement.
- .3 Bond edge banding to cores.
- .4 Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware
- .5 Provide edge clearances in accordance with AWMAC unless otherwise noted.

### **2.4 FINISH**

- .1 Factory primer finish.
- .2 Seal door top edge with sealer to match door facing.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- .1 Verify that opening sizes and tolerances are acceptable.
- .2 Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

**3.2 INSTALLATION**

- .1 Install doors in accordance with manufacturer's instructions.

**3.3 ADJUSTING**

- .1 Adjust door for smooth and balanced door movement.
- .2 Adjust closer for full closure

**3.4 CLEANING**

- .1 Do cleaning in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**



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**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Non-rated, thermally insulated fiberglass clad door with wood frame.

**1.2 RELATED SECTIONS**

- .1 Section 08 14 16 - Flush Wood Doors
- .2 Section 08 71 00 - Door Hardware.
- .3 Section 09 90 00 – Painting.

**1.3 SUBMITTALS**

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Indicate frame configuration and finishes. Indicate door configurations, location of cut-outs for hardware reinforcement.
- .3 Shop Drawings: Indicate frame elevations, reinforcement, anchor types and spacings, location of cut-outs for hardware, and finish. Indicate door elevations, internal reinforcement, closure method, and cut-outs for glazing, louvers, and finishes.

**1.4 QUALITY ASSURANCE**

- .1 Conform to requirements of CSDFMA SDI-100.

**1.5 PROJECT CONDITIONS**

- .1 Coordinate the work with frame opening construction, door, and hardware installation.

**PART 2 PRODUCTS**

**2.1 EXTERIOR DOORS AND JAMBS**

- .1 Fiberglass outer and inner skin, embossed with a “Craftsman” style two panel design.
- .2 One quarter light glazing panel, low E glass.
  - .1 Obscuring glass with horizontal and vertical mullion design.
  - .2 Double glazing.
- .3 Polyurethane core.
- .4 Pre hung in wood frame
- .5 Pre bored for lock set.

**2.2 FABRICATION FRAMES**

- .1 Coordinate hinge and hardware placement with the requirements of Section 08 71 00 Door Hardware.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- .1 Verify existing conditions before starting work.
- .2 Verify that opening sizes and tolerances are acceptable.

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**3.2           INSTALLATION**

- .1       Install frames in accordance with CSDFMA.
- .2       Coordinate installation of doors and frames with installation of hardware specified in Section 08 71 00 Door Hardware.
- .3       After installation, touch up all scratched or damaged surface and prime.
- .4       Insulate all door and window frames exposed to the exterior.

**3.3           ERECTION TOLERANCES**

- .1       Maximum Diagonal Distortion: 1.5 mm measured with straight edges, crossed corner to corner.
- .2       Clearance on door at head and jambs shall be: 3 mm maximum.

**3.4           ADJUSTING**

- .1       Adjust door for smooth and balanced door movement.

**3.5           CLEANING**

- .1       Do cleaning in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

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**Part 1      General**

**1.1      SECTION INCLUDES**

- .1      Ceiling access doors in frames for plumbing access.

**1.2      RELATED SECTIONS**

- .1      Section 09 21 16 - Gypsum Board Assemblies: installation of ceiling access doors; gypsum board infill; filling and finishing of frames to gypsum board surfaces.

**1.3      SUBMITTALS**

- .1      Make submissions in accordance with procedures described in Section 01 33 00 - Submittal Procedures.
- .2      Shop drawings:
  - .1      Submit catalogue details for each type of access door illustrating profiles, dimensions and methods of assembly.
- .3      Samples:
  - .1      Submit samples for each type of access door, if requested by Departmental Representative.

**Part 2      Products**

**2.1      CEILING ACCESS DOORS**

- .1      Description: 1.6 mm metal thickness galvanized sheet steel drywall bead taping flange specifically for use with gypsum board, concealed rod hinge, 1.6 mm metal thickness formed sheet steel recessed door panel to accept gypsum board infill, screw driver or Allen key cam latch, electrostatically applied off white prime coat.
- .2      Sizes: detailed/indicated on drawings.

**Part 3      Execution**

**3.1      INSTALLATION**

- .1      Installation:
  - .1      Gypsum board surfaces: Section 09 21 16 - Gypsum Board Assemblies.

**END OF SECTION**

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**Part 1            General**

**1.1                SECTION INCLUDES**

- .1      Overhead sectional door.
- .2      Hardware and supports.

**1.2                RELATED SECTIONS**

- .1      Section 07 92 00 - Joint Sealants: Perimeter sealant and backup materials.

**1.3                REFERENCES**

- .1      ASTM A653/A653M-08 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2      Canadian General Standards Board (CGSB).
  - .1      CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.
  - .2      CAN/CGSB-12.8-M90, Insulating Glass Units.
  - .3      CAN/CGSB-12.10-M76, Glass, Light and Heat Reflecting.
- .3      IGMAC, Insulating Glass Manufacturer's Association of Canada, Glazing Guidelines for Sealed Insulating Glass Units.
- .4      TBCBC, The British Columbia Building Code (TBCBC) 2006.

**1.4                SYSTEM DESCRIPTION**

- .1      Sectional steel garage door.
- .2      Panels: Steel construction, embossed wood grain, simulated frame and panel design.
  - .1      Double glazed top panels.
- .3      Thermally insulated.
- .4      Operation: Electric.

**1.5                SUBMITTALS FOR REVIEW**

- .1      Section 01 33 00: Submission procedures.
- .2      Shop Drawings:
  - .1      Indicate door design, dimensions, construction, finishes, glazing arrangements.
  - .2      Indicate arrangement of hardware, operating mechanisms and required clearances, fixing and anchorage requirements, finishes.
  - .3      Submit shop drawings of sectional door prepared under the supervision and bearing the seal of a Professional Engineer of the Province of BC, for wind load and seismic design.

- .3 Product Data: Submit manufacturer printed product literature, specifications and data sheets.
- .4 Samples: Submit exterior panel finish samples illustrating colour and finish prior to ordering project materials. Printed paper color samples are not acceptable.

## **1.6 CLOSEOUT SUBMITTALS**

- .1 Section 01 78 10: Submission procedures.
- .2 Operation and Maintenance Data:
  - .1 Full identification of each type of door installed (i.e., model and model/series number) for Owner's later use in obtaining service and replacement parts.
  - .2 Name, address and telephone numbers of installer and of local service/repair agent.
  - .3 Warranty certificates made out to Owner.

## **1.7 QUALITY ASSURANCE**

- .1 Use sectional door products that have been used in similar applications for at least 10 years.
- .2 Installer Qualifications: Company specializing in performing the work of this section with minimum 5years documented experience.
- .3 Furnish evidence of installer experience on request.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Sheet Steel: ASTM A653/A653M galvanized to Z275; pre-coated with silicone polyester finish.
- .2 Insulation: Rigid polystyrene same thickness as core framing members bonded to facing.

### **2.2 PANEL CONSTRUCTION**

- .1 Solid door sections: 50 mm thick. width x length required to suit door opening. Door sections to use minimum 0.48 mm metal thickness galvanized sheet steel interior and exterior faces interlocked together mechanically, interior face isolated from exterior face by means of continuous effective thermal break, arranged in hinged door sections full width of each opening, each section filled completely with bonded polystyrene core providing R9.8 insulation value through non-glazed door sections, minimum 1.6 mm metal thickness door section end caps.
  - .1 Simulated frame and panel design.
  - .2 Upper section of door to be glazed.
- .2 Glazed door sections: as indicated x lengths required to suit door opening full vision glazing sections.

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## 2.3 DOOR COMPONENTS

- .1 Track: Galvanized sheet steel profiles, with fittings suitable for torsion spring lifting, including all required attachment/suspension items.
- .2 Hinges: door manufacturer standard, non-corroding finish 14 ga.
- .3 Rollers: 10 ball nylon rollers.
- .4 Roller brackets: heavy duty galvanized sheet steel adjustable profile.
- .5 Counterbalances:
  - .1 Torsion springs: oil tempered, helically wound, 200,000 cycle rating.
  - .2 Shafts: ball-bearing mounted keyed steel profile.
  - .3 Drums: precision grooved steel profiles.
  - .4 Cables: aircraft quality.
- .6 Pusher springs: door manufacturer standard design.
- .7 Weatherstripping:
  - .1 Jambs: continuous vinyl sweeps to seal doors to jambs.
  - .2 Heads: continuous vinyl stripping or tube to seal doors to head jamb.
  - .3 Bottom: continuous vinyl tube to seal door bottom to floor.
  - .4 Section-to-section: Tongue and groove joints between all panels.

## 2.4 OPERATORS

- .1 Minimum 1/2 HP electric trolley draw bar or jack shaft operator, with manual disconnect for use during power failure, auto reversing when striking an object or detecting object in path via photo electric detector across doorway.
  - .1 Electrical motors, controller units, relays and other electrical components to CSA approval with CSA enclosure Type CEMA 1.
  - .2 Verify fused electrical power supply with Division 26 - Electrical before ordering operators.
  - .3 Controller units with integral motor reversing starters and heater elements for overload protection, with relays as applicable.
  - .4 Motor capacity and rating: sized for intended door usage and cycles.
- .2 Electric operator safety switch: infra-red photo-electric cells positioned across indoor face of opening which when detecting vehicle or obstruction will reverse door closing travel to full open position and initiate delayed automatic closing cycle.
- .3 Manual release device: rope pull quick release to disconnect electric operator from door for manual use.

## 2.5 CONTROLS

- .1 Radio receivers: operator-mounted device programmed to recognize and receive radio signals.
- .2 Transmitters: compact devices capable of communicating with radio receiver, fitted with sun visor clips for car storage and with following features.
  - .1 One button per transmitter coded to initiate door open/close cycle.
  - .2 Individual assigned operator codes.
  - .3 Capable of being re-coded by maintenance personnel without need of call-out door service technician.
  - .4 Capable of individual transmitter codes being blocked from/locked out of system by maintenance personnel without need of call-out door service technician, in event that transmitter is lost or stolen.
  - .5 Provide 2 transmitters per garage door.
    - .1 Package 2 transmitters together and label to respective housing unit number.
    - .2 Include name, address and telephone number of local distributor for transmitters to assist Departmental Representative in obtaining additional matching stock.
    - .3 Deliver to Departmental Representative
    - .4 Obtain written receipt from Departmental Representative for delivery of transmitters.
- .3 Delay timers: operator mounted solid state variable timer adjustable from 0 to 3 minutes, with interruption reset returning back to start, to initiate delayed automatic close cycle after garage door has been opened fully. Timer to be tamper-proof and capable of adjustment by maintenance personnel without need of call-out door service technician.
- .4 Pushbutton stations:
  - .1 Low voltage momentary contact pushbutton to initiate door open/close cycle from inside of garage for convenience.
  - .2 Location adjacent to each living unit-to-garage connecting door.

## 2.6 FINISHES

- .1 Door finishes: 2 coat baked-on paint system consisting of primer plus polyester finish coat.
  - .1 Colour: Selected from manufacturers full range of premium colours.
  - .2 Colour to be selected by Departmental Representative from samples provided.
- .2 Finish all other galvanized sheet steel components using Z275 designation zinc coating.

## Part 3 Execution

### 3.1 INSTALLATION

- .1 Install sectional doors, track, operators and all required hardware in accordance with reviewed shop drawings and door manufacturer instructions.

- .2 Maintain dimensional tolerances and alignment with adjacent construction.
  - .1 Variation from plumb: maximum 3 mm.
  - .2 Variation from level: maximum 3 mm.
- .3 Fix track and hardware items in place to resist pulling away and loosening.
- .4 Adjust operable parts for correct operation.
- .5 Touch up damaged paint and galvanized finishes.
- .6 Install electrical motors, controller units, detectors, relays and other electrical equipment required for full door operation. Make following connections or arrange for connections to be made by appropriate trades where this trade is excluded from making such connections.
  - .1 Connections and electric wiring between doors and fused power supply locations.
  - .2 Provide hanging loop of flexible cable at electrical connection to motor to further isolate assembly from direct contact with building structure.
  - .3 Connections and wiring between doors and wired door controls.
  - .4 Connections and wiring between doors and to wired door safety devices.
- .7 Adjust operable parts for correct operation.
- .8 Adjust delay timer to interval suitable for safe vehicular movement in and out of garages with least amount of door open time.
- .9 Adjust safety switch devices for proper operation.

### **3.2 ADJUSTING**

- .1 Adjust door assembly to smooth operation and in full contact with weatherstripping.

### **3.3 DEMONSTRATION**

- .1 Instruct maintenance personnel on operation and adjustment of sectional doors and related devices, at no additional cost to Contract.
- .2 Instruct maintenance personnel on re-coding of operators and transmitters, at no additional cost to Contract.

### **3.4 CLEANING**

- .1 Section 01 74 11: Cleaning installed work.
- .2 Clean doors, frames and glass.
- .3 Remove temporary labels and visible markings.

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

- .1 Do not permit construction traffic through overhead door openings after adjustment and cleaning.



**END OF SECTION**

## Part 1 General

### 1.1 SECTION INCLUDES

- .1 Window frames, sashes and patio doors constructed of fiberglass pultrusions.
- .2 Windows and patio doors as pre-assembled units, including factory installation of glass and glazing.
- .3 Furnish all labour, materials, equipment and services required for the design, fabrication, supply and installation of windows as shown on the drawings and as specified. Furnishment to include, but not be limited to the following:
  - .1 Fully glazed fiberglass window assemblies including fiberglass shapes and glass.
  - .2 All glazing accessories for window assemblies including gaskets, setting blocks, and sealants as required to meet the air and water tightness requirements of the section.
  - .3 All necessary reinforcing members, brackets, anchors, fasteners and other accessories as required to meet the structural requirements of the installation and specifications in this section.
  - .4 Shop applied galvanizing and electrolytic barrier painting of all steel parts.
  - .5 All perimeter closures, membranes, sealants, flashings, and trim required to integrate the window assemblies with other cladding and finishing materials.
  - .6 Assessment of the alignment of the existing façade elements as required to allow design and layout of the work in this section.
  - .7 All fastening of the window assemblies to the rough openings
- .4 Include also the following:
  - .1 Checking of building lines and levels as required for the proper layout and installation of all work included in this section.
  - .2 Shop painting of all steel shapes and ferrous metal used in attachment or reinforcing of window and field painting after steel shapes are installed.
- .5 Window systems of the following types:
  - .1 Single fixed lites.
  - .2 Composite, with fixed lites and operable casement lites.
  - .3 All windows and doors to be triple glazed.
  - .4 All window mullions indicated on drawings to be installed within glazing units.
  - .5 Patio door.

### 1.2 REFERENCE STANDARDS (Most recent version unless noted otherwise.)

- .1 AAMA/WDMA/CSA101/I.S.2/A440-08-NAFS- North American Fenestration Standard/ Specification for windows, doors, and skylights.
- .2 CSA A440S1 – 09 “Canadian Supplement to AAMA/WDMA/CSA101/I.S.2/A440-08 – NAFS – North American Fenestration Standard/Specification for windows, doors, and skylights”.

- .3 British Columbia Energy Efficiency Act – Energy Efficiency Standards Regulation (BCEEA).
- .4 CAN/CSA-A440-Windows; A440.1 User Selection Guide to A440; A440.2 Energy Performance Evaluation; A440.3 User Guide to A440.2; A440.4 Window and Door Installation.
- .5 CAN/CSA-G164-Hot-Dip Galvanizing of Irregularly Shaped Articles.
- .6 CAN/CGSB-1.40-Primer, Structural Steel, Oil Alkyd Type.
- .9 Glazing Contractor’s Association of B.C. (GCABC) publication: Glazing Systems Specifications Manual.
- .10 IGMA Glazing Recommendations for Sealed Insulating Glass Units.

### 1.3 DEFINITIONS

- .1 Single Unit Window: a window consisting of one fixed or one operable lite.
- .2 Composite Window: a window consisting of a maximum of three lites in one main frame. Composite windows may consist of fixed or operable windows, or a combination of both.
- .3 Patio door consisting of one fixed lite and one rolling lite.
- .4 Glazed swinging door and frame.

### 1.4 DESIGN CRITERIA

- .1 Materials, fabrications, attachments, accessories, assembly and performance, other than thermal performance, shall meet or exceed applicable requirements of CSA-A440, Windows, including appendices. The more stringent of CSA-A440 or this specification shall apply.
- .2 Thermal performance shall be determined in conformance with CSA-A440.2, Thermal Performance Evaluation of Windows and Sliding Glass Doors, and Appendix A – Overview of the Procedure for Determining the U-Value by Computer Simulation.
- .3 Design windows to be glazed from the interior.
- .4 Design windows to equalize both positive and negative pressure between outside air and:
  - .1 cavities surrounding insulating glass units, and
  - .2 cavities surrounding operable sash.
- .5 Design windows to provide drainage from spaces around operable sash and around insulating glass units to exterior.
- .6 Design windows to provide for the continuity of the air seal from the inside face of the sealed unit to the surrounding frame.
- .7 Design window anchorage to withstand wind load equal to or greater than calculated loads as per CSA A440S1-09 in accordance to the Performance Class specified herein or to Part 4 of the BC Building Code.

- .8 Design vinyl components to accommodate thermally induced movement and to prevent creep deflection. Limit of creep deflection 3mm per meter in any member or assembly.
- .9 Design assembly to accommodate structure movements due to wind, seismic, creep and live loads where applicable and/or as noted.

## 1.5 PERFORMANCE REQUIREMENTS

- .1 This is a performance specification issued in conjunction with the drawings for the work. The drawings show the general arrangement of the finished work and these specifications described the minimum requirements of the finished system. The Contractor is responsible for designing and furnishing a window system that will fulfill the requirements of the specifications and drawings including items which may not be shown or specified but are required for performance of the system.
- .2 The window shall be designed, fabricated and installed to meet or exceed the criteria in this subsection.
- .3 Structural
  - .1 Wind Load Resistance to NAFS in conjunction with CSA A440.09.
  - .2 The window assembly and fasteners shall be designed to withstand negative and positive wind loads in accordance to BCBC using an annual probability factor of **1/50 years** for the reference wind velocity, and 8 per 1000 glass failure rate under this load.
  - .3 The glass and window frames shall be designed to withstand guard loads at locations required by the BCBC.
  - .4 The glass shall be designed to withstand thermal stresses imposed in service. In calculation, assume the use of blinds located not less than 50 mm from the inside surface of the glass.
  - .5 The window system shall be designed to limit deflection orthogonal to the plane of the glass under wind or guard loads to **L/175** in all clear span dimensions of glass and framing members.
  - .6 Anchors and fasteners shown on the drawings do not represent the required location or types required for installation of the new widow. Any attachment points must be shown on shop drawings for review by the Departmental Representative.
  - .7 All fastenings and attachments shall be concealed.

- .8 Movement and Tolerances
  - .1 The window installation shall accommodate a building structure live load deflection of 9 mm at midspan of longest project window header/lintel without transferring load to the window.
  - .2 The window shall accommodate expansion and contraction of component materials over an exterior air temperature range of -18°C to 35°C and a possible solar heating range to 70°C, and an interior temperature range of 0°C to 30°C without causing:
    - .1 failure of joint seals necessary for air and water tightness of the system,
    - .2 failure of perimeter seals at interfaces to adjacent wall systems,
    - .3 overstressing of fasteners,
    - .4 pinching or distortion or breakage of glass,
    - .5 distortion of aluminum members,
    - .6 or other harmful effects.
- .4 The window shall be fabricated and installed square, level and plumb as follows:
  - .1 Plumb to within 3 mm of vertical over the height of each unit.
  - .2 Within 3.0 mm of level relative to a datum established for frames at the same floor.
  - .3 Within 1.5 mm of level relative to an adjacent frame.
  - .4 Each frame shall be within 3.0 mm of square when measured across the diagonals.
  - .5 Clearances required for installation should be considered and indicated on the shop drawings.
  - .6 All movements of the window system shall be noiseless.
- .5 Weather Tightness
  - .1 Water Tightness to NAFS in conjunction with CSA A440.09.
  - .2 The glazing system shall be installed so that it forms a continuous unbroken air seal on the room side of the assembly. The air seal shall extend from the glazing assembly to adjoining wall components at all interfaces. Airtightness of the window and interfaces shall restrict infiltration and exfiltration of air through the system in accordance to NAFS.
  - .3 The window system shall be designed in accordance with rainscreen principles, incorporating venting and drainage mechanisms and separate air and water barriers, effective so that any water entering the system past exterior seals drains harmlessly to the exterior via pressure equalized drainage cavities.
  - .4 Vent and drain holes shall be present in inconspicuously locations and shall not contribute to staining or marking of glass, mullions, or spandrels.
- .6 Durability
  - .1 The window frames and integral seals shall be designed to have an expected service life of 30 years. All seals, gaskets, corrosion protection, coatings and attachments are expected to be serviceable at the end of this service period.
  - .2 The glazing shall have a guaranteed service life of twenty years. Any glazing failing to meet this service life shall be removed and replaced at no cost to the

Owner under guarantee by the Contractor. Failure of any glazing shall be deemed to occur if any of the following are noted:

- .1 Chipping, cracking, or breakage of glass panes occurring due to manufacturing defects or under specified service conditions.
- .3 Seals between unitized components of the glazing system shall be formed with clamped rubber gaskets. Seals between frame units made with field applied sealants alone will not be accepted.

## **1.6 RESPONSIBILITY FOR MEETING PERFORMANCE REQUIREMENTS**

- .1 Meeting the performance requirements of this section during the design fabrications and installation of the work shall be the complete responsibility of the Contractor.
- .2 The details shown on associated drawings show dimensions and profiles similar to those expected to be required to meet the specifications of this section. The Contractor may submit design proposals with minor changes to the details shown on the drawings in order to meet or exceed the performance requirements of this section by using proprietary technology. Every effort has been made to show on the drawings and in the specification items of the design that may not be altered or altered only to limited extents.
- .3 The structural and energy use requirements of this section shall be certified by an Engineer employed by the Contractor using standards recognized by the local authority having jurisdiction, the product manufacturer and current trade associations.
- .4 The design of the product and the responsibility of the Contractor's Engineer shall extend to accommodate all temporary conditions associated with fabrication, transport, storage, lifting, installation and temporary closure of the building without detrimental effect on the performance requirements of these contract documents.
- .5 The Departmental Representative's review of the Contractor's submittals and the work is of the benefit only of the Owner. The Contractor shall remain responsible for the design, fabrication, installation and performance of the product.

## **1.7 SUBMITTALS**

- .1 Submittals to be made in accordance with Section 01 33 00 - Submittals.
- .2 Product Data: Submit catalogue details for each type of window and framing system illustrating profiles, dimensions and methods of assembly, installation procedures, recommendations and data that products have been tested and comply with performance requirements.
- .3 Submit test reports from an independent testing agency acceptable to the Departmental Representative, indicating windows to be supplied for the project meet specified requirements, including compliance with AAMA/WDMA/CSA101/I.S.2/A440-08-NAFS. Testing conducted by manufacturer to follow all required product test and sequence tests as described under Clause 5 in AAMA/WDMA/CSA101/I.S.2/A440-08-

- NAFS in conjunction with CSA A440S1-09.
- .4 Energy Conformance: Supply documentation sufficient to confirm conformance of project window sizes and configurations with the British Columbia Energy Efficiency Act, using one of the following testing agencies or persons.
    - .1 A person or organization accredited by the Standards Council of Canada
    - .2 National Fenestration Rating Council accredited Inspection Agency
    - .3 Architect or Professional Engineer, authorized to practice in British Columbia.
  
  - .5 Shop Drawings:
    - .1 Submit shop drawings of windows prepared under the supervision and bearing the seal of a Professional Engineer of the Province of BC for seismic and wind loads. Submit completed BC Building Code Letters of Assurance (Schedules B1 and B2) together with the initial shop drawing submission. Upon request, provide structural calculations per conformance to Building Codes, By-Laws and CAN/CGSB 12.20.
    - .2 Clearly indicate each type of window, hardware and locations, framing system, extrusion profiles, methods of assembly, section and hardware reinforcement, anchorages and location of exposed fasteners, isolation coatings, finishes, glazing components, insect screens, and location of manufacturer's name plates (if applicable).
    - .3 Provide scaled elevations, sections, plans, dimensions and quantity of units. Indicate rough opening requirements and tolerances of adjacent construction.
    - .4 Provide full size details for head, sill and jamb conditions, junctions between combination units (coupling mullions), and interior and exterior trim. Clearly indicate method and location of connection and continuity of the envelope air, vapour and water seals. Clearly indicate drainage and ventilation paths within the window assembly and at the interface to the building envelope. Confirm compatibility of materials that form the air/vapour/water barrier of the integrated system.
    - .5 Provide manufacturer's assembly instructions for operable units if they will be supplied demounted from main frame.
    - .6 Shop drawings are submitted to allow the Departmental Representative to review conformance of the proposed system. Review of the shop drawings by the Departmental Representative shall not relieve the Contractor of any responsibilities to perform under the terms of this specification. Notify the Departmental Representative of any sequencing of submittals and reviews that will expedite the Contractor's delivery of the project
    - .7 No materials shall be purchased or units fabricated until final review of shop drawings is completed by the Departmental Representative.
  
  - .6 Samples: If requested, make the following samples available for Departmental Representative review at least one week prior to shop drawing preparation:
    - .1 150 mm long corner sections of head, jamb, sill, mullions, and coupling mullions to indicate profile.
    - .2 One (1), 4'x 4' with 2' operable section, representative model of each type of window.

- .7 Letters of Assurance: The Registered Professional Engineer who signed and sealed the shop drawings shall perform sufficient field reviews in order to provide a letter of professional assurance after completion of the Work, giving assurance that the Work has been fabricated and installed in general conformance with the sealed shop drawings. Approved forms are BC Building Code Letters of Assurance (Schedule C). Written inspection reports of field reviews shall be submitted to the Architect promptly as the field reviews are made.
- .8 Maintenance Data: Provide in accordance with Section 01 78 10 – Closeout Submittals, the following data for incorporation into specified maintenance manual:
  - .1 A recommended inspection procedure and schedule and component replacement schedule.
  - .2 Data for cleaning and maintenance of framing finishes, glazing and hardware.
- .9 Warranties:
  - .1 Provide a written warranty signed and issued in the name of the Owner stating:
    - .1 All windows will be free from defects in material and workmanship for a period of two (2) years from the date of substantial Performance of the Work.
    - .2 All windows will continue to provide satisfactory resistance to water penetration for a period of five (5) years from the date of Substantial Performance of the Work.
    - .3 All insulating sealed double glazing units shall be covered for a period of twenty (20) years from the date of Substantial Performance of the Work, against material obstruction of vision as a result of hermetic seal failure and dust or film formation on inner glass surfaces.
  - .2 If a 3rd party warranty is provided then the warranty requirements are to be the most stringent of the 3rd party warranty or the requirements listed above.
  - .3 Satisfactory performance means compliance with the performance criteria and the testing and construction standards of this specification, and with the reviewed shop drawings. This includes the performance of finishes, hardware glass and glazing materials, structural attachment, sealants and flashings.
  - .4 Correct all deficiencies that appear during the warranty period at no cost to the Owner.

## **1.8 QUALITY ASSURANCE**

- .1 Sealed insulation unit manufacturer to be a member in good standing of the Insulating Glass Manufacturers Alliance (IGMA).
- .2 Glass and glazing work under this section to conform to IGMA standards.
- .3 Window manufacturer and installation contractor to be a member in good standing of the Glazing Contractors Association of BC (GCABC) and have a minimum of 5 years uninterrupted experience in successfully carrying out projects of similar size. Contractor



to document past experience on request.

## Part 2 Products

### 1.2 WINDOWS

- .1 Description: sash comprised of purpose-made fiberglass pultrusions, thermally broken, rain screen design with fiberglass sub sill, exterior flange mount, fitted with insulated glass unit glazing and rigid pultruded fiberglass snap-in glazing stop, in sizes and arrangements detailed/indicated.

### 1.3 DOORS

- .1 Patio and Swing doors: comprised of purpose-made fiberglass pultrusions, thermally broken, rain screen design with fiberglass sub sill, exterior flange mount, fitted with insulated glass unit glazing and rigid pultruded fiberglass snap-in glazing stop, in sizes and arrangements detailed/indicated.

### 1.4 SINGLE UNIT WINDOWS

- .1 Meet or exceed requirements of selected Performance Class and Performance Grade as per AAMA/WDMA/CSA101/I.S.2/A440-08- NAFS- North American Fenestration Standard/Specification for windows, doors, and skylights and CSA A440S1- 09 – Canadian Supplement to NAFS and the secondary performance requirements:
  - .1 All windows shall conform to:
    - .1 Class **CW – PG30 (metric)** - Fixed
    - .2 Class **CW – PG30 (metric)** – Casement and Awning
  - .2 Water Penetration: Water penetration test pressures shall be **400 Pa**.
  - .3 Air Tightness Rating, Fixed Windows: Fixed Level.
  - .4 Air Tightness Rating, Operable Windows: A3 Level
  - .5 Operation Force for: Casement window - Normal Use (Clause 5.3.1.1, Table 6)
  - .6 Energy Performance: Overall Window U-Value averaged over all fenestration products within the scope of work to be no more than **1.8 W/m<sup>2</sup>•K**.
  - .7 All windows are to be labeled with the AAMA, CSA or WDMA label and have sash, leaf and size shown on the drawings.

### 2.4 COMBINATION WINDOWS

- .1 Meet or exceed requirements of selected Performance Class and Performance Grade as per AAMA/WDMA/CSA101/I.S.2/A440-08- NAFS- North American Fenestration Standard/Specification for windows, doors, and skylights and CSA A440S1- 09 - Canadian Supplement to NAFS, and the secondary performance requirements. Refer to Clause 2.1.1 for Window Performance Grades and Energy Performance.
- .2 Air and water tightness of joints along frames mullied together, and at mullions where lites within one main frame join, shall meet or exceed performance ratings specified for the higher rated adjacent single unit windows.

- .3 Lateral deflection of muller frames shall not exceed **L/175** of span when subjected to loading equivalent to wind load resistance of the adjacent single unit windows.

## **2.5 WINDOW TYPES**

- .1 Fixed: with removable double-glazed insulated sealed units. Minimum performance standard to meet AAMA/WDMA/CSA 101/I.S.2/A440-08 – NAFS Class CW-PG30.
- .2 Casement (Outswing sash): with removable double-glazed insulated sealed units. Minimum performance standard to meet AAMA/WDMA/CSA 101/I.S.2/A440-08 – NAFS Class CW-PG30.
- .3 Screens: provide on ventilating portions of windows.

## **2.6 FRAME AND SASH REQUIREMENTS**

- .1 Frame and sash profiles and glazing detailed on drawings are not intended to restrict product types conforming to these specifications.
- .2 Provide fiberglass frame and sash conforming to the following standards:
  - .1 Minimum external wall thickness of extrusions: 2.5 mm nominal.
- .3 Seal sash perimeter continuously at three locations minimum, with primary seal located between operator and interior seal.
- .4 Secure hardware and attachments using screws into H-ports or penetrating minimum of two walls of framing or internal steel reinforcement.
- .5 Join single units to form combination units with joints at combination unit frame perimeter finished with sealant and steel plate, 75 mm x 75% of depth of framing. Plate shall be screw fastened with a minimum of four screws through plastic into steel reinforcing.
- .6 Anchor using metal retaining clips at head, nailing flanges at jambs and continuous back angle at sill.

## **2.7 GLASS AND GLAZING MATERIAL**

- .1 Insulating Glass Units: meet or exceed requirements as described in AAMA/WDMA/CSA101/I.S.2/A440-08- NAFS and CSA A440S1- 09 - Canadian Supplement to NAFS . Units shall be certified by the Insulating Glass Manufacturers Alliance (IGMA). Overall unit thickness shall be a minimum of 24 mm using a minimum of 4 mm glass thickness. In combination and composite units use the greater glass thickness throughout. Use two-stage seal method of manufacture, as follows:
  - .1 Primary Seal: polyisobutylene or hot-melt butyl.
  - .2 Secondary Seal: polyisobutylene, silicone or polysulphide based sealant, filling gap between the two lites of glass at the edge up to the spacer/separator and primary seal.
  - .3 Spacer/separator: non-conductive, as required to suit performance requirements.
- .2 Insulated glass unit assembly to provide following minimum performance requirements. Following is based on 6 mm thick Low E glass in 25 mm thick insulating unit with 13 mm thick Argon gas filled space and 6 mm thick clear inner glass.

.1 Transmittance:

Ultra-violet (UV) light: 19%  
Visible daylight: 70%  
Total solar energy: 33%

.2 Reflectance:

Visible light: 11%  
Total solar energy: 30%

.3 U-values (Imperial):

Winter night time: 0.25  
Summer day time: 0.25

.4 Shading coefficient factor: 0.44

.5 Solar heat gain coefficient: 0.37

.6 Light-to-solar gain (LSG): 1.84

- .3 All windows to be fitted with triple glazed units, refer to window schedule.
- .4 Clear Float Glass: to CAN/CGSB-12.3, glazing quality, for inner and outer lite.
- .5 Glazing Gaskets for PVC Sections: neoprene, thermoplastic rubber or EPDM, flexible at minimum design temperature, and as follows:
- .1 Profiles with a minimum of two (2) fins to contact glazing at interior and exterior of glass units
  - .2 Designed to maintain pressure contact against glass units through design temperature range.
  - .3 Co-extruded gaskets are not acceptable on the main frame or sash.
  - .4 Foam or butyl glazing tapes are not acceptable.
- .6 Other Glazing Accessories: setting blocks to AAMA/WDMA/CSA101/I.S.2/A440-08-NAFS.

## 2.8 HARDWARE

- .1 Exposed Hardware Components: cast metal, in finish selected by Departmental Representative from hardware manufacturer's standard range.
- .2 Hardware exposed to exterior environment with sash in closed and open positions shall be corrosion-resistant stainless steel or bi-chromated steel composites.
- .3 Secure hardware and attachments using screws into H-ports or penetrating a minimum of two walls of framing. Wherever possible provide metal reinforcement embedded in vinyl frames at screw attachment locations.

- .4 Equip operable windows with hardware as follows:
  - .1 Casement: concealed dual arm operator and stainless steel tracks, with under screen roto operator assembly. Provide multi-point locking with single handle operation.
  - .2 Hardware to be adjustable to accommodate compression set of weather and air seals.
- .5 Provide ADA approved handles for roto operators.
- .6 Force to operate locking devices shall not exceed 20 N.
- .7 Provide pole operated hardware where window latching devices are located in excess of 1900 mm above floor level:

## 2.9 ACCESSORIES

- .1 Weatherstripping for operable sash: neoprene, thermoplastic rubber or EPDM, flexible at minimum design temperature, and as follows:
  - .1 Profiled to mechanically key into window and sash framing members, at interior and exterior of sash.
  - .2 Removable without special tools and without dismantling of frames.
  - .3 Designed to maintain pressure contact against frame through design temperature range.
  - .4 Provide a minimum of one weather seal gasket to the exterior and one air seal gasket to the interior of drained and vented cavities.
- .2 Steel Reinforcement: sheet steel to ASTM A653M, hot dip galvanized, minimum Z275 coating designation.
- .3 Transition membrane: minimum 1.6 mm thick SBS membrane sheet reinforced with non-woven polyester or glass fleece. Stripping to be a minimum 150mm wide.
- .4 Joint Sealants: as specified in Section 07 92 00, as recommended for substrates.
- .5 Foam Backer Rod: extruded closed cell backer rod, oversize 30 to 50%.
- .6 Screens: To CAN/CGSB-79.1.
  - .1 Insect screening mesh: count 18 x 16.
  - .2 Fasteners: tamper proof.
  - .3 Screen frames: vinyl or aluminum, colour to match window frames.

## 2.10 FRAME AND SASH FINISHES

- .1 Factory applied water-borne urethane finish.

## **2.11 AIR/VAPOUR RETARDER**

- .1 Ensure continuity of air/vapour retarder and seal from walls to window frame.

### **Part 3 Execution**

#### **3.1 FABRICATION**

- .1 Fabricate window units square and true with maximum tolerance of plus or minus 1.5 mm for units with a diagonal measurement over 1800 mm.
- .2 Mitre and heat weld full length of fiberglass frame and sash joints at corners. All welding flash to be neatly removed.
- .3 Fasten steel reinforcement to extruded vinyl mullions with concealed stainless steel fasteners at maximum 300 mm o/c.
- .4 Continuously and uniformly compress length of gaskets during installation, to compensate for linear shrinkage.
- .5 Fabricate swing door to accept hardware specified in Section 08 71 00 Door Hardware.

#### **3.2 GLAZING**

- .1 Clean sealing surfaces at perimeter of glass and sealing surfaces of rabbets and stop beads before applying tape, splines or gaskets. Use solvents and cleaning agents recommended by manufacturer of sealing materials.
- .2 Install glazing gaskets uniformly with accurately formed corners and bevels. Ensure that proper contact is made with glass and rabbet interfaces.
- .3 Support both lites of glass thermal units on levelled setting blocks, 4 or 6 mm minimum, spaced as recommended by glass manufacturer. Provide at least one setting block at quarter points from each corner. For casement windows, locate setting blocks closer to corners as recommended by manufacturer.
- .4 Centre glass thermal units in glazing rabbet to maintain 6 mm minimum clearance between edges of glazing and plastic framing at sill or 4 mm minimum clearance between edges of glazing and plastic framing at sill if glazing bite incorporates a drainage channel with depth of 3 mm minimum.
- .5 Size glass thermal units to ensure exposed face of spacer is in line with glazing stops.
- .6 Use spacers and shims in accordance with glass manufacturer's recommendations.
- .7 Immediately replace damaged or broken glass.

### **3.3 WINDOW AND DOOR INSTALLATION**

- .1 Install in accordance with CAN/CSA-A440 and reviewed shop drawings.
- .2 Arrange components to prevent abrupt variation in colour.
- .3 Erect and secure window units in prepared openings, plumb and square, free from warp, twist or superimposed loads.
- .4 Secure work accurately to structure and in a manner not restricting thermal movement of materials.
- .5 Transfer window dead load to wall construction by anchors alone or in combination with plastic shims. Wood shims are not acceptable.
- .6 Place shims under sill frame at exact setting block locations, and as marked on frames by window frame manufacturer.
- .7 Conceal all anchors and fitments. Exposed heads of fasteners are not permitted.
- .8 Maintain dimensional tolerances after installation. Maintain alignment with adjacent work.
- .9 Provide seal around interior perimeter of window frame using foam joint sealant or foam backer rod, size as required to lightly compress between frame and rough opening, and sealant. Ensure continuity of air/vapour retarder and seal to window frame.
- .10 Provide seal at head and jamb of exterior perimeter of window frame using foam joint sealant or foam backer rod, size as required to lightly compress between frame and rough opening, and sealant. Do not seal sill at exterior.
- .11 Install jamb extensions, casings, brick moulds and trim as indicated on drawings.
- .12 Install sealant, in accordance with Section 07 92 00, and related materials as indicated on drawings.
- .13 Adjust operable sash and hardware to operate smoothly.
- .14 Temporary installations of windows if needed are to meet all requirements for occupant and public safety, such as but not limited to, operable unit restrictors, fastening, sharp edges etc.

### **3.4 CAULKING**

- .1 Seal joints between windows and window sills with sealant. Bed sill expansion joint cover plates in bedding compound. Caulk butt joints in continuous sills.
- .2 Apply sealant in accordance with Section 07 92 00 – Joint Sealing. Conceal sealant within window units except where exposed use is permitted by the Departmental Representative.

### **3.5 PROTECTION AND CLEANING**

- .1 Do cleaning in accordance with Section 01 74 11 - Cleaning.
- .2 Protect windows/doors from damage/staining during and after installation.
- .3 Clean interior and exterior surfaces as soon as adjacent contaminating activities are completed, to recommendations of window manufacturer.

### **3.6 ENERGY CERTIFICATE**

- .1 Site certificates to be supplied in accordance with the British Columbia Energy Efficiency Act.
- .2 Certificates to include the following information:
  - .1 The whole-product U-value for each fenestration product provided on site (in W/m<sup>2</sup>K).
  - .2 The overall average U-value for the whole project, averaged over every fenestration product in the scope of work (in W/m<sup>2</sup>K).
  - .3 The name of the person or agency acting as verifier for the fenestration products.
- .3 Certificates are to be posted in plain view at the project site for a period of at least 120 days after the last manufactured fenestration product is installed in the building.

**END OF SECTION**

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**Part 1      General**

**1.1      SECTION INCLUDES**

- .1      Hardware for wood doors.
- .2      Lock sets and dead bolts for pre-hung doors.

**1.2      RELATED SECTIONS**

- .1      Section 08 14 16 – Interior Doors: operating hardware (hinges, thresholds, weatherseals) for pre-hung wood doors
- .2      Section 08 16 13 - Fiberglass Exterior Doors: operating hardware (hinges, thresholds, weatherseals) for fiberglass clad wood door packages and for steel clad wood door packages.

**1.3      QUALITY ASSURANCE**

- .1      Qualifications:
  - .1      Hardware supplier: company specializing in supplying residential door hardware with not less than 3years of documented experience.
  - .2      Regulatory requirements: conform to ULC requirements for fire rated doors, frames and hardware.
  - .3      Hardware: conform to CSA requirements for all hardware.

**1.4      SUBMITTALS**

- .1      Make submissions in accordance with procedures described in Section 01 33 00 - Submittal Procedures.
- .2      Product data: provide product data on specified hardware.
- .3      Shop drawings: indicate on shop drawings, locations and mounting heights of each type of hardware.
- .3      Templates: supply templates to door and frame installers to enable accurate sizes, locations of cut-outs for hardware.

**1.5      CLOSEOUT SUBMITTALS**

- .1      Provide in accordance with Section 01 78 10 - Closeout Submittals.
- .2      Maintenance tools and materials:
  - .1      Provide 10 extra key lock cylinders for each master keyed group.
  - .2      Provide special wrenches and tools applicable to each different or special hardware component.



- .3 Provide maintenance tools and accessories supplied by hardware component manufacturer.
  - .4 Package like items together.
  - .5 Clearly identify each package. Include complete re-ordering information to assist Departmental Representative in obtaining additional correct replacements.
- .3 Maintenance data:
    - .1 Provide maintenance data, parts list and manufacturer's instructions for each type of door closer and lock set installed.

## Part 2 Products

### 2.1 MANUFACTURERS

- .1 Hinges: 3 hinges per door.
  - .1 Stanley 821 4 x 4-1/4 radius 26D
  - .2 Mckinney 1414 4 x 4-1/4 radius 26D
  - .3 Reliance 060-4014 (4-1/4 radius) 26D
- .2 Spring hinges (Door Garage to house): 3 hinges per door.
  - .1 Stanley 420000 series (4-1/4 radius) 26D
  - .2 Mckinney RC1502 (4-1/4 radius) 26D
  - .3 Reliance 066-4014 (4-1/4 radius) 26D
- .3 Passage latch sets:
  - .1 Schlage AL10S x SAT
  - .2 Sargent 7U15 "LL"
  - .3 Unison LSBL730-26D
- .4 Privacy lock sets:
  - .1 Schlage AL40S x SAT
  - .2 Sargent 7U65 "LL"
  - .3 Unison LSB720-26D
- .5 Entrance lock sets: combination a Passage Latch Set (see Passage Latch Sets above) and a Deadlock (commercial).
  - .1 Schlage B500 series
  - .2 Sargent 470 series
  - .3 Unison DBBX110 series
- .4 Dummy levers (pairs of closet doors):
  - .1 Schlage "AL" commercial.
  - .2 Sargent 7 line "LL" design.
  - .3 Unison "BL" design.
- .5 Dead bolts: see Entrance Locks Sets above.
- .6 Weatherstripping: complete with pre-hung unit.

- .7 Door sweeps: complete with pre-hung unit.
  
- .8 Roller catches for closet doors:
  - .1 Ives RL32 26D
  - .2 Reliance 020-1401 26D
  
- .9 Hinge stops:
  - .1 Ives 69F 26D
  - .2 Reliance 022-1507HD 26D
  - .3 Hager 301D 26D
  
- .10 Base stops: solid construction.
  - .1 Ives 60B 26D
  - .2 Reliance 022-1510 26D
  - .3 Hager 324W 26D
  
- .11 Floor stops: rise.
  - .1 Ives FS17 (Rise) 26D
  - .2 Reliance 022-1502 26D
  - .3 Hager 243F 26D
  
- .12 Floor stops: non-rise.
  - .1 Floor Stop FS346 (Non Rise) 26D
  - .2 Reliance 022-1503 26D
  - .3 Hager 241F 26D

## 2.2 KEYING

- .1 Departmental Representative to supply keying schedule after contract award.

## Part 3 Execution

### 3.1 PREPARATION

- .1 Co-ordinate work of this section with other directly affected sections involving manufacturer of and internal reinforcement for door hardware.
  
- .2 Ensure that door and frame components are ready to receive work and dimensions are as indicated on shop drawings.

### 3.2 INSTALLATION

- .1 Install hardware to manufacturer written instructions.
  
- .2 Use templates provided by hardware item manufacturer.

- .3 Maintain following mounting heights for doors, from finished floor to centreline of hardware item:
- .1 Dead bolts: 1219 mm.
  - .2 Entrance lock sets: 1023 mm.
  - .3 Privacy lock sets: 1023 mm.
  - .4 Passage latch sets: 1023 mm.

### 3.3 SCHEDULE

#### Hardware Code 1

Doors 01, 11A, 10B

3 each Hinges	c/w door & frame	match hardware
1 each Passage Set	AL10S x SAT	626
1 each Deadlock	B560P	626
1 each Hinge Stop	60B	26D

Weather-strip, sill and door shoe by pre-hung door and frame supplier.

#### Hardware Code 2

Bathrooms 04, 26A

3 each Hinges	c/w door & frame	match hardware
1 each Privacy Set	AL40S x SAT	626
1 each Base Stop	60B	26D

#### Hardware Code 3

Closet 22B, 24B:

6 each Hinges	c/w door & frame	match hardware
2 each Roller Catch	RL32	26D
2 each Single Dummy	AL170 x SAT	626
2 each Hinge Stop	69F	26D

#### Hardware Code 4

Closet Doors 11B, 11C, 21, 22C, 23B, 24C

6 each Hinges	c/w door & frame	match hardware
2 each Roller Catch	RL32	26D
2 each Single Dummy	AL170 x SAT	626
1 each Hinge Stop	69F	26D
1 each Base Stop	60B	26D

#### Hardware Code 5

Laundry/Utility Doors 13B, 16

3 each Hinges	c/w door & frame	match hardware
1 each Passage Set	AL10S x SAT	626
1 each Base Stop	60B	26D

#### Hardware Code 6

Sliding Glass Door 15

Hardware by door supplier.

**Hardware Code 7**

Garage to Laundry 07

3	each Spring Hinge	RC1502 4. X 4. 1/4R	26D
1	each Passage Set	AL10S x SAT	626
1	each Deadlock	B560P	626
1	each Floor Stop	FS17	26D

Weather-strip, sill and door shoe by pre-hung door and frame supplier. All hardware to be fire rated.

**Hardware Code 8**

Exterior Garage Overhead Doors 09.

All hardware supplied complete by that door supplier.

**Hardware Code 9**

Bedroom Doors 03A, 22A 23A, 24A.

3	each Hinges	c/w door & frame	match hardware
1	each Passage Set	AL10S x SAT	626
1	each Base Stop	60B	26D

**Hardware Code 10**

Pocket Doors (powder rooms fitted with pocket doors) 12.

1	each Pocket Lock	54 mm face bore x 60.3 mm backset.	
		Cylindrical tubular privacy	26D

Balance of hardware complete with pocket door and frame supplied by that door supplier.

**Hardware Code 11**

Hall Linen Doors 03B, 26B.

3	each Hinges	c/w door & frame	match hardware
1	each Passage Set	AL10S x SAT	626
1	each Hinge Stop	60B	26D

**Hardware Code 12**

Bypass Closet Doors 02A, 03C.

Hardware by door supplier

**Hardware Code 13**

Bifold Door 02B.

Hardware by door supplier

**END OF SECTION**

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**Part 1            General**

**1.1                REFERENCES**

- .1    ASTM International
  - .1    ASTM D2240-05, Standard Test Method for Rubber Property - Durometer Hardness.
  - .2    ASTM E330-02, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
  - .3    ASTM F1233-08, Standard Test Method for Security Glazing Materials and Systems.
- .2    Canadian General Standards Board (CGSB)
  - .1    CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.
  - .2    CAN/CGSB-12.8-9, Insulating Glass Units.
- .3    AAMA/WDMA/CSA101/I.S.2/A440-08-NAFS- North American Fenestration Standard/ Specification for windows, doors, and skylights.
- .4    CSA A440S1 – 09 “Canadian Supplement to AAMA/WDMA/CSA101/I.S.2/A440-08 – NAFS – North American Fenestration Standard/Specification for windows, doors, and skylights.”
- .5    British Columbia Energy Efficiency Act – Energy Efficiency Standards Regulation (BCEEA).

**1.2                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 Glazing materials and sealants. Include product characteristics, performance criteria, physical size, finish and limitations.
  - .2    Submit 2 copies of WHMIS - Material Safety Data Sheets.
    - .1    Indicate VOC for glazing materials during application and curing.
- .3    Samples
  - .1    Submit minimum 305 x 305 mm size samples of glass requested by Departmental Representative.
  - .2    Manufacturers instructions.
    - .1    Submit installation instructions.

**1.3                QUALITY ASSURANCE**

- .1    Installer qualifications: company specializing in performing work of this section and approved by manufacturer. Provide such evidence upon Departmental Representative request.

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#### **1.4 DESIGN CRITERIA**

- .1 Provide continuity of building enclosure vapour and air barrier using glass and glazing materials as follows:
  - .1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.
  - .2 Size glass to withstand local positive and negative wind loads listed in NBC for location of building or identified on structural drawings, whichever more severe.
  - .3 Size glass to withstand seismic conditions for building location listed in NBC.

#### **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 and recycle waste materials in accordance with Section 01 74 19 – Construction Waste and Disposal.

#### **1.7 WHMIS**

- .1 Comply with WHMIS requirements regarding use, handling and storage of glazing materials.

#### **1.8 WARRANTY**

- .1 For Work of this Section 08 80 50 - Glazing, 12 months warranty period is extended to:
  - .1 120 months for insulating glass units of this Section to be free from manufacturing defects.
  - .2 Manufacturing defects will be deemed to occur if any of following conditions are noted.
    - .1 Appearance of condensation between panes.
    - .2 Obstruction of vision within unit perimeter.
    - .3 Measurable deterioration (more than 10%) of specified thermal transmission or shading coefficient performance ratings.
    - .4 Chipping, cracking or breakage of glass panes occurring due to manufacturing defects or under specified service conditions.
    - .5 Migration of edge spacer.
- .2 Defective products to be corrected, replaced or maintained without cost to Canada as necessary to enable such products to perform as warranted.
- .3 Start warranties at date of Final Certificate of Completion.

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**Part 2**            **Products**

**2.1**                **MATERIALS**

- .1 Flat Glass:
  - .1 Safety glass: to CAN/CGSB-12.1,
    - .1 Type 2-tempered.
    - .2 Class B-float.
    - .3 Transparent.
  - .2 Insulating Glass Units:
    - .1 Refer to Section 08 53 13 Fiberglass Windows for sealed unit requirements.
    - .2 All mullions indicated on the Architectural drawings to be installed within the glazing units.

**2.2**                **ACCESSORIES**

- .1 Setting blocks: neoprene, EPDM or silicone, 80-90 durometer hardness to ASTM D2240, to suit each application.
- .2 Spacer shims: neoprene, EDPM or silicone, 50-60 durometer hardness to ASTM D2240, Sized to suit each application.
- .3 Glazing tape: Glazing tapes: pre-formed macro-polyisobutylene tape with continuous integral neoprene shim (to prevent "pumping out" of tape under glass load conditions), paper release, black colour, width x thickness to suit installations.
- .4 Primers, sealers, cleaners: to glass manufacturer standards and compatible with framing system material/finish.
- .5 Glazing sealant: purpose-made for glazing use, compatible with insulating glass units.
- .6 Weather sealant: polyurethane, non-sag, 1-part formulation, colours selected by Departmental Representative.
- .7 Insulation: to ASTM C612 Type IVB, non-combustible, 70 kg/m<sup>3</sup> density mineral wool fibre board, zero flame spread and smoke development in accordance with CAN/ULC-S102, maximum water absorption of 0.03% in accordance with ASTM C1104/C1104M, minimum 5 year "aged" thermal resistance value RSI 0.74 per 25 mm thickness, of thicknesses or total RSI values detailed/indicated.

**Part 3**            **Execution**

**3.1**                **MANUFACTURERS INSTRUCTIONS**

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

### **3.2 GENERAL GLAZING REQUIREMENTS**

- .1 Clean sealing surfaces at perimeter of glass and sealing surfaces of rabbets before applying glazing tapes and sealant. Use solvent and cleaning agents recommended by manufacturer of sealing materials. Wipe dry.
- .2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- .3 Install glazing tapes uniformly with accurately formed corners and bevels. Ensure that proper contact is made with glass and rabbet interfaces.
- .4 Set glass on setting blocks, spaced as recommended by glass manufacturer. Place at least one block at quarter points from each corner.
- .5 Centre glass in glazing rabbet to maintain required clearances at perimeter on all 4 sides.
- .6 Use glazing sealant for heel beads to seal glazing vapour tight to frames.
- .7 Install wired glass with wire parallel to sash members and aligned in adjacent panels.
- .8 Make door glass installations rattle-free.

### **3.3 INSTALLATION**

- .1 Install glass and insulating glass units to metal doors and frames:
  - .1 Use glazing tape, on both sides. Butt tape tight at corners. Use full length pieces of glazing tape, from corner to corner.
  - .2 Install removable stops without displacing glazing tape.
  - .3 For interior exposure applications:
    - .1 Set glazing tape flush with glass sight line.
    - .2 Trim off glazing tape protruding above top of stops.
  - .4 For exterior exposure applications:
    - .1 Set glazing tape approximately 2 mm below glass sight line to allow cap bead of sealant.
    - .2 Place cap bead of weather sealant to exterior side full perimeter of glass.
    - .3 Apply sealant to uniform and level line, flush with sight line.
    - .4 Tool sealant to a smooth concave appearance.
- .2 Install tempered glass in aluminum railing system in accordance with engineered shop drawings and manufacturer's requirements.

### **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.
    - .1 Remove traces of primer, caulking.
    - .2 Remove glazing materials from finish surfaces.
    - .3 Remove labels.
    - .4 Clean glass and mirrors using approved non-abrasive cleaner in accordance with manufacturer's instructions.



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

### **3.5**

#### **PROTECTION**

- .1 After installation, mark each light with an "X" by using removable plastic tape or paste.
- .2 Remove markings when directed by Departmental Representative.

**END OF SECTION**

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**Part 1      General**

**1.1      SECTION INCLUDES**

- .1      Acoustic batt insulation.
- .2      Gypsum board and joint treatment.
- .3      Acoustic caulking.

**1.2      RELATED SECTIONS**

- .1      Section 06 10 00 – Rough Carpentry.
- .2      Section 07 21 05 - Insulation: thermal insulation.
- .3      Section 08 31 00 - Access Doors-Mechanical: supply of ceiling access doors.

**1.3      REFERENCES**

- .1      American Society for Testing and Materials (ASTM International).
  - .1      ASTM C473-10, Standard Test Methods for Physical Testing of Gypsum Panel Products.
  - .2      ASTM C475/C475M-02(2007), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
  - .3      ASTM C840-08, Standard Specification for Application and Finishing of Gypsum Board.
  - .4      ASTM C1002-07, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
  - .5      ASTM C1047-10, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
  - .6      ASTM C1396/C1396M-09a, Standard Specification for Gypsum Board.
- .2      Canadian General Standards Board (CGSB).
  - .1      CAN/CGSB-19.21-M87, Sealing and Bedding Compound, Acoustical.
- .3      Gypsum Association (GA).
  - .1      GA-214-10, Recommended Levels of Gypsum Board Finish.
- .4      Underwriters' Laboratories of Canada (ULC).
  - .1      CAN/ULC S102-07, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .2      CAN/ULC-S702-1997, Standard for Mineral Fibre Insulation.

**1.4      QUALITY ASSURANCE**

- .1      Perform Work in accordance with ASTM C840.

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**Part 2 Products**

**2.1 MATERIALS**

- .1 Standard gypsum board: to ASTM C1396/C1396M, thicknesses detailed/indicated on drawings x widths to suit framing centres x maximum practical lengths, wrapped tapered edges, square cut ends.
  - .1 Paper facing: no less than 75% recycled.
  - .2 Gypsum core: no less than 10% recycled content.
- .2 Fire rated gypsum board: to C1396/C1396M, Type X, thicknesses detailed/indicated on drawings x widths to suit framing centres x maximum practical lengths, wrapped tapered edges, square cut ends, bearing ULC fire rating labels.
  - .1 Paper facing: no less than 75% recycled.
  - .2 Gypsum core: no less than 10% recycled content.

**2.2 ACCESSORIES**

- .1 Acoustic insulation: CAN/ULC-S702 Type 1, pre-formed mineral fibre (rock wool) batt with zero flame spread and smoke development in accordance with CAN/ULC S102.2, thicknesses or total RSI/R-values detailed/indicated.
- .2 Acoustic sealant: CAN/CGSB-19.21; non-hardening, non-bleeding compound suitable for acoustic sealing use.
  - .1 VOC limit: maximum 250 g/L.
- .3 Corner beads: ASTM C1047/C1047M, metal corner bead.
- .4 Edge trim: ASTM C1047/C1047M; Type U casing bead.
- .5 Joint materials: ASTM C475; reinforcing tape, joint compound, adhesive and water.
- .6 Gypsum board fasteners: screws, ASTM C1002, Types S and W.

**Part 3 Execution**

**3.1 ACOUSTIC ACCESSORIES INSTALLATION**

- .1 Place acoustic insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions and tight to items passing through partitions.

**3.2 GYPSUM BOARD INSTALLATION**

- .1 Install gypsum board in accordance with ASTM C840.
- .2 Erect gypsum board horizontal, with ends and edges occurring over firm bearing.

- .3 Erect single layer fire rated gypsum board vertically, with edges and ends occurring over firm bearing.
- .4 Use screws when fastening gypsum board to resilient furring or wood framing.
- .5 Place corner beads at external corners. Use longest practical length. Crimp in place 300 mm o.c. along entire corner bead length and mechanically fix 300 mm o.c. between crimping points with care not to dislodge or cause crimped edges to lift.
- .6 Place edge trim where gypsum board abuts dissimilar materials.
- .7 Install ceiling access doors.

### **3.3 JOINT TREATMENT**

- .1 Finish in accordance with GA-214:
  - .1 Level 1 Finish: use this finish in areas wherever assembly will be completely concealed from view such as behind solid wall finishes, behind bath/shower surrounds.
  - .2 Level 5 Finish: use this finish wherever assembly will receive painted finish.

### **3.4 ACOUSTIC CAULKING**

- .1 Sealing for acoustical performance: seal perimeter of and penetrations through acoustic insulation filled construction.
  - .1 Apply continuous 13 mm dia. bead acoustical sealant around perimeter of each face of acoustical partition to seal board to unlike construction. Keep sealant well within gypsum board applications to prevent staining of subsequent floor finishes.
  - .2 Seal full perimeter of cut-outs at service/utility boxes, ducts, grilles and other penetrations.

**END OF SECTION**

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**Part 1            General**

**1.1                REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM E84-12c, Standard Test Method for Surface Burning Characteristics of Building Materials.
  - .2 ASTM F1700 -20, Standard Specification for Solid Vinyl Floor Tile.
  - .3 ASTM F710-11, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
  - .4 ASTM F1913-19 Standard Specification for Vinyl Sheet Floor Covering Without Backing.
  - .5 ASTM D2047-17 Standard Test Method for Static Coefficient of Friction of Polish -Coated Flooring Surfaces as Measured by the James Machine.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .3 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102-07, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide product data:
  - .1 Submit manufacturer's printed product literature, specifications and data sheets.
  - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets for each type of adhesive.
- .2 Provide samples:
  - .1 Submit duplicate 300 x 300 mm sample pieces of each flooring material specified.
  - .2 Departmental Representative to choose colour from manufacturer's standard range. Provide physical samples.
- .3 Manufacturer's Instructions: submit manufacturer's installation instructions.

**1.3                CLOSEOUT SUBMITTALS**

- .1 Operation and Maintenance Data: submit operation and maintenance data for installed products for incorporation into manual.
- .2 Warranty Documentation: submit warranty documents specified.

**1.4                QUALITY ASSURANCE**

- .1 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience.

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**1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Protect roll materials from damage by storing on end.

**1.6 ENVIRONMENTAL CONDITIONS**

- .1 Store materials for three (3) days prior to installation in area of installation to achieve temperature stability.
- .2 Maintain ambient temperature required by adhesive manufacturer three (3) days prior to, during, and forty-eight (48) hours after installation of materials.

**1.7 MAINTENANCE**

- .1 Provide floor maintenance information for inclusion in O&M manual.

**1.8 QUALITY ASSURANCE**

- .1 Qualifications: Provide proof of qualifications when requested by Consultant:
  - .1 Resilient Flooring Installer: Use an installer who is competent in heat welding and have a minimum of five (5) years documented experience in the installation of resilient sheet flooring and seams in accordance with manufacturer's training or certification program.
  - .2 Source Limitations: Obtain each type, colour, and pattern of flooring or accessories specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

**1.9 WARRANTY**

- .1 Manufacturer's Warranty: provide a manufacturer's 10 year Limited Warranty.
  - .1 Submit manufacturer's standard warranty document executed by authorized company official for Consultant's acceptance.
- .2 Installation Warranty: provide a one (1) year installation warranty, covering labour, repair or replacement of defective components for one (1) year after date of substantial performance

**Part 2 Products**

**2.1 MATERIALS**

- .1 Vinyl plank flooring to : to ASTM F1700, Class III, Type B.
  - .1 Material: Commercial Grade vinyl plank, approx. 2.5mm material thickness.
  - .2 .50mm wear layer.
  - .3 Plank size 18.4 cm x 122 cm.
  - .4 Pure solid vinyl construction.
  - .5 Printed design.

- .6 No wax finish.
- .7 Bevel edge profile.
- .8 Slip resistance to ASTM D2047.
- .9 Glue down installation.
- .10 Lifetime residential warranty.
- .2 Vinyl Sheet Flooring:
  - .1 Homogenous Flooring 2mm thickness, to ASTM F 1913.
  - .2 No wax finish.
  - .3 Non directional pattern.
  - .4 Abrasion resistant
  - .5 2m width roll.
  - .6 Slip resistance to ASTM D2047.
  - .7 Polyurethane reinforced.
  - .8 20 year warranty.

## **2.2 ACCESSORIES**

- .1 Primers and adhesives: of types recommended by resilient flooring manufacturer for specific material on applicable substrate, above, on or below grade.
- .2 Sub-floor filler and leveller: as recommended by flooring manufacturer for use with their product.
- .3 Reducer strips: rubber, size to suit depth of adjacent materials, ADA and barrier free compliant.
- .4 External corner protectors: stainless steel, type recommended by flooring manufacturer.
- .5 Edging to floor penetrations: stainless steel, type recommended by flooring manufacturer.

## **Part 3 Execution**

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

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

### **3.2 SITE VERIFICATION OF CONDITIONS**

- .1 Ensure concrete and wood floors are clean and dry by using test methods recommended by flooring manufacturer.

### **3.3 PREPARATION**

- .1 Prepare subfloor to manufacturer's recommendations.
- .2 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.

- .3 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.
- .4 Surface Preparation: prepare surface in accordance with manufacturer's written recommendations.

### **3.4 SHEET AND PLANK FLOORING INSTALLATION**

- .1 Install sheet flooring to manufacturers written instructions.
- .2 Spread only enough adhesive to permit installation of materials before initial set.
- .3 Set flooring in place, press with heavy roller to attain full adhesion.
- .4 Lay flooring with joints and seams to produce minimum number of seams.
- .5 Install sheet flooring parallel to length of room. Provide minimum of one third (1/3) full roll width. Double cut sheet; provide butt joint.
- .6 Terminate flooring at centreline of door openings where floor finish is dissimilar.
- .7 Install edge strips at unprotected or exposed edges, and where flooring terminates.
  - .1 Secure metal strips after installation of flooring with stainless steel screws.
- .8 Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

### **3.5 CLEANING**

- .1 Progress Cleaning:
  - .1 Remove waste materials from site daily. Do not burn waste materials on site.
  - .2 Leave Work area clean at end of each day.
- .2 Final Cleaning:
  - .1 Upon completion remove surplus materials, rubbish, tools and equipment.
  - .2 Remove excess adhesive from floor, base and wall surfaces without damage.
  - .3 Clean floor and base surface to flooring manufacturer's printed instructions.
- .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.

### **3.6 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Prohibit traffic on new flooring for period of 48 hours minimum after installation and until adhesive is cured.
- .3 Protect new floors from time of final set of adhesive until final inspection.
- .4 Repair damage to adjacent materials caused by tile carpeting installation.

**END OF SECTION**



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**Part 1      General**

**1.1      SECTION INCLUDES**

- .1      Carpeting and cushioned underlay on stairs.

**1.2      REFERENCES**

- .1      Carpet and Rug Institute (CRI).
  - .1      Indoor Air Quality Carpet Testing Green Label Program.
- .2      Underwriters' Laboratories of Canada (ULC).
  - .1      CAN/ULC-S102.2-10, Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

**1.3      REGULATORY REQUIREMENTS**

- .1      Conform to applicable code for carpet and cushioned underlay combustibility requirements of 300 maximum flame spread rating and 500 maximum smoke developed classification when tested to CAN/ULC-S102.2.
- .2      Conform to or exceed CRI Indoor Air Quality Carpet Testing Green Label Program.

**1.4      SUBMITTALS**

- .1      Make submissions in accordance with procedures described in Section 01 33 00 - Submittal Procedures.
- .2      Product data:
  - .1      Provide product data on specified products, describing physical characteristics; sizes, patterns, colours available, and method of installation.
- .3      Samples:
  - .1      Submit 2 samples not less than 300 x 300 mm in size illustrating colour and pattern for each carpet and cushion material proposed.

**Part 2      Products**

**2.1      CARPETING**

- .1      Tufted carpet conforming to following criteria:
  - .1      Pile surface appearance: non-textured level loop.
  - .2      Pile fibre: BCF nylon 6.
  - .3      Pile weight: 950 g/m<sup>2</sup>
  - .4      Gauge: 1/10.
  - .5      Pile height: 6 mm.
  - .6      Primary backing: polypropylene, 100 g/m<sup>2</sup> minimum weight.
  - .7      Secondary backing: proprietary coating.
  - .8      Colours: selected by Departmental Representative.

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**2.2 CUSHIONED UNDERLAY**

- .1 Cushioned underlay: minimum 9.5 mm thickness, minimum 120 kg/m<sup>3</sup> density, foam chip composition.

**2.3 ACCESSORIES**

- .1 Carpet gripper (tack strip): type recommended by carpet manufacturer.

**Part 3 Execution**

**3.1 PREPARATION**

- .1 Remove sub-floor ridges and bumps.
- .2 Fill low spots, cracks, joints, holes and other defects with sub-floor filler.
- .3 Install continuous carpet grippers (tack strip) along back edge of tread and long bottom edge of risers.

**3.2 INSTALLATION - CUSHIONED UNDERLAY**

- .1 Install in accordance with manufacturer instructions.
- .2 Install cushion using one piece per stair tread and lap over nosing.
- .3 Secure with staples.

**3.3 INSTALLATION - CARPET**

- .1 Install in accordance with manufacturer instructions.
- .2 Start fastening carpet at bottom of 1st riser using riser carpet gripper (tack strip).
- .3 Stretch carpet up and over stair with knee kicker and push carpet into place while tucking behind tread carpet gripper (tack strip).
- .4 Finish installations by tucking carpet securely in place behind carpet grippers (tack strips) using carpet wedging tool.
- .5 Fit carpet tight to stair stringers and to adjacent walls.

**3.4 CLEANING**

- .1 Clean and vacuum carpet surfaces to remove lint and loose fibres.

**END OF SECTION**

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**Part 1            General**

**1.1                REFERENCES**

- .1 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .2 Master Painters Institute (MPI)
  - .1 MPI Architectural Painting Specifications Manual, 2004.
- .3 National Fire Code of Canada – 1995
- .4 Green Seal Environmental Standards
  - .1 Standard GC-03-97, Anti-Corrosive Paints.
  - .2 Standard GS-11-93, Architectural Paints.
  - .3 Standard GS-36-00, Commercial Adhesives
- .5 South Coast Air Quality Management District (SCAQMD), California State
  - .1 SCAQMD Rule 1113-04, Architectural Coatings.
  - .2 SCAQMD Rule 1168-05, Adhesives and Sealants Applications.

**1.2                SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit product data and instructions for each paint and coating product to be used.
  - .2 Submit product data for the use and application of paint thinner.
  - .3 Submit copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOCs during application.
- .3 Samples:
  - .1 Submit duplicate 200 x 300 mm draw down samples of each scheduled paint colour with specified paint colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards.
  - .2 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.
  - .3 Manufacturer's Instructions:
    - .1 Submit manufacturer's installation application instructions.
  - .4 Closeout Submittals: submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals include following:
    - .1 Product name, type and use.
    - .2 Manufacturer's product number.
    - .3 Colour numbers.

### **1.3 MAINTENANCE**

- .1 Extra Materials:
  - .1 Deliver to extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Section 01 78 10 - Closeout Submittals.
  - .2 Quantity: provide one four litre can of each type and colour of finish coating. Identify colour and paint type in relation to established colour schedule and finish system.
  - .3 Delivery, storage and protection: comply with Departmental Representative requirements for delivery and storage of extra materials.

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

- .1 Packing, Shipping, Handling and Unloading:
  - .1 Pack, ship, handle and unload materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.
- .2 Acceptance at Site:
  - .1 Identify products and materials with labels indicating:
    - .1 Manufacturer's name and address.
    - .2 Type of paint or coating.
    - .3 Compliance with applicable standard.
    - .4 Colour number in accordance with established colour schedule.
- .3 Remove damaged, opened and rejected materials from site.
- .4 Storage and Protection:
  - .1 Provide and maintain dry, temperature controlled, secure storage.
  - .2 Store materials and supplies away from heat generating devices.
  - .3 Store materials and equipment in well ventilated area.
- .5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
- .6 Keep areas used for storage, cleaning and preparation clean and orderly. After completion of operations, return areas to clean condition.
- .7 Remove paint materials from storage only in quantities required for same day use.
- .8 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.

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

- .1 Separate waste materials for recycling in accordance with Section 01 74 19 - Construction Waste and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Unused coating materials must be disposed of at official hazardous material collections site as approved by Departmental Representative.

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## **1.6 SITE CONDITIONS**

- .1 Surface and Environmental Conditions:
  - .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
  - .2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.
  - .3 Apply paint when previous coat of paint is dry or adequately cured.
- .2 Additional interior application requirements:
  - .1 Apply paint finishes when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Provide paint materials for paint systems from single manufacturer.
- .3 Conform to latest MPI requirements for painting work including preparation and priming.
- .4 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.
- .5 Linseed oil, shellac, and turpentine: highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.
- .6 Paint materials to conform to the requirements of:
  - .1 Green Seal Environmental Standards.
    - .1 Standard GS-11-93, Architectural Paints.
  - .2 South Coast Air Quality Management District (SCAQMD), California State
    - .1 SCAQMD Rule 1113-04, Architectural Coatings.

### **2.2 COLOURS**

- .1 Departmental Representative to provide interior colour schedule after Contract award
- .2 Selection of colours from manufacturers full range of colours.
- .3 Where specific products are available in restricted range of colours, selection based on limited range.

### 2.3 GLOSS/SHEEN RATINGS

- .1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

	Gloss @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 - Matte Finish (flat)	Max. 5	Max. 10
Gloss Level 2 - Velvet-Like Finish	Max.10	10 to 35
Gloss Level 3 - Eggshell Finish	10 to 25	10 to 35
Gloss Level 4 - Satin-Like Finish	20 to 35	min. 35
Gloss Level 5 - Traditional Semi-Gloss Finish	35 to 70	
Gloss Level 6 - Traditional Gloss	70 to 85	
Gloss Level 7 - High Gloss Finish	More than 85	

### 2.4 PAINTING SYSTEMS

- .1 Exterior doors and frames (fiberglass).
- .1 EXT 6.7c- W.B. Light industrial coating over solvent based bonding primer : G5 gloss level finish.
- .2 Exterior Trims (comb face)
- .1 EXT 6.2A over factory installed primer. Gloss level 3.
- .3 Exterior Trims (columns, wooden railings/ballister. Staircase)
- .1 EXT 6.2A over exterior primer. Gloss level 5
- .4 Dressed lumber: including, doors:
- .1 INT 6.3A - High Performance Architectural Latex, gloss level 4
- .5 Interior running trim, window sills, doors, door jambs and trim:
- .1 INT 6.3A - High Performance Architectural Latex, gloss level 4.
- .6 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:
- .1 INT 9.2A - Latex –gloss level 3 finish (over latex sealer).
- .2 Kitchens and Bathrooms gloss level 5.
- .7 Ceilings: INT 9.2M - Institutional Low Odour/VOC - Gloss Level 1.
- .8 Wooden handrails
- .1 INT 6.3E Polyurethane Varnish (over stain) - Gloss Level 5 - MPI Premium Grade.
- .2 Stain to be selected by Departmental Representative.

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**Part 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

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

**3.2 GENERAL**

- .1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.
- .2 Apply paint materials in accordance with paint manufacturer's written application instructions.

**3.3 EXAMINATION**

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

**3.4 PREPARATION**

- .1 Protection:
  - .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Departmental Representative
  - .2 Protect items that are permanently attached such as Fire Labels on doors and frames.
  - .3 Protect factory finished products and equipment.
  - .4 Protect building occupants and general public in and about the building.
- .2 Surface preparation: clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements.
- .3 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
  - .1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
  - .2 Apply wood filler to nail holes and cracks.
  - .3 Tint filler to match stains for stained woodwork.
- .4 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.
- .5 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Touch up of shop primers with primer as specified.

**3.5 APPLICATION**

- .1 Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:

- .1 Apply paint in uniform layer using brush and/or roller type suitable for application.
- .2 Work paint into cracks, crevices and corners.
- .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
- .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.
- .5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray application:

- .1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
  - .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
  - .3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.
  - .4 Brush out immediately all runs and sags.
  - .5 Use brushes and rollers to work paint into cracks, crevices and places which are not adequately painted by spray.
- .4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.
- .5 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .7 Sand and dust between coats to remove visible defects.
- .8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

**3.6 SITE TOLERANCES**

- .1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.
- .2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.
- .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

**3.7 CLEANING**

- .1 Do cleaning in accordance with Section 01 74 11 - Cleaning.



**END OF SECTION**

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**Part 1      General**

**1.1          SECTION INCLUDES**

- .1      Toilet, bath and shower accessories.

**1.2          RELATED SECTIONS**

- .1      Section 06 10 00 – Rough Carpentry: wall framing, wood blocking.

**1.3          REFERENCES**

- .1      American Society for Testing and Materials International (ASTM).
  - .1      ASTM B456-03(2009), Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

**1.4          SUBMITTALS**

- .1      Make submissions in accordance with procedures described in Section 01 33 00 - Submittal Procedures.
- .2      Product data:
  - .1      Provide product data on accessories describing size, finish, details of function, attachment methods.
- .3      Samples: submit as requested by Departmental Representative.

**1.5          WARRANTY**

- .1      Provide warranty to following term beyond contract warranty:
  - .1      Framed mirrors: 10 years.
- .2      Remove and replace mirrors which fail within guarantee period at no cost to Canada. Failure will be deemed to occur if any of following are noted.
  - .1      Loss of silver mirror finish detrimental to reflection.

**1.6          CLOSEOUT SUBMITTALS**

- .1      Submit following required for incorporation into maintenance manual described in Section 01 78 10 - Closeout Submittals.
  - .1      Mirror warranty certificates.

**Part 2      Products**

**2.1          MATERIALS**

- .1      Mounting screws: non-corroding finish.

## **2.2 TOILET ACCESSORIES**

- .1 Toilet roll holders: recessed mounting, single roll capacity, chrome plated zinc/aluminum/magnesium/copper alloy die cast construction with spring loaded telescoping plastic tube toilet roll let roll holder.
- .2 Mirrors: surface mount, concealed fixings, 6 mm thick silvered float glass in bright polish finish stainless steel channel frame with tight fitted mitred corners, galvanized sheet steel back, sizes detailed/indicated.

## **2.3 BATH ACCESSORIES**

- .1 Towel bars: surface mounting with concealed fixing plates, chrome plated zinc/aluminum/magnesium/copper alloy die cast arms with square shape chrome plated sheet steel tube, of maximum lengths to suit locations detailed/indicated.
- .2 Robe hooks: surface mounting with concealed fixing plate, double hook units, chrome plated zinc/aluminum/ magnesium/copper alloy die cast construction.
- .3 Shower rods: surface mounting with concealed fixing plates, 25 mm o.d. x 0.9 mm wall thickness stainless steel tube, stainless steel end flanges, lengths to suit tubs.

## **2.4 FINISHES**

- .1 Chrome plating: ASTM B456, Type SC 2, polished finish.
- .2 Stainless steel: No. 4 satin lustre finish.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Do not install accessories prior to painting of walls.

### **3.2 INSTALLATION**

- .1 Install accessories in accordance with manufacturer instructions. Install items level.
- .2 Fix through wall finishes into wall framing/wood blocking.
  - .1 Direct fastening to gypsum board alone not acceptable.
- .3 Refer to drawings for locations and heights. Final locations and heights to be directed by Departmental Representative.
  - .1 Robe hooks: mount towards top of bathroom/powder room side of each bathroom/powder room door, at centreline of door.

**END OF SECTION**

**Part 1            General**

**1.1                SUMMARY**

- .1        Section includes common work results for fire suppression systems - Division 21.

**1.2                RELATED SECTIONS**

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

**1.3                DESCRIPTION OF WORK**

- .1        This Section pertains to the fire protection systems and fire protection water supply to a point 900 mm [36"] beyond the exterior face of the building.
- .2        This Section pertains to the fire protection systems from the point of connection to the water main at the backflow prevention unit, including the backflow prevention unit.
- .3        All equipment, elbows, fittings, nipples, drains, test connections and all accessory pipework for a complete and operational fire protection system is included in this Section of the work within the basic Tender price.
- .4        No extra cost will be considered based on failure of Contractor to allow for all required equipment, piping and fittings. This shall include extra fittings and pipework as required during construction to avoid existing structure, ductwork or other obstacles whether shown on drawings or not.

**1.4                SYSTEM DESIGN**

- .1        Arrange and pay for the services of a BC registered Professional Engineer. This Engineer shall provide all required engineering services related to the fire protection systems as indicated below.
- .2        The Fire Protection Engineer shall:
  - .1        Produce the fire protection working shop drawings in CAD format. Drawings shall be of the same size as the Contract Drawings.
  - .2        Perform hydraulic calculations. Software shall meet NFPA calculation requirements.
  - .3        Seal all documents submitted for construction and permits.
  - .4        Assume full responsibility for the detailed fire protection system design, and submit Schedules B-1, and B-2, and C-B (for Detailed Design) to the Municipality.
  - .5        Provide assistance to the Fire Protection Contractor as required.
  - .6        Witness sprinkler testing.
  - .7        Inspect the completed installation.
  - .8        On project completion, submit a sealed statutory declaration to the Departmental Representative stating that the fire protection system is installed in accordance

with the fire protection engineer drawings, instructions and the regulatory requirements.

## 1.5 SUBMITTALS

### .1 Shop Drawings:

- .1 Shop drawings shall indicate all the information required by NFPA, and the Authority Having Jurisdiction.
- .2 Indicate essential building construction features such as direction and size of concrete beams, partitions and lighting.
- .3 Bring to the attention of the Departmental Representative any sprinkler head, pipe, valve or system component in a location different from where specifically shown on the project Fire Protection Drawings. These alternate locations shall be reviewed during the shop drawing review.
- .4 Indicate piping and sprinkler head elevations, the sprinkler temperature rating, the spacing and types of hangers; seismic bracing details; drain test and flushing connections; type of sprinkler alarm; location and type of sprinkler control valve; and all other essential features of the piping system.
- .5 Submit shop drawings to the Departmental Representative, which have been approved and stamped by the Authority Having Jurisdiction and sealed by the Fire Protection Engineer. Allow a minimum of three weeks for review by Departmental Representatives. Submit a minimum of six [6] copies. Allow for resubmission(s) of drawings to reflect the Departmental Representative's review comments.
- .6 Submit a copy of the sprinkler shop drawings for review to the Departmental Representative's insurance agency.
- .7 Submit shop drawings for the following items:
  - .1 General:
    - .1 Fire protection sprinkler system.
    - .2 Fire department connections.
    - .3 Flow switches.
    - .4 Pressure switches.
    - .5 Supervisory switches.
    - .6 Valves, fittings and couplings.
    - .7 Water motor gong.
  - .2 Wet sprinklers:
    - .1 Sprinkler heads and escutcheon plates.
    - .2 Riser manifolds.
    - .3 Alarm Valves.

- .2 Record Drawings
  - .1 Refer to Section 23 0500 - Common Work Results for Mechanical.
  - .2 Provide "Record Drawings", Record Drawings shall include revised CAD drawings files on disk and one set of plots on mylar.
  - .3 Provide a CAD disk to the Departmental Representative for his records.
- .3 Closeout Submittals
  - .1 Provide maintenance data for incorporation into Operational and Maintenance manual.

## **1.6 SEISMIC PROTECTION**

- .1 Supply and install sway-bracing hangers on fire protection systems in accordance with NFPA requirements. Generally this shall apply to:
  - .1 All cross mains 50 mm [2"] and larger.
  - .2 All feed mains.
  - .3 All standpipe risers.
  - .4 Horizontal piping shall be 2-way bracing and vertical piping shall include 4-way bracing at the tops of all risers.
  - .5 On floor loops, sway-braces are also required at the corners of all loops.

## **Part 2 Products**

### **2.1 HANGERS AND SUPPORTS**

- .1 All hangers and supports shall conform to the appropriate NFPA standards.
- .2 Toggle hangers are unacceptable.

### **2.2 MISCELLANEOUS METALS RELATED TO FIRE PROTECTION SYSTEM**

- .1 All miscellaneous metal related to the fire protection systems including all metal back up plates and supports for all ceiling or wall supported equipment is part of this section of the work.

### **2.3 BACKFLOW PREVENTION STATIONS**

- .1 Backflow prevention stations for fire service shall be listed by Underwriters' Laboratories Canada (ULC).
- .2 Reduced pressure principle device (RPPD) complete with OS&Y inlet and outlet shut-off valves, double check valve assembly and differential relief outlet.

## **Part 3 Execution**

### **3.1 ACCESS DOORS**

- .1 Install at concealed sprinkler heads, unions, expansion joints, valves, control valves and special equipment.

- .2 Locate access doors so that all concealed items are readily accessible for adjustment, operation and maintenance.
- .3 Do not locate access doors in feature wall or ceiling construction without the prior approval of the Departmental Representative. Locate in service areas wherever possible.
- .4 In concealed ceiling spaces containing upright heads and exposed supply piping below the ceiling, a hole around the sprinkler head riser large enough to allow passing the entire sprinkler head through the ceiling with an oversized escutcheon plate to cover the hole is an acceptable alternative to providing an access panel.

### **3.2 GRADING AND DRAINING OF PIPING**

- .1 Grade all fire protection piping so that it can be drained through drain cocks.
- .2 All main drains shall be directed to the outside of the building wherever possible.

### **3.3 PIPING EXPANSION**

- .1 All piping systems, including all take-offs shall be so installed within the building that the piping and connected equipment will in no way be distorted by expansion, contraction or settling.
- .2 If circumstances on the job require additional changes in direction from those shown on the drawings, the configuration shall be adjusted to suit at no extra cost.
- .3 Anchors shall be installed where necessary to control expansion.

### **3.4 CORE DRILLING**

- .1 Arrange and pay for the cost of all core drilling for the fire protection work under Division 21.
- .2 Verify the location of existing service runs and structural reinforcement within existing concrete floors and walls prior to core drilling and cutting. Coring and cutting of structural building components shall only take place upon the receipt of specific written approval of the structural engineer. Repairs to existing services damaged as a result of core drilling is included in this section of the work.
- .3 Penetrations up to 150 mm [6"] nominal pipe size in precast concrete may be cored on site by fire protection contractor. Larger penetrations shall be located and arranged for in precast work with precast manufacturer prior to shipping to construction site.

### **3.5 PIPE SLEEVES AND ESCUTCHEONS**

- .1 Supply and installation of pipe sleeves is included in this section of the specification. Refer to Section 23 0505 - Installation of Pipework.

### **3.6 BACKFLOW PREVENTION STATIONS**

- .1 Pipe differential relief outlet to drain.
- .2 Installation shall comply with CSA B64.10.

- .3 Test all backflow prevention devices and submit signed declarations to that effect prior to Substantial Completion.

### **3.7 PRESSURE GAUGES**

- .1 Provide pressure gauges at the following locations:
  - .1 Incoming water and downstream of backflow prevention device.
  - .2 Zone manifold.

### **3.8 MISCELLANEOUS METALS RELATING TO FIRE PROTECTION SYSTEMS**

- .1 Prime coat after fabrication with two coats of red primer.
- .2 See separate division of specification for finish painting requirements.

### **3.9 TESTS AND INSPECTION**

- .1 Furnish all labour, materials, instruments, etc. necessary for all required tests. All work shall be subject to inspection by the local plumbing inspector or design authority. At least forty-eight (48) hours notice shall be given in advance of making the required tests.
- .2 Tests on Fire Protection systems shall consist of pressure tests and shall conform to standards of Inspection Authority as listed in separate clauses of this section of specification.
- .3 Responsibility for completing "Contractor's Materials and Test Certificate" in accordance with inspection authority test procedure is included in this section.

**END OF SECTION**



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**Part 1      General**

**1.1      SUMMARY**

- .1      Section includes materials and installation for wet pipe fire protection and sprinkler systems for heated areas.
- .2      This is a performance specification clarified in this Section and on the Project sprinkler drawings to establish a minimum standard of equipment, design and installation.
- .3      The specification describes the basic system and design required but not all of the details or components.
- .4      This Trade shall have the experience to design the sprinkler system. Materials and work necessary to achieve the specification requirements will not be considered an extra to the Contract.
- .5      The system design shall meet the requirements of the building, based on the Contract Drawings and Specifications.
- .6      Provide hydraulically calculated suppression systems for the entire building project to NFPA 13R.

**1.2      RELATED SECTIONS**

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

**1.3      ENGINEERING DESIGN CRITERIA**

- .1      The design criteria for the building shall be:
  - .1      Make water distribution uniform throughout the area in which sprinkler heads will open.
- .2      The design criteria for the building shall be:
  - .1      Make water distribution uniform throughout the area in which sprinkler heads will open.
  - .2      Light hazard occupancy with a density of 4.1 (L/min)/m<sup>2</sup> [0.10 gpm/ft<sup>2</sup>] for the most remote 278 m<sup>2</sup> [3000 ft<sup>2</sup>] in all unless indicated otherwise.
  - .3      Ordinary Hazard Group 1 occupancy with a density of 6.1 (L/min)/m<sup>2</sup> [0.15 gpm/ft<sup>2</sup>] for the most remote 13R9 m<sup>2</sup> [1500 ft<sup>2</sup>] in the following areas:
    - .1      Utility Room.
- .3      Include with each system materials, accessories, and equipment inside and outside building to provide each system complete and ready for use.
- .4      Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts, and other construction and equipment in accordance with

detailed shop drawings. Locate sprinkler heads in consistent pattern with ceiling grid, lights, and air supply diffusers.

## **Part 2 Products**

### **2.1 GENERAL**

- .1 Devices and equipment for fire protection service shall be to NFPA 13R, ULC listed, FM approved for use in wet pipe sprinkler systems.
- .2 All piping shall be to NFPA 13R.

### **2.2 PIPE**

- .1 Black steel pipe to ASTM A53 and ANSI Standard B36.10:
  - .1 Schedule 40 standard wall pipe for pressure to 2070 kPa [300 psi].
  - .2 Schedule 30 pipe in sizes 200 mm [8"] and larger for pressure to 2070 kPa [300 psi].
  - .3 "Light wall" pipe for welded or roll grooved pipe only shall conform to the following wall thicknesses:
    - .1 Up to 125 mm [5"] Schedule 10.
    - .2 150 mm [6"] 3.40 mm [0.13R4"].
    - .3 200 to 250 mm [8" to 10"] 4.78 mm [0.188"].
- .2 Hot dipped galvanized steel to ASTM A53 and ANSI Standard B36.10:
  - .1 Schedule 40 standard wall pipe for pressure to 2070 kPa [300 psi].
  - .2 Schedule 30 pipe in sizes 200 mm [8"] and larger for pressure to 2070 kPa [300 psi].
  - .3 "Light wall" pipe for welded or roll grooved pipe only shall conform to the following wall thicknesses:
    - .1 Up to 125 mm [5"] Schedule 10.
    - .2 150 mm [6"] 3.40 mm [0.13R4"].
    - .3 200 to 250 mm [8" to 10"] 4.78 mm [0.188"].
- .3 High strength low carbon steel Tube: to ASTM A795, grade A, type E.
  - .1 Pipe with mechanical roll grooved or locking lug type fittings.
- .4 Steel tubing: to ASTM A13R5, A795 or A53
  - .1 Schedule 5 pipe with cold drawn steel fittings with integral "O" rings.
- .5 Chlorinated polyvinyl chloride (CPVC) ULC listed for fire sprinkler piping where separated from the area it serves and any other fire compartments by ceilings, walls, or soffits consisting of a minimum of lath and plaster, 9 mm [3/8"] thick gypsum, 13R mm [1/2"] thick plywood, or lay-in ceilings incorporating steel suspension grids where the density of the panels equals or exceeds 1.7 kg/m<sup>2</sup> [0.35 pounds/ft<sup>2</sup>] and where openings through the ceiling are limited to locations immediately adjacent to the sprinklers.

- .6 Copper tube, drawn, seamless to ASTM B75, seamless water tube to ASTM B88, wrought seamless and alloy type to ASTM B251, brazing filler metal (Classification BcuP-3 or BcuP-4) to AWS A5.8 and solder 95/5 (tin/antimony grade 95TA) solder to ASTM B32 of wall thickness type 'K', 'L', or 'M'.

## **2.3 FITTINGS AND JOINTS**

- .1 Compatible with piping material.
- .2 Suitable for maximum pressures in system but not less than 1210 kPa [175 psi] working pressure.
- .3 Welding fittings shall comply with the latest edition of the following standards: ANSI B16.9 and B16.25 and ASTM A234.
- .4 All grooved end fittings shall be of one manufacturer.
- .5 Flexible connections shall be ULC listed.

## **2.4 VALVES**

- .1 Gate - 1210 kPa [175 psi]:
  - .1 Open by counter-clockwise rotation.
- .2 Butterfly - 1210 kPa [175 psi]:
  - .1 12 mm [1/2"] - 50 mm [2"]:
    - .1 Slow closing with indicator and integral supervisory switch.
  - .2 50 mm [2"] - 75 mm [3"]:
    - .1 Groove end with integral supervisory switch.
- .3 Check - 1210 kPa [175 psi]:
  - .1 Provide spool piece to ensure full check valve opening where adjacent an alarm or gate valve.
- .4 Drain Valve: 25 mm [1"] complete with hose end adaptor, cap and chain.
- .5 Solenoid valves shall be ULC listed.
- .6 If the system working pressure exceeds 1035 kPa [175 psi] all valves shall be 2070 kPa [300 psi] rated.
- .7 Groove end valves shall be used wherever groove end pipe is employed. All groove end valves shall be of one manufacturer.

## **2.5 SPRINKLER HEADS**

- .1 Sprinkler heads shall be ULC listed for use in occupancies and hazard type for which they are installed.
- .2 Temperature rating on fusible links shall suit the specific hazard they serve.

- .3 Provide sheet metal sheets, to prevent cold soldering of sprinkler head, as indicated on drawings and as required by NFPA 13R. Colour of shields as per Architects direction. Size and install as per NFPA 13R requirements.
- .4 Sprinkler deflector elevations shall be within 12 mm [1/2"] of each other in the same room.
- .5 All sprinklers except where noted shall be in satin chrome finish with polished chrome escutcheons except natural bronze finish may be used in the following areas:
  - .1 Utility/Mechanical Rooms
  - .2 Electrical rooms
  - .3 Concealed spaces
  - .4 Service spaces
- .6 Escutcheons used on T-bar ceilings shall allow ceiling panel removal without removing the sprinkler head.
- .7 Escutcheons shall be provided by the sprinkler manufacturer to suit the model of sprinkler and maintain the approvals.
- .8 Wet System sprinkler head finishes:
  - .1 Upright - Glass bulb, brass finish.
  - .2 Pendent - Glass bulb, brass finish.
  - .3 Pendent Recessed - Glass bulb, chrome plate finish.
  - .4 Pendent Concealed: - Concealed glass bulb, brass body, custom painted cover plate, T-bar White.
  - .5 Horizontal Sidewall (finished areas) - Glass bulb, chrome plate finish.
  - .6 Horizontal Sidewall (unfinished areas) - Glass bulb, brass body.
  - .7 Window Sprinkler - Glass bulb, chrome plate finish.
- .9 Acceptable Products: Astra, Automatic, Grinnell, Reliable, Star, Gem, Tyco.
- .10 Baffles: Baffles to be located and installed as per NFPA 13R requirements.

## **2.6 SUPERVISORY SWITCHES**

- .1 Mechanically attached to valve body.
- .2 24V DC contact rating unless noted otherwise.
- .3 Two sets of SPDT contacts or one set normally open and one set normally closed contacts.
- .4 Looped cable devices are not acceptable
- .5 Approved valves with integral supervisors are acceptable alternatives.

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## **2.7 FLOW SWITCHES**

- .1 ULC listed for mounting pipe size in sprinkler system.
- .2 24V DC contact rating unless noted otherwise.
- .3 Two sets of SPDT contacts or one set normally open and one set normally closed contacts.
- .4 Time delay feature and paddle indicator.
- .5 Provide a sight glass in accordance with NFPA with drain connection. Alternatively, provide a Victaulic "Testmaster".

## **2.8 PRESSURE SWITCHES**

- .1 24V DC contact rating unless noted otherwise.
- .2 Two sets of SPDT contacts or one set normally open and one set normally closed contacts.

## **2.9 PIPE HANGERS**

- .1 All hangers and supports shall be ULC listed for fire protection services.
- .2 Toggle hangers are unacceptable.

## **2.10 PRESSURE GAUGES**

- .1 Maximum limit of not less than twice normal working pressure at point where installed.

## **2.11 ESCUTCHEONS AND PLATES**

- .1 Provide on pipes passing through walls, partitions, floors and ceilings in finished areas.
- .2 Plates shall be stamped steel, split type, chrome plated or stainless steel, concealed hinge, complete with springs, suitable for external dimensions of piping/insulation. Secure to pipe or finished surface. Outside diameter shall cover opening or sleeve.
- .3 Where pipe sleeve extends above finished floor, escutcheons or plates shall clear sleeve extension.
- .4 Do not install escutcheons and plates in concealed locations.

## **2.12 SPARE SPRINKLERS AND PARTS CABINET**

- .1 Provide metal cabinet with extra sprinkler heads and sprinkler head wrench in the Mechanical Room.
- .2 Spare Sprinkler Heads
  - .1 Number and types of extra sprinkler heads as specified in NFPA 13R (minimum 6 heads).

- .2 Provide a minimum of two spare sprinklers for each type installed.
- .3 Provide a special sprinkler wrench to be kept in the cabinet for maintenance use in the removal and installation of sprinklers.

### **2.13 SIGNS**

- .1 Attach properly lettered and approved metal signs to each valve and alarm device to ANSI/NFPA 13R.
- .2 Permanently fix hydraulic design data nameplates to riser of each system.

## **Part 3 Execution**

### **3.1 DESIGN**

- .1 Perform on site flow tests to obtain required water data.
- .2 Hydraulically calculate the sprinkler systems in accordance with this specification and NFPA 13R requirements.
- .3 Hydraulic calculations shall be based upon the flow test data, which has been reduced by 10%.
- .4 Hydraulic calculations shall not be based on the largest room area as indicated in NFPA 13R.
- .5 Confirm with the Consultant any interpretive aspects of the listed Codes, Standards or approvals that differ from the Contract Documents. Such interpretations shall not be used without the Consultant's approval.

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

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

### **3.3 INSTALLATION**

- .1 Install, inspect and test to acceptance in accordance with NFPA 13R.
- .2 All grooved end valves, fittings and couplings etc. shall be of one manufacturer.
- .3 Pipe Installation:
  - .1 Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings.
  - .2 Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter.

- .3 Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.
  - .4 Inspect piping before placing into position.
  - .5 All welding shall be performed off site using welding fittings. Field welding is not permitted.
  - .6 Adjust sprinkler piping up or down if conflicts occur between structure, lighting, electrical, plumbing piping or ductwork.
  - .7 Arrange piping routing to provide sufficient access to mechanical and electrical equipment.
  - .8 A wrap around hanger or other approved means shall be provided at the end of each branch sprinkler line to prevent excessive movement.
- .4 Flow Switches:
- .1 Install flow switches with a tight pipe drain connection to open discharge outside the building at grade level or other acceptable discharge point as approved by the Engineer.
  - .2 Install a 25 mm [1"] flow switch test drain valve with a 25 mm [1"] brass ball plug. Immediately downstream of flow switch for each flow switch. This is in addition to the normal inspector's test connections required by NFPA.
  - .3 Locate flow switches where shown.
- .5 Supervisory Switches - Valves:
- .1 Install supervisory switches on all valves supplying the sprinkler and standpipe system inside the building. Switches shall be compatible with the valve supervised.
- .6 Sprinkler Heads:
- .1 Locate heads in relation to ceiling and spacing of sprinkler heads not to exceed that permitted by NFPA 13R.
  - .2 All sprinkler head locations shall be coordinated with the Architectural and Electrical ceiling plans and with existing site conditions.
  - .3 Do not install any sprinkler heads until all piping systems have been flushed of all contaminants.
  - .4 Provide dry pendent or sidewall heads on all wet sprinkler systems where heads are piped into cold areas.
- .7 Provide inspector's test valves and pipes at all remote points in the system.
- .8 Flanged fittings shall be used at valve stations and at fire department connections.
- .9 Install monitored valves and flow switches for all zones. Electrical Division shall wire monitored valves and flow switches to the central fire alarm system. Identify which portion of the system each valve controls.
- .10 Locate water motor alarm high above ground on an exterior wall in order to avoid vandalism
- .11 Protection of Electrical Equipment from Water:

- .1 Responsibility for water damage to electrical equipment from the sprinkler system installation whether due to testing or leakage shall be the responsibility of this section.
- .2 Provide and install in this section of the work minimum 20 gauge metal protective hoods, individually located over all electrical equipment susceptible to water damage upon release of sprinkler heads in electrical areas. Such electrical equipment shall include all transformers and all equipment with ventilation grilles that will allow water entry into the electrical equipment. Protective hoods shall be sloped to allow shedding for water, shall project horizontally beyond the equipment perimeter and shall not be mounted on the equipment unless prior approval is obtained from the electrical authorities. Holes through protective hoods shall be sealed watertight.

### **3.4 FLUSHING**

- .1 Provide flushing connections on all sprinkler systems.
- .2 Flush all underground mains before connecting to sprinkler systems.
- .3 Flush all pipelines so effluent is clear and free of debris.
- .4 Rate of flushing flows shall be as per NFPA 13R requirements.
- .5 Provide proper drainage for this flushing operation.

**END OF SECTION**



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**Part 1            General**

**1.1                SUMMARY**

- .1 Section Includes:
  - .1 Materials and installation for plumbing pumps.

**1.2                REFERENCE STANDARDS**

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Safety Data Sheets (SDS).

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and data sheet for fixtures and equipment.
- .3 Shop Drawings.
  - .1 Submit shop drawings to indicate:
    - .1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.
    - .2 Wiring and schematic diagrams.
    - .3 Dimensions and recommended installation.
    - .4 Pump performance and efficiency curves.
- .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.
- .7 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 10 - Closeout Submittals, include:
  - .1 Manufacturers name, type, model year, capacity and serial number.
  - .2 Details of operation, servicing and maintenance.
  - .3 Recommended spare parts list with names and addresses.

**Part 2            Products**

**2.1                SUMP PUMP SUBMERSIBLE**

- .1 Capacity: 75 L/s at 45 kPa head with NPS 75mm discharge.
- .2 Construction: duplex CSA approved, housing epoxy coated cast iron, stainless steel bronze stainless steel shaft, non-clog bronze impeller, mechanical shaft seal.

- .3 Motor: 1/3hp hermetically sealed, with automatic overload protection.
- .4 Control: buoyant case and switch level control and duplex control box.

### **Part 3 Execution**

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

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

#### **3.2 INSTALLATION**

- .1 Make piping and electrical connections to pump and motor assembly and controls as indicated.
- .2 Ensure pump and motor assembly do not support piping.
- .3 Align vertical pit mounted pump assembly after mounting and securing cover plate.
- .4 Place 150 mm sand under sump pit tank.

#### **3.3 FIELD QUALITY CONTROL**

- .1 Site Tests/Inspection:
  - .1 Check power supply.
  - .2 Check starter protective devices.
- .2 Start-up, check for proper and safe operation.
- .3 Check settings and operation of hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.
- .4 Adjust flow from water-cooled bearings.
- .5 Adjust impeller shaft stuffing boxes, packing glands.

#### **3.4 START-UP**

- .1 General:
  - .1 In accordance as specified herein.
  - .2 Procedures:
    - .1 Check power supply.
    - .2 Start pumps, check impeller rotation.
    - .3 Check for safe and proper operation.
    - .4 Check settings, operation of operating, limit, safety controls, over-temperature, audible/visual alarms, other protective devices.
    - .5 Test operation of hands-on-auto switch.
    - .6 Test operation of alternator.
    - .7 Adjust leakage through water-cooled bearings.
    - .8 Adjust shaft stuffing boxes.

- .9 Adjust leakage flow rate from pump shaft stuffing boxes to manufacturer's recommendations.
- .10 Check base for free-floating, no obstructions under base.
- .11 Run-in pumps for 12 continuous hours.
- .12 Check installation, operation of mechanical seals, packing gland type seals. Adjust as necessary.
- .13 Adjust alignment of piping and conduit to ensure full flexibility.
- .14 Eliminate causes of cavitation, flashing, air entrainment.
- .15 Measure pressure drop across strainer when clean and with flow rates as finally set.
- .16 Replace seals if pump used to degrease system or if pump used for temporary heat.
- .17 Verify lubricating oil levels.

### **3.5 PV - SANITARY SUMP PUMPS**

- .1 Application tolerances:
  - .1 Flow: plus 10 %; minus 0 %.
  - .2 Pressure: plus 10 %; Minus 5 %.
- .2 PV Procedures:
  - .1 Fill sump at rate slower than capacity of pump #1.
  - .2 Record levels at which pump #1 starts and stops. Determine flow rate by observing time taken to down water level.
  - .3 Fill sump at rate faster than capacity of pump #1 but slower than capacities of pumps #1 and #2 operating in parallel.
  - .4 Record levels at which pumps start and stop - water level rising and water level falling.
  - .5 Verify operation of alternator.
  - .6 Adjust water level controls as necessary.
  - .7 Fill sump at rate faster than capacities of pumps #1 and #2 operating in parallel.
  - .8 Record levels at pump starts and stops - water level rising and falling.
  - .9 Check operation of alternator.
  - .10 Adjust level controls as necessary.
  - .11 Check level at which high water level alarm starts and stops. Adjust as necessary.
- .3 Check removability of pumps for servicing without interfering with installation or operation of other equipment.
- .4 Verify non-clog capability and maximum size of solids, using procedures recommended by manufacturer.

### **3.6 REPORTS**

- .1 In accordance supplemented as specified.

- .2 Include:
- .1 PV results on approved PV Report Forms.
  - .2 Product Information report forms.
  - .3 Pump performance curves (family of curves) with final point of actual performance.

**END OF SECTION**

**PART 1      General**

**1.1          SUMMARY**

- .1 Section includes materials, requirements and installation for copper domestic water service used in the following:
  - .1 Copper incoming domestic water service, up to 65 mm [2 1/2"].
  - .2 Hard drawn copper domestic hot and cold water services inside building.
  - .3 Plastic incoming domestic water service.
  - .4 Plastic domestic hot and cold water services inside building.
  - .5 This section applies to domestic hot water, domestic cold water and domestic hot water recirculation systems inside the building to a point 900 mm [36"] upstream of the point where the water service passes through or under the perimeter foundation of the building.

**1.2          RELATED SECTIONS**

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

**1.3          SUBMITTALS**

- .1 Shop Drawings:
  - .1 Submit a list of all valves, manufacturer and model number, of all types used.
- .2 Closeout Submittals:
  - .1 Provide maintenance data for incorporation into Operational and Maintenance manual.

**PART 2      Products**

**2.1          PIPING**

- .1 Pipe and fittings below ground:
  - .1 75 mm [3"] and smaller.
    - .1 Type 'K' seamless soft copper tubing to ASTM B88.
    - .2 Copper pipe to ASTM B42.
    - .3 Piping shall be protected in a polyethylene sleeve.
- .2 Pipe and fittings above ground:
  - .1 All lead-free materials required for all piping and fixtures, as per latest CSA B125.1 – Plumbing Supply Fittings standard.
  - .2 Copper tubing type 'L' hard drawn, seamless, CSA or Warnock Hersey certified to ASTM B88.

- .3 Copper pipe type 'L' to ASTM B42.
- .4 Flexible tubing System:
  - .1 All components - of system shall be provided by one manufacturer including tubing, tubing fittings, manifolds, manifold support brackets and tubing bend supports.
  - .2 All components shall carry a twenty-five (25) year non-prorated warranty against failure due to manufacturing defect or exposure to stress cracking agents.
  - .3 Tubing:
    - .1 Cross-linked polyethylene tubing rated for 82°C [180°F] maximum working temperature at 688 kPa [100 psi] working pressure.
    - .2 To ASTM Standard F876-877 and CSA-B137.5.
  - .4 Tube Fittings:
    - .1 Fittings shall be dezincification resistant brass. The tubing manufacturer shall supply these fittings.
    - .2 The tube fitting shall consist of an insert, a compression ring and a nut.
    - .3 Tube fittings shall be CSA-B137.5.
  - .5 Manifolds: Cast bronze construction to CSA-B137.5.

## 2.2 FITTINGS

- .1 Bronze pipe flanges and flanged fittings to ANSI/ASME B16.24.
- .2 Cast bronze threaded fittings 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 All below ground fittings shall be provided with integral tie lugs. Weld on lugs are not acceptable.
- .6 Cast bronze or wrought copper roll grooved pressure fittings with grooved mechanical pipe connector couplings complete with angle bolt pad to provide a rigid joint, with 'flush seal' gaskets to CSA B242.
- .7 Compression fittings shall conform to ANSI B16.
- .8 Mechanical formed tee fittings to ASME, ANSI B31.5C.
- .9 Ductile iron pressure coupling to ANSI/AWWA C-606 for cut grooved ductile iron pressure pipe with synthetic rubber gasket, plated carbon steel bolts, alkyd phenolic primer and protective enamel finish.

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### 2.3 PIPE JOINTS

- .1 All flanged adaptors used on copper to iron connections shall be brass.
- .2 Rubber gaskets, latex-free 1.6 mm thick: to AWWA C111.
- .3 Bolts, nuts, hex head and washers to ASTM A307, heavy series.
- .4 Solders and fluxes shall not contain lead.
- .5 Teflon tape for threaded joints.
- .6 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket.
- .7 Provide dielectric couplings in lieu of unions between interconnected dissimilar metals.

### 2.4 VALVES - GENERAL

- .1 All valves shall be rated for 860 kPa [125 psi] service unless noted otherwise.

### 2.5 GATE VALVES

- .1 50 mm [2"] and smaller:
  - .1 Non-rising stem, bronze body, solid wedge disc, bronze trim or stainless steel to MSS-SP-80, Class 125, 860 kPa.

### 2.6 GLOBE VALVES

- .1 50 mm [2"] and smaller:
  - .1 Bronze body with bronze or stainless steel trim, bronze bevel or composition disc.
  - .2 Threaded ends to MSS-SP-80, Class 150, 1 MPa.
  - .3 Sweat ends to MSS-SP-80, Class 125, 860 kPa.212.

### 2.7 BALL VALVES

- .1 50 mm [2"] and smaller:
  - .1 Lever handle, brass two piece body, blow-out proof stem, PTFE seats, brass ball chrome plated.
  - .2 Sweat ends to ANSI/ASME B16.18, Class 150.
  - .3 Threaded ends to Class 150.

### 2.8 DRAIN VALVES

- .1 Ball type with bronze body and trim, suitable for maximum system operating pressure, c/w cap and chain.

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## **2.9 SWING CHECK VALVES**

- .1 50 mm [2"] and smaller:
  - .1 Bronze body, bronze or stainless steel disc holder and Teflon disc.
  - .2 Threaded ends to MSS-SP-80, Class 150, 1 MPa.
  - .3 Sweat ends to MSS-SP-80, Class 125, 860 kPa.

## **PART 3 Execution**

### **3.1 INSTALLATION**

- .1 Install in accordance with the most recent edition of BC Building Code, National Building Code of Canada and local Authority Having Jurisdiction requirements. In cases of conflicting requirements, the most stringent shall apply.
- .2 Install pipe work in accordance with ASPE and current National Plumbing Code requirements.
- .3 Assemble piping using fittings manufactured to ANSI standards.
- .4 Install DCW piping below and away from DHW so as to maintain temperature of cold water as low as possible.
- .5 Concealed water piping to plumbing fixtures and fittings shall utilize cast brass drop ear elbows and tees as required to rigidly secure the piping. Provide blocking within the concealed space and secure the drop ear fittings using brass screws.
- .6 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.
- .7 Pipe Joints:
  - .1 Install dielectric couplings at copper piping connections to plumbing equipment of dissimilar material.
  - .2 At the water service entry to the building provide a flexible standard sleeve transition coupling with stainless steel nuts and bolts, below grade at the building perimeter excavation.
- .8 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.

### **3.2 VALVES**

- .1 Disassemble all sweat end valves prior to soldering. Where disassembly is not feasible special attention shall be given not to damage valve during soldering.



- .2 Isolation Valves:
  - .1 Install isolation valves as indicated on the drawings and in the following locations:
    - .1 At each main branch supply point.
    - .2 At each group of plumbing fixtures.
    - .3 At each plumbing fixture individually.
    - .4 At each piece of equipment.
    - .5 As required by the codes and bylaws governing this project.
  - .3 Drain Valves:
    - .1 Provide a hose-end adapter with cast brass cap and chain on all drain valves not piped directly to drain.
    - .2 Drain valves shall be 20 mm [3/4"] minimum but line size up to 40 mm [1-1/2"] unless noted otherwise.

### **3.3 PRESSURE TESTS**

- .1 Conform to requirements of Section 23 05 00 - Common Work Results - Mechanical.
- .2 Perform a hydrostatic test on all domestic water piping at 1380 kPa [200 psi] for 8 hours.
- .3 Comply with all requirements of the most recent edition of BC Building Code, National Building Code of Canada and local Authority Having Jurisdiction requirements. In cases of conflicting requirements, the most stringent shall apply.

### **3.4 FLUSHING AND CLEANING**

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

### **3.5 DISINFECTION**

- .1 Flush out, disinfect and rinse system to the most recent edition of BC Building Code, National Building Code of Canada and local Authority Having Jurisdiction requirements. In cases of conflicting requirements, the most stringent shall apply.
- .2 Coordinate with Civil Contractor.
- .3 Upon completion, provide laboratory test reports on water quality for Departmental Representative's review.

**END OF SECTION**

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**PART 1      General**

**1.1            SUMMARY**

- .1      Section includes the installation of drainage waste and vent piping.
- .2      Building perimeter drainage system.
- .3      Building sanitary waste and vent piping to 1 m [3 ft] beyond the foundation of the building.
- .4      Building storm drainage piping and rainwater leaders to 1 m [3 ft] beyond the foundation of the building.
- .5      Existing sanitary waste piping as indicated on the drawings.
- .6      Redundant existing interior sanitary waste and storm drainage piping shall be removed where access is readily available or capped off and abandoned in place as referenced on the drawings. All vents through the roof shall be capped.

**1.2            RELATED SECTIONS**

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

**PART 2      Products**

**2.1            PERIMETER DRAINS**

- .1      Pipe and Fittings:
  - .1      Polyvinyl Chloride (PVC) series 100 perforated building sewer pipe and fittings conforming to CSA-B137.3.
  - .2      Perimeter drainage shall be nominal diameter 100 mm [4"] unless noted otherwise on the contract drawings.
- .2      Cleanouts:
  - .1      Cleanouts shall be 100 mm [4"] minimum on pipe up to 150 mm [6"].
  - .2      For exterior cleanouts in traveled areas:
    - .1      Heavy-duty epoxy coated cast iron construction with a 12 mm [1/2"] thick cover, terminated at grade.
  - .3      For exterior cleanouts in landscaped areas:
    - .1      Cleanouts shall be 100 mm [4"] minimum.
    - .2      ABS or PVC cleanout terminated at grade.
    - .3      Irrigation water valve type box.

- .4 For interior cleanouts refer to Section 22 4201 - Plumbing Specialties and Accessories.
- .3 Drain Gravel: 100% granular material of 14 mm to 17 mm [9/16" to 11/16"] diameter.
- .4 Pea Gravel: 100% granular material of 12 mm to 25 mm [1/2" to 1"] diameter.
- .5 Filter Cloth:
  - .1 2.2 mm [0.0866"] thick polyester filter cloth.

## 2.2 DRAIN, WASTE AND VENT PIPE AND FITTINGS

- .1 Below ground:
  - .1 Class 4000 cast iron mechanical joint pipe to CAN/CSA-B70.
    - .1 Mechanical joints: Neoprene or butyl rubber compression gaskets to ASTM C564 or CAN/CSA-B70.
    - .2 Stainless steel clamps.
  - .2 Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Drain Waste and Vent Pipe Fittings.
    - .1 Conforming to CSA/CAN 3-B181.1 and ASTM F628.
    - .2 Joints: solvent weld to ASTM D2235.
  - .3 Polyvinyl Chloride (PVC) Drain Waste and Vent Pipe and Pipe Fittings:
    - .1 Conforming to CSA B181.2.
    - .2 Joints: solvent weld to ASTM D2564.
  - .4 Additional requirements:
    - .1 Plastic (PVC or ABS) piping where used underground shall adapt to approved non-plastic material prior to penetration above the building slab; where such above slab piping will not be concealed within drywall or a non-flammable plumbing fixture.
    - .2 Pressure waste piping from pumping stations and other equipment shall be pressure piping and fittings as specified for domestic water.
- .2 Above ground:
  - .1 DWV copper drainage pipe to ASTM B306
    - .1 Cast brass or wrought copper drainage pattern fittings to CAN/CSA-B125.
    - .2 Solder: 50/50 Sn/Pb recessed solder joints to ASTM B32.
  - .2 Class 4000 cast iron mechanical joint pipe to CAN/CSA-B70.
    - .1 Mechanical joints (up to 200 mm [8"]): Neoprene or butyl rubber compression gaskets to ASTM C564 or CAN/CSA-B70.
    - .2 Stainless steel clamps.
  - .3 Acrylonitrile-Butadiene-Styrene (ABS) Drain Waste and Vent Pipe Fittings (Fire separations limit the use of this material.)
    - .1 Conforming to CSA/CAN 3-B181.1 and ASTM F628.

.2 Joints: solvent weld to ASTM D2235.

.3 Additional requirements:

- .1 Pressure waste piping from pumping stations and other equipment shall be pressure piping and fittings as specified for domestic water.
- .2 Copper to cast iron joints shall be male brass adaptors with tapped fittings.
- .3 Nipples shall be cast iron or heavy brass.
- .4 Class 4000 mechanical joint cast iron soil pipe and mechanical joint couplings shall be of one manufacturer.
- .5 Use acceptable reduced outside diameter DWV piping in confined locations inside the building; wall spaces, duct spaces, ceiling spaces, etc. where there is not sufficient room for cast iron pipe.
- .6 Plastic (PVC or ABS) piping where used underground shall adapt to approved non-plastic material prior to penetration above the building slab; where such above slab piping will not be concealed within drywall or a non-flammable plumbing fixture.

### **PART 3 Execution**

#### **3.1 INSTALLATION**

- .1 Install in accordance with the most recent edition of BC Building Code, National Building Code of Canada and local Authority Having Jurisdiction requirements. In cases of conflicting requirements, the most stringent shall apply.
- .2 Install pipe work in accordance with ASPE and current National Plumbing Code requirements.

#### **3.2 TESTING**

- .1 Pressure test buried systems before backfilling.
- .2 Hydraulically test to verify grades and freedom from obstructions.
- .3 Tests on the sanitary waste and storm drainage systems shall consist of hydraulic pressure testing of 3000 mm [118"] for 8 hours.
- .4 An air test in accordance with the most recent edition of BC Building Code, National Building Code of Canada and local Authority Having Jurisdiction requirements, may be used during freezing conditions. In cases of conflicting requirements, the most stringent shall apply.

#### **3.3 PERIMETER DRAINS**

- .1 Any unstable areas or unsatisfactory conditions i.e. poor compaction slopes shall be reported to the Departmental Representative.

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- .2 Ensure foundation wall waterproofing has been inspected and approved by the Departmental Representative.
  - .3 Installation of perimeter drainage shall not begin until subgrade and foundation wall deficiencies have been corrected.
  - .4 Pipe and Fitting Installation:
    - .1 Prior to pipe placement ensure sub-grade complies with the required drainage pattern.
    - .2 Pipe joints spigots shall face downstream of flow.
    - .3 Install so perforations are on the bottom half of the pipe.
    - .4 Use manufacturer's recommended fittings only.
    - .5 Shims to establish pipe slope is not acceptable.
    - .6 Pipe bedding shall be drain gravel to 150 mm [6"] minimum below pipe, 300 mm [12"] minimum above pipe and 500 mm [20"] wide. Backfill above the drain gravel shall be 300 mm [12"] minimum above the drain gravel.
    - .7 Perforated pipe and drain gravel shall be covered with filter cloth.
    - .8 Connect drainage piping to the sediment sump.
    - .9 Take note that the water from the dewatering of the site by pumping or gravity shall not be permitted to drain directly into the permanent sewers. Only clear, clean water may be discharged and only into the storm sewer.
    - .10 Pipe and fittings cast in walls shall be schedule 40 ABS or cast iron.
    - .11 ABS and cast iron fittings shall adapt to PVC Pipe with recommended manufacturer's adapters.
    - .12 Prior to backfilling, the Departmental Representative shall approve the piping installation.
  - .5 Cleanouts:
    - .1 Provide cleanouts as indicated on the contract drawings, at the start of all runs and at 15 m [50 ft] intervals.
    - .2 Cleanouts will be rejected if not accessible for maintenance.
    - .3 Location of all cleanouts shall be clearly recorded on the as-built drawings.
    - .4 Cleanouts shall be brought to grade and set in an irrigation type box in landscaped areas or in traveled areas anchored in a concrete collar.
    - .5 Cleanouts on interior piping shall be as specified under Section 22 4201 - Plumbing Specialties and Accessories.
  - .6 Excavation and Backfill:
    - .1 Excavation for perimeter drainage shall be a minimum of 150 mm [6"] below invert of pipe unless otherwise stated in the contract document.
    - .2 Backfill material above the pipe shall be drain gravel and above drain gravel shall be pea gravel.

.7 Inspection:

- .1 Do not backfill until pipe grade and alignment is inspected and accepted by the Departmental Representative.
- .2 Provide a minimum of 2 working days notice to the Departmental Representative for field inspections prior to backfilling.

**END OF SECTION**

**PART 1      General**

**1.1            SUMMARY**

- .1      Section includes the installation of domestic water heaters.

**1.2            RELATED SECTIONS**

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

**1.3            SUBMITTALS**

- .1      Shop Drawings:
  - .1      Submit shop drawings for all domestic water heaters and tanks.
- .2      Closeout Submittals
  - .1      Provide maintenance data for incorporation into Operational and Maintenance manual.

**1.4            WARRANTY**

- .1      Provide an extended warranty for the Work of this Section, over and above the 12 month warranty period, to the number of years specified for each product.

**PART 2      Products**

**2.1            TANKS - DOMESTIC HOT WATER - ELECTRIC (HWT-1)**

- .1      Commercial grade porcelainized glass-lined tank, electric hot water heater, CSA certified, maximum hydrostatic working pressure 1034 kPa [150 psi].
- .2      Rigid R-16 polyurethane foam, mineral wool or fibreglass insulation.
- .3      Enamelled steel jacket.
- .4      Fully automatic controls, manually adjustable thermostat, 4.5kW 60 gallon, 240 volt control circuit with fused transformer.
- .5      3 year extended warranty certificate.
- .6      Refer to equipment schedules on mechanical drawing coversheet for selection information.

**2.2 EXPANSION TANK (ET-DHW)**

- .1 Provide a diaphragm expansion tank for protection of the hot water tank complete with dielectric coupling on connections, CSA certified, maximum hydrostatic working pressure 1034 kPa [150 psi].
- .2 Refer to equipment schedules on mechanical drawing coversheet for selection information.

**PART 3 Execution**

**3.1 INSTALLATION**

- .1 Install in accordance with manufacturer's recommendations, most recent edition of BC Building Code, National Building Code of Canada and local Authority Having Jurisdiction requirements. In cases of conflicting requirements, the most stringent shall apply.
- .2 Install the domestic hot water tank in the location shown on the drawings.
- .3 Provide design and install seismic restraint of tanks.
- .4 Bolt legs or cradles to floor or support structure.
- .5 Install a drain valve in the tank drain connection and pipe to drain.
- .6 Pipe relief valve at full size to drain.
- .7 Provide vacuum relief valve on cold water supply.
- .8 Provide isolating valves at tank connections.
- .9 Provide a drain pan piped to drain for installations other than slab on grade.

**END OF SECTION**



**PART 1      General**

**1.1            SUMMARY**

- .1      Section includes materials and installation for plumbing specialties and accessories.

**1.2            RELATED SECTIONS**

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

**1.3            SUBMITTALS**

- .1      Shop Drawings:
  - .1      Submit shop drawings for all plumbing specialties and accessories.
- .2      Closeout Submittals
  - .1      Provide maintenance data for incorporation into Operational and Maintenance manual.

**PART 2      Products**

**2.1            AREA DRAIN**

- .1      To CSA B79.
- .2      Area Drain AD1:
  - .1      Cast iron floor drain with anchor flange and adjustable collar. 305 x 305 nickel bronze grate, vandal proof.
  - .2      Pipe size to be 75 mm, provide sediment bucket.

**2.2            FLOOR DRAINS**

- .1      Floor Drains: to CSA B79.
- .2      FD1 general duty ; cast iron body as indicated round, adjustable head, nickel bronze strainer, integral seepage pan, and clamping collar.

**2.3            CLEANOUTS**

- .1      Cleanouts shall be full size for pipe sizes up to 100 mm [4"] and not less than 100 mm [4"] on larger sizes complete with a clamping collar other than outside or slab on grade type.
- .2      Cleanouts in inside finished areas shall all be round. Covers shall be scoriated.
- .3      All interior of building covers shall be nickel bronze.

- .4 Pipe manufacturers' cleanouts are acceptable for vertical installation at the base of soil and waste stacks or rainwater leaders only.
- .5 Make cleanouts with Barrett type fitting that has a bolted cover plate and gasket, fitting that has a threaded plug, or a cleanout ferrule that is installed in a wye or extended wye.
- .6 Outside area cleanouts shall be of heavy duty construction, with scoriated cast iron covers.
- .7 Unfinished concrete area cleanouts shall be of heavy duty construction and have a fully exposed scoriated cover.
- .8 Lino or lino tiled area cleanouts shall have the centre portion of cover recessed to receive a piece of tile that matches the adjoining tile.

## **2.4 WALL HYDRANTS AND HOSE BIBBS**

- .1 Hose Bibb (HB1) - Interior Use:
  - .1 Faucet with hose end spout in chrome plate finish.
  - .2 Removable "T" type lockshield handle.
  - .3 Chrome plated vacuum breaker on outlet.
- .2 Hose Bibb (HB2) - Exterior Non-freeze:
  - .1 Encased non-freeze self-draining wall hydrant with integral vacuum breaker, box type with cover lock key, and operating key.

## **2.5 WATER HAMMER ARRESTORS**

- .1 Piston style with stainless steel casing or bellows style with welded stainless steel nesting bellows, ANSI approved and PDI certified.

## **2.6 BACKFLOW PREVENTION STATIONS**

- .1 Backflow preventers shall meet the requirements of the latest edition of CAN/CSA - B64.10-01/CAN/CSA-B64.10.1-01 Manual for the Selection and Installation of Backflow Prevention Devices/Manual for the Maintenance and Field Testing of Backflow Prevention Devices.
- .2 Double check valve (DCV), factory assembled station complete with inlet and outlet isolation valves to CSA B64.
- .3 Reduced pressure principle device (RPPD) c/w inlet and outlet isolation valves, double check valve, differential relief outlet to CSA B64.10.
- .4 Provide a repair/maintenance kit for each size of RPPD installed.

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**2.7 PRESSURE REGULATORS**

- .1 12 mm to 50 mm [1/2" to 2"], 860 kPa [125 psi] rating.

**2.8 WATER MAKE-UP ASSEMBLY**

- .1 Pressure reducing valve shall have screwed, bronze or cast iron body, suitable to 1380 kPa [200 psig], composition seat.
- .2 Each reducing station to include:
  - .1 Gate or ball valve, strainer, union, backflow preventer, union, gate or ball valve.
  - .2 Gate or ball valve, union, pressure reducing valve, union, gate or ball valve.
  - .3 Bypass with globe valve.
  - .4 20 mm [3/4"] relief valve.

**2.9 VACUUM BREAKERS**

- .1 For pressure applications provide a 12 mm [1/2"] unit on pipe sizes up to 25 mm [1"].
- .2 For pressure applications provide a 20 mm [3/4"] unit on pipe sizes up to 40 mm [1 1/2"].
- .3 For pressure applications provide a 25 mm [1"] unit on pipe sizes up to 75 mm [3"].
- .4 For atmospheric applications provide a unit size to match the pipe size it serves.
- .5 Pressure Applications:
  - .1 Vacuum breakers shall meet the requirements of the latest edition of CAN/CSA B64.
- .6 Atmospheric Applications:
  - .1 Vacuum breakers shall meet the requirements of the latest edition of CAN/CSA B64.

**2.10 VACUUM RELIEF VALVES**

- .1 20 mm [3/4"] and smaller:
  - .1 Domestic hot water tank relief.

**2.11 TEMPERATURE AND PRESSURE RELIEF VALVES**

- .1 Minimum requirements:
  - .1 All water exposed parts shall be stainless steel or copper.
  - .2 A.S.M.E. rated.

**2.12 TRAP SEAL PRIMING DEVICES**

- .1 Provide flow actuated devices piped to the closest plumbing fixture.

- .2 Provide pressure actuated devices where the trap to be sealed is too remote from plumbing fixtures.

### **2.13 STRAINERS**

- .1 50 mm [2"] and smaller:
  - .1 Threaded ends, bronze body, 'Y' pattern, 304 stainless steel screen, 1034 kPa [150 psi] rating.

## **PART 3 Execution**

### **3.1 INSTALLATION**

- .1 Comply and install to manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.
- .2 Install in accordance with the most recent edition of BC Building Code, National Building Code of Canada and local Authority Having Jurisdiction requirements. In cases of conflicting requirements, the most stringent shall apply.

### **3.2 FLANGES AND UNIONS**

- .1 Provide an all bronze union with ground seat for pipe sizes 50 mm [2"] and smaller.
- .2 Provide grooved or flanged connections for pipe sizes 65 mm [2-1/2"] and larger.
- .3 Union and flanges shall be 1035 kPa [150 psi] rated.
- .4 Provide on connections to all fixtures and appliances, at pumps, control valves and reducing valves.

### **3.3 FLOOR DRAINS**

- .1 Install floor drains set low to provide proper drainage.
- .2 Water piping from trap primer to floor drain to be protected in a polyethylene sleeve where buried below slab.

### **3.4 CLEANOUTS**

- .1 Install cleanouts at the following locations:
  - .1 Building drain leaving building on the upstream side of exterior wall.
  - .2 Changes of direction of more than 45 degrees in drainage piping.
  - .3 Nominally horizontal branch or building drain at intervals of not more than 15 m [50 ft] for 100 mm [4"] and smaller and 30 m [100 ft] for 150 mm [6"] and larger.
  - .4 Base of soil or waste stacks and rainwater leaders.

- .5 As called for by the Building Code.
- .2 Cleanouts which are located low on walls shall be located 75 mm [3"] minimum above the top of the baseboard or minimum 200 mm [8"] above finished floor level where there is no baseboard.
- .3 Cleanouts shall be coordinated with all millwork and with all other obstructions, shall be placed in readily accessible locations and shall have sufficient clearance for rodding and cleaning.
- .4 Extend cleanouts to the finished floor or wall unless exposed in a basement room, pipe tunnel or accessible crawlspace.
- .5 Cleanouts passing through a waterproofed floor or a slab on grade shall possess a clamping collar which shall be clamped to the floor membrane or lead flashing.
- .6 Cleanouts on outside drains shall be brought to grade and anchored in a concrete collar or in a plastic box in landscaped areas.

### **3.5 SAFES, FLASHING AND VENT TERMINALS**

- .1 All cleanouts passing through walls or floors subject to hydrostatic pressure and waterproofed by means other than a membrane shall be provided with clamping collars and flashings of 25 kg/m<sup>2</sup> [5 lb/ft<sup>2</sup>] lead.
- .2 Supply and fix 25 kg/m<sup>2</sup> [5 lb/ft<sup>2</sup>] sheet lead flashings to all cleanouts, floor drains and roof drains. Securely fix to flashing clamps and extend 300 mm [12"] beyond edge of cast iron fittings.
- .3 Vent flashing minimum 450 x 450 mm [18" x 18"] base dimension shall terminate flush with the top of 300 mm [12"] high vent pipe and the gap between the flashing and pipe shall be closed to a 25 kg/m<sup>2</sup> [5 lb/ft<sup>2</sup>] separate lead cap 75 mm [3"] high. The main flashing shall not be turned over the pipe.
- .4 Coordinate with the Roofing Contractor to locate roof flashings away from ridges in steel deck roofing.

### **3.6 WALL HYDRANTS AND HOSE BIBBS**

- .1 Provide operating keys to the Departmental Representative prior to substantial completion.
- .2 Provide an accessible isolation valve upstream of hose bibbs.
- .3 Provide access panel as required.

### **3.7 BACKFLOW PREVENTION STATION**

- .1 Installation shall comply with the manual "Cross Connection Control" First Edition, published by the B.C. Section of the American Water Works Association.

- .2 Provide backflow preventers at each fixture or appliance where domestic water contamination can occur.
- .3 Locate at suitable height to allow maintenance.
- .4 Pipe differential relief outlet to drain.
- .5 Test all backflow prevention devices and submit a signed declaration to that effect prior to substantial completion.
- .6 A Certified Backflow Preventer Tester shall submit a test report to the Cross Connection Control Officer.
- .7 Locate the Backflow Preventer Test Report tag on or immediately adjacent to the backflow prevention assembly. The Test Report shall indicate the required details of the assembly and initial testing information.

### **3.8 PRESSURE REDUCING VALVES**

- .1 Pressure reducing valve stations minimum requirements:
  - .1 Pressure reducing valve, strainer, shut off valve on the inlet and outlet.
  - .2 A bypass around the pressure reducing valve with a globe valve at one size less than the incoming service size and pressure gauges upstream and down stream of the valve.
- .2 Set the pressure-reducing valve serving the main incoming water service to an initial setting of 415 kPa [65 psi].

### **3.9 VACUUM BREAKER**

- .1 Installation shall comply with the manual "Cross Connection Control" First Edition, published by the B.C. Section of the American Water Works Association.
- .2 Provide vacuum breakers at each fixture or appliance where domestic water contamination can occur.
- .3 Atmospheric vacuum breakers shall be installed a minimum of 300 mm [12"] above the flood level rim of the fixture or appliance served.
- .4 Pressure vacuum breakers shall be installed with a drain pan and enclosure piped to drain.
- .5 Test all vacuum breakers and submit a signed declaration to that effect prior to substantial completion.

### **3.10 TRAP SEAL PRIMING DEVICES**

- .1 Provide trap seal priming for all sanitary floor drains.
- .2 Install devices in areas that are readily accessible. Provide access panels as required.

- .3 Provide isolation valves on all piping serving trap seal primers.

### **3.11 STRAINERS**

- .1 Install with sufficient room to remove basket.
- .2 Provide strainer blow down capabilities as follows:
  - .1 Cold water strainer - plug at the blow-down connection.

### **3.12 TESTING AND ADJUSTING**

- .1 General:
  - .1 Tests on the sanitary waste and storm drainage systems shall consist of hydraulic pressure testing of 3000 mm [118"] for 8 hours.
  - .2 An air test in accordance with the most recent edition of BC Building Code, National Building Code of Canada and local Authority Having Jurisdiction requirements, may be used during freezing conditions. In cases of conflicting requirements, the most stringent shall apply.
- .2 Area/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, and removability of strainer.
  - .5 Clean out baskets.
- .3 Vacuum Breakers, Backflow Preventers:
  - .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.
- .4 Access Doors:
  - .1 Verify size and location relative to items to be accessed.
- .5 Cleanouts:
  - .1 Verify covers are gas-tight, secure, yet readily removable.
- .6 Hose Bibbs:
  - .1 Verify complete drainage, freeze protection.
  - .2 Verify operation of vacuum breakers.
- .7 Pressure regulators, PRV assemblies:
  - .1 Adjust settings to suit locations, flow rates, pressure conditions.

- .8 Strainers:
  - .1 Clean out repeatedly until clear.
  - .2 Verify accessibility of cleanout plug and basket.
  - .3 Verify that cleanout plug does not leak.

**END OF SECTION**



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**Part 1            General**

**1.1                SUMMARY**

- .1            Section includes the supply and installation of plumbing fixtures and trim.

**1.2                RELATED SECTIONS**

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

**1.3                SUBMITTALS**

- .1            Shop Drawings:
  - .1            Submit shop drawings for all plumbing fixtures.
- .2            Closeout Submittals:
  - .1            Provide maintenance data for incorporation into Operational and Maintenance manual.

**1.4                FINISHES**

- .1            Stainless steel fixtures shall be satin and/or mirror finish or a combination thereof.
- .2            Exposed plumbing fittings and metal work shall be extra heavy chrome plated.

**Part 2            Products**

**2.1                MANUFACTURED UNITS**

- .1            Provide brand new fixtures and fittings, CSA approved, free from flaws and blemishes. All surfaces shall be clear, smooth, bright and be dimensionally stable.
- .2            Fixtures of the same type shall be the product of one manufacturer.
- .3            Fittings of the same type shall be the product of one manufacturer.
- .4            Protect all fixtures and fittings against use and damaged during construction.
- .5            Provide an individual stop or valve on each domestic water service serving a plumbing fixture.

**2.2                WATER CLOSET 'WC1':**

- .1            Maximum Flush Performance Rating (MaP) score of 800 or better and performance rated (CSA approved).

- .2 Floor mounted, 2 piece vitreous china, close-coupled closet combination with elongated bowl, insulated tank, bolt caps, single 4.0 Lpf (1.1Gpf) flushing system or dual flush, polished chrome trip lever.
- .3 Provide floor flange, flange bolts and gasket.
- .4 Seat: Elongated heavy duty solid plastic closed front with cover, reinforced stainless steel check hinge, posts, washers and nuts. colour white.

### **2.3 LAVATORY BASIN 'L1':**

- .1 Lavatory: Vitreous china self-rimming countertop lavatory, semi-oval, round or rectangular bowl, swivel clamps drilled on 100 mm [4 inch] centres, front overflow, and flexible supplies, seal of putty or caulking;
- .2 Waste fittings: Rubber stopper and chain.
- .3 Faucet and Trim: Chrome plated metered mixing faucet with washerless valves 5.7LPM flow aerator and cover plate, open grid strainer, chrome plated P-trap with clean-out plug and arm with escutcheon;

### **2.4 KITCHEN SINK 'KS1':**

- .1 Bowl: Double compartment 787x521x178 mm [ 31x 20.5 x7 inch] outside dimensions, 0.9 mm [20 ga] thick, stainless steel type 302, self-rimming with undercoating, 90 mm [3-1/2 inch] crumb cup and chromed brass drain, ledge back 3 faucet drillings to suit;
- .2 Faucet and Trim: Chrome plated brass washerless valves with vegetable side spray self closing spray, 3 hole supply with swing spout, water economy aerator, single lever handle; chrome plated brass P-trap with clean-out plug and arm with escutcheon.

### **2.5 BATHTUB AND SHOWER 'BT':**

- .1 Bathtub: porcelain-enamelled steel one-piece recess bathtub with slip resistant surface, contoured front apron, left/right hand (refer to drawing). Standard nominal size 1524 x 762 x 393.7 mm [60 x 30 x 15.5 inches] long.
- .2 Faucet and Trim: Concealed over rim supply single handle lever, chrome plated brass with pressure balance cycling valve with stops, includes spout, showerhead and arm. Concealed pop-up waste and overflow fitting, manual pop up and stopper.
- .3 Water Saving Shower Head, C.P. cast brass, one piece, with 5.7 LPM (1.5 GPM) Turbine Flow.

### **2.6 LAUNDRY SINK 'LS':**

- .1 Bowl single compartment, polypropylene, with stainless steel strainer, tailpiece, tailpiece nut(s) and gasket(s): 559 x 635 mm [22 x 25 inch] with moulded drain and stopper, angular steel legs;

- .2 Faucet and Trim: Double handle, washerless, chrome, deck mount; rubber hose, hose clamp.

**2.7 CLOTHES WASHER 'CW':**

- .1 Recessed box with single lever shut off.
- .2 12 mm [1/2"] hot and cold.
- .3 Provide 600mm drop drain with 'p' Trap, 2" [50mm].

**2.8 DISHWASHER 'DW':**

- .1 12 mm [1/2"] hot with stop.
- .2 Pipe drain to sink waste.

**Part 3 Execution**

**3.1 FIXTURE INSTALLATION**

- .1 Provide all hangers, supports, brackets, reinforcement, steel back-up plates and floor flanges to set fixtures level and square. Mount fixtures so that 90 kg [200 lb.] mass will not loosen or distort mounting.
- .2 Sinks
  - .1 Faucets shall be complete with nuts and tailpieces.
  - .2 Gooseneck spouts shall have a clearance of 200 mm [8"] from nozzle tip to countertop, unless otherwise specified.
  - .3 Plastic control handles and spouts are unacceptable.

**3.2 FIXTURE TRIM HOLES OR PUNCHINGS**

- .1 Fixtures shall not contain more punching's than necessary for the specified trim.
- .2 Drilling holes and cutting cutouts for the installation of plumbing fixture trim and faucets including the forming of recesses or grooves in the underside of countertops or the provision of extension pieces for faucet nipples is the responsibility of the General Contractor.

**3.3 CLEAN-UP**

- .1 All fixtures and trim shall be left in a clean and polished condition.

**3.4 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 Vacuum breakers, backflow preventers: operation under all conditions.
- .4 Thermostatic controls: Verify temperature settings, operation of control, limit and safety controls.

**END OF SECTION**

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**PART 1      General**

**1.1            SUMMARY**

- .1      Section includes common work results for Divisions 21, 22, 23 and 25.

**1.2            RELATED SECTIONS**

- .1      These common works apply for Divisions 21, 22, 23 and 25. Should there be any conflict between any requirement of this Section and the General Conditions, Supplements and Amendments, the more stringent shall apply.
- .2      This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

**1.3            DEFINITIONS**

- .1      Provide means supply and install.
- .2      Work means material and labour.
- .3      Departmental Representative refers to owner's representative.
- .4      The specification sections are titled and divided under the headings of General, Products and Execution and under clause headings. These titles and headings are for general organization only and shall in no way limit or restrict the specification requirements.

**1.4            GENERAL SCOPE**

- .1      Provide the work indicated in the Contract Documents and as required to provide complete, tested and fully operational systems including all work not normally indicated but necessary for a complete and operational installation.
- .2      The Contractor is expected to be experienced and competent and knowledgeable about the trades and applicable codes, ordinances and industry standards and shall perform the work accordingly, on schedule and fully coordinated with all other trades.
- .3      Except where precisely indicated, the Contract Documents are diagrammatic and generally indicating the scope of work, general arrangement, and establishing minimum quality and performance requirements. Where there are conflicting requirements the Contractor shall allow for and provide the better quality and/or greater quantity unless the conflicting requirements are interpreted otherwise in writing by the Departmental Representative.
- .4      The Contract Documents for this Division are an integral part of the complete Contract Documents for the project and will be interpreted in conjunction with all other Divisions.

**1.5            CODES, REGULATIONS AND STANDARDS**

- .1      Mechanical work shall conform to the following codes, regulations and standards, and all other codes in effect at the time of award of Contract, and any others having jurisdiction. The revision of each code and standard and their amendments which are adopted by the Authority Having Jurisdiction shall apply unless otherwise specified in the Contract

Documents, adhere to the code bylaw that is the most stringent:

- .1 Bylaws
    - .1 Local Building Bylaws.
  - .2 Canadian Standards Association
    - .1 CSA B64.10-17 Selection and installation of backflow preventers.
  - .3 National Fire Codes
    - .1 NFPA 10 Portable Fire Extinguishers.
    - .2 NFPA 13R Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies.
  - .4 National Research Council of Canada
    - .1 NRCC 23174 National Building Code of Canada, most current.
    - .2 NRCC 23178 National Building Code of Canada, Supplement.
    - .3 NRCC 23175 National Fire Code of Canada.
  - .5 Province of British Columbia
    - .1 BC Building and Plumbing Code (2018).
    - .2 BC Fire Code (2018).
    - .3 BC Industrial Health & Safety Regulations, WorkSafeBC.
  - .6 SMACNA Publications
    - .1 HVAC Duct Construction Standards.
    - .2 Guidelines for seismic restraints of mechanical systems.
- .2 All specification references to the Building Code refer to the BC Building Code or National Building Code, which ever is the most stringent shall take precedence.

## **1.6 PERMITS AND FEES**

- .1 Obtain all required permits and pay all fees including service connection fees as applicable to the mechanical work. Comply with all Provincial, Municipal and other legal regulations and bylaws applicable to the work.
- .2 Unless confirmed otherwise by the General Contractor, Mechanical Contractor shall pay the fees for the following service connections:
  - .1 Sanitary Sewer.
  - .2 Storm Sewer.
  - .3 Domestic Water Service.
  - .4 Fire Water Service.
- .3 Arrange for inspection of all Work by the Authorities Having Jurisdiction. On completion of the Work, furnish final unconditional certificates of approval by the inspecting authorities.

## **1.7 DRAWINGS AND MEASUREMENTS**

- .1 Drawings are generally diagrammatic and are intended to indicate the scope and general arrangement of work. They are not detailed installation drawings.
- .2 Do not scale the drawings.

- .3 Obtain accurate dimensions from the Architectural and Structural Drawings.
- .4 Consult the Architectural drawings for exact locations of fixtures and equipment. Obtain this information from the Departmental Representative where not obtainable from the drawings.
- .5 Field measure as required to size and locate services and equipment.

**1.8 PRICE BREAKDOWN**

- .1 Within ten [10] days of award of the Contract provide to the Departmental Representative a price breakdown in the following categories as applicable. This information is for the Departmental Representative's use in evaluating progress claims. All work shall be included and the component prices shall add up to the total Contract price.
- .2 Prices for the Proposed Changes shall be submitted broken down sufficiently for the Departmental Representative's review and shall show mark-ups.
- .3 Submit any further breakdown as determined by the Departmental Representative as necessary to allow assessment of Progress Claims or Proposed Changes.
- .4 Price breakdown categories:
  - .1 Start-Up
  - .2 Site Work:
    - .1 Material
    - .2 Labour
  - .3 Building Underground Services:
    - .1 Material
    - .2 Labour
  - .4 Plumbing Piping Systems:
    - .1 Material
    - .2 Labour
  - .5 Plumbing Fixtures
    - .1 Material
  - .6 Fire Protection Systems
    - .1 Material
    - .2 Labour
  - .7 HVAC Piping Systems:
    - .1 Material
    - .2 Labour
  - .8 Piping Systems Equipment
    - .1 Material
  - .9 Piping Insulation
  - .10 Ductwork
    - .1 Material
    - .2 Labour

- .11 Air Handling Equipment
  - .1 Material
- .12 Ductwork Insulation
- .13 Controls:
  - .1 Material
  - .2 Labour
- .14 Commissioning, Testing, Balancing
- .15 Contract Close Out (Record Drawings, Maintenance Manuals, Submissions).
- .16 Total Mechanical Contract Price.

### **1.9 WARRANTY**

- .1 Use of installed equipment during construction shall not shorten or alter the warranty period as specified in the General Conditions.
- .2 Take note of and submit written information for any extended warranties specified.

### **1.10 WORKMANSHIP**

- .1 Workmanship shall be in accordance with well-established practice and with standards accepted and recognized by the Departmental Representative and the Trade.
- .2 The Departmental Representative may reject any work not conforming to the Contract Documents or to accepted standards of performance, quietness of operation, finish or appearance.
- .3 Employ only tradesmen with valid Provincial Trade Qualification Certificates. Tradesmen shall perform only work permitted by their certificates. Certificates shall be available for review by the Departmental Representative.

### **1.11 ACCESSIBILITY**

- .1 All work shall be readily accessible for adjustment, operation and maintenance. Supply access doors where required in building surfaces for installation by building trades.

### **1.12 SUBMITTALS**

- .1 Shop Drawings:
  - .1 Process:
    - .1 Shop drawings/product data shall be submitted as elsewhere specified.
    - .2 Shop drawings/product data shall be reviewed, signed and processed as described in the General Conditions and as further described by the Mechanical Contractors Association of British Columbia.
  - .2 Content:
    - .1 Shop drawings submitted title sheet.
    - .2 Data shall be specific and technical.
    - .3 Identify each piece of equipment.
    - .4 Information shall include all scheduled data.
    - .5 Advertising literature will be rejected.



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- .6 The project shall be identified on each document.
  - .7 Information shall be given in SI units consistent with the system of units in the Contract Documents.
  - .8 The shop drawings/product data shall include:
    - .1 Dimensioned construction drawings with plans and sections showing size, arrangement and necessary clearances, with all equipment weights and mounting point loads.
    - .2 Mounting arrangements.
    - .3 Capacity and performance characteristics indicated on performance curves for fans and pumps.
    - .4 Sound Power Data, where requested.
    - .5 Motor efficiencies on motors 1 HP and larger.
    - .6 List of the manufacturers and figure numbers for all valves, traps and strainers.
    - .7 Detailed drawings of bases, supports and anchor bolts.
    - .8 Control explanation and internal wiring diagrams for packaged equipment.
    - .9 Control system drawings.
    - .10 A written description of control sequences relating to the schematic diagrams.
  - .9 Clearly indicate selected options and accessories. Cross out any items that do not apply. Add any additional specified features such as finishes, high temperature seals, etc.
  - .3 Format:
    - .1 Black line print 216 mm x 280 mm [8-1/2" x 11"] or 280 mm x 430 mm [11" x 17"].
    - .2 Larger drawings may be submitted on reproducible sepia with space for stamps and signatures - master set plus one working copy.
    - .3 An assembly of related components, e.g. grilles, registers and diffusers or radiation with sheet metal cabinets, etc. between covers with the contents listed on the front cover with item identification numbers.
    - .4 A brochure for plumbing fixtures between covers with the contents named with model numbers listed on the front cover with item identification numbers
  - .4 Coordination: Where mechanical equipment requires electrical connections, power or other services, the shop drawings shall also be circulated through the Electrical Contractor prior to submission to the Departmental Representative.
  - .5 Keep one (1) copy of shop drawings and product data, on site, available for reference
  - .6 Review or non-review of shop drawings does not alter the requirements of the equipment and materials provided to conform to the specification.

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- .2 Closeout Submittals:
    - .1 Operating and Maintenance Manuals:
      - .1 Provide maintenance data for incorporation into Operational and Maintenance manual.
      - .2 Employ the Balancing Agency to prepare the manuals.
      - .3 Allow sufficient time to provide the final reviewed manuals to the Departmental Representative before Substantial Performance.
      - .4 Provide one draft digital pdf copy of the manuals to the Departmental Representative for review. PDF files shall have searchable text within PDF reader software. Make all required changes and resubmit to the Departmental Representative. Repeat until accepted. Then submit the following, identical to the accepted copy, to the Departmental Representative:
        - .1 Three (3) hard copies - organized in binders, refer to below.
        - .2 Two (2) PDF electronic copies with searchable text (minimum of 300 DPI scanning quality) of full binder contents on USB flash drive.
      - .5 Obtain a receipt and send a copy to the Departmental Representative. Allow ten days for the first submittal review by the Departmental Representative and seven days for each subsequent review.
      - .6 If the manuals are not accepted and submitted to the Departmental Representative by the time of Substantial Performance, submit at Substantial Performance a draft copy to the Departmental Representative with clear indication that it is a draft copy, not a final copy, for interim use by the Departmental Representative. When the final copies are submitted to the Departmental Representative, retrieve the draft copy and modify it to match the other final copies.
      - .7 The binders shall be 3-ring binder. The maximum overall thickness of the filled binder shall be 100 mm [4"]. Provide multiple binders for each manual as required.
      - .8 Each binder shall have large clear lettering in a clear label insert on the front cover indicating the name of the project and "OPERATING AND MAINTENANCE MANUAL - MECHANICAL".
      - .9 Provide an index and tab each section.
      - .10 The manual shall include:
        - .1 Air and water balance report.
        - .2 Commissioning report.
        - .3 Copy of any required approvals, certifications and acceptance by Authorities Having Jurisdiction.
        - .4 All shop drawings.
        - .5 List of local source of supply.
        - .6 Manufacturer's operating and maintenance literature and wiring and control diagrams.

- .2 Site Records:
  - .1 Keep a set of contract prints on site for the sole purpose of keeping an up-to-date record marked in red of the installation of the mechanical work where they vary from the drawings.
  - .2 Changes for all mechanical work and piped site service trades, including sketches for Change Orders and Site Instructions shall be kept on this set of drawings.
  - .3 For all buried new services and all existing services exposed by the work indicate the inverts and dimensioned locations at all connections and changes in direction.
  - .4 Services shall not be buried or concealed until the Record Drawings are up-to-date for the services.
  - .5 All inaccessible concealed services shall be accurately located.
  - .6 Minor changes in the routing of services within a space which are readily observable and obvious after all construction is complete, need not be recorded.
  - .7 Identify each drawing in lower right hand corner in letters at least 10 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" and under this add the Contractor's name, an authorized signature and the date.
  - .8 Submit the prints for review by the Departmental Representative. Make any additional changes identified by the Departmental Representative including returning to the site if necessary to make measurements and/or to confirm installation locations and details. Resubmit to the Departmental Representative.
- .3 Record Drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of As-Built Drawings.
  - .2 Upon completion of the Departmental Representative's review, submit final Record Drawings to the Departmental Representative. Final record drawings shall include revised CAD files prepared by a qualified draftsman to the same standards as the original drawings.

### **1.13 DIMENSIONS AND UNITS**

- .1 The Contract Documents are generally in metric units and in places are followed by non-metric equivalents in square brackets.
- .2 Generally the conversions for the equivalents are not exact but close enough that both are sufficiently accurate to be used.
- .3 Many sizes or capacities shown are an indication of a nominal size, not an exact dimension, and these are as generally understood by the trade.
- .4 Pipe sizes are nominal pipe sizes. Neither the metric size in mm or the often used Imperial sizes in inches are either equal to the inside or outside diameter of the pipe; they

are used as follows to be equivalent to the NPS sizes (Nominal Pipe Size):

.1	NPS 1/2,	12 mm,	1/2".
.2	NPS 3/4,	20 mm,	3/4".
.3	NPS 1,	25 mm,	1".
.4	NPS 1-1/4,	30 mm,	1-1/4".
.5	NPS 1-1/2,	40 mm,	1-1/2".
.6	NPS 2,	50 mm,	2".
.7	NPS 2-1/2,	65 mm,	2-1/2".
.8	NPS 3,	75 mm,	3".
.9	NPS 4,	100 mm,	4".

- .5 Duct sizes are intended to be the actual size shown. However, some duct products are premanufactured in standard sizes or a sheet metal shop may be set up to work in standard sizes (generally Imperial based sizes) in which case a size shown in metric shall be soft converted to the Imperial inch size which is slightly larger e.g.:
- .1 300 mm shall be 12".
  - .2 600 mm shall be 24".
  - .3 1200 mm shall be 48".
- .6 Sheet metal thickness is shown in gauges (ga) only as it is not generally referred to in its metric or Imperial thickness.
- .7 Equipment dimensions are nominal sizes but are close to actual size. A 600 x 600 diffuser shall be close to 600 x 600 mm in overall dimension but where it is in a T-bar grid ceiling it shall be sized to lay in the grid whether it is a metric grid at 600 mm centres or an Imperial grid at 609 mm centres. A 600 x 600 mm surface mounted diffuser will be larger overall than 600 x 600 mm depending on the flange width.

## **PART 2 Products**

### **2.1 MAINTENANCE**

- .1 Provide maintenance materials in accordance with Section (01 78 Closeout Submittals.
- .2 Obtain signed receipt from the Departmental Representative when spare parts are handed over.
- .3 Provide the following spare parts:
  - .1 Provide two (2) sets of filter media (for each filter) or filter bank installed - one for installation and one for hand over to the Departmental Representative as a spare.

### **2.2 ASBESTOS**

- .1 All material/products provided shall be free of asbestos.

## **2.3 ACCESS DOORS**

- .1 Supply flush mounted access doors, for installation by Building Trades in non-accessible type ceilings and walls where necessary for access to service and/or to inspect mechanical equipment and accessories and life safety devices and where specifically indicated.
- .2 Sizes: Except as indicated otherwise, to be minimum sizes as follows:
  - .1 600 x 600 mm [24" x 24"] for body entry.
  - .2 300 x 300 mm [12" x 12"] for hand entry.
  - .3 200 x 200 mm [8" x 8"] for cleanout access.
  - .4 Access doors in building surfaces shall be at least as large as duct access panels accessed through them and shall be oversized when necessary.
- .3 Construction: 180 degree door swing, mitred rounded safety corners flush welded, concealed hinges, screwdriver latches, and anchor straps or lugs to suit construction, all steel shall be prime coated.

## **2.4 MISCELLANEOUS METAL**

- .1 Be responsible for all miscellaneous steel work relative to the mechanical work of the Specifications, including but not limited to:
  - .1 Support of equipment.
  - .2 Hanging, supporting, anchoring, guiding and related work as it applies to piping, ductwork and mechanical equipment.
  - .3 Earthquake restraint devices.
- .2 All exterior miscellaneous steel shall be hot-dipped galvanized.
- .3 All steelwork not galvanized shall be prime and undercoat painted ready for finish under Painting Division. On galvanized materials that are subsequently welded apply galvicon. Refer to drawings for details.

## **PART 3 Execution**

### **3.1 COORDINATION**

- .1 Examine all Contract Drawings to verify space and headroom limitations for the required work. Coordinate the work with all trades and modify without changing the design intent to facilitate a satisfactory installation. Make no changes to the design intent involving extra cost to the Departmental Representative, without the Departmental Representative's prior written approval.
- .2 The drawings indicate the general location and route to be followed by the piping and ductwork. Where details are not shown on the drawings or are only shown diagrammatically, the pipes and ductwork shall be installed in such a way as to conserve headroom and interfere as little as possible with the free use of space through which they pass. Service lines shall run parallel to building lines. All ducts and pipes in the ceiling shall be kept as tight as possible to beams or other limiting members at high level. All pipes and ducts shall be coordinated in elevation to ensure that they are concealed unless indicated otherwise.

- .3 Work out jointly all interference problems on the site and coordinate all work before fabricating or installing any material or equipment. No consideration of payment will be made for additional work due to fabricating or installing materials before a coordination issue was identified and resolved. Where necessary produce interference drawings showing exact locations of mechanical equipment within service areas, shafts and the ceiling space. Ensure that all materials and equipment fit into the allotted spaces and that all equipment can be properly serviced and replaced, if and when required. Advise the Departmental Representative of space problems before fabricating or installing any material or equipment. Demonstrate to the Departmental Representative on completion of the work that all equipment installed can be properly, safely serviced and replaced, if and when required.

### **3.2 CONCEALMENT**

- .1 Conceal all tubing, piping, ductwork and conduit in partitions, walls, crawlspaces, and ceiling spaces, unless otherwise noted.
- .2 Do not install tubing, piping and conduit in outside walls or roof construction unless specifically directed, in which case, make provision to ensure that the building insulation is between them and the outside face of the building.

### **3.3 PROTECTION OF WORK**

- .1 Protect equipment and materials, stored or installed, from the weather, moisture, dust and physical damage.
- .2 Mask machined surfaces. Secure temporary covers over equipment openings and open ends of piping, ductwork and conduits, as required to keep them clean.
- .3 Rusting, pitting or physical damage will be cause for rejecting equipment.
- .4 Make good damaged or marred factory finish.
- .5 Air systems must have air filters installed before fans are operated. Air filters must be clean at Substantial Completion.

### **3.4 EQUIPMENT INSTALLATION**

- .1 Provide unions and flanges to permit equipment maintenance, disassembly or removal, to minimize disturbance to piping and duct systems and to avoid interfering with building structure or other equipment.
- .2 Provide means of access for servicing equipment including permanently lubricated bearings.
- .3 Pipe equipment drains to floor drains.
- .4 Align equipment, rectangular cleanouts and similar items with building lines wherever possible.
- .5 Ensure that equipment does not transmit noise or vibration to other parts of the building as a result of poor installation practices.

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### **3.5 CUTTING, PATCHING, DIGGING, CANNING AND CORING**

- .1 Lay out all cutting, patching, digging, canning and coring required to accommodate the mechanical services. Coordinate with other Divisions. The performance of actual cutting, patching, digging, canning and coring is specified under other Divisions. Be responsible for correct location and sizing of all openings required under the mechanical work, including pipe sleeves and duct openings. Allow oversized openings for fire dampers and for pipe penetrations where continuous insulation is specified.
- .2 Verify the location of existing service runs and structural components within existing concrete floors and walls prior to core drilling and/or cutting. The Contractor is responsible to repair existing services and structural components damaged as a result of core drilling and cutting.
- .3 Openings through structural members of the building shall not be made without the approval of the Departmental Representative.

### **3.6 FIRESTOP MATERIALS**

- .1 Firestopping and Smoke Seal Systems: Install assembly capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of ULC CAN4-S115-M85, or ULI 1479 and ASTM 814, and not to exceed opening sizes for which they are intended.
- .2 Fire resistance rating of installed firestopping assembly shall be not less than the fire resistance rating of surrounding floor and wall assembly.

### **3.7 SERVICE PENETRATIONS IN RATED FIRE SEPARATIONS**

- .1 All piping, tubing, ducts, wiring, conduits, etc. passing through rated fire separations shall be smoke and fire proofed with ULC approved materials in accordance with CAN4-S115 and ASTM E814 standards and which meet the requirements of the Building Code in effect. This includes new and existing services passing through existing rated separations and new and existing services passing through new rated separations or existing separations whose rating is being upgraded.
- .2 Fire resistance rating of installed firestopping assemblies shall not be less than fire resistance rating of the surrounding assembly.
- .3 All smoke and fire stopping shall be installed by a qualified Contractor who shall submit a letter certifying that all work is complete and in accordance with this specification.
- .4 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions in formed, sleeved or cored penetrations.
- .5 Submit shop drawings for each type of pipe and separation type combination showing the approved materials and installation data.

### **3.8 SERVICE PENETRATIONS OF NON-RATED SEPARATIONS**

- .1 All piping, tubing, ducts, wiring, conduits, etc. passing through non-rated fire separations and non-rated walls and floors shall be tightly fitted and sealed on both sides of the separation with silicon sealant to resist the passage of smoke and/or transmission of sound.

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**3.9 DUCT AND PIPE MOUNTED CONTROL EQUIPMENT**

- .1 The following automatic control equipment will be supplied by the controls trade but installed by the appropriate trade sections of mechanical work:
  - .1 Automatic control dampers.

**3.10 START-UP**

- .1 Before starting the plant, provide confirmation in writing to the Departmental Representative that the plant is ready for start-up and the following conditions have been met. These include:
  - .1 All safety controls are installed and fully operational.
  - .2 Permanent electrical connections have been made to all equipment.

**3.11 CLEANING AND FINAL ADJUSTMENT**

- .1 Clean mechanical systems daily.
- .2 Balance and adjust all systems and each piece of equipment to operate efficiently.

**3.12 PAINTING REPAIRS AND RESTORATION**

- .1 Apply a coat of rust inhibiting primer to all exposed, bare steel provided under the mechanical work. Clean and prepare the surfaces first in accordance with the paint manufacturer's recommendations.
- .2 Apply the primer before or immediately after installation where the steel will be exposed to moisture.
- .3 Make good any damage to factory finishes on equipment supplied under the mechanical work.
- .4 Any finish painting of the equipment and materials provided under the mechanical work is by Painting Division (except where specifically indicated otherwise). Coordinate with Painting Division including identifying the various mechanical services for painting.
- .5 Colours for equipment and materials in finished areas and outdoors shall be as directed by the Departmental Representative.

**3.13 DEMONSTRATION AND INSTRUCTION TO DEPARTMENTAL REPRESENTATIVE**

- .1 Provide certified personnel to demonstrate plant operation and to instruct operating staff on operation of mechanical equipment. Provide maintenance specialist personnel to instruct operating staff on maintenance and adjustment of mechanical equipment and any changes or modification in equipment made under terms of guarantee.
- .2 The demonstration shall include:
  - .1 Operation and sequencing of all automatic control dampers.
  - .2 Operation and maintenance requirements of all equipment and systems under each mode of operation including:
    - .1 Automatic controls.
    - .2 Fans.



- .3 Fire protection systems.
  - .4 Heat pumps.
  - .5 Heat recovery systems.
  - .6 Plumbing Systems.
  - .7 Pumps.
- 
- .3 Provide instruction during regular work hours prior to acceptance and turnover to operating staff for regular operation.
  - .4 Use Operating and Maintenance manuals for instruction purposes.
  - .5 Submit the proposed instructional agenda for approval.
  - .6 Finalize demonstration and instructions by obtaining a signed statement from the Departmental Representative that the demonstration and instructions have been given satisfactorily.

**END OF SECTION**

**Part 1            General**

**1.1                SUMMARY**

- .1    Section includes materials and requirements for thermometers and pressure gauges in piping systems.

**1.2                RELATED SECTIONS**

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

**1.3                SUBMITTALS**

- .1    Shop Drawings:
  - .1    Submit shop drawings for:
    - .1    Thermometers.
    - .2    Pressure gauges.
- .2    Closeout Submittals:
  - .1    Provide maintenance data for incorporation into Operational and Maintenance manual.

**1.4                REQUIRED COMPLIANCE**

- .1    All thermometers shall comply with the Canadian General Standards Board Requirements.
- .2    All gauges shall comply with ANSI B40.1 Grade "A" level.
- .3    Gauges used on fire protection systems shall be ULC listed.
- .4    Gauges and separable sockets on liquid systems to be registered with Provincial Boiler and Pressure Vessel Safety Branches with CRN number.
- .5    Select thermometers and pressure gauges so that the operating range is at the midpoint of the scale or range.

**Part 2            Products**

**2.1                THERMOMETERS - LIQUID SYSTEMS**

- .1    Variable angle stem type:
  - .1    Pipe mount with separable socket.
  - .2    Cast aluminum, high heat or ABS plastic casing.
  - .3    225 mm [9"] scale length.
  - .4    White background, black numerals and red reading mercury.
  - .5    Dual Celsius and Fahrenheit scale.

## **2.2 PRESSURE GAUGES - LIQUID SYSTEMS**

- .1 Case stainless steel, size 115 mm [4-1/2"] diameter with gasketted clear window.
- .2 Phosphor bronze bourdon tube, silver brazed tip and socket 6 mm [1/4"] lower connection.
- .3 Rotary type bushed movement, silicone dampened to prevent pointer oscillation.
- .4 White background with black numerals.
- .5 Dual kPa and psig scale.
- .6 Accurate within 1% of scale range.

## **2.3 ACCEPTABLE PRODUCTS**

- .1 Thermometers and liquid system pressure gauges: Marsh, Moeller, Trerice, Weiss Instruments, Weksler, Winters.

## **2.4 TEST THERMOMETER**

- .1 Provide a stem type test thermometer in protective case to the Departmental Representative during the Departmental Representative's Demonstration and Instruction Period.
- .2 Provide the same make and model as installed on the project. Thermometer shall be suitable for use in separable sockets.
- .3 Scale range 0°C to 115°C [30°F to 240°F].
- .4 Obtain a signed receipt from the Departmental Representative on receipt of the thermometer.

## **2.5 SEPARABLE SOCKETS**

- .1 For installation in copper pipe socket shall be copper or bronze. For installation in steel pipe socket shall be brass.
- .2 20 mm [3/4"].

## **Part 3 Execution**

### **3.1 GENERAL**

- .1 Design point to be at mid point of scale or range.
- .2 Install thermometers and gauges so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading thermometers and gauges.
- .3 Install engraved lamicoïd nameplates identifying medium under remote reading thermometers and gauges.

### **3.2 THERMOMETERS**

- .1 Install the separable socket so as to minimize any flow restriction. If necessary, install in a section of oversized pipe.

- .2     Install wells where indicated for use with test thermometers.
- .3     Install as indicated on the drawings and in the following locations:
  - .1        On the inlet and outlet pipes of:
    - .1          DHW tank/s.
- .4     Use extensions where thermometers are installed through insulation.

### **3.3            PRESSURE GAUGES**

- .1     Install a needle valve ahead of each gauge.
- .2     Install as indicated on the drawings and on the inlet and outlet pipes in the following locations:
  - .1        Inlet and outlet of PRV station at water entry
- .3     Use extensions where pressure gauges are installed through insulation.
- .4     Where a single gauge is used to measure multiple points provide needle valves to isolate each point, including pressure gauge.

### **3.4            NAMEPLATES**

- .1     Install engraved lamicoïd nameplates as specified in Section 23 05 53.01 - Mechanical Identification.

**END OF SECTION**

**PART 1      General**

**1.1            SUMMARY**

- .1      Section includes concrete housekeeping pads, hangers and supports for mechanical piping, ducting and equipment.
- .2      It is the entire responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of the mounting points and internal components of the equipment exceeds the force level used to restrain and anchor the unit to the supporting structure during a seismic event of code design magnitude.

**1.2            RELATED SECTIONS**

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

**1.3            SUBMITTALS**

- .1      Shop Drawings:
  - .1      Shop drawings shall be stamped and signed by Professional Engineer registered or licensed British Columbia for seismically rated hangers and supports.
  - .2      Submit shop drawings and product data for:
    - .1      Bases, hangers and supports.
    - .2      Connections to equipment and structure.
    - .3      Structural assemblies.
  - .3      Submit manufacturer's name and model number for all hanger components.
- .2      Closeout Submittals:
  - .1      Provide maintenance data for incorporation into Operational and Maintenance manual.

**1.4            SYSTEM DESCRIPTION**

- .1      Design Requirements:
  - .1      Fabricate and construct pipe hangers, supports and sway braces to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
  - .2      Base maximum load ratings on allowable stresses prescribed by ANSI B31.1 or MSS SP58.
  - .3      Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipe work or connected equipment and to maintain grade.
  - .4      Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP58.

- .5 Where possible use cast-in-place concrete inserts.
- .6 Support from structural members, not from metal decking.
- .2 Design for Seismic Events
  - .1 Design supports hangers, to withstand seismic events of the magnitude prescribed for the area in the BC Building Code.

## **PART 2 Products**

### **2.1 GENERAL**

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

### **2.2 PIPE HANGERS**

- .1 Finishes:
  - .1 Pipe hangers and supports: electroplated galvanized, cadmium plated or painted with zinc-rich paint after manufacture in corrosive locations and in all mechanical rooms.
  - .2 All steel hangers in contact with copper piping shall be copper plated or plastic dipped.
- .2 Shop and field-fabricated assemblies:
  - .1 Supports and sway braces may be shop or field fabricated but must be in accordance with the requirements of ANSI B31.1 and MSS-SP58.
- .3 Hanger rods: threaded rod material to MSS-SP58.
  - .1 Ensure that hanger rods are subject to tensile loading only.
  - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
  - .3 Do not use 22 mm or 28 mm rod.
- .4 Pipe attachments:
  - .1 Material to MSS-SP58.
  - .2 Attachments for steel piping: carbon steel.
  - .3 Attachments for copper piping: copper plated black steel.
  - .4 Use insulation shields for cold piping and oversize pipe hangers to surround the insulation on cold piping.

### **2.3 WALL SUPPORTS**

- .1 Welded angle for iron brackets for equipment.

## **2.4 INSULATION PROTECTION SHIELDS**

- .1 Insulated cold piping: Insulation with uninterrupted vapour barrier plus insulation protection shield to: MSS-SP69, galvanized sheet carbon steel. Grinnell Fig. 167. Insulation shall be high-density type for 65 mm [2-1/2"] and larger.
- .2 Insulated hot piping 100 mm [4"] and larger: Curved plate 300 mm [12"] long, with edges turned up, carbon steel to comply with MSS-SP69. Insulation fitted between saddle and pipe.

## **2.5 EQUIPMENT SUPPORTS**

- .1 Provide stands and supports for equipment and materials supplied.
- .2 Fabricate equipment supports not provided by equipment manufacturer as required.
- .3 Submit calculations with shop drawings.

## **2.6 HOUSE-KEEPING PADS**

- .1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads [75] mm larger than equipment; chamfer pad edges.

## **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
  - .2 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

### **3.3 HANGER SPACING**

- .1 Plumbing piping: most stringent requirements of Building Code or Authority Having Jurisdiction.
- .2 Fire protection: to applicable Fire Code (no toggle hangers).
- .3 Copper piping: up to 12 mm [1/2"] every 1.5 m [5 ft].
- .4 Within 300 mm [12"] of each horizontal elbow.

- .5 Rod Diameter:
  - .1 10 mm [3/8"] for 50 mm [2"] and smaller.
  - .2 12 mm [1/2"] for 65 mm to 100 mm [2-1/2", 3", 4"].
- .6 Maximum spacing for
  - .1 Maximum spacing for copper pipe.
    - .1 1.5 m [5 ft] for 12 mm [1/2"].
    - .2 1.8 m [6 ft] for 20 mm, 25 mm, 30 mm, 40 mm [3/4", 1", 1-1/4", 1-1/2"].
    - .3 3.0 m [10 ft] for 50 mm [2"] and larger.

### **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 12 mm [1/2"], 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 and provide grades.

**END OF SECTION**



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**PART 1      General**

**1.1            SUMMARY**

- .1      Section includes materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.

**1.2            RELATED SECTIONS**

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

**1.3            SUBMITTALS**

- .1      Closeout Submittals:
  - .1      Provide maintenance data for incorporation into Operational and Maintenance manual.
- .2      Samples:
  - .1      Samples to include nameplates, labels, tags, lists of proposed legends.

**PART 2      Products**

**2.1            MANUFACTURER'S EQUIPMENT NAMEPLATES**

- .1      Each piece of manufactured equipment shall have a metal nameplate, with embossed letters, mechanically fastened to the equipment.
- .2      Manufacturer's nameplates shall indicate:
  - .1      Manufacturer's name.
  - .2      Equipment.
  - .3      Model, size.
  - .4      Serial number.
  - .5      Electrical characteristics.
  - .6      Motor: voltage, Hz, phase, power factor, duty, frame size.
  - .7      Other services characteristics.
- .3      Include ULC, CSA and other agency registration logos that apply.
- .4      Nameplates shall be easily read.

**2.2            SYSTEM NAMEPLATES**

- .1      Painted identification letters shall be 50 mm [2"] high black letters on a white background.
- .2      Lamicaid labels (black background white letters) shall be 35 x 200 mm [1-1/2"x 8"] with 20 mm [3/4"] high letters or proportionally smaller as appropriate to fit equipment.

- .3 Identify systems, and areas or zones of building being serviced.

## 2.3 IDENTIFICATION OF PIPING SYSTEMS

- .1 Each system shall be labelled including directional flow arrows in accordance with the Pipe Identification Schedule and to CAN/CGSB 24.3 except where specified otherwise.
- .2 Pictograms: Where required by Codes, WorkSafeBC (Workers' Compensation Board of British Columbia) and any other Authorities Having Jurisdiction.
- .3 Arrows showing direction of flow:
- .1 Outside diameter of pipe or insulation less than 75 mm [3"]: 100 mm long x 50 mm high [4" long x 2" high].
- .2 Outside diameter of pipe or insulation 75 mm [3"] and greater: 150 mm long x 50 mm high [6" long x 2" high].
- .4 Extent of background colour marking:
- .1 To full circumference of pipe or insulation.
- .2 Length to accommodate pictogram, full length of legend and arrows.
- .5 Materials for background colour marking, legend, arrows:
- .1 Adhesive labels:
- .1 Identification labels may be stencilled or be vinyl cloth or vinyl film, with adhesive compatible with the surface temperature.
- .2 Identification colour bands shall overlap a minimum of 150 mm [6"]. Ends to be stapled.
- .2 Coiled plastic pipe labels:
- .1 Printed coiled vinyl identification strips.
- .2 Material: 0.508 mm [0.020"] vinyl service suitable for service temperatures of -40°C [-40° F] to 71° C [160° F].
- .3 Attachment:
- .1 10mm – 145mm pipe OD: self-adhering tight-fitting coil
- .2 150mm pipe OD and larger: cable tie fastening.
- .6 Colours and Legends:
- .1 Where not listed, obtain direction from Departmental Representative.
- .2 Colours for legends, arrows: to following table:

Background colour:	Legend, arrows:
Yellow	BLACK
Green	WHITE
Red	WHITE

.7 Pipe Identification Schedule:

Service	Identification Lettering	Primary Colour	Secondary Colour
Cold Water Service	CW	Green	--
Domestic H.W. Supply - 60°C [140°F]	DHWS 60°C [140°F]	Yellow	Black
Fire lines - Sprinkler (Wet)	SPR	Red	White

**2.4 IDENTIFICATION DUCTWORK SYSTEMS**

- .1 Where not otherwise obvious, identify plenum access doors as to accessed item, e.g. Filter F-1, Supply Fan SF-1, Cooling Coil CC-1.
- .2 50 mm [2"] high stencilled letters and directional arrows 150 mm long x 50 mm high [6" long x 2" high].
- .3 Colours: back, or coordinated with base colour to ensure strong contrast.
- .4 Identify automatic control dampers concealed in ductwork. Identify the 'open' and 'closed' position of the operator arm where clearly visible on the outside of the duct.
- .5 Identification letters shall be 50 mm [2"] high black letters on white background. Flow arrows shall be 50 mm [2"] wide by 150 mm [6"] long black arrows on a white background. Stencil over final finish only.

**2.5 CONTROLS COMPONENTS IDENTIFICATION**

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this Section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position.

**PART 3 Execution**

**3.1 TIMING**

- .1 Provide identification only after painting has been completed.

**3.2 NAMEPLATES**

- .1 Locations:
  - .1 Each piece of equipment shall be identified with its equipment schedule identification, e.g. B-2, P-3, RF-1
  - .2 In conspicuous location, on cool surfaces, to facilitate easy reading and identification from operating floor.
- .2 Standoffs: Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection: Do not paint, insulate or cover.

**3.3 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS**

- .1 Identify piping adjacent to valves. Identify piping at least once in each room and at 15 m [50 ft.] maximum spacing in open areas
- .2 Identify piping both sides where piping passes through walls, partitions and floors.
- .3 Identify piping at each access opening.
- .4 Adjacent to each change in direction.
- .5 Where system is installed in pipe chases, ceiling spaces, confined spaces, at entry and exit points, and at access openings.
- .6 At beginning and end points of each run and at each piece of equipment in run.
- .7 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .8 Identification easily and accurately readable from usual operating areas and from access points: Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

Equipment	Colour	Letters
Dampers, (backdraft, balance and controls)	Black	D.
Fire dampers	Red	F.D.

- .9 Ceiling Access: Secure 6 mm [1/4"] self adhesive coloured dots, to the ceiling, to identify the location of access to equipment concealed above the ceiling according to the following schedule:

Equipment	Colour
Concealed equipment	Yellow
Control equipment, including control valves, dampers and heat sensors.	Black
Pipe mounted equipment, other than fire, smoke and sprinkler equipment.	Green

**3.4 IDENTIFICATION SCHEDULES**

- .1 Submit schedules of the following for review, prior to laminating.
  - .1 Pipe Identification
  - .2 Ceiling Access Identification Colours
  - .3 Duct Access Identification Colours.
- .2 Schedules will be required in each major mechanical room. Laminate in clear plastic. Punch a hole in top corner and hang.

- .3 Include one copy of schedules in each operating and maintenance manual.

**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            RELATED SECTIONS**

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

**1.3            QUALIFICATIONS OF TAB PERSONNEL**

- .1      Submit names of personnel to perform TAB to the Departmental Representative within 90 days after award of the Contract.
- .2      Provide documentation confirming qualifications, successful experience.

**1.4            PURPOSE OF TAB**

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

**1.5            EXCEPTIONS**

- .1      TAB of systems and equipment regulated by Codes, Standards to satisfaction of Authority Having Jurisdiction.

**1.6            TESTS**

- .1      Scope of Tests:
  - .1      The pressure testing of piping systems shall be the responsibility of the installing trade. The tests are specified under the appropriate specification section.
  - .2      TAB measurement instruments to be calibrated within 30 days of use. Proof and date of calibration to be submitted to Departmental Representative upon request.

- .3 The pressure/leakage testing of air handling systems shall be the responsibility of the installing trade. The tests are specified under the appropriate specification section.
  - .4 The testing of fire dampers shall be the responsibility of the Balancing Agency responsible for balancing. The tests are specified in this section of the specification.
  - .5 The performance testing of equipment shall be the responsibility of the supplying trade. For certain larger, or complex or specialized equipment the start-up and/or testing shall be performed by a manufacturer's qualified representative. The tests are specified under the appropriate specification section.
- .2 General Requirements:
- .1 Give written minimum 48 hour notice of date for tests to Departmental Representative and to any Authorities Having Jurisdiction.
  - .2 Do not externally insulate or conceal work until tested and reviewed.
  - .3 Make good and retest as required until test is successful.
  - .4 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures.
  - .5 Tests shall be to applicable codes, to the requirements of Authorities Having Jurisdiction and in accordance with recognized industry standards.
  - .6 Obtain and provide certificates of approval where applicable from Authorities Having Jurisdiction.

## **1.7 BALANCING - AIR SYSTEMS**

- .1 Adjust duct and terminal balance dampers, adjustable air turning devices and adjust or change drive sheaves to balance supply, return and exhaust air systems to provide the design air quantities (within +10%/-5%) at each outlet and inlet and to maintain the design relationship between the supply, return and exhaust air system quantities.
- .2 Adjust air terminals to optimize the air distribution pattern while minimizing drafts and noise.
- .3 Permanently mark the final balance position on all balance dampers and adjustable air turning devices.
- .4 Submit a report to the Departmental Representative indicating final fan speed, motor operating amperages, system static pressure, filter static pressure and final air quantities obtained.
- .5 Pre-load filters using blanket material to midway between clean and dirty static pressure drop at system balance.

## **1.8 COMMISSIONING AND DEMONSTRATION**

- .1 Be responsible for the performance and commissioning of all equipment supplied under the HVAC Sections of Mechanical Division. Commissioning is the process of advancing the installation from the stage of static completion to full working order in accordance

- 
- with the Contract Documents and design intent. It is the activation of the completed installation.
- .2 The commissioning shall be executed in accordance with the intent of ASHRAE Standard 1 "Guideline for Commissioning of HVAC Systems" and to comply with CSA Standard Z320-11.
  - .3 In consultation with the General Contractor, ensure that sufficient time is allowed and fully identified on the construction schedule for the proper commissioning of all mechanical systems.
  - .4 Submit a schedule for the commissioning phase of the work. This schedule shall show:
    - .1 Equipment start-up schedule.
    - .2 Submission dates for the various documents required prior to substantial completion.
    - .3 Timing of the various phases of the commissioning, testing, balancing and demonstration process.
  - .5 Commissioning is concluded when air systems have been balanced and the installation is in full working order and acceptable for use. The work will include the following:
    - .1 Balancing of the air systems as specified in this section.
    - .2 Set up air diffusers, registers and grilles for optimum distribution/comfort.
    - .3 Set up constant fans.
    - .4 Adjust vibration isolators and earthquake restraints for optimum performance.
    - .5 Verification and certification of the sealing of all HVAC penetrations through fire separations (rated & non-rated) and sound separations.
    - .6 Verification that all coil drain pans operate.
    - .7 Set up all automatic control dampers and automatic temperature control devices.
    - .8 Set up and test all alarm and protective devices.
  - .6 At the conclusion of commissioning, demonstrate the operation of the systems to the Departmental Representative and then to the Departmental Representative's Operating Staff.
  - .7 The verification process shall include the demonstration of the following:
    - .1 The ease of access that has been provided throughout for motors, drives, fusible link fire dampers, control dampers and damper operators.
    - .2 Location of and opening and closing of all access panels.
    - .3 Operation of all automatic control dampers and automatic temperature control devices.
    - .4 Operation of all alarm and protective devices.
    - .5 Operability of randomly selected fire dampers.
    - .6 Noise level from typical mixing boxes and air valves under extreme operating conditions.



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- .7 Operation of all equipment and systems under each mode of operating, and failure, including:
    - .1 Heat Recovery Ventilator.
    - .2 Heat Pump.
    - .3 Fans.
    - .4 Tanks - domestic hot water and expansion.
  - .8 At the completion of the commissioning, testing, balancing and demonstration submit the following to the Departmental Representative:
    - .1 A letter certifying that all work specified under this Contract is complete, clean and operational in accordance with the specification and drawings.
    - .2 Completed copies of all commissioning check lists plus copies of start-up reports from specialty contractors and vendors.
    - .3 Record Drawings, as specified.
    - .4 A list of all alarm and protective devices tested, with the final operating settings.

**PART 2 Products**

- .1 NOT APPLICABLE

**PART 3 Execution**

- .1 NOT APPLICABLE

**END OF SECTION**

**Part 1            General**

**1.1                SUMMARY**

- .1        Section includes materials, requirements and installation for thermal insulation for ductwork and accessories in a commercial type application.

**1.2                RELATED SECTIONS**

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

**1.3                SUBMITTALS**

- .1        Shop Drawings:
  - .1        Submit shop drawings for insulation and accessories.
- .2        Closeout Submittals:
  - .1        Provide maintenance data for incorporation into Operational and Maintenance manual.

**1.4                DEFINITIONS**

- .1        "CONCEALED" describes insulated mechanical services above ceilings, in furred spaces and shafts.
- .2        "EXPOSED" - will mean not concealed.

**1.5                QUALITY ASSURANCE**

- .1        Installer: Journeyman insulation applicators, skilled in this trade, shall perform the work.
- .2        The latest edition of the "BC Insulation Contractors Association (BCICA) Quality Standards Manual", shall apply except where exceeded in this specification.

**1.6                ASBESTOS**

- .1        All material/products provided shall be free of asbestos.

**Part 2            Products**

**2.1                FIRE AND SMOKE RATING**

- .1        In accordance with BC Building Code, NFPA 90A and CAN/ULC-S102.
  - .1        Maximum flame spread rating: 25.
  - .2        Maximum smoke developed rating: 50.

**2.2 INSULATION**

- .1 External Insulation - Flexible:
  - .1 Maximum thermal conductivity per 25 mm [1"]: 0.040 W/m-°C at 24°C [0.27 Btu-in/(hr-ft2-°F) at 75°F].
- .2 External Insulation - Rigid:
  - .1 Maximum thermal conductivity per 25 mm [1"]: 0.033 W/m-°C at 24°C [0.23 Btu-in/(hr-ft2-°F) at 75°F].

**2.3 ACCESSORIES**

- .1 Insulation Adhesive.
- .2 Vapour Barrier Tape: foil self-adhesive tape.
- .3 Vapour Barrier Adhesive
- .4 Insulation Finish Coating.
- .5 Weather Coating - vapour barrier.
- .6 Reinforcing Membrane: Glass fibre-reinforcing membrane.
- .7 Fabric Adhesive.
- .8 Aluminum Jacket for exterior installation.

**2.4 JACKETS**

- .1 Aluminum:
  - .1 To ASTM B209.
  - .2 Thickness: 22 ga.
  - .3 Finish: Corrugated or smooth.
  - .4 Joining: longitudinal and circumferential slip joints with 50 mm [2"] laps.
  - .5 Fittings: die-shaped fitting covers with factory-attached protective liner.
  - .6 Metal jacket banding and mechanical seals: stainless steel, 20 mm [3/4"] wide, 0.5 mm thick at 300 mm [12"] spacing.

**2.5 SCOPE OF INSULATION**

	Scope 1: External Insulation - Flexible.	Thickness	
		mm	[ins]
.1	Outdoor air ductwork (from intake to return air duct).	50	[2]
.2	Exhaust air discharge through roof.	50	[2]

	Thickness	
	mm	[ins]
.1 Scope 1: External Insulation - Flexible.		
.3 All exhaust air ductwork from outside wall or roof to backdraft damper.	25	[1]

Note: If ductwork is exposed use external rigid insulation.

	Thickness	
	mm	[ins]
.1 Refer to External Insulation, Flexible - if insulation is exposed use external rigid insulation of the thickness indicated.		

**Part 3 Execution**

**3.1 PRE-INSTALLATION REQUIREMENTS**

- .1 Apply external insulation to ductwork after successful pressure tests have been made.
- .2 Apply insulation and accessories so that the finished product is smooth and neat and with longitudinal seams concealed from view.
- .3 Apply insulation, accessories and finishes in accordance with the manufacturer's recommendations.
- .4 Insulation and vapour barrier shall be continuous through all non-rated separations.
- .5 Surfaces clean, dry, free from foreign material.

**3.2 INSTALLATION**

- .1 Do not externally insulate any ductwork that is specified to be internally insulated (unless noted otherwise).
- .2 Application of External Insulation - Flexible
  - .1 Adhere insulation with insulation adhesive applied in 150 mm [6"] wide strips on 300 mm [12"] centres.
  - .2 On rectangular ductwork and plenums, over 610 mm [24"] in width, spot weld pins 6 mm [1/4"] longer than the insulation thickness, one per 0.1 sq. m [1.0 sq ft] minimum. Impale the insulation over the pins, and hold in place using metal or nylon clips (washers). Alternatively, use welded pins with integral head washers welded in place through the insulation.
  - .3 Adhere foil faced vapour barrier tape over all butt joints, raw edges, holding washers and other points of penetration of the vapour barrier jacket on all exposed hot and cold ducts and concealed cold ducts.

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**3.3 DUCTWORK INSULATION FINISHES**

- .1 "Concealed" insulation will require no further finish except in damp locations where it shall have a vapour barrier continuously sealed.
- .2 "Exposed" insulation inside the building shall be finished as follows:
  - .1 Where insulation is external provide rigid insulation.
- .3 "Exposed" insulation inside the building shall be finished as follows:
  - .1 Apply two coats of white insulation coating.
- .4 "Exposed" outdoor insulation - aluminum jacket.
  - .1 Provide a total enclosure with aluminum jacket.
  - .2 The jacket shall be totally vapour and water sealed and seams located to shed water.
  - .3 Install with accessories and procedures as recommended by the manufacturer.

**END OF SECTION**

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**Part 1      General**

**1.1          SUMMARY**

- .1      Section includes materials, requirements and installation for thermal insulation for piping and accessories in commercial type applications.

**1.2          RELATED SECTIONS**

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

**1.3          SUBMITTALS**

- .1      Shop Drawings:
  - .1          Submit shop drawings for insulation and accessories.
- .2      Closeout Submittals:
  - .1          Provide maintenance data for incorporation into Operational and Maintenance manual.

**1.4          DEFINITIONS**

- .1      "CONCEALED" describes insulated mechanical services above suspended ceilings, in trenches, chases, furred spaces and shafts.
- .2      "EXPOSED" - will mean not concealed.

**1.5          QUALITY ASSURANCE**

- .1      Installer: Journeyman insulation applicators, skilled in this trade, shall perform the work.
- .2      The latest edition of the "BC Insulation Contractors Association (BCICA) Quality Standards Manual", shall apply except where exceeded in this specification.

**1.6          ASBESTOS**

- .1      All material/products provided shall be free of asbestos.
- .2      All work performed on systems with asbestos containing material must be reported in advance to WorkSafeBC.

**Part 2      Products**

**2.1          FIRE AND SMOKE RATING**

- .1      In accordance with BC Building Code, NFPA 90A and CAN/ULC-S102.
  - .1          Maximum flame spread rating: 25.
  - .2          Maximum smoke developed rating: 50.

**2.2          INSULATION**

- .1      Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2      Thermal conductivity ("k" factor) not to exceed specified values at 24°C [75°F] mean temperature when tested in accordance with ASTM C335.

- .3 Mineral Fibre - Low and Medium Temperature:
  - .1 Maximum thermal conductivity per 25 mm [1"]: 0.033 W/m-°C at 24°C [0.23 Btu-in/(hr-ft<sup>2</sup>-°F) at 75°F].

### **2.3 CEMENT**

- .1 Thermal insulating and finishing cement:
  - .1 Hydraulic setting or Air drying on mineral wool, to ASTM C449/C449M.

### **2.4 VAPOUR RETARDER FINISH**

- .1 Vinyl emulsion type acrylic, compatible with insulation.

### **2.5 COATINGS**

- .1 Vapour barrier coating on reinforcing membrane or on insulating cement.
- .2 Flexible elastomeric and flexible closed cell insulation finish coating.

### **2.6 JACKETS**

- .1 All Service Jacket:
  - .1 Securement: Staples (flare type), compatible jacket finishing tape, contact adhesives recommended by the jacket manufacturer.
- .2 Polyvinyl Chloride (PVC):
  - .1 One-piece moulded type and sheet to CAN/CGSB-51.53 with pre-formed shapes as required.
  - .2 Minimum service temperatures: -20°C.
  - .3 Maximum service temperature: 65°C.
  - .4 Moisture vapour transmission: 0.02 perm.
  - .5 Thickness: 0.38 mm [0.015"].
  - .6 Fastenings: Use solvent weld adhesive compatible with insulation to seal laps and joints, tacks and staples, plastic pop rivets., pressure sensitive vinyl tape of matching colour.
- .3 Thermocanvas:
  - .1 Cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
  - .2 Fastenings: Staples (flare type), compatible jacket finishing tape, contact adhesives recommended by the jacket manufacturer.
  - .3 Lagging adhesive: compatible with insulation.
  - .4 Thermocanvas Jacket.
- .4 Aluminum:
  - .1 To ASTM B209.
  - .2 Thickness: 22 ga.
  - .3 Finish: Corrugated or smooth.
  - .4 Joining: longitudinal and circumferential slip joints with 50 mm [2"] laps.
  - .5 Fittings: die-shaped fitting covers with factory-attached protective liner.
  - .6 Securement: Sheet metal screws, pop rivets, bands.

- .7 Aluminum Jacket.
- .8 Aluminum Fitting Covers or Shield.
- .5 Refrigerant Piping with PVC or aluminum jacketing for outside:
  - .1 Flexible Foamed Elastomeric Insulation:
    - .1 Maximum thermal conductivity per 25 mm [1"]: 0.039 W/m-°C at 24°C [0.27 Btu-in/(hr-ft2-°F) at 75°F].
  - .2 Flexible Closed Cell Insulation:
    - .1 Maximum thermal conductivity per 25 mm [1"]: 0.036 W/m-°C at 24°C [0.25 Btu-in/(hr-ft2-°F) at 75°F].

**2.7 PIPING INSULATION SCHEDULES**

- .1 Below the most stringent shall apply.
- .2 Thickness of insulation as listed in following table (to ASHRAE 90.1).

Service	Temperature	Pipe Size in mm [inch]				
		Up to 20 [3/4]	25 to 30 [1 to 1-1/4]	40 to 75 [1-1/2 to 3]	100 to 150 [4 to 6]	Over 150 [6]
Continuous C.W. Drainage	5°C	12	12	25	25	25
Domestic Cold Water	5°C	12	12	25	25	25
Domestic Hot Water Supply	41-60°C	25	25	40	40	40
Rainwater Storm Drainage (buried & exterior)	5°C	None	none	none	none	none
Refrigerant Suction and Hot Gas	Above 4°C	25	25	25	25	25

**2.8 PIPING INSULATION SCHEDULES**

- .1 Thickness of insulation as listed in following table (to NECB).

Service	Temperature	Pipe Size in mm [inch]			
		Up to 25 [1]	30 to 50 [1.25 to 2]	65 to 100 [2.5 to 4]	Over 100 [Over 4]
Continuous C.W. Drainage	5°C	12	12	25	25
Domestic Cold Water	5°C	25	25	25	25
Domestic Hot Water Supply	41-60°C	25	25	40	40
Rainwater Storm Drainage (buried & exterior)	5°C	None	none	none	none
Refrigerant Suction and Hot Gas	Above 4°C	25	25	25	25

**2.9 SCOPE OF INSULATION**

- .1 Warm and Hot Piping Systems:
  - .1 Insulate the following systems, unless otherwise noted:
    - .1 Domestic hot water piping.
    - .2 Traps on handicapped lavatories.



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- .3 Condensate piping.
  - .4 Trace heated piping.
  - .2 Do not insulate the following, unless otherwise noted:
    - .1 Drain lines.
  - .3 Insulate the following valves and fittings if the pipe is insulated:
    - .1 Elbows, tees, reducers.
    - .2 Strainers (terminate insulation to allow basket removal.)
  - .4 Do not insulate the following fittings, even if pipe is insulated:
    - .1 Valves, smaller than 65 mm [2-1/2"].
    - .2 Unions.
    - .3 Drip legs.
    - .4 Flexible connections.
    - .5 Expansion joints.
    - .6 Check valve covers.
  - .2 Cold Piping Systems:
    - .1 Insulate and vapour seal the following systems, unless otherwise noted:
      - .1 Refrigerant suction and hot gas piping.
      - .2 Domestic cold water system including:
        - .1 Meter body
        - .2 PRV's, backflow preventers.
        - .3 Interior piping to a hose bibb or for irrigation.
      - .3 All piping containing water or for draining water in unheated spaces.
    - .2 Insulate and vapour seal the following, if the pipe is insulated:
      - .1 Elbows, tees, reducers.
      - .2 Valves, (bodies and bonnets) except check valve covers.
      - .3 Strainers (with removable insulation plug for basket removal).
      - .4 Flanges
      - .5 Unions
    - .3 Do not insulate the following, unless otherwise noted:
      - .1 Fire protection piping (except in unheated spaces).
      - .2 Soil stacks, vents.
      - .3 Flexible connections or expansion joints.
      - .4 Flexible fixture connections.
    - .4 Pipe penetrations through walls and floors:
      - .1 All material for the stuffing, sealing and caulking of the pipe penetration shall be supplied and installed under this section.

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**Part 3 Execution**

**3.1 PRE-INSTALLATION REQUIREMENT**

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- .2 Surfaces clean, dry and free from foreign material.

**3.2 INSTALLATION**

- .1 Apply materials in accordance with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet and this specification.
- .2 Install in accordance with TIAC National Standards.
- .3 Apply insulation and accessories so that the product is smooth and neat and with the longitudinal seams concealed from view. Apply insulation, accessories and finishes in accordance with manufacturer's recommendations.
- .4 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm [3"].
- .5 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
- .6 Install hangers, supports outside vapour retarder jacket.
- .7 Supports, Hangers: Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.
- .8 Maintain vapour barrier without interruption at sleeves, fittings and supports.
- .9 Insulation and vapour barrier shall be continuous through all non-rated separations

**3.3 INSULATION TERMINAL POINTS**

- .1 Where exposed, terminate insulation 75 mm [3"] back from all uninsulated fittings for working clearance and bevel insulation at 45° and finish with a hard coat insulating cement to match the adjacent insulation.
- .2 Where concealed, terminate insulation 75 mm [3"] back from all uninsulated fittings, with heavy coat of insulation coating to secure glass fibres.
- .3 Cut back insulation at 45° and finish with a hard coat of insulating cement around the base of thermometer wells, pressure gauges, flow switches and pressure and control sensors.

**3.4 VERTICAL RISERS**

- .1 On vertical pipe larger than 75 mm [3"] provide insulation supports welded or bolted to pipe, directly above lowest pipe fitting and at 4.5 m [15 ft] intervals.

**3.5 APPLICATION TO WARM AND HOT PIPING (ABOVE 27°C [80°F])**

- .1 Piping:
  - .1 Install medium temperature pipe insulation with integral jacket on pipe and hold in place with spreading staples at 75 mm [3"] centres
  - .2 Install strip of tape over each butt joint. Overlap minimum 25 mm [1"] and secure with spreading staples.

- .2 Fittings:
  - .1 Insulate fittings to thickness of adjacent pipe insulation with sections of the pipe insulation mitred to fit tightly, or with preformed insulation fittings, or with tightly wrapped flexible insulation to full thickness with PVC fitting cover.
- .3 Valves, Strainers:
  - .1 Insulate valve bodies and strainers with fitted pipe insulation, or mitred blocks all to thickness of adjacent pipe insulation or insulate with preformed insulation fittings. Drains, blowoff plugs and caps shall be left uncovered.

### **3.6 APPLICATION TO COLD PIPING SYSTEMS - (BELOW 11°C [52°F])**

- .1 Piping:
  - .1 Install low/medium temperature pipe insulation with integral vapour barrier jacket on pipe and secure and seal flaps with vapour barrier adhesive and spreading staples at 75 mm [3"] centres.
  - .2 Install strip of vapour barrier jacket over each butt joint. Overlap minimum 25 mm [1"] and secure with vapour barrier adhesive and spreading staples.
- .2 Fittings:
  - .1 Insulate fittings to thickness of adjacent pipe insulation with sections of the pipe insulation mitred to fit tightly, or preformed insulation fittings, then apply reinforcing membrane embedded in barrier coating or with tightly wrapped flexible insulation to full thickness with PVC fitting covers. Apply vapour barrier adhesive and tape on all joints and overlaps.
  - .2 Alternatively insulate fittings with tightly placed flexible insulation and apply premoulded 25/50 rated PVC fitting covers. Apply vapour-barrier adhesive and tape on all joints and overlaps.
- .3 Valves, Strainers:
  - .1 Insulate valve bodies, bonnets and strainers with fitted pipe insulation, or mitred blocks all to thickness of adjacent pipe insulation, then apply reinforcing membrane embedded in barrier coating or insulate with preformed insulation fittings covered with reinforcing membrane, stapled in place and covered with a barrier coating. Drains, blow-off plugs and caps shall be left uncovered.
- .4 Unions, Flanges and Victaulic Fittings:
  - .1 Insulate with oversized pipe insulation or mitred blocks to the thickness of the adjacent pipe insulation, then apply reinforcing membrane embedded in barrier coating.

### **3.7 ANTI-SWEAT COATING**

- .1 Coat with an anti-sweat coating, No Sweat or approved alternate, uninsulated metallic surfaces on cool or cold systems:
  - .1 Connecting surfaces of thermometers, pressure gauges, flow switches, controllers and riser clamps.
- .2 The coating thickness shall be as recommended by the coating manufacturer.

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**3.8 PIPE INSULATION FINISHES**

- .1 "Concealed" insulation will require no further finish except in damp locations where it shall have a vapour barrier jacket continuously sealed.
- .2 "Exposed" insulation inside the building shall be finished as follows:
  - .1 Apply thermocanvas jacket with fabric adhesive.
  - .2 Over insulating fittings apply hard coat cement and finish with thermocanvas or apply PVC fitting covers. Over all other insulated components apply thermocanvas jacket with fabric adhesive.
  - .3 Finish fabric with one (1) coat of fabric coating.
  - .4 Over piping, continuous all-service jacket with all edges and joints taped.
  - .5 Over insulated fittings apply skim coat of finishing cement, apply reinforcing membrane and cover with fitting mastic or apply hard coat finishing cement or apply PVC fitting cover. Over insulated valve bodies, valve bonnets, strainers and flanges, apply all-service jacketing using necessary fastenings and jacket finishing tape, or alternatively use PVC fitting covers.
- .3 "Exposed" outdoor insulation shall be finished as follows:
  - .1 Insulation shall have a vapour sealed vapour barrier jacket.
  - .2 Over the pipe insulation jacket apply aluminum [PVC] weather protecting jacket. The longitudinal seam shall be located to shed water. Secure the jacket using necessary fastenings on approximately 150 mm [6"] centres.
  - .3 Over insulated fittings, valve bodies, valve bonnets, strainers and flanges apply metal jacket or preformed metal fittings to provide a complete jacket system. Secure with necessary fastenings.
  - .4 Locate seams on underside and seal all outdoor jacketing watertight.

**3.9 INSULATION PACKING OF PIPE SLEEVES**

- .1 Tightly pack the space between all pipe sleeves and pipe or between pipe sleeve and pipe insulation with mineral wool insulation, Thermal Ceramics "Cerafiber" or Carborundum "Fiberfax", to full depth of sleeve to prevent transmission of sound and/or passage of smoke.

**END OF SECTION**

**PART 1      General**

**1.1          SUMMARY**

- .1      Section includes materials and installation procedures for electric heating and cooling controls.

**1.2          RELATED SECTIONS**

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

**1.3          SUBMITTALS**

- .1      Shop Drawings:
  - .1      Submit shop drawings for all electric and electronic control system equipment and components.
- .2      Closeout Submittals:
  - .1      Provide maintenance data for incorporation into Operational and Maintenance manual.

**PART 2      Products**

**2.1          TEMPERATURE CONTROL UNITS:**

- .1      Low voltage 24 VDC.
- .2      Electronic, programmable, 7-day.
- .3      LCD clock and temperature read-out.
- .4      Battery power back-up.
- .5      Plastic enclosure.

**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 SEQUENCE OF OPERATION**

- .1 Range Hood Exhaust Fan (RH-1):
  - .1 Fan shall be controlled by a range hood switch.
- .2 Heat Recovery Ventilator (HRV-1):
  - .1 Provide a time clock to START and STOP HRV, set to minimum of 2 hours every 8 hour operation and shall be enabled by manual override in Bathrooms.
  - .2 Thermostat required on intake outside air side of HRV to enable electric preheat duct heater to maintain air temperature above 10°C entering HRV.
- .3 Domestic Hot Water Tank (T-DHW):
  - .1 The domestic hot water tank's integral controls shall control the tank's operation.
- .4 Heat Pump (HP-1)
  - .1 Occupied
    - .1 Programmable thermostat shall be set to heat to Default room heating temperature setpoint, of 21°C (70°F) and a cooling temperature setpoint of 24 °C (75°F).
  - .2 Unoccupied
    - .1 Programmable thermostat shall be set to heat to Default room heating temperature setpoint, of 15°C (59°F) and a cooling temperature setpoint of 25°C (76°F).

### **3.3 INSTALLATION**

- .1 Install control devices.
- .2 On outside wall, mount thermostats on bracket or insulated pad 25mm from exterior wall.
- .3 Install control units to manufacturer instructions.
- .4 Wire to heat pump control circuit.

**END OF SECTION**

**PART 1      General**

**1.1            SUMMARY**

- .1      Section includes materials, requirements and installation of low-pressure metallic ductwork, joints and accessories where working static pressure does not exceed 500 Pa [2" w.g.].

**1.2            RELATED SECTIONS**

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

**1.3            SUBMITTALS**

- .1      Closeout Submittals:
  - .1      Provide maintenance data for incorporation into Operational and Maintenance manual.

**PART 2      Products**

**2.1            DUCTS - GALVANIZED STEEL**

- .1      All ductwork shall be constructed and sealed to withstand without damage or permanent deformation at least 150% of the working static pressure.
- .2      Construct rectangular ducts in accordance with Section I of the SMACNA Duct Standards. Of the tables and figures, use only Tables 1-5, 1-10, 1-11, 1-12, 1-13 and Figs. 1-4 through 1-18.
- .3      Construct round ducts in accordance with Section III of the SMACNA Duct Standards. Of the tables and figures, use only Table 3-2 and Figs. 3-1 and 3-2, but excluding beaded crimp joints and snaplock seams.
- .4      500 Pa [2" w.g.] working static pressure on:
  - .1      All exhaust air ductwork, except where otherwise specified.
  - .2      All outdoor air ductwork, except as otherwise specified.

**2.2            FITTINGS**

- .1      Construct rectangular duct fittings in accordance with Section II of the SMACNA Duct Standards. Of the figures, use only Figs. 2-1 to 2-11 and Figs. 2-16 to 2-18.
- .2      Sheet metal gauge of fittings and elbows shall be not less than the thickness of that specified for longitudinal seam straight duct of the equivalent size.
- .3      Square throated - radius heel elbows shall not to be used.
- .4      Adjustable elbows are not permitted.

- .5 Radiused elbows.
  - .1 Rectangular: Centreline radius of a rectangular duct elbow at least equal to 1.5 times the duct width, measured in the direction of the radius. If it is not possible to install a full radius elbow, use a square elbow with multi-blade turning vanes.
  - .2 Round: Centreline radius of 1.0 times duct diameter.
- .6 Mitred elbows, rectangular: Construct with single wall turning vanes.
- .7 Branches:
  - .1 Rectangular main and branch: 45 degrees entry on branch.
  - .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.
- .8 Transitions: In accordance with Fig. 2-9 of the SMACNA Duct Standards:
  - .1 Maximum taper of diverging transitions shall be 20°.
  - .2 Maximum taper of converging transitions shall be 30°.
  - .3 Maximum divergence upstream of equipment shall be 30°.
  - .4 Maximum convergence downstream of equipment shall be 45°.
  - .5 Maximum divergence of evase from centrifugal fan scroll outlet shall be 7°.
- .9 Offsets: Full radiused elbows.

### 2.3 FIRE STOPPING

- .1 Retaining angles around duct, on both sides of fire separation.
- .2 Fire stopping material and installation must not distort duct.

### 2.4 HANGERS AND SUPPORTS

- .1 Support ductwork to SMACNA using:
  - .1 Galvanized steel straps.
  - .2 Cadmium plated threaded rods.
  - .3 Flat bar or angle hangers.
- .2 Attachments to the structure shall be compatible with the structure and selected for the load of the ductwork.
- .3 Install ductwork hangers in accordance with Section IV of the SMACNA Duct Standards. Of the tables and figures, use only Tables 4-1 through 4-3 and Figs. 4-1 through 4-9.
- .4 Support duct risers at their base and at each floor and at not greater than 3.7 m [12 ft] intervals.

### 2.5 WIRE MESH SCREENS

- .1 Provide wire mesh screens in all air intake openings where noted on the drawings.
- .2 Screens shall be constructed from 16 ga aluminum wire.
- .3 Screen mesh shall be 12 mm [1/2"] grid.



- .4 Mount screens in 20 ga folded aluminum frames.

## **2.6 SEALANT**

- .1 SMACNA Seal Classification B for ductwork 500 Pa [2" w.g.] and under working static pressure.
- .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.
- .3 Oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of -30°C to 93°C.

## **PART 3 Execution**

### **3.1 GENERAL**

- .1 The project drawings are diagrammatic. Effort has been made to indicate offsets and transitions, but not all are necessarily shown. Changes may be required to ductwork to avoid interference with structure and other services. Determine all required adjustments prior to fabrication and provided the adjustments without additional cost to the Contract.
- .2 Working static pressure means the maximum pressure that could be created by the equipment when operating at the speed required to achieve the specified performance, by the closure (including closure due to failure) of any specified devices in the ductwork.
- .3 Ductwork means ducts and plenums.
- .4 Where a duct is to be internally insulated, size the duct so as to provide the free area duct dimensions shown on the drawings.
- .5 Plenum sizes are the sheet metal plenum dimension.
- .6 Where ducts penetrate roofs, install sleeves and roof curb c/w flashing and counterflashing. Pack sleeves in roof with fibreglass insulation and provide sheet metal below to hold it in place.
- .7 Flash and counterflash ducts through roofs and exterior walls.
- .8 Arrange openings for ductwork through floors and walls to accommodate insulation, packing, sleeves, and fire dampers as appropriate.
- .9 Arrange for 100 mm [4"] high watertight curbs around all ductwork penetrations of floor slabs except inside duct shafts.
- .10 During construction, protect ductwork openings from the entry of dirt, dust and debris with suitable covers.
- .11 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .12 Where ductwork is required to pass through open web steel joists, coordinate with the joist fabricator before fabricating ductwork.

### **3.2 DUCTWORK INSTALLATION**

- .1 Square throated - radius heel elbows shall not to be used.

- .2 Where a duct contains a fire or smoke damper, construct the duct so that the free area of the duct is maintained through the fire or smoke damper unless otherwise indicated.
- .3 Install tie rods to limit the maximum unsupported vane length to 914 mm [36"]. Refer to Fig. 2-4 of the SMACNA Duct Standards.
- .4 Cross-break or bead all metal ductwork panels unless otherwise noted.
- .5 Arrange ductwork so that equipment can be easily serviced and removed.
- .6 Ductwork passing through non-rated fire separations, sound insulated walls and through walls and floors which are not fire separations shall be tightly fitted and sealed on both sides of the separation with silicon sealant to prevent passage of smoke and/or transmission of sound (ULC approved fire stop sealant is not a requirement). Where ducts are externally insulated provide a 24 ga thick galvanized steel band tightly fitted around the insulation and then caulk from band to wall or floor.
- .7 Install breakaway joints in ductwork on sides of fire separation.
- .8 To avoid a conflict with structure or other services a duct may be reduced up to 10% in cross-sectional area for up to 2 meters [6'-8"] in length. Also, to assist installation any duct may be changed in dimension by up to 50 mm [2"] with a corresponding change in the other dimension to maintain the cross-sectional area. Notify the Departmental Representative of the change. Any other changes in duct dimensions must first be reviewed and accepted by the Departmental Representative.

### **3.3 SEALING**

- .1 Apply sealant to outside of joint to manufacturer's recommendations.
- .2 Where accessible, apply sealer to inside of joints on ductwork under positive pressure.
- .3 Apply sealer to outside of joints on ductwork under negative pressure.
- .4 Duct tape is not a permitted sealing method.

### **3.4 DUCTWORK CLEANING**

- .1 It is the intent that the ductwork system shall be clean. No dirt, debris or dust shall be evident in a visual examination.
- .2 Protect ductwork from fabrication to the completion of the project to keep it clean. Any dust, dirt or debris in the systems shall be removed.
- .3 If in the opinion of the Departmental Representative the systems are not clean, provide cleaning as required including, if necessary, retaining a Cleaning Agency to do the work.
- .4 Cleaning shall be to the satisfaction of the Departmental Representative.
- .5 Submit a letter signed by a principal of the ductwork installing company certifying that all ductwork systems are clean.

**END OF SECTION**

**PART 1      General**

**1.1          SUMMARY**

- .1      Section includes materials, requirements and installation for balancing dampers for mechanical forced air ventilation and air conditioning systems.

**1.2          RELATED SECTIONS**

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

**1.3          SUBMITTALS**

- .1      Closeout Submittals:
  - .1      Provide maintenance data for incorporation into Operational and Maintenance manual.

**PART 2      Products**

**2.1          GENERAL**

- .1      Manufacture to SMACNA standards.

**2.2          SINGLE BLADE DAMPERS**

- .1      Fabricate from same material as duct but one sheet metal thickness heavier 16 ga, with V-groove stiffened.
- .2      Size and configuration to recommendations of SMACNA, except maximum height 300 mm [12"] on rectangular ducts.
- .3      Locking quadrant with shaft extension to accommodate insulation thickness.
- .4      Inside and outside end bearings. Nylon on dampers up to 300 mm [12"] high, oilite bronze on dampers over 300 mm [12"] high or diameter.
- .5      Channel frame of same material as adjacent duct, complete with angle stop.

**2.3          MULTI-BLADED DAMPERS**

- .1      Factory manufactured of material same as duct, 16 ga.
- .2      Opposed blade configuration. Metal thickness and construction to recommendations of SMACNA.
- .3      Maximum blade height: 200 mm [8"].

- .4 Bearings: bronze oilite bushings.
- .5 Linkage: shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.

**PART 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

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

**3.2 INSTALLATION**

- .1 Install where indicated and where required by the Balancing Agent for balancing.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3 Runouts to registers and diffusers: install as far as possible from registers and diffusers.
- .4 All dampers shall be vibration free and have no free play when set.
- .5 The lever of quadrant operators shall be parallel with the blades.
- .6 Provide sheet metal bridge for operators on round ducts over 300 mm [12"] diameter and to raise operator above insulation on insulated ducts.
- .7 Ensure damper operators are observable and accessible.

**END OF SECTION**

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**PART 1      General**

**1.1            SUMMARY**

- .1      Section includes materials, requirements and installation for acoustic duct lining.

**1.2            RELATED SECTIONS**

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

**1.3            SUBMITTALS**

- .1      Shop Drawings:
  - .1      Submit shop drawings for acoustic duct lining.
- .2      Closeout Submittals:
  - .1      Provide maintenance data for incorporation into Operational and Maintenance manual.

**PART 2      Products**

**2.1            FIRE AND SMOKE RATING**

- .1      In accordance with BC Building Code, NFPA 90A and CAN/ULC-S102.
  - .1      Maximum flame spread rating: 25.
  - .2      Maximum smoke developed rating: 50.

**2.2            DUCT LINER - FLEXIBLE**

- .1      Minimum Noise Reduction Criteria (NRC): 0.70 at 25 mm [1"] thickness based on Type A mounting to ASTM C423.
- .2      Maximum thermal conductivity per 25 mm [1"]: 0.040 W/m-°C at 24°C [0.28 Btu-in/(hr-ft<sup>2</sup>-°F) at [75]°F].

**2.3            DUCT LINER- RIGID**

- .1      Minimum Noise Reduction Criteria (NRC): 0.70 at 25 mm [1"] thickness based on Type A mounting to ASTM C423.
- .2      Maximum thermal conductivity per 25 mm [1"]: 0.040 W/m-°C at 24°C [0.28 Btu-in/(hr-ft<sup>2</sup>-°F) at [75]°F].

**2.4            ACCESSORIES**

- .1      Insulation Adhesive: Water-based fire retardant type.
- .2      Insulation Sealer
- .3      Fasteners: Weld pins, length to suit thickness of insulation. Polymer, nylon or metal retaining clips.

- .4 Reinforcing Membrane: Glass fibre-reinforcing membrane.

## 2.5 SCOPE OF INSULATION

	Thickness	
	mm	[ins]
.1 Scope 1: Internal Duct Liner - Flexible.		
.1 All ductwork where indicated by single hatching.	25	[1]
.2 All ductwork where noted on the drawings.	refer to drawings	
.2 Scope 2: Internal Duct Liner - Rigid.		
		Thickness
		mm   [ins]
.3 All outdoor air plenums - walls and top.	50	[2]

## PART 3 Execution

### 3.1 GENERAL

- .1 Where a duct is to be internally insulated, size the duct so as to provide the free area duct dimensions shown on the drawings.

### 3.2 APPLICATION OF INTERNAL DUCT LINER - FLEXIBLE

- .1 Adhere insulation with insulation adhesive applied to the entire metal surface, with the coating side of insulation exposed to the air stream.
- .2 Ducts 610 mm [24"] in width and less require no further adhesion.
- .3 Seal all transverse joints, raw edges, and other points of penetration of the coating with reinforcing membrane and insulation coating/sealer.
- .4 Seal all longitudinal joints with insulation coating sealer.
- .5 No raw edges of internal insulation material shall be exposed to the moving air stream.
- .6 Duct size shown is dimension inside the insulation. Metal duct sizes shall be increased to allow for the internal acoustic insulation thickness.
- .7 Adhere UL Class I material film over the internal surface of all acoustic insulation. Overlap all edges and seal all joints with insulation adhesive/coating/sealer.

### 3.3 APPLICATION OF INTERNAL DUCT LINER - RIGID

- .1 Adhere the internal rigid duct liner in the same manner as specified for internal flexible duct liner.
- .2 Adhere UL Class #1 Material film over the internal surface of all acoustic insulation. Overlap all edges and seal all joints with insulation adhesive/coating/sealer.
- .3 Cover plenum wall insulation with galvanized perforated metal sheet having over 50% open area. Protective metal shall be held in place by securing it to the projecting pins with washers.

- .4 All sheet metal and perforated sheet metal is under Section 23 3113.01 - Metal Ducts - Low Pressure to 500 Pa.

**3.4 INSULATION TERMINATION**

- .1 Terminate insulation short of all control, smoke and fire dampers so as not to interfere with their operation.
- .2 Terminate insulation 900 mm [36"] short of duct mounted electric heating coils.
- .3 Seal butt joints, exposed edges, weld pin and clip penetrations and damaged areas of liner with sealer.
- .4 Replace damaged areas of liner at discretion of the Departmental Representative.
- .5 Protect leading and trailing edges of duct sections with sheet metal nosing having 15 mm overlap and fastened to duct.

**END OF SECTION**

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**Part 1 General**

**1.1 SUMMARY**

- .1 Section includes materials, requirements and installation for fans, motors, accessories and hardware for commercial use.

**1.2 RELATED SECTIONS**

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

**1.3 SUBMITTALS**

- .1 Shop Drawings:
  - .1 Submit shop drawings for all fans.
  - .2 Indicate, at minimum, the following:
    - .1 Sound rating data.
    - .2 Fan curves showing operating point plotted on curves.
    - .3 Motor efficiencies.
    - .4 Sound rating data at point of operation.
- .2 Closeout Submittals:
  - .1 Provide maintenance data for incorporation into Operational and Maintenance manual.

**1.4 PERFORMANCE REQUIREMENTS**

- .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.
- .2 Capacity: flow rate, total static pressure, BHP, W, efficiency, RPM, power, model, size, sound power data and as indicated on schedule.
- .3 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99. Dynamically balance fans to 1.5 mm/s [0.06 in/s] vibration amplitude, maximum measured on bearing housings. Provide fan shafts with critical speed at least 1.5 times operational speed.
- .4 Submit fan sound power levels with shop drawings, measured to AMCA 300 and calculated to AMCA 301, or other data acceptable to the Departmental Representative. Provide test data if requested. Fans exceeding design levels may be rejected.
- .5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210 and ASHRAE 51. Units shall bear AMCA certified rating seal.



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**1.5 MAINTENANCE**

- .1 Provide maintenance materials in accordance with Section 01 78 10 - Closeout Submittals.
- .2 Obtain signed receipt from the Departmental Representative when spare parts are handed over.

**Part 2 Products**

**2.1 FANS GENERAL**

- .1 Refer to drawings for motor position, rotation and discharge arrangements.
- .2 Motors:
  - .1 High efficiency motors unless otherwise specified.
  - .2 Sizes as scheduled.
- .3 Accessories and Hardware:
  - .1 Fan inlet and/or outlet safety screens.
- .4 Factory primed before assembly in colour standard to manufacturer.
- .5 Scroll casing drains: as scheduled.
- .6 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.

**2.2 KITCHEN RANGE HOODS**

- .1 Fan: Resiliently mounted, multi-blade direct driven fan and motor, with two-speed plug-in type motor with permanently lubricated bearings. Minimum capacity 160 CFM (76 L/s), width [to match appliance, Maximum loudness rating of 1.5 sones at normal (low) speed and 5.0 at high (max) speed. Minimum efficacy level 1.3 L/s [2.8 CFM] per Watt.
- .2 Hood: Baked enamel, White, with rocker type switches for light and fan, with washable, aluminum mesh.
- .3 HVI (Home Ventilating Institute) certified, ENERGY STAR certified.

**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.

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**3.2 FAN INSTALLATION**

- .1 Install fans as indicated, complete with vibration isolators and seismic restraints as required and per SMACNA requirements.
- .2 Install fans with flexible connections on inlet ductwork and on discharge ductwork in accordance with SMACNA requirements. Ensure metal bands of connectors are parallel with minimum 25 mm [1"] flex between ductwork and fan during running.
- .3 Install connectors on the suction side of axial fans in such a manner so that the connectors cannot be sucked into the air stream. Provide flange extensions as necessary.
- .4 Provide safety screens where fan inlet or outlet is exposed.
- .5 Provide belt guards on belt driven fans.
- .6 Provide and install sheaves and belts required for final air balance.

**END OF SECTION**

**Part 1            General**

**1.1                SUMMARY**

- .1        Section includes materials, requirements and installation for supply, return and exhaust grilles and registers, diffusers and linear grilles, for commercial and residential use.

**1.2                RELATED SECTIONS**

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

**1.3                SUBMITTALS**

- .1        Shop Drawings:
  - .1        Submit shop drawings for diffusers, registers and grilles.
  - .2        Indicate, at minimum, following:
    - .1        Throw and terminal velocity.
    - .2        Noise criteria.
    - .3        Pressure drop.
    - .4        Neck velocity.
- .2        Closeout Submittals:
  - .1        Provide maintenance data for incorporation into Operational and Maintenance manual.

**1.4                PERFORMANCE REQUIREMENTS**

- .1        Catalogued or published ratings shall be those obtained from tests carried out by the manufacturer or those ordered by him from an independent testing agency signifying adherence to codes and standards.

**Part 2            Products**

**2.1                MANUFACTURED UNITS**

- .1        Grilles, registers and diffusers of same generic type shall be the product of one manufacturer.

**2.2                GENERAL**

- .1        Acceptable Products for grilles, registers and diffusers shall meet capacity, pressure drop, terminal velocity, throw, noise level and neck velocity as indicated on equipment schedules on mechanical drawing coversheet.

- .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 where scheduled.
- .4 Coordinate with ceiling type and grid size.
- .5 Means of attachment for two seismic restraint wires unless screwed to sheet metal duct.
- .6 Refer to Air Terminal schedules for terminal details and to drawings for sizes, air quantities and location.
- .1 Floor Registers: Rectangular adjustable pattern, stamped steel with baked enamel finish, with radial opposed blade.

### **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 AIR TERMINAL INSTALLATION**

- .1 Install in accordance with manufacturer's instructions.
- .2 Install with oval head, cadmium plated screws in countersunk holes where fastenings are visible.
- .3 Bolt grilles, registers and diffusers, in place, in gymnasium and similar game rooms.
- .4 Paint ductwork matte black behind terminals where internal surfaces are visible.
- .5 Install ductwork as high as practical using offsets if necessary to obtain a duct neck length of minimum two diameters.
- .6 Confer with the Departmental Representative in advance of ductwork construction where there are conflicts with light locations or where locations on mechanical drawings differ from the Architectural reflected ceiling plans.
- .7 Connect diffusers or troffer boots to low pressure ducts with 1.5 m (5 ft) maximum length of flexible duct. Hold in place with strap or clamp.

**END OF SECTION**

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**Part 1            General**

**1.1                SUMMARY**

- .1        Section includes materials, requirements and installation for louvres, intakes, vents and gooseneck hoods.

**1.2                RELATED SECTIONS**

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

**1.3                SUBMITTALS**

- .1        Shop Drawings:
  - .1        Submit shop drawings for louvres, intakes and vents.
  - .2        Indicate, at minimum, the following:
    - .1        Pressure drop.
    - .2        Face area.
    - .3        Free area.
- .2        Test Reports:
  - .1        Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.
- .3        Closeout Submittals:
  - .1        Provide maintenance data for incorporation into Operational and Maintenance manual.

**1.4                PERFORMANCE REQUIREMENTS**

- .1        Catalogued or published ratings shall be those obtained from tests carried out by the manufacturer or those ordered by him from an independent testing agency signifying adherence to codes and standards.

**Part 2            Products**

**2.1                MANUFACTURED UNITS**

- .1        Louvres, intakes, vents and gooseneck hoods of same generic type shall be the product of one manufacturer.

**2.2                GRAVITY ROOF OUTSIDE AIR INTAKES AND RELIEF VENTS**

- .1        Factory manufactured aluminium or galvanized steel.

- .2 Complete with integral birdscreen of 2.7 mm [0.106"] diameter aluminium wire. Use [12 mm [1/2"] mesh on exhaust, 19 mm [3/4"] mesh on intake, provide with weather hood, cowl, drainable construction as indicated on drawings.
- .3 Vertical backdraft dampers on two faces.
- .4 Maximum throat velocity: 3.3 m/s [650 fpm] intake.
- .5 Maximum loss through unit: 15 Pa [0.06" w.g.] exhaust static pressure.
- .6 Maximum velocity through damper area: [1.5 m/s [300 fpm].
- .7 Shape: as indicated.

### **Part 3 Execution**

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

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

#### **3.2 LOUVRE/VENT/INTAKE INSTALLATION**

- .1 Install in accordance with manufacture's and SMACNA's recommendations.
- .2 Reinforce and brace air vents, intakes and goosenecks to withstand local wind loads.
- .3 Provide all necessary flashing and counter flashing.
- .4 Anchor securely into opening from inside. Seal with caulking all around to ensure weather tightness.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            Section 23 05 00 Common Work Results for Mechanical.

**1.2                REFERENCE STANDARDS**

- .1            American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
  - .1            ASHRAE 84-2013, Method of Testing Air-to-Air Heat/Energy Exchangers (ANSI approved).

**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 [energy recovery equipment] 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 BC Canada.
- .4            Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .5            Test Reports:
  - .1            Catalogued or published ratings: obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.
  - .2            Provide confirmation of testing.
- .6            Manufacturers' Instructions: submit manufacturer's installation instructions.
  - .1            Departmental Representative will make available [1] copy of systems supplier's installation instructions.

**Part 2            Products**

**2.1                GENERAL**

- .1            Comply with ASHRAE 84.

**2.2                AIR TO AIR FIXED PLATE EXCHANGER**

- .1            Casing: 0.8 mm thick galvanized steel or anodized aluminum.
- .2            Heat transfer surfaces: corrugated aluminum, edge sealed and bonded to casing.

- .3 Cross contamination: not permitted.
- .4 Condensate drain: NPS [2].
- .5 Removable access panels.
- .6 Accessories: water wash.
- .7 Performance characteristics: as indicated.
- .8 General
  - .1 Power connection: 240V/1/60, less than 250 Watts.
  - .2 Come with manufacturer supplied duct heater and thermostat for induct sensor for outdoor air at 4kW 240/1/60.
- .9 Casing:
  - .1 Painted aluminum with enamel finish.
  - .2 25 mm insulated case.
  - .3 Removable access panels.
- .10 Core:
  - .1 Material: Polypropylene.
  - .2 Type: Crossflow.
- .11 Blowers:
  - .1 Supply and exhaust blowers using PSC motors with permanently sealed bearings.
  - .2 90 L/s [200 CFM], 125 Pa [0.5" W.C.].
- .12 Controls:
  - .1 Built in interlock options: commands heat pump blower when HRV is on.
  - .2 Automatic defrost cycle.
  - .3 Independent speed adjustment of either supply or exhaust motor in both high and low speeds.
  - .4 24V circuit protection with self -resetting fuse.
  - .5 Drain, hanger kit, polyester air filters included.
  - .6 12 VDC
- .13 ENERGY STAR certified.

### **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 energy recovery equipment 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 Mount on Unistrut frame or hang from deck as indicated on drawings. Provide seismic supports as required.
- .2 Install in accordance with manufacturers recommendations.
- .3 Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.
- .4 Install flexible connections between fan inlet and discharge ductwork. Ensure metal bands of connectors are parallel with minimum 25 mm [1 inch] flex between ductwork and fan while running.
- .5 Install units on vibration isolators.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            Section 23 05 00 Common Work Results for Mechanical.

**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 the heat pump and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2            Include information as follows:
    - .1            Replacement data for motor element, thermostat and switch.
    - .2            Mounting methods.
    - .3            kW rating.
    - .4            Cabinet material thicknesses.
    - .5            Cabinet surface temperature.
    - .6            Thermostat, transformer, controls where integral.
  - .3            Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .4            Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.
  - .5            Manufacturer's Field Reports:
    - .1            Submit manufacturer's field reports specified.

**1.3                CLOSEOUT SUBMITTALS**

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

**Part 2            Products**

**2.1                SPLIT AIR HEAT PUMP UNIT (HP-1, CU-1)**

- .1            ENERGY STAR Certified.
- .2            Split type heat pump, HSPF $\geq$  7.1, SEER  $\geq$  14.5, EER  $\geq$  12.0.
- .3            ARI classification HRCU-A-CB indoor coil with fan and outdoor compressor.

.4 INDOOR UNIT

- .1 Direct drive multi-speed fan in an acoustic lined cabinet, with resilient isolated blower/motor assembly, for vertical installation.
- .2 Coil: Aluminum fin mechanically bonded to copper tubing, factory pressure and leak tested with integral drain pan.
- .3 25 mm [1"] thick disposable filters.
- .4 Auxiliary heating coil on board for single point connection, 14.4 kW.
- .5 735 L/s [1,600 CFM], 185 Pa [0.75" W.C.] at medium flow.
- .6 Power connection: 240V/1/60.

.5 OUTDOOR UNIT

.1 General

- .1 Power connection: 240V/1/60.
- .2 Compressor: one, single stage.
- .3 R-410A refrigerant.
- .4 Capacity: nominal 4 ton.
- .5 Low ambient cooling to 12.7°C [55°F].
- .6 Anti-short cycle timer.
- .7 Evaporator defrost control.
- .8 Snow leg - base and cap.

.2 Casing:

- .1 Heavy gauge, galvanized steel and painted with weather-resistant powder paint on all louvers, panels, pre-paint on all other panels. Corrosion and weatherproof base.
- .2 Removable access panels.

.3 Compressors:

- .1 Commercial duty hermetic, internally sprung and externally isolated.
- .2 Centrifugal oil pump.
- .3 Crankcase heater.
- .4 High/low pressure and temperature protection.

.4 Refrigerant circuit:

- .1 Liquid line filter drier(s).
- .2 Liquid line service valve(s) with gauge port.
- .3 Suction line service valve(s) with gauge port.

.5 Condenser:

- .1 Direct drive propeller fan, vertical discharge.
- .2 Fan safety guards.
- .3 Condenser coil with aluminum fins bonded to copper tubes.

.6 Controls:

- .1 Factory wired in separate enclosure.
- .2 24 volt control circuit, control power transformer.

- .3 Magnetic contactors.
- .4 Overload devices for compressor(s) and fan(s).
- .5 Anti-short cycle timer.

### **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 incremental heating and cooling unit 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 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

#### **3.2 INSTALLATION**

- .1 Install in accordance with manufacturer's written instructions.
- .2 Make power and control connections.
- .3 Ensure positive contact between condenser frame and exterior louvre to prevent cross-ventilation of supply and discharge air.
- .4 Provide and install all necessary refrigerant piping and interconnecting wiring between "split" units and condensate drains.
- .5 Maintain proper clearance around equipment to permit performance of service maintenance.

#### **3.3 FIELD QUALITY CONTROL**

- .1 Site Tests/Inspection:
  - .1 Set controls and operate each unit.
  - .2 Take readings and record:
    - .1 Current.
    - .2 Air velocity at discharge.
    - .3 Discharge air temperature.
- .2 Manufacturer's Field Services:
  - .1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, protection and cleaning of its product(s), and

- 
- submit written reports, in acceptable format, to verify compliance of work with Contract.
- .2 Provide manufacturer's field services, consisting of product use recommendations and periodic site visits for inspection of product installation, in accordance with manufacturer's instructions.
  - .3 Schedule site visits to review work at stages listed:
    - .1 After delivery and storage of products, and when preparatory work on which work of this Section depends is complete, but before installation begins.
    - .2 Upon completion of work, after cleaning is carried out.
  - .3 Obtain reports within [3] days of review and submit immediately to Departmental Representative.
  - .4 Halocarbons Management:
    - .1 Comply with all of:
      - .1 Federal Halocarbon Regulations, 2003;
      - .2 Environmental Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems (the Environment Canada "Refrigeration Code of Practice") Cat. No.: En14-207/2015E-PDF, April, 2015.
    - .2 Work on Halocarbon Systems includes installation, servicing, leak testing or charging of a refrigeration system or an air-conditioning system or doing any other work on the system that may result in the release of a halocarbon.
    - .3 All work on Halocarbon Systems shall be carried out only by a "Certified Person" as defined by the Federal Halocarbon Regulations 2003.
      - .1 Provide copies of all technicians' certificates to the Departmental Representative.
    - .4 Halocarbons listed under Item 1 through 10 of Schedule 1 of Federal Halocarbon Regulations, 2003 (S)R/2003-289) are not acceptable refrigerants.
    - .5 Contractor shall work with Departmental Representative to provide necessary information as required to update halocarbon records on site.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED SECTIONS & SUMMARY**

- .1        The General Conditions, Supplements and Amendments shall govern this Section (read in conjunction with Instructions to Tenderers / Bidders). This section covers items common to all Electrical sections and is intended only to supplement the requirements of Division 01.
- .2        Reference to "Electrical Divisions" shall mean all sections of Divisions 26, 27, 33 in the Master Format or the Canadian Master Specifications.
- .3        The word "Provide" shall mean "Supply and Install" the products and services specified. "As Indicated" means that the item(s) specified are shown on the drawings.
- .4        Provide materials, equipment and plant, of specified design, performance and quality; and, current models with published certified ratings for which replacement parts are readily available. Provide project management and on-site supervision to undertake administration, meet schedules, ensure timely performance, ensure coordination, and establish orderly completion and the delivery of a fully commissioned installation.
- .5        The most stringent requirements of this and other electrical sections shall govern.
- .6        All work shall be in accordance with the PROJECT Drawings and Specifications and their intent, complete with all necessary components, including those not normally shown or specified, but required for a complete installation.
- .7        Provide seismic restraints for all required fixtures, devices, equipment, pathway, and wiring systems as required by the BC Building Code.
- .8        Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors or by the Departmental Representative. Uncrate equipment, move in place and install complete; start-up and test. Include all field assembly of loosely/separately packaged accessories

**1.2                CODES AND STANDARDS**

- .1        Comply with all laws, ordinances, rules, regulations and codes of all authorities having jurisdiction relative to this project.
- .2        The project will be constructed to the current adopted edition of applicable standards, including:
- .3        CSA C22.1, Canadian Electrical Code (CEC)
- .4        British Columbia Building Code (BCBC)
- .5        National Fire Code of Canada (NFCC)
- .6        ASHRAE 90.1, Standard for Energy Efficient Design of New Buildings
- .7        Provincial Fire Marshall Regulations
- .8        WorkSafe BC Regulations
- .9        Applicable NFPA Regulations

### **1.3 REFERENCES**

- .1 Install in accordance with CSA C22.1 (current adopted edition) – except where specified otherwise.
- .2 Refer to CSA C22.1 Appendix A “Safety Standards for Electrical Equipment” for applicable codes and the related revisions
- .3 Refer to CSA C22.1 Pages xxix – xxxii for related ‘Reference Publications’
- .4 Refer to NBCC Table 1.3.1.2 for applicable codes and the related revisions.
- .5 Comply with Local Electrical Bulletins and by-laws relating to the Authority having Jurisdiction.
- .6 Install overhead and underground systems in accordance with CSA C22.3 No.1 (current adopted edition) – except where specified otherwise.
- .7 Preferred Voltage Levels for AC Systems, 0-50,000V in accordance with CAN3-C235 (current adopted edition)

### **1.4 PERMITS**

- .1 Submit to the Electrical Inspection Authority having jurisdiction the necessary number of drawings and specifications for review and approval prior to commencement of the project.
- .2 Pay all associated fees and obtain all permits, licenses etc. to complete the project.
- .3 Obtain a Certificated of Acceptance from the Inspection Authority having jurisdiction upon completion of the project and include in the O&M manual.

### **1.5 SCOPE OF WORK**

- .1 This project includes the construction of a new employee housing residence. The new residence will include a 2-story residence complete with 3 bedrooms, a garage and a secondary suite in the basement. The electrical work includes utility coordination and installation, temporary power coordination and installation, power distribution, grounding, lighting, mechanical equipment connections and other mechanical loads. The project also consists of providing CATV and telephone cabling in conduit from the telecom demarcation to device locations for all telecommunications systems.

### **1.6 DESIGN REQUIREMENTS**

- .1 Operating voltages: to CAN3-C235- current edition
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 All electrical work to be installed with common work practices and methods.

### **1.7 SUBMITTALS**

- .1 Submittals to be in accordance with Division 01.

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- .2 Shop Drawings:
    - .1 The term “shop drawing” means drawings, diagrams, illustrations, schedules, performance characteristics, brochures and other data which are to be provided by the contractor to illustrate details of a portion of the work.
    - .2 Prior to submitting the shop drawings to the Departmental Representative, the contractor shall review the shop drawings to determine that the equipment complies with the requirements of the specifications and drawings.
    - .3 Submit shop drawings, product data and samples for all electrical equipment and materials in accordance with Division 01. The submission shall be reviewed, signed and processed as described in Division 01.
    - .4 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.
    - .5 Where applicable, include wiring, line and schematic diagrams. Include wiring drawings or diagrams showing interconnection with work of other Sections.
    - .6 Manufacturer of products shall conform to revised shop drawings.
  - .3 Content
    - .1 Shop drawings submitted title sheet.
    - .2 Data shall be specific and technical.
    - .3 Identify each piece of equipment including specific options selected for each type to be included in the project.
    - .4 Information shall include all scheduled data.
    - .5 Advertising literature will be rejected.
    - .6 The project and equipment designations shall be identified on each document.
    - .7 The shop drawings/product data shall include:
      - .1 Dimensioned construction drawings with plans and sections showing size, arrangement and necessary clearances, with all equipment weights and mounting point loads.
      - .2 Mounting arrangements.
      - .3 Control explanation and internal wiring diagrams for packaged equipment.
      - .4 A written description of control sequences relating to the schematic diagrams.
      - .5 Copies of factory tests, where applicable.
  - .4 Format
    - .1 Shop Drawings to be submitted in PDF format; larger submittals may be submitted on flash drives or uploaded to an FTP site set up the contractor.
  - .5 Coordination
    - .1 Where electrical equipment requires support or backing by other trades or mechanical connections, the shop drawings shall also be circulated through the other "services" contractor(s) prior to submission to the Departmental Representatives.
  - .6 Keep one [1] copy of shop drawings and product data, on site, available for reference.



- .7 Quality Control: in accordance with Division 01 - Quality Control
  - .1 Provide CSA certified equipment and material. Where CSA certified equipment and/or material is not available, submit such equipment and/or material to the authority having jurisdiction for special approval before delivery to site.
  - .2 Submit test results of installed electrical systems and instrumentation.
  - .3 Submit, upon completion of Work, the electrical "load balance" report.
- .8 Permits and Fees:
  - .1 Submit to Electrical Inspection Department, Local Fire Authorities and Supply Authority the necessary number of drawings and specifications for examination and approval prior to commencement of work. Obtain all required permits and pay all fees.
  - .2 Arrange for inspection of all Work by the authorities having jurisdiction. On completion of the Work, furnish final unconditional certificates of approval by the inspecting authorities.

## **1.8 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Division 01 - Quality Control
- .2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial and/or Territorial Act.
  - .1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.
  - .2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.
- .3 Site Meetings: in accordance with Division 01 - Construction Progress Schedule
  - .1 Site Meetings: as part of Manufacturer's Field Services: schedule site visits, to review Work, at stages listed below:
    - .1 At time of initial shop drawing submission to confirm any existing conditions and to coordinate with the project schedule and any cross discipline requirements.
    - .2 After delivery and storage of products, and when preparatory Work is complete but before installation begins.
    - .3 During progress of Work at key schedule points as determined.
    - .4 At commissioning.
    - .5 Upon completion of Work, after cleaning is carried out.
- .4 Health and Safety Requirements: do construction occupational health and safety in accordance with Division 01 - Health and Safety Requirements.

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**1.9 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:
- .4 Store materials ins in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .5 Store and protect equipment and materials from nicks, scratches, and damage. Protect from dust where applicable.
- .6 Replace defective or damaged materials with new.

**1.10 OPERATING INSTRUCTIONS**

- .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
- .2 Operating instructions to include following:
  - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
  - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
  - .3 Safety precautions.
  - .4 Procedures to be followed in event of equipment failure.
  - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.
- .4 Post instructions where directed.
- .5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
- .6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

**1.11 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction Waste and Disposal.
- .2 Avoid using landfill waste disposal procedures when recycling facilities are available.
- .3 Place materials defined as hazardous or toxic waste in designated containers.

**1.12 DRAWINGS AND MEASUREMENTS**

- .1 Drawings are generally diagrammatic and are intended to indicate the scope and general arrangement of work and are not detailed installation drawings. Do not scale the drawings. Obtain accurate dimensions from the Architectural and Structural drawings.

- .2 Consult the architectural drawings and details for exact locations of fixtures and equipment. Obtain this information from the Departmental Representative where definite locations are not indicated.
- .3 Take field measurements, where equipment and material dimensions are dependent upon building dimensions.
- .4 Where imperial units have been indicated in brackets [ ] following the requirements in SI units, the conversion is approximate and provided for convenience. The SI units shall govern.

### **1.13 PROJECT COORDINATION**

- .1 Check drawings of all trades to verify space and headroom limitations for work to be installed. Coordinate work with all trades and make changes to facilitate a satisfactory installation. Make no deviations to the design intent involving extra cost to the Departmental Representative without written approval from the Departmental Representative.
- .2 The drawings indicate the general location and route to be followed by the electrical services. Where details are not shown on the drawings or only shown diagrammatically, the services shall be installed in such a way as to conserve head room and interfere as little as possible with the free use of space through which they pass. Service lines shall run parallel to building lines. All services in the ceiling shall be kept as tight as possible to beams or other limiting members at high level. All electrical services shall be coordinated in elevation to ensure that they are concealed in the ceiling or structural space provided unless detailed otherwise on drawings.
- .3 Work out jointly all interference problems on the site and coordinate all work before fabricating, or installing any material or equipment. Where necessary, produce interference/coordination drawings showing exact locations of electrical systems or equipment within service areas, shafts and the ceiling space. Distribute copies of the final interference/coordination drawings to the Departmental Representative and all affected parties.
- .4 Ensure that all materials and equipment fit into the allotted spaces and that all equipment can be properly serviced and replaced, if and when required. Advise the Departmental Representative of space problems before installing any material or equipment. Demonstrate to the Departmental Representative on completion of the work that all equipment installed can be properly, safely serviced and replaced, if and when required.

### **1.14 PROVISION FOR FUTURE EQUIPMENT AND CONSTRUCTION**

- .1 Leave clear spaces designated for future equipment or building expansion where indicated. Plan for the installation under this contract and ensure clear accessible, unhindered access to the space is allowed for.
- .2 Were contract documents don't clearly indicate the future expansion requirements, but known services are required, provide written "request for information" to the Departmental Representative before making assumptions as to intent.

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**1.15 EQUIPMENT RESTRAINT**

- .1 Related Section: 26 05 05 Seismic Restraint.
- .2 It is the entire responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

**1.16 PHASED CONSTRUCTION**

- .1 See Architectural specifications and drawings for construction phasing. Make all allowances to phase the work in accordance with the project phasing.
- .2 All trades in this Division shall make allowance for the implications of having to totally complete all work in the new addition before proceeding with work in the existing building.

**1.17 WARRANTY**

- .1 Use of installed equipment during construction shall not shorten or alter the warranty period as specified in the Division 01.
- .2 Take note of any extended warranties specified in other sections of this Division or in Division 27.
- .3 Furnish a written warranty stating that all work executed under this Division will be free from defects of material and workmanship for a period of one (1) year from the date of substantial performance and include in O&M manual.
- .4 Promptly investigate any electrical or control malfunction, and repair or replace all such defective work and all other damages thereby which becomes defective during the time of the warranty.

**1.18 TENDER INQUIRIES**

- .1 All contractor queries during the tender period shall be made in writing to the Departmental Representative. Contractor queries will be collected and suitable addenda will be issued for clarification. No verbal information will be considered valid or issued by the Departmental Representative's office during tender. All tender queries may be emailed, mailed or couriered to the Departmental Representative's office. No telephone questions will be answered.

**1.19 RESPONSIBILITIES**

- .1 Provide temporary lighting, power and systems for construction services and remove after construction is complete.
- .2 Ensure that equipment does not transmit noise and/or vibration to other parts of the building, as a result of poor installation practice.
- .3 Where the Contract Documents do not contain sufficient information for the proper selection of equipment for bidding, notify the Departmental Representative during the tendering period. If clarification is not obtainable, allow for the most expensive arrangement. Failure to do this shall not relieve the Contractor of responsibility to provide the intended equipment.

- .4 Protect equipment and material from the weather, moisture, dust and physical damage.
- .5 Cover equipment openings and open ends of conduit, piping and pullboxes as work progresses. Failure to do so will result in the Trade being required to adequately clean or replace materials and equipment at no extra cost to the Departmental Representative.
- .6 Refinish damaged or marred factory finish to factory finish.
- .7 The specifications and drawings form an integral part of the Contract Documents. Neither the drawings nor the specifications shall be used alone. Work omitted from the drawings but mentioned or reasonably implied in the specifications, vice versa, shall be considered as properly and sufficiently specified and shall be provided. Misinterpretation of any requirement of either plans or specifications shall not relieve this Contractor of the responsibility of properly completing his trade to the approval of the Departmental Representative.

## **1.20 STANDARD OF ACCEPTANCE**

- .1 Standard of Acceptance means that the item named and specified by manufacturer and/or catalogue number forms part of specification and sets standard regarding performance, quality of material and workmanship and when used in conjunction with a referenced standard, shall be deemed to supplement the standard.
- .2 Where a manufacturer's equipment is listed, the manufacturer's listed equipment was used in preparing the base design. Tenders may be based on the listed equipment or preapproved alternate manufacturer's equivalent products, provided that they meet every aspect of the base design and every aspect of the drawings and specifications.
- .3 Where other than the listed manufacturer's equipment is selected or approved, include for the cost of any resulting work (both under this Division and other Divisions) and any necessary redesign of installation or structure. Submit redesign drawings for review with Shop Drawings. Maintain installation, access and servicing clearances. Equipment/materials shall not exceed the available space limitations. Redesign drawings shall be to scale and of a standard equal to the Project Drawings.
- .4 A visible manufacturer's nameplate shall indicate manufacturer's name, model number, serial number, capacity data, electrical characteristics and approval stamps.
- .5 All materials shall be new, of the quality specified and shall confirm to the standards of the Canadian Standards Association. Where equipment or materials are specified by technical description only, they shall be of the best quality for the listed application in which it is to be installed.
- .6 All work shall be executed in a neat and workmanlike manner by qualified tradespersons. Electrical contractor shall keep a competent foreman and necessary assistants all satisfactory to the Departmental Representative on the project during the progress of the work.

## **1.21 ADDITION OF ACCEPTABLE MANUFACTURERS**

- .1 Material/products considered to satisfy the specification, but of a manufacturer other than those named may be submitted to the Departmental Representative for consideration not later than five (5) working days prior to closing of tender or of bid depository subtrade tender whichever is earlier.

- .2 Alternate approvals will be given by written addendum only. No other substitution will be permitted after closing of tenders.
- .3 Alternate approvals granted before the closing of tenders will be limited to a manufacturer's system and/or series only. This limited approval will not preclude substitute equipment/material from complying with specific features included with equipment/material specified. Determine that the alternate product meets the specification intent before basing a tender on the product
- .4 Where alternate equipment/materials are selected, allow for effects on other parts of the work of this Trade and other Trades. Where substantial changes in arrangement are required, submit shop drawings of the proposed changes with Plan and Section views and show effects on work of other Trades. Alternate equipment/materials shall not exceed the available space limitations. Maintain installation, access and servicing clearances. No extra will be allowed due to the use of alternate equipment/materials.
- .5 Where two or more items of equipment and/or material, of the same type, are required, provide products of a single manufacturer.
- .6 Install and test all equipment and material, in accordance with the detailed recommendations of the manufacturer.

#### **1.22 CASH ALLOWANCES**

- .1 Coordinate cash allowances with bid documents. Allowances directly affecting this Division include: None.

#### **1.23 PROJECT CLOSE-OUT REQUIREMENTS**

- .1 Refer to detailed specifications in each section for detailed requirements. Record drawings to be submitted to Departmental Representative and all life safety systems must be operational, verified and tested and demonstrated to Departmental Representative prior to issuance of Schedule C.

#### **1.24 SUBSTANTIAL PERFORMANCE REQUIREMENTS**

- .1 Before the Departmental Representative is requested to make a site review for substantial performance of the work:
  - .1 Commission all systems and prove out all components, interlocks and safety devices.
  - .2 Submit a letter certifying that all work is complete for the intended use, operational, clean and all required submissions have been completed.
  - .3 A complete list of incomplete or deficient items shall be provided. If, in the opinion of the Departmental Representative, this list indicates the project is excessively incomplete, a substantial completion review will not be performed.

- .2 The work will not be considered to be ready for use or substantially complete until the following requirements have been met:
  - .1 All reported deficiencies have been corrected.
  - .2 Operating and Maintenance Manuals completed.
  - .3 "As Built" Record Drawing ready for review.
  - .4 Systems Commissioning has been completed and has been verified by Departmental Representative.
  - .5 All demonstrations to the Departmental Representative have been completed.
- .3 Departmental Representatives Letters of Assurance will not be issued until the following requirements have been met:
  - .1 All items listed in .1 above have been completed or addressed.
  - .2 Certificate of Penetrations through separations.
  - .3 Provincial or City Electrical Inspection - Certificate of inspection.
  - .4 Seismic Departmental Representative's letter of Assurance and final inspection report.
  - .5 Certificate of Substantial Performance.
  - .6 Signed off copy of Departmental Representatives final site review report.

## **1.25 DEFICIENCY HOLDBACKS AND DEFICIENCY INSPECTIONS**

- .1 Work under this Division which is still outstanding when substantial performance is certified will be considered deficient and a sum equal the estimated cost of completing that work will be held back.
- .2 It is expected that outstanding work will be completed in an expeditious manner and the entire holdback sum will be retained until the requirements for Total Performance of Division 26, 27, 33 (electrical) work have been met and verified.

## **Part 2 PRODUCTS**

### **2.1 MATERIALS AND EQUIPMENT**

- .1 Provide materials and equipment in accordance with Division 01 and as follows.
- .2 Material and equipment to be CSA certified. Where CSA certified material or equipment is not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval.
- .3 Where equipment or materials are specified by technical description only, they are to be of the best quality available for the application for which it is to be installed.

### **2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS**

- .1 Provide all power and control wiring, conduit, wire, fittings, disconnect switches, motor starters, for all mechanical equipment unless otherwise specified.
- .2 Bond all motors to conduit system with separate bonding conductor in flexible conduit or bonding conductor in the flexible conduit.

- .3 Connections shall be made with watertight flexible conduit with watertight connectors.
- .4 Control wiring and conduit standards are specified in the Electrical Divisions. Refer to Sections 26 05 21 Wires & Box Connectors and the Mechanical Divisions for scope of work and particular details.

### 2.3 WARNING SIGNS

- .1 Provide warning signs as specified or to meet the requirements of Inspection Department, Authority having Jurisdiction, and the Departmental Representative.
- .2 Use decal signs, minimum 175 x 250 mm [7" x 10"] size

### 2.4 EQUIPMENT IDENTIFICATION

- .1 Identify all electrical equipment including but not limited to starters, disconnects, remote ballasts and controls with nameplates and labels as follows:

- .2 Nameplates:

- .1 Lamicoid 3 mm [0.125"] thick plastic engraving sheet, white face, black core, self adhesive unless specified otherwise. Provide white face, red core for all essential distribution equipment.

- .2 Nameplate Sizes:

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .3 Typical Labelling:

- .1 Panelboard & CDP – 5 lines

- .1 Line 1 – Conditional/Vital – Size 4 lettering
- .2 Line 2 – Panel/CDP designation – Size 4 lettering
- .3 Line 3 – eg 225A, 120/208V, 3 phase 4W – Size 2 lettering
- .4 Line 4 – Feeder: eg 4#3 – 35mm C – Size 2 lettering
- .5 Line 5 – Origin eg: Main Elect. Room – Size 2 lettering

- .2 Distribution Circuit Breakers – 4 lines

- .1 Line 1 – Conditional/Vital – Size 4 lettering
- .2 Line 2 – Main Circuit Breaker – Size 4 lettering
- .3 Line 3 – Feeder: eg 4#3 – Size 2 lettering
- .4 Line 4 – Origin: eg K1 Sub-station – Size 2 lettering

- .3 Label colours unless otherwise indicated:

- .1 Normal Power: white letters on black base.
- .2 Vital Power labels: white letters on red base.

- .4 Wording on nameplates to be approved prior to manufacture.
- .5 Allow for average of twenty-five (25) letters per nameplate.



- .6 Disconnects, starters and contactors: indicate equipment being controlled and voltage and CCT.
- .7 Terminal cabinets and pull boxes: indicate system and voltage and source.
- .8 Transformers: indicate capacity, primary and secondary voltages, source and lead.
- .3 Labels:
  - .1 Identify each outlet, starter, disconnect and all items of fixed equipment with the appropriate panel and circuit number origin by means of a small but good quality vinyl, self-laminating label such as T & B E-Z Code WSL, Dymo Letratag or Brother P-Touch equivalent printable markers. Embossed Dymo or any labels with edges and corners that are prone to lift will be rejected. Confirm location of labels with Departmental Representative before installing. Circuit number to agree with Record Drawings.
- .4 Provide plastic covered panel directory with circuits and areas served typed in, and mounted on inside of door. Directory to conform to Record Drawings.

## **2.5 WIRING IDENTIFICATION**

- .1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour code: to Canadian Electrical Code CSA 22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

## **2.6 CONDUIT, CABLE AND PULLBOX IDENTIFICATION**

- .1 Colour code conduits, metallic sheathed cables, pullboxes and junction boxes.
- .2 Code with 25 mm plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor and at 15 m intervals.
- .3 Colour coding to be as outlined in Canadian Electrical Code CSA 22.1

## **2.7 FINISHES**

- .1 Shop finish metal enclosure surfaces by removal of rust and scale, cleaning, application of rust resistant primer inside and outside and at least two coats of finish enamel.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original finish.
- .3 Clean and prime paint exposed hangers, racks, fastenings to prevent rusting. Finish painting shall be provided by Division 09.
- .4 Paint outdoor electrical equipment "equipment green" finish.
- .5 Paint indoor switchgear and distribution enclosures light gray unless otherwise indicated in particular specification sections for specialised or emergency power equipment.

## **2.8 ACCESS PANELS (DOORS)**

- .1 Unless otherwise noted, access doors shall be minimum: 450mmx450mm [18"x18"] for body entry; 300mmx300mm [12"x 12"] for hand entry.
- .2 Access doors in fire separations of 3/4 hour rating, and higher, and firewalls shall have a compatible fire rating and a ULC label with tamper-proof latch, self closing.
- .3 Paint access panels to match wall colour. Contractor to coordinate with general contractor and painting trade to ensure all access panels are painted to match wall finishing.
- .4 Standard of Acceptance: Zurn, Wade, Acudor, Can-Aqua, Milcor, Maxam, Van-Met.

## **2.9 ANCHOR BOLTS AND TEMPLATES**

- .1 Supply anchor bolts and templates for installation by other Divisions.

## **2.10 FASTENING TO BUILDING STRUCTURE**

- .1 General:
  - .1 Do not use inserts in base material with a compressive strength less than 13.79 MPa [2000 psi].
  - .2 All inserts supporting conduit racks shall have a factor of safety of 5. All other inserts shall have a factor of safety of 4.
- .2 Types:
  - .1 Cast-in-place type:
    - .1 Channel type - Burndy, Canadian Strut, Unistrut, Cantruss or Hilti Channel.
    - .2 Wedge type galvanized steel concrete insert, Grinnell Fig. 281 for up to 200 mm [8"] pipe size.
    - .3 Universal type malleable iron body insert, Grinnell Fig. 282 for up to 200 mm [8"] pipe size.
  - .2 Drilled, mechanical expansion type:
    - .1 Hilti HSL or UCAN LHL heavy duty anchor for use in concrete with compressive strength not less than 19.6 MPa [2840 psi].
    - .2 Hilti Kwik-Bolt or UCAN WED stud anchor for concrete. (Do not use in seismic restraint applications).
    - .3 Hilti HDI or UCAN IPA drop-in anchor for concrete.
    - .4 Hilti or UCAN Sleeve Anchor (medium and light duty) for concrete and masonry.
    - .5 Hilti ZBP or UCAN Zamac pin bolt (light duty) for concrete and masonry.
  - .3 Drilled, adhesive type:
    - .1 Hilti HVA or UCAN Adhesive Anchor consisting of anchor rod assembly with a capsule containing a two-component adhesive, resin and hardener.
    - .2 Hilti HY150 consisting of anchor rod with a 2 part adhesive system.
    - .3 For use in concrete housekeeping bases (in vertical downward position) where the distance to the edge of the concrete base could cause weakness if a mechanical expansion type anchor were used.
    - .4 Rod assemblies shall extend a minimum of 50 mm [2"] into the concrete slab below the housekeeping bases.

- .3 Note:
- .1 All drilling for inserts shall be performed using the appropriate tool specifically designed for the particular insert. The diameter and depth of each drilled hole shall be to the exact dimensions as specified by the insert manufacturer.
  - .2 Refer to manufacturer's recommendations for tightening torques to be applied to inserts.
  - .3 Where specifically called for, drills shall include a dust vacuum system, Hilti SAV Dust Vacuum System.

## **2.11 EQUIPMENT SUPPORTS**

- .1 Provide stands and supports for equipment and materials supplied.
- .2 Lay out concrete bases and curbs required under Electrical Divisions. Coordinate with Concrete Divisions.
- .3 Concrete bases shall be a minimum of 100 mm [4"] thick, or as noted and shall project at least 150 mm [6"] outside the equipment base, unless otherwise directed. Bases and curbs shall be keyed to the floor and incorporate reinforcing bars and/or steel mesh. Chamfer edges of bases at 45 degrees.
- .4 Equipment with bedplates shall have metal wedges placed under the edges of the bedplates to raise them 25mm [1"] above the base after levelling. The wedges shall be left permanently in place. Fill the space between the bedplate and the base with non-shrink grout - Embeco or In-Pakt.
- .5 Construct equipment supports of structural steel. Securely brace. Employ only welded construction. Bolt mounting plates to the structure.
- .6 Support ceiling hung equipment with rod hangers and/or structural steel.

## **2.12 MISCELLANEOUS METAL**

- .1 Be responsible for all miscellaneous steel work relative to Electrical Divisions of the Specifications, including but not limited to:
  - .1 Support of equipment.
  - .2 Hanging, support, anchoring, guiding and relative work as it applies to wiring raceways and electrical equipment.
  - .3 Earthquake restraint devices - refer also to "Seismic Restraint" sections
  - .4 Bridle rings - secure to structure or steel supports.
- .2 All steel work shall be prime and undercoat painted ready for finish under the related Division.

## **2.13 MAINTENANCE MATERIALS AND CABINET**

- .1 Provide maintenance materials in accordance with Division 01 and specified in appropriate Sections.
- .2 Provide a finished painted sheet steel "spare equipment cabinet". Cabinet to have a continuous hinge and complete with shelves and hasp to suit padlock. Minimum size 600 [24"] x 900 [36"] x 200 [8"] deep. Mount on wall in the Electrical Room. Provide a plastic covered typewritten list of spare parts and affix to the inside of the door.

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**2.14 OPERATION AND MAINTENANCE DATA**

- .1 Refer to Section 01 78 10 – Closeout Submittals for Operation and Maintenance Manual requirements.
- .2 Refer to Section 26 05 03 – Operation and Maintenance Manual for detailed submittal requirements.
- .3 Provide operation and maintenance data for incorporation into maintenance manual specified in Division 01 and as follows.
- .4 Include in operations and maintenance data:
  - .1 Details of design elements, construction features, component function and maintenance requirements, to permit effective operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.
  - .2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature not acceptable.
  - .3 Wiring and schematic diagrams.
  - .4 Names and addresses of local suppliers for items included in maintenance manuals.
- .5 Include in the manual the following major sections:
  - .1 Title page (in plastic cover).
  - .2 Comprehensive description of the operation of the systems, including the function of each item of equipment within the system.
  - .3 Detailed instructions for the normal maintenance of all systems and equipment installed including procedures and frequency of operational checks and service and troubleshooting instructions.
  - .4 Local source of supply for each item of equipment.
  - .5 Wiring and control diagrams.
  - .6 Spare parts list.
  - .7 Copies of guarantees and certificates.
  - .8 Manufacturer's maintenance brochures and shop drawings.

**2.15 PROJECT RECORD DRAWINGS**

- .1 Provide project record documents as specified in Division 01 as further called for in this Division.
- .2 The contractor shall keep a complete set of white prints at the site office, including all addendums, change orders, site instructions, clarifications and revisions for the purpose of record drawings. As the work on site proceeds, the contractor shall clearly record in Red all as-built conditions which deviate from the original contract documents. Redline drawings to include cable runs (complete with number of cables and ID number) and locations of all telecommunications equipment.

- .3 Prior to substantial performance, the Contractor shall submit completed red-line drawings to the Departmental Representative. The Contractor shall certify, in writing that the as-built drawings are complete and that they accurately indicate all electrical services and electrical pathway, including exposed as well as concealed items.
- .4 Preparation of record drawings in AutoCAD shall be performed by the Contractor after review and acceptance of the redlines by Departmental Representative.

### **Part 3 EXECUTION**

#### **3.1 INSTALLATION**

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

#### **3.2 NAMEPLATES AND LABELS**

- .1 Ensure manufacturers nameplates and CSA labels to be visible and legible after equipment is installed.

#### **3.3 CONDUIT AND CABLE INSTALLATION**

- .1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit and protruding 50 mm [2"].
- .2 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.
- .3 Install roof jacks where conduit and cables penetrate roofs. Apply sealant after installation. Install roof stand offs where conduit or teck is installed on roof.
- .4 All cables and conduits to be installed concealed in finished areas.

#### **3.4 LOCATION OF OUTLETS**

- .1 Do not install outlets back-to-back or in the same stud space in wall; allow minimum 400mm [16"] horizontal clearance between boxes.
- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000mm [10'- 0"] and information is given before installation.
- .3 Locate light switches on latch side of doors unless otherwise indicated.
- .4 Locate disconnect devices in mechanical and elevator machine rooms on latch side of door.

#### **3.5 MOUNTING HEIGHTS**

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not indicated verify before proceeding with installation. Confirm the height of devices in handicapped facilities before installation.
- .3 Adjust mounting heights to accessible heights to meet the BC Building Code where applicable.

- .4 Refer to detail on drawings; in the absence of a drawing detail or drawing note, use the following (note, not all devices may be present in this project):

Device	Height		Comment
Local switches	1200	[48"]	
Wall receptacles/data	300	[12"]	General
Wall receptacles/data	175	[7"]	Above top of counters or counter splash backs – coordinate with Architectural detail
Wall receptacles/data	900	[36"]	In mechanical rooms
Exterior receptacles	600	[24"]	
Panelboards	2000	[80"]	Panelboards: as required by Code or as indicated.
Wall mtd telephone	1500	[60"]	
Thermostat	1200	[48"]	Confirm before installation
Wall Mounted Luminaires	2140	[82"]	

### 3.6 COORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to the required values and settings to provide a fully coordinated system. Adjust and modify the protective devices to the recommendations of the Analysis to minimize available incident energy in arc flash situations and maximize the coordination of the protective devices.

### 3.7 FIELD QUALITY CONTROL

- .1 Load and Balance:
- .1 Measure voltage and phase & neutral currents to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
  - .2 Measure phase and neutral currents to dry-core transformers and motor control centres, operating under normal load,
  - .3 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .2 Conduct and pay for the following tests:
- .1 Power generation and distribution system including phasing, voltage, grounding and load balancing.
  - .2 Circuits originating from branch distribution panels.
  - .3 Lighting and its control to ASHRAE 90.1 requirements; this commissioning shall be conducted by the manufacture and the Departmental Representative shall receive a letter from the manufacturer detailing the commissioning and it's certification.
  - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

- .5 Systems: fire alarm system and communications.
- .6 Main ground resistance (at all grounding locations).
- .7 Insulation resistance testing:
  - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
  - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
  - .3 Check resistance to ground before energizing.
- .3 Provide Departmental Representative with at least one week's notice prior to testing.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Reports:
  - .1 Provide written reports in a timely manner upon completion of the testing and load balance. Indicate test hour and date.

### **3.8 CLEANING**

- .1 Do final cleaning in accordance with Division 01.
- .2 At time of final cleaning, clean lighting reflectors, lenses and other lighting surfaces that have been exposed to construction dust and dirt.
- .3 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .4 Clean and prime paint exposed non-galvanised hangers, racks, fastenings to prevent rusting. Coordinate finish painting with Division 09.
- .5 Clean Communication Rooms and equipment located therein with vacuum or similar compressed air/pressurized duster system.

### **3.9 WORKMANSHIP**

- .1 Workmanship shall be in accordance with well-established practice and standards accepted and recognized by the Departmental Representative and the Trade.
- .2 The Departmental Representative shall have the right to reject any item of work that does not conform to the Contract Documents and accepted standards of performance, quietness of operation, finish and appearance.
- .3 Employ only tradesmen holding valid Provincial Trade Qualification Certificates. Tradesmen shall perform only work that their certificate permits. Certificates shall be available for inspection by the Departmental Representative.

### **3.10 PROTECTION OF WORK**

- .1 Protect equipment and materials, stored or in place, from the weather, moisture, dust and physical damage.
- .2 Mask machined surfaces. Secure covers over equipment openings and open ends of equipment and conduit, as the installation work progresses.

- .3 Equipment having operating parts, bearings or machined surfaces, showing signs of rusting, pitting or physical damage will be rejected.
- .4 Refinish damaged or marred factory finish.
- .5 All communication rooms shall be dust free at the time of installation of cabling and equipment. Communication rooms shall remain dust free during construction.

### **3.11 PROTECTION OF ELECTRICAL EQUIPMENT**

- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark live parts, e.g. "LIVE 120 VOLTS".
- .3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

### **3.12 CONCEALMENT**

- .1 Conceal wiring and conduit in partitions, walls, crawlspaces and ceiling spaces, unless otherwise noted.
- .2 Do not install wiring and conduit on outside walls or on roofs unless specifically directed.

### **3.13 SERVICE PENETRATIONS IN RATED FIRE SEPARATIONS**

- .1 All fire stopping materials shall be of one manufacturer; pre-approved manufactures are Hilti and STI.
- .2 All cabling, wiring, conduits, cable trays, etc. passing through rated fire separations shall be smoke and fire stopped to a ULC or cUL tested assembly system, in accordance with CAN4-S115-95, that meets the requirements of the Building Code in effect.
- .3 The scope includes new services which pass through existing rated separations and also all existing services which pass through a new rated separation or existing separations whose rating has been upgraded.
- .4 Firestop System installation must meet requirements of ASTM E 814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.
- .5 Install firestopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions. The Applicator shall be approved, licensed and supervised by the manufacturer in the installation of firestopping and are to follow the requirements of a rated system; installer to be FM 4991 Approved Contractor, UL Approved Contractor or Hilti Accredited Fire Stop Specialty Contractor.
- .6 Contractors are expected to submit system information detailing firestopping product, backing, penetrant, penetrated assembly, Fire (F) and Temperature (T) rating, and ULC or cUL system number during shop drawing stage.
- .7 Provide fire stopping material and system information in the maintenance manuals and via labels at major penetrations that are likely to be re-penetrated.
- .8 All penetrations for communication cabling are to be firestopped using re-penetrable EZ Path System (Specified Technologies Inc - STI) or re-penetrable Hilti Firestop Systems designated and installed for each specific application.



- .9 Allow openings for 100% capacity of raceway or 200% capacity of J-hooks (if applicable).
- .10 Provide Firestopping approval certificate in including a Building Code / By-Law Schedule B & C-B signed by a BC registered Professional Departmental Representative. Submit a letter certifying that all work is complete and in accordance with this specification.
- .11 A manufacturer's direct representative (account manager, fire protection specialist, not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details. Manufacturer's fire protection specialist to work with Departmental Representative to determine frequency of site walk-throughs to be submitted to construction manager and Departmental Representative.
- .12 Inspection of through-penetration firestopping by the manufacturer shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard and a field report shall be issued by the manufacturer to the Departmental Representative.
- .13 Electrical Contractor to provide for a 10% deconstruction test by the Departmental Representative during walk-through.

### **3.14 SERVICE PENETRATIONS IN NON-RATED SEPARATIONS**

- .1 All cabling, wiring, conduits, cable trays, etc. passing through non-rated fire separations and non-rated walls and floors shall be tightly fitted and sealed on both sides of the separation with caulking or silicon sealant to prevent the passage of smoke and/or transmission of sound.

### **3.15 CONDUIT SLEEVES**

- .1 Provide conduit sleeves for all conduit and wiring passing through rated walls and floors. Sleeves to be concentric with conduit or wiring.
- .2 Except as otherwise noted conduit sleeves are not required for holes formed or cored in interior concrete walls or floors.
- .3 Conduit sleeves shall extend 50 mm [2"] above floors in unfinished areas and wet areas and 6 mm [1/4"] above floors in finished areas.
- .4 Conduit sleeves shall extend 25 mm [1"] on each side of walls in unfinished areas and 6 mm [1/4"] in finished areas.
- .5 Conduit sleeves shall extend 25mm [1"] beyond exterior face of building. Caulk with flexible caulking compound.
- .6 Sleeve Size: 12 mm [1/2"] clearance all around, between sleeve and conduit or wiring.
- .7 Paint exterior surfaces of ferrous sleeves with heavy application of rust inhibiting primer.
- .8 Packing of Sleeves:
  - .1 Where sleeves pass through foundation walls and perimeter walls the space between sleeve and conduit shall be caulked with waterproof fire retardant non-hardening mastic.

- .2 Pack future-use sleeves with mineral wool insulation and then seal with ULC approved fire stop sealant for rated fire separations.

### **3.16 ACCESSIBILITY AND ACCESS PANELS**

- .1 Install all equipment, controls and junction boxes so as to be readily accessible for future modification, adjustment, operation and maintenance as appropriate.
- .2 Provide access panels where required in building surfaces. Do not locate access panels in panelled or special finish walls, without prior approval of the Departmental Representative.
- .3 Access panels in U.L.C. fire separations and fire walls shall have a compatible fire rating and U.L.C. label. Acquire approval in writing from the local fire authority if required.
- .4 Access panels shall be painted with a primer coat if applicable and then with a finish coat, colour and type to the Departmental Representative's approval.
- .5 Locate equipment and junction boxes in service areas wherever possible.

### **3.17 EQUIPMENT INSTALLATION**

- .1 Provide means of access for servicing equipment.
- .2 CSA identification and equipment labels to be clearly visible after installation.

### **3.18 CUTTING, PATCHING, DIGGING, CANNING, CORING & CONCRETE**

- .1 Lay out all cutting, patching, digging, canning and coring required to accommodate the electrical services. Coordinate with other Divisions. The performance of actual cutting, patching, digging, canning and coring is specified under other Divisions.
- .2 The Electrical Contractor shall be responsible for all cutting, patching, digging, canning and coring required to accommodate the electrical services.
- .3 The Electrical Contractor shall be responsible for correct location and sizing of all openings required under Electrical Divisions, including piped sleeves.
- .4 Verify the location of existing and planned service runs and structural components within concrete floor and walls prior to core drilling and/or cutting.
- .5 Openings through structural members of the building shall not be made without the approval of the Structural Departmental Representative.
- .6 Openings in Concrete:
  - .1 Be responsible for the layout of all openings in concrete, where openings are not left ready under previous contract.
  - .2 All openings shall be core drilled or diamond saw cut.
  - .3 Refer to structural drawings for permissible locations of openings and permissible opening sizes in concrete floors and walls.
  - .4 Refer to structural drawings for locations of steel reinforcing.
  - .5 Be responsible for repairing any damage to steel reinforcing.

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- .7 Openings in building surfaces other than concrete:
    - .1 Lay out all openings required.
  - .8 Poured concrete for duct encasements, pole bases, transformer pads and housekeeping pads shall be provided by other Divisions, coordinated and supervised by the Electrical Divisions.
  - .9 Precast concrete items such as transformer pad bases, pull boxes and light pole bases to be provided and installed by the Electrical Divisions unless otherwise specified.
  - .10 Excavation and backfilling will be provided by other Divisions. This Division to supervise the work and provide all layouts and parameters.

**3.19 PAINTING**

- .1 Clean exposed bare metal surfaces supplied under the Electrical Divisions removing all dirt, dust, grease and millscale. Apply at least one coat of corrosion resistant primer paint to all supports and equipment fabricated from ferrous metal.
- .2 Paint all hangers and exposed sleeves, in exposed areas, with a rust inhibiting primer, as they are installed.
- .3 Repaint all marred factory finished equipment supplied under the Electrical Divisions, to match the original factory finish.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED WORK**

- .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                SCOPE**

- .1        Electrical operations and maintenance manuals (hereinafter referred to as O&M manuals) shall be prepared by a firm specializing in this type of work.
- .2        Specialty firm to be responsible for:
  - .1        The supply and preparation of four sets of O&M manual binders and tabs as specified in the index below.
  - .2        The preparation of all written system descriptions and schematics (neatly drafted) for each tab section identified as article 1.4. Format as directed by the Departmental Representative, utilizing proportional typewritten format, with schematics in appendices at the end of each section. System description shall include an overview of basic design philosophy, description of future expansion capability, general construction of components, electrical characteristics not readily deduced from the contract documents, basic system configuration and interfaces with other systems existing or new.
  - .3        Securing and assembling all necessary literature describing operational and maintenance procedures for all equipment into the O&M manual binders, including Preventative Maintenance data as described below. Preventative maintenance data and maintenance suggestions to be compiled in tabular format in applicable section to provide a comprehensive overview of maintenance procedures.
  - .4        Preparing in coordination with Electrical Divisions and equipment manufacturer's technical specialist, scheduled maintenance sheets and check lists. Scheduled maintenance sheets shall include safety in maintenance data plus detailed daily, monthly and yearly scheduled maintenance information. Format as directed by the Departmental Representative.
  - .5        Preparation of safety in maintenance suggestions and procedures.
  - .6        Summarized daily, monthly and yearly maintenance charts.
  - .7        Prestonia No. 2047-10 plastic sheet protectors for all drawings larger than 210 mm × 275 mm. Locate drawing title block on lower right hand corner.
- .3        Division 26 shall be responsible for:
  - .1        Supply of four (4) copies of all information as described below:
    - .1        Final shop drawings.
    - .2        All wiring diagrams.
    - .3        List of all major trades, sub-trades and suppliers including names of equipment supplied and by whom, addresses, phone numbers, facsimile numbers and contact persons.

- .4 Obtaining all data necessary to compile a complete comprehensive Preventative Maintenance program. Data gathered shall be neatly handwritten on forms provided by the Departmental Representative. Data to be collected for all systems described in the index below.
- .5 Spare/replacement parts lists for all of the above. Copies of the electrical contractor's data collection sheets available during tendering period when requested.
- .6 Test results and verification reports as outlined in other sections of this specification.
- .7 Warranties as outlined in this and other sections of the Specifications.

### 1.3 ELECTRONIC FORMAT

- .1 In addition to the specified hardcopy, provide an electronic copy in pdf format. Electronic copy to be produced on a CD-ROM in the latest version of Acrobat.
- .2 CD-ROM to be reproducible by Departmental Representative as required to carry out his duties.
- .3 Electronic copy to consist of a single pdf file divided into chapters to allow a quick and easy access to the different sections of the manual.
- .4 All log sheet, maintenance tables, preventative maintenance sheets, intended to be completed by the Departmental Representative are to be completely interactive allowing the Departmental Representative to complete all pertinent information and save, print or modify these forms as required.
- .5 Provide a proposed layout to the Departmental Representative for approval prior to the construction of the O&M manuals.
- .6 Electrical contractor to submit complete system description and schematics by 50% complete stage of construction. O&M manuals to be submitted to the Departmental Representative 90% complete three (3) months prior to substantial completion review.
- .7 Electrical O&M manuals to be assembled in 210 mm × 275 mm capacity, expanding spine catalogue binders complete with plated piano hinges, bound in heavy fabric, hot stamped lettering on front and spine. Electrical contractor to provide sufficient quantity to allow all binders to hold system data while in full closed position (not expanded).
- .8 Electrical contractor to provide sample of art work and fabric cover (before having binders constructed) to the Departmental Representative.
- .9 In addition to the specified hardcopy, provide an electronic copy in pdf format. Electronic copy to be produced on a CD-ROM in the latest version of Acrobat.
  - .1 CD-ROM to be reproducible by Departmental Representative as required to carry out his duties.
  - .2 Electronic copy to consist of a single .pdf file divided into chapters to allow a quick and easy access to the different sections of the manual.
  - .3 All log sheet, maintenance tables preventative maintenance sheets, intended to be completed by the Departmental Representative are to be completely interactive allowing the Departmental Representative to complete all pertinent information and save, print or modify these forms as required.

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- .4 Provide a proposed layout to the Departmental Representative for approval prior to the construction.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED WORK**

- .1        This Section of the Specification is to be read, coordinated and implemented in conjunction with all other parts of the Contract Documents.

**1.2                REGULATORY REQUIREMENTS**

- .1        Restraints shall meet the requirements of the latest edition of the British Columbia Building Code and amendments.
- .2        The Seismic Consulting Engineer should be able to provide a proof of professional insurance and the related practice credentials if requested by the Departmental Representative. The Seismic Consulting Engineer should be familiar with SMACNA, ECABC & NFPA guidelines as well as BCBC and VBBL requirements.
- .3        The Contractors' Seismic Consultant shall submit original signed BC Building Code "Letters of Assurance" "Schedules B and C-B" to the Departmental Representative.
- .4        Project shall comply with the local bylaw where applicable.
- .5        The above requirements shall not restrict or supplant the requirements of any local bylaws, codes, or other certified agencies which may have jurisdiction over all or part of the installation.

**1.3                SCOPE**

- .1        It is the responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.
- .2        Manufacturer's shop drawings to be submitted with seismic information on equipment structure, bracing and internal components and as required by Division 01.
- .3        Provide restraint on all equipment and machinery, which is part of the building electrical services and systems, to prevent injury or hazard to persons and equipment in and around the structure. Restrain all such equipment in its normal position in the event of an earthquake.
- .4        The total electrical seismic restraint design and field review and inspection will be by a B.C. registered professional structural engineer who specializes in the restraint of building elements. Contractor to allow for coordination, provision of seismic restraints, as well as all costs for the services of the Seismic Restraint Engineer. This engineer, herein referred to as the Seismic Consultant, will provide normal engineering functions as they pertain to seismic restraint of electrical installations.
- .5        The Contractor shall be aware of, and comply with, all current seismic restraining requirements and make provision for those that may come into effect during construction of the project. Make proper allowance for such conditions in the tender.
- .6        The Seismic Consultant shall provide detailed seismic restraint installation shop drawings to the Contractor. Copies of the shop drawings to be included in the final project manual.

- .7 Provide seismic restraints on all equipment, and/or installations or assemblies, which are suspended, pendant, shelf mounted, freestanding and/or bolted to the building structure or support slabs.
- .8 The Seismic Consultant shall provide inspections during and after installation. The Contractor shall correct any deficiencies noted without additional cost to the contract.
- .9 Include all costs associated with the Seismic installation and certification in the base tender.

## **Part 2 Products**

### **2.1 SLACK CABLE SYSTEMS**

- .1 Slack cable restraint systems shall be as designed and supplied by Vibra-Sonic Control or equal.
- .2 Slack cable restraints shall be provided on suspended and shelf mounted transformers along with associated equipment and assemblies connected to them at the points of vertical support (4 points). The restraint wires shall be oriented at approximately 90 degrees to each other (in plan), and tied back to the ceiling slab or its structure at approximately 45 degrees to the slab or basic structure. The restraints shall be selected for a 1 g earthquake loading, i.e. each wire shall have a working load capacity equal to the weight of the transformer. The anchors in the structure shall be selected for a load equal to the weight of the transformers at a 45 degree pull.
- .3 Slack cable systems to allow normal maintenance of equipment and shall not create additional hazard by their location or configurations. Contractor shall rectify any such installations at no additional cost, all to the satisfaction of the Departmental Representative and inspection authority having jurisdiction.
- .4 Coordinate requirements of slack cables with suppliers prior to installation.

## **Part 3 Execution**

### **3.1 GENERAL**

- .1 All seismic restraints systems shall conform to local authority having jurisdiction and all applicable code requirements.

### **3.2 CONDUITS**

- .1 Provide restraint installation information and details on conduit and equipment as indicated below:
- .2 Vertical Conduit:
  - .1 Attachment - Secure vertical conduit at sufficiently close intervals to keep the conduit in alignment and carry the weight of the conduits and wiring. Stacks shall be supported at their bases and, if over 2 stories in height, at each floor by approved metal floor clamps.



- .2 At vertical conduit risers, wherever possible, support the weight of the riser, at a point or points above the center of gravity of the riser. Provide lateral guides at the top and bottom of the riser, and at intermediate points not to exceed 9.2 m.
- .3 Riser joints shall be braced or stabilized between floors.
- .4 Horizontal Conduits:
  - .1 Supports - Horizontal conduit shall be supported at sufficiently close intervals to keep it in alignment and prevent sagging.
  - .2 EMT tubing - tubing shall be supported at approximately 1.2 m [4 ft] intervals for tubing.
- .5 Do not brace conduit runs against each other. Use separate support and restraint system.
- .6 Support all conduits in accordance with the capability of the pipe to resist seismic load requirements indicated.
- .7 Trapeze hangers may be used. Provide flexible conduit connections where conduits pass through building seismic or expansion joints, or where rigidly supported conduits connect to equipment with vibration or seismic isolators.
- .8 A conduit system shall not be braced to dissimilar parts of a building or two dissimilar building systems that may respond in a different mode during an earthquake. Examples: wall and a roof; solid concrete wall and a metal deck with lightweight concrete fill.
- .9 Provide large enough conduit sleeves through walls or floors to allow for anticipated differential movements with firestopping where required.
- .10 It is the responsibility of the contractor to ascertain that an appropriate size restraint device be selected for each individual piece of equipment. Submit details on shop drawings. Review with seismic consultant and submit shop drawings to Departmental Representatives for their reference.

### **3.3 FLOOR MOUNTED EQUIPMENT**

- .1 Bolt all equipment, e.g. transformers, switchgear, generators, motor control centres, free standing panelboards, control panels, capacitor banks, etc. to the structure. Design anchors and bolts for seismic force applied horizontally through the center of gravity to a seismic force of 0.5g. For equipment which may be subject to resonances, use a nominal 1.0 g seismic force.
- .2 Provide flexible conduit connections between floor mounted equipment to be restrained and its adjacent associated electrical equipment.

### **3.4 LIGHT FIXTURES**

- .1 Fixtures in suspended ceilings shall be hung independently of the ceiling system. Fixtures shall be secured to concrete or structural deck above by at least two taught cables which are connected to the fixture at diagonal points.
- .2 Surface and recessed style fixtures shall be hung independently of the ceiling system. Fixtures shall be secured to concrete or structural deck above by taut cables.
- .3 Fixtures which are hung independently of ceiling systems shall have minimum of one seismic cable in addition to the chain or cable used to support the fixture. Seismic restraint cables shall be secured into the concrete or structural deck above.

- .4 Cables shall be corrosion resistant and approved for the application.
- .5 Fixtures which are rod hung shall have seismic ball alignment fittings at the ceiling and fixture.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED SECTIONS**

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

**1.2                EXCAVATION AND BACKFILL**

- .1            Check the drawings of other Divisions of the work for the existence of underground services, and report any serious interference before proceeding with the work. The services of Utility Authorities shall be engaged to accurately determine the location of any underground services prior to excavation.
- .2            Carefully coordinate conduit locations below building with the structure.
- .3            In the execution of this work, or any extra work in connection therewith, do not move any structure or services without the consent of the proper parties. In crossing or running parallel with said structures or services, secure same in place until the work is completed. Any damage to structures or services of this kind caused by neglect to attend to same shall be paid for by the Contractor.
- .4            Keep excavations dry at all times by bailing, pumping, or other means as is necessary.
- .5            Prove grades and the route of ductwork and conduits and the location of manholes far enough along the route in advance of forming and concrete pour so that any relocation or re-design necessitated by unforeseen obstacles may be carried out.
- .6            Grade the bottom of trenches for ducts and conduit and level with pit-run gravel and sand, graded from coarse to fine with a maximum size of 38mm [1½"]. Where excavation is carried out to a depth greater than that required for the proper elevation for the ducts, duct bank, or conduit, backfill with carefully compacted and power-tamped sand and pit-run gravel as specified to the required grade.
- .7            Backfill trenches under building floor areas with sand placed in layers in an approved manner to achieve 95% modified Proctor compaction. Material from excavation shall not be used for backfilling.
- .8            In locations other than under building floor areas, thoroughly tamp same around and over ducts and conduits to a height of at least 300mm [12"] above. Fill remainder of trench and consolidate on 450mm [18"] layers with approved excavated materials, free from stone and foreign materials.
- .9            Except where beneath the building, supply and install polyethylene HIGH VOLTAGE marking tape over and along the full length of underground services at a depth of 300mm [12"] below grade.
- .10          Backfill the top 150mm [6"] of the excavation with pit-run gravel where the excavation is situated on a paved or travelled road; crushed rock screenings where the excavation is

situated on a concrete sidewalk; black loam where the excavation is on a developed grass boulevard; and sand or earth free of clay, extraneous material, or rock no larger than 38mm [1½"] in any dimensions elsewhere. All shall be thoroughly tamped. Where area was originally grassed, rake loam clear of all stones and debris and leave ready for re-sodding.

- .11 Backfill as soon as possible, so that regular traffic in and around the work will not be inconvenienced.
- .12 Fill depressions to restore the correct grade after a period adequate to reveal settlement has passed. Restore all surfaces (paving, sidewalk, grass) to same quality as the surroundings. Assume responsibility for making good any subsequent settlement of such fill. Pay costs involved in making good pavement, surfacing lawns, curbs and all other surfaces damaged by such settlement and subsequent restoration.
- .13 Store materials excavated during the progress of the work in such locations as directed by the Departmental Representative and in such a manner as to produce a minimum of inconvenience, damage or disfigurement of existing ground.
- .14 Remove and dispose of excess excavated material remaining on completion of the work and leave site clear and unencumbered.

### **1.3 WATERPROOFING/VAPOUR BARRIERS**

- .1 Generally penetrations through waterproofing members and vapour barriers will not be permitted. However, where any work must pierce vapour barriers and waterproofing membranes including waterproofed concrete, the method of installation, colour of caulking material and location of penetration shall be as approved by the Departmental Representative and as coordinated with Division 07 prior to proceeding with the work. Supply and install all necessary sleeves, caulking and flashing and make the penetrations watertight. For penetrations of vapour barrier, maintain integrity of the system. Restore penetrations through existing surfaces to match the surroundings.
- .2 Provide specified caulking around all exterior recessed lighting fixtures in concrete steps, walls, etc.
- .3 Provide clear silicon bead on top and down both sides of all exterior wall mounted devices (e.g. light fixtures and gongs) where devices are exposed to the weather.

### **1.4 EQUIPMENT FINISHES**

- .1 Thoroughly degrease all metalwork and apply one overall coat of zinc chromate primer to all electrical equipment enclosures, supports, switchgear cubicles, bus ducts, gutters, panelboards, low tension and other cabinets. Unless otherwise directed, apply one overall coat of grey enamel and a second coat of gloss enamel. Paint all exposed surfaces Grey ASA #61 unless matching existing equipment in which case colour shall match existing.

- .2 Unless otherwise directed, paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1-1955.
- .3 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint. Ensure that equipment finishes are not defaced during installation. Scratched or otherwise marred surfaces shall be refinished before the job will be accepted. Other surfaces shall be completely repaired to match original paint. Patching of damaged area will not be accepted.
- .4 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.
- .5 Generally, equipment finishes shall be as outlined under applicable sections of the specifications.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED WORK**

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

**1.2                BRANCH WIRING**

- .1            Adhere to the circuit numbers indicated on the drawings. Provide all branch circuit wiring using materials and methods described herein and in consultation with the Departmental Representative.
- .2            Calculate volt drop of all feeders and branch circuit wiring and increase wire sizes based on actual wire run to meet the minimum requirements of the Canadian Electrical Code.
- .3            Install a green insulated bonding conductor in all conduits; do not rely on metallic conduit for bonding continuity. Size bonding conductor as per the Canadian Electrical Code.
- .4            Phase all panelboard buses throughout the building such that the left, centre, and right hand buses represent phase A, B, and C respectively. Identify all indicating meters to this sequence.
- .5            Provide all conduits and wiring including flexible connections, outlet boxes complete with wiring devices and surface raceways for all casework and millwork as shown on the drawings, unless otherwise noted. Arrange conduit so that it will be completely concealed along the entire run to the outlet.
- .6            Where wiring devices are indicated on free-standing benches or tables, locate conduit so that it will be concealed along the entire run to the outlet. Location of conduit floor penetrations shall be to the approval of the Departmental Representative. Conduits will not be permitted to run in concrete floor or topping or below slab on grade.
- .7            Wire to all electrical appliances indicated on the drawings. The word appliance is intended to include cooking equipment not of 'plug-in' nature, laundry equipment, stills, hot water tanks, and other special equipment throughout the building for which outlets are indicated on the drawings or noted in the equipment schedule. Use flexible conduit or liquid-tight flexible conduit for connection from outlets to appliances.
- .8            Unless otherwise noted, appliances will be supplied and set in place in the rooms by others. Check with the trades involved and with the Departmental Representative to determine correct orientation of the appliances, the final and exact location and electrical requirements of each outlet (both control and supply) before proceeding with the installation.
- .9            Prior to rough-in of outlet boxes confirm final furniture layout with the Departmental Representative.
- .10          Prior to installation of switch outlets, confirm door swing on Drawings. Where switch cannot be located on latch side of door, install the outlet box a minimum of three feet from the door swing, do not install switch behind door.

- .11 Wiring circuits for electronic equipment, such as computers, printers and Communications equipment shall have a separate dedicated neutral for each and every circuit.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED SECTIONS**

- .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                REFERENCES**

- .1        Canadian Standards Association (CSA International)
  - .1        CAN/CSA-C22.2No.18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
  - .2        CSA C22.2No.65, 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)

**Part 2            Products**

**2.1                MATERIALS**

- .1        Pressure type wire connectors to: CSA C22.2No.65, with current carrying parts of copper alloy sized to fit copper conductors as required.
- .2        Fixture type splicing connectors to: CSA C22.2No.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 round copper conductors.
  - .2        Clamp for round copper conductors.
  - .3        Clamp for stranded aluminum conductors round aluminum bar.
  - .4        Stud clamp bolts.
  - .5        Bolts for copper conductors and bar.
  - .6        Bolts for aluminum conductors and bar.
  - .7        Sized for conductors or bars as indicated.
- .4        Clamps or connectors for armoured cable, aluminum sheathed 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 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
  - .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2No.65.
  - .3 Install fixture type connectors and tighten. Replace insulating cap.
  - .4 Install bushing stud connectors in accordance with EEMAC 1Y-2/NEMA.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED WORK**

- .1        This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.
- .2        Refer to Division 27 & 28 for particular Communications, Electronic Safety & Security wiring systems and types.

**1.2                TERMS OF REFERENCE**

- .1        Use insulated 98% conductivity copper conductor wiring for the all communication systems unless otherwise indicated. Refer to "Site Services" Section for allowable site conduits as an alternative to steel.
- .2        Aluminium conductors only permitted where indicated on drawings and then typically only for feeder conductors larger than 3/0 AWG. All conductor sizes indicated on drawings are based on copper conductors unless otherwise noted.
- .3        Teck cable may only be used where specifically indicated on the drawings or in the specifications. Where permitted, Teck wiring up to 750 system volts to be PVC jacketed armoured cable, multi-copper conductor type Teck90 1000 volt having a PVC jacket with FT-4 flame spread rating.
- .4        Flexible armoured cabling (AC90) and NMD90 is permissible to be used for the general wiring systems.
- .5        Provide all control wiring except mechanical equipment controls as specified in Section 26 24 21 Mechanical Equipment Controls and the Mechanical Divisions.
- .6        Refer to Equipment Schedule(s) for detailed responsibilities.
- .7        Non-metallic sheathed copper cable type: NMD90XLPE size as indicated.

**1.3                PRODUCT DATA**

- .1        Provide product data in accordance with Division 01

**Part 2            Products**

**2.1                WIRING & CABLES – GENERAL**

- .1        Conductors: stranded for 10 AWG and larger. Minimum size #12 AWG.
- .2        Insulation to be 300 volt NMD90 for the general building wiring.
- .3        Use RWU75XLPE for underground installations.
- .4        Site services sub-circuits, including site lighting, to be minimum #10 AWG for power and #12 AWG for controls. Increase wiring size for lengthy and/or loaded circuits so that system will not exceed the maximum voltage drop as recommended by the Canadian Electrical Code CSA 22.1.

- .5 Main feeders to be conduit and copper insulated wiring unless otherwise noted on drawings. Provide bond wiring for all conduits. Increase conduit size as required.
- .6 Armoured (AC-90) cable "Tite Bite" connectors and their counterparts of other manufacturers shall not be used. Use anti-short connectors.
- .7 Conductors to be colour-coded. Conductors #10 AWG and smaller shall have colour impregnated into insulation at time of manufacture. Conductors size #8 AWG and larger may be colour-coded with adhesive colour coding tape, but only black insulated conductors shall be employed in this case, except for neutrals which shall be white wherever possible. Where colour-coding tape is utilized, it shall be applied for a minimum of 50 mm at terminations, junctions and pullboxes and conduit fittings. Conductors shall not be painted.
- .8 Where cabling is required to be protected by a minimum of 1-hour (or greater) fire rating the electrical contractor shall provide 2 hour rated cabling (Vitalink Armored cabling or Vitalink Ethernet for communications). All installation methods shall meet the manufacturers recommendations and UL 2196 and CAN/ULC-S101 requirements. Note: fire rated shafts for conductors is not an acceptable method of fire protection.

## 2.2 **TECK CABLE**

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Conductors: copper and sized as indicated.
- .3 Insulation: Chemically cross-linked thermosetting polyethylene rated type RW75XLPE,600V
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: flat galvanized steel.
- .6 Overall covering: PVC jacket with FT-6 flame spread rating. PVC flame retardant jacket over armour meeting requirements of Vertical Tray Fire Test of CSA C22.2 No. 0.3 with maximum flame travel of 1.2 m.
- .7 Fastenings:
  - .1 One (1) hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
  - .2 Channel type supports for two (2) or more cables.
  - .3 Threaded rods: 6 mm dia. to support suspended channels.
- .8 Connectors: Watertight approved for TECK cable

## 2.3 **ARMOURED CABLE (AC-90)**

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90 600 V rated.
- .3 Armour: interlocking type fabricated from galvanized steel.
- .4 Anti-short connectors.
- .5 AC-90 cable is only to be used where permitted by the Departmental Representative.

## **2.4 LOW VOLTAGE CONTROL CABLES**

- .1 Type LVT: soft annealed copper conductors, with thermoplastic insulation, outer covering of thermoplastic jacket. Minimum size #18 AWG. FT-6 Rated.
- .2 Unless otherwise specified wiring to be multicore individually identified and colour coded with grey sheath.

## **2.5 NON-METALLIC SHEATHED CABLE**

- .1 Non-metallic sheathed copper cable type: NMD90XLPE, size as indicated.

## **2.6 WIRE & BOX CONNECTORS**

- .1 Pressure type wire connector current carrying parts to be copper and sized to fit conductors used.
- .2 Fixture type splicing connector current carrying parts to be copper sized to fit conductors 10 AWG or less.
- .3 Bushing stud connectors to EEMAC 1Y-2 and suitable for stranded copper conductors
- .4 Clamps or connectors for armoured cable, flexible conduit, as required.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install all cables and wiring.
- .2 Conductor length for parallel feeders to be identical. Provide permanent plastic nametag indicating load fed.
- .3 Group Teck, Armoured, MI & Sheathed cables on channels wherever possible.
- .4 Lace or clip groups of feeder conductors at all distribution centres, pullboxes, and termination points.
- .5 Wiring in walls should typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls should be avoided unless indicated.
- .6 All grounding and bonding conductors and straps to be copper. All bonding conductors to have green insulation jacket.
- .7 Colour coding to be strictly in accordance with Section 26 05 00 – Common Work Results.
- .8 Provide sleeves where cables enter or exit cast concrete or masonry.
- .9 Power wiring up to and including #6 AWG shall be spliced with nylon-insulated expandable spring-type connectors. Large conductors shall be spliced using split-bolt or other compression type connectors wrapped with cambric tape then PVC tape.
- .10 Wires shall be sized for 2% maximum voltage drop to farthest outlet on a loaded circuit. Increase home run cable size to meet these requirements.

- .11 All branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.
- .12 Provide numbered wire collars for all control wiring. Numbers to correspond to control drawing legend. Obtain wiring diagram for control wiring of other Divisions.

### **3.2 VOLTAGE REGULATION**

- .1 The drawings are diagrammatic and indicate the general routing of conduit runs and not exact routing, either horizontally or vertically.
- .2 Branch circuit conductor sizes shall be #12 AWG or larger based on the Canadian Electrical Code CSA 22.1 Section 8, which allows a maximum 3% voltage drop for branch circuits.

### **3.3 WIRE & BOX CONNECTORS**

- .1 Remove insulation carefully from ends of conductors and:
  - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65
  - .2 Install fixture type connectors and tighten. Replace insulating cap.
  - .3 Install bushing stud connectors in accordance with EEMAC 1Y-2

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED REQUIREMENTS**

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

**1.2                REFERENCES**

- .1        American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE) – most recent version
  - .1        ANSI/IEEE 837, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.
  - .2        Grounding equipment to: CSA C22.2 No.41.
  - .3        All grounding conductors to be stranded soft annealed copper unless otherwise noted.
  - .4        Install complete grounding and bonding system in accordance with Canadian Electrical Code and local inspection authority requirements.
  - .5        ANSI/TIA 607B Generic Telecommunications Bonding and Grounding for Customer Premises.

**Part 2            Products**

**2.1                EQUIPMENT**

- .1        Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
- .2        Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, soft annealed, size as indicated.
- .3        Rod electrodes: copper clad steel 19 mm diameter by minimum 3 m long.
- .4        Plate electrodes: to CSA Standard 41.
- .5        Grounding conductors: bare stranded copper, tinned, soft annealed, size as per C.E.C.
- .6        Insulated grounding conductors: green, copper conductors, sized as per C.E.C.
- .7        Ground bus: copper, complete with insulated supports, fastenings, connectors.
- .8        Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
  - .1        Grounding and bonding bushings.
  - .2        Protective type clamps.
  - .3        Bolted type conductor connectors.
  - .4        Thermit welded type conductor connectors.
  - .5        Bonding jumpers, straps.
  - .6        Pressure wire connectors.

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## **2.2 STANDARDS OF ACCEPTANCE**

- .1 Acceptable manufacturers:
  - .1 Burndy Corp.
  - .2 Erico Inc.
  - .3 Cadweld.

## **Part 3 Execution**

### **3.1 EXAMINATION**

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

### **3.2 INSTALLATION GENERAL**

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermite process, permanent mechanical connectors or inspectable wrought copper compression connectors to ANSI/IEEE 837.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Install bonding wire in EMT conduits.
- .7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .9 Install separate ground conductor to outdoor lighting standards.
- .10 Connect building structural steel and metal siding to ground by welding copper to steel.
- .11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .12 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.
- .13 Ground secondary service pedestals.

- .14 Provide a grounding/bonding bus in each electrical room and in the Generator room. Connect a #2/0cu bonding conductor or as shown on the drawings between grounding/bonding buses.
- .15 All bonding and grounding connections to be compression type unless noted otherwise.
- .16 Bond bonding bus of switchboard to the grounding grid with a #3/0 copper conductor.
- .17 Ground the secondary winding of potential and current transformers.
- .18 Supply and install complete grounding and bonding system as indicated and as required by Canadian Electrical Code and the local electrical inspection authorities.
- .19 Provide grounding/bonding bus bars mounted on standoff insulators or as shown on the drawings.
- .20 All components shall be securely and adequately bonded and where required to accomplish this, bonding jumpers, grounding studs and bushings shall be used.
- .21 Ensure that all raceways, terminal panels, etc. for fire alarm, etc. are securely and adequately bonded and provide grounding conductor to main ground bus where called for or when required.
- .22 All interior metallic gas piping which may become energized to be made electrically continuous and to be bonded in accordance with requirements of Canadian Electrical Code.
- .23 Bond all low tension equipment with #6 AWG green insulated bonding conductor.
- .24 Bond all structural steel, all concrete reinforcing steel and all metal systems with a #6 AWG copper bonding conductor. Connect to closest ground bus or bonding point.
- .25 All metallic conduits longer than 1m in length, containing a single grounding or bonding conductor, shall be bonded as per the Canadian Electrical Code.

### **3.3 ELECTRODES**

- .1 Make ground connections to continuously conductive underground water pipe on street side of water meter.
- .2 Install water meter shunt.
- .3 Install concrete encased electrodes in building foundation footings, with terminal connected to grounding network.
- .4 Install rod electrodes and make grounding connections as indicated.
- .5 Bond separate, multiple electrodes together.
- .6 Use size 2/0 AWG copper conductors for connections to electrodes.
- .7 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

### **3.4 SYSTEM AND CIRCUIT GROUNDING**

- .1 Install system and circuit grounding connections to neutral of primary system, secondary 240/120V 3 wire system.



### **3.5 EQUIPMENT BONDING**

- .1 Install bonding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, UPS units, elevators and escalators, distribution panels, outdoor lighting and cable trays.
- .2 Provide a bonding conductor from the secondary of every distribution transformer to the grounding system. Bond conductor to be sized and installed in accordance with Canadian Electrical Code.

### **3.6 GROUNDING BUS**

- .1 Provide a ground bus in the main electrical room. Ground bus shall consist of suitable length of 50mm x 6mm [2"x 1/4"] copper bus mounted on a 25mm [1"] insulating standoffs. This bus shall be drilled and tapped to receive all the bonding conductors indicated and an engraved nameplate or tag installed above or below individual conductors indicating their function.
- .2 Bond items of electrical equipment in electrical room and IT equipment in communication equipment room to ground bus with individual bare stranded copper connections size 2/0AWG.

### **3.7 MECHANICAL EQUIPMENT BONDING**

- .1 Bond wires to be installed in all conduit serving motor feeder circuits and to extend to ground screws on junction and outlet boxes for bonding.

### **3.8 COMMUNICATION SYSTEMS**

- .1 Install Bonding connections for telephone, sound, fire alarm, security systems, intercommunication systems as required in ANIS/TIA 607B:
  - .1 Utility Provider grounding system in accordance with telephone company's requirements.
  - .2 Communication, sound, fire alarm, security systems, intercommunication systems as indicated.

### **3.9 SYSTEMS BONDING**

- .1 Install a home run #6 AWG insulated bonding conductor in conduit from the main ground bus to the:
  - .1 Main Security panel.
  - .2 Communication systems head end.

### **3.10 LABELLING**

- .1 Provide equipment identification labelling nameplates for grounding bus bar, bonding and grounding conductors.
- .2 Apply identification and warning labels to grounding bus bar, bonding and grounding conductors.

**3.11 FIELD QUALITY CONTROL**

- .1 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .2 Perform tests before energizing electrical system.
- .3 Disconnect ground fault indicator during tests.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

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

**Part 2            Products**

**2.1                SUPPORT CHANNELS**

- .1            U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted, suspended or set in poured concrete walls and ceilings.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1            Secure equipment to hollow and solid masonry, tile and plaster surfaces with lead anchors or nylon shields.
- .2            Secure equipment to poured concrete with expandable inserts.
- .3            Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4            Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .5            Fasten exposed conduit or cables to building construction or support system using straps.
  - .1            One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
  - .2            Two-hole steel straps for conduits and cables larger than 50 mm.
  - .3            Beam clamps to secure conduit to exposed steel work.
- .6            Suspended support systems.
  - .1            Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
  - .2            Support 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            Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .8            Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

- .9 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .10 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.
- .11 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**

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**Part 1            General**

**1.1                RELATED WORK**

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

**Part 2            Products**

**2.1                SPLITTERS**

- .1            Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2            Main and branch lugs, connection bars to match required size and number of incoming and outgoing conductors as indicated.
- .3            At least three spare terminals on each set of lugs in splitters less than 400 A.

**2.2                JUNCTION AND PULL BOXES**

- .1            Welded steel construction with screw-on flat covers for surface mounting.
- .2            Covers with 25 mm [1"] minimum extension all around, for flush-mounted pull and junction boxes.

**2.3                CABINETS**

- .1            Type E: sheet steel, hinged door and return flange overlapping sides, handle and catch, for surface mountings.
- .2            Type T: sheet steel cabinet, with full length hinged door, latch, lock, 2 keys, containing 19 mm G1S fir plywood backboard for surface or flush mounting as appropriate.
- .3            Include filtered vents and/or fan-cooling when enclosed equipment is heat producing.

**Part 3            Execution**

**3.1                SPLITTER INSTALLATION**

- .1            Install splitters as indicated and mount plumb, true and square to the building lines.
- .2            Extend splitters full length of equipment arrangement except where indicated otherwise.

**3.2                JUNCTION, PULL BOXES AND CABINETS INSTALLATION**

- .1            Install pull boxes in inconspicuous but accessible spaces.
- .2            Only main junction and pull boxes are indicated. Provide pull boxes so as not to exceed 30 m of conduit run between pull boxes.
- .3            Provide pull boxes and junction boxes in locations shown on the drawings and as required to suit job conditions.

- .4 Locate pull boxes and junction boxes above removable ceilings, in electrical rooms, utility rooms or storage areas.
- .5 Junction boxes, when used, to be installed in areas that are accessible through luminaire openings, and/or access panels.
- .6 Where pull boxes are flush mounted, provide overlapping covers with flush head cover retaining screws, prime coated and painted to match wall or ceiling finish.
- .7 Where cast corrosion resistant boxes are used, covers to be of matching type and gasketed.
- .8 For special (not 100mm [4"] square or octagonal) pull boxes and/or junction boxes, paint identification for the system and provide lamicaid nametags to box covers with a size 2 nameplate 5mm [0.25"] lettering identifying system.
- .9 Interior of all pull boxes and junction boxes for each system to be spray painted with colour as specified in Section 26 05 00
- .10 All pull boxes, junction boxes and cabinets to be supported directly from building structure using one or a combination of galvanized screws, galvanized bolts, galvanized rods, and approved box clip.
- .11 Support of pull boxes, junction boxes by conduit fittings or wire is not acceptable.

### **3.3 CABINETS INSTALLATION**

- .1 Mount cabinets with top not higher than 2 m [6'] above finished floor.
- .2 Cabinets shall be flush mounted in finished areas where depth can be accommodated in the walls. Provide flush trim to suit.
- .3 Provide fit up in Type T cabinets as indicated.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED WORK**

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

**Part 2 Products**

**2.1 OUTLET AND CONDUIT BOXES IN GENERAL**

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm [4"] square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped. Do not use sectional boxes.
- .4 Blank cover plates for boxes without wiring devices.
- .5 Combination boxes with barriers where outlets for more than one system are grouped shall be multi-gang boxes.

**2.2 SHEET STEEL OR PVC OUTLET BOXES**

- .1 PVC or Electro-galvanized steel single and multi-gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm [3" x 2" x 1.5"] or as indicated. Larger 102 mm square x 54mm deep [4"x 2"] outlet boxes to be used when more than one conduit enters one side. Provide extension and plaster rings as required.
- .2 For larger boxes use GSB solid type as required.
- .3 Boxes for surface mounted switches, receptacles, communications, telephone to be 100mm square PVC with cover plate colour to be determined by Departmental Representative.
- .4 Lighting fixture outlets: 102 mm [4"] square outlet boxes or PVC octagonal outlet boxes.
- .5 103 mm [4"] square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster and/or tile walls.

**2.3 MASONRY BOXES**

- .1 Electro-galvanized steel masonry single and multi-gang type MDB boxes for devices flush mounted in exposed block walls.

**2.4 CONCRETE BOXES**

- .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

**2.5 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.

## **2.6 SURFACE CONDUIT BOXES**

- .1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles.

## **2.7 FITTINGS – GENERAL**

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of foreign materials.
- .3 Conduit outlet bodies for conduit up to 35 mm [1.25"] Use pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal or plastic boxes.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Typical outlet box mounting heights are indicated in Section 26 05 00 or refer to wiring device and communication specification sections and to Departmental Representative's layouts for particular mounting heights of outlet boxes where indicated.
- .2 Support boxes independently of connecting conduits.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm [0.25"] of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers not to be used.
- .5 All outlet boxes to be flush mounted in all areas, excluding mechanical rooms, electrical rooms, and above removable ceilings.
- .6 Adjust position of outlets in finished masonry walls to suit masonry course lines. Coordinate cutting of masonry walls to achieve neat openings for all boxes. All cutting of masonry work for installation of electrical fittings to be done using rotary cutting equipment.
- .7 No sectional or handy boxes to be installed.
- .8 When installed in wood walls, plastic outlet boxes shall only be used with permission of the Departmental Representative.
- .9 Provide vapour barrier wrap or boots behind outlets mounted in exterior walls. Maintain integrity of the vapour barrier and insulation to prevent condensation through boxes.
- .10 Coordinate location and mounting heights of outlets above counters, benches, splash-backs and with respect to heating units and plumbing fixtures. Coordinate with Departmental Representative's details.
- .11 Outlets installed back to back in party stud walls to be off-set by one stud space.
- .12 Back-boxes for all communications systems equipment to be provided in accordance with specific manufacturer's recommendations and as specified in the communications sections of these specifications.



- .13 Separate outlets located immediately alongside one another to be mounted at exactly the same height above finished floor. Similarly, outlets mounted on a wall in the same general location at varying heights to be on the same vertical centre-line unless otherwise noted.
- .14 Where outlet boxes penetrate through a fire separation, ensure that the boxes are externally tightly fitted with an approved non-combustible material to prevent passage of smoke or flame in the event of a fire.
- .15 Conduit for floor mounted boxes shall terminate with a locknut and bushing in base of the fitting. Seal around conduit and the conduit itself after installation of conductors with heavy density fiberglass.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED WORK**

- .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 SCOPE**

- .1 Conduit is required for the main service feeder.
- .2 Rigid PVC conduit is to be used for all in-ground conduit systems.
- .3 Unless noted, conduit is not required for typical wiring. The specifications within detail conduit requirements only where conduit is mandated.
- .4 Drawings do not show all conduits. Those shown are in diagrammatic form only.
- .5 Where conduits are required, conceal all conduits where possible in finished areas. Conduits may be surface mounted either only where indicated or in service areas accessible only to authorized personnel.
- .6 If a finished area is concrete (existing) or concealment is not practical, obtain ruling from Departmental Representative's where exposed wiremold may be substituted.
- .7 Note particular requirements for routing of conduits where detailed.
- .8 Provide polypropylene pull cord in all "empty" conduits.

**Part 2 Products**

**2.1 CONDUITS**

- .1 Rigid metal conduit: to CSA C22.2 No.45 Galvanized Steel.
- .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 liquid-tight flexible metal conduit.

**2.2 CONDUIT FASTENINGS**

- .1 One hole steel straps to secure surface conduits 41mm [1.5"] and smaller. Use two hole steel straps to conduits larger than 41mm [1.5"].
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits.
- .4 10mm [3/8"] threaded rods to support suspended channels.

**2.3 CONDUIT FITTINGS**

- .1 Fittings manufactured for use with conduits specified. Coating same as conduit.

- .2 Provide factory "ells" where 90 degree bends are required for 27mm [1"] and larger conduits.
- .3 EMT couplings and connectors shall be steel, or Regal Die-cast zinc alloy. Couplings used on conduit containing fire-rated cable shall be steel. Regular die-cast alloy fittings and couplings are not acceptable. Provide plastic bushings (insulated throat) for all connectors for 27mm EMT or larger. Provide water-tight connectors in damp or wet locations and for surface equipment (e.g. Panelboards, MCC's, etc.) in rooms that are fire sprinkler protected.

#### **2.4 EXPANSION FITTINGS FOR RIGID CONDUIT**

- .1 Weatherproof expansion fittings with internal bonding assembly suitable linear expansion.
- .2 Water-tight expansion fittings: with integral bonding jumper, suitable for linear expansion and 21mm [3/4"] deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel as required.

#### **2.5 RIGID P.V.C. CONDUIT**

- .1 Conduit: rigid non-metallic conduit of unplasticized polyvinyl chloride as manufactured C.G.E. "Sceptre".
- .2 Fittings: threaded male or female solvent weld connectors and solvent weld couplings, as supplied by conduit manufacturer.
- .3 Solvent: as recommended by conduit manufacturer.

### **Part 3 Execution**

#### **3.1 INSTALLATION - GENERAL**

- .1 Where noted on drawings, use electrical metallic tubing (EMT) in the building interior and in above grade slabs except where subject to mechanical injury or where otherwise indicated.
- .2 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass. Set out the work and coordinate with other services prior to installation. Maintain access to junction and pull boxes.
- .3 Where practical conceal conduits.
- .4 Any exposed conduit in finished areas to be free of unnecessary labels and trademarks.
- .5 All conduit ends to be reamed to ensure a smooth interior finish that will not damage the insulation of the wiring.
- .6 Ensure bonding continuity in all conduit systems.
- .7 Surface conduits are acceptable in mechanical and electrical service rooms and in unfinished areas or where indicated.
- .8 Use rigid galvanized steel (RGS) threaded conduit where the installation is subject to mechanical injury. In any event, use RGS conduit for surface installations up to 1.5m [5'] above the finished floor.

- .9 Field threads on rigid conduit shall be sufficient length to draw conduits ends together.
- .10 Unless otherwise noted and where practical, all conduits to be routed through the ceiling space rather than in, or below, slabs or floor structures to facilitate future changes.
- .11 Conduits in walls should typically drop (or loop) vertically from above to better facilitate future renovations. Generally conduits from below and horizontal conduits in walls and concrete structures should be avoided unless indicated.
- .12 All communication conduits to be minimum 27 mm [1"] diameter unless otherwise indicated.
- .13 Generally use Rigid PVC conduits in or below ground level slab unless otherwise noted. Transition to RGS conduit in exposed locations: eg where conduits emerge from ground level slab.
- .14 Conduits are not permitted in terrazo or concrete toppings.
- .15 Cap turned up conduits to prevent the entrance of dirt or moisture during construction.
- .16 Locate conduits more than 75mm [3"] parallel to steam or hot water lines with a minimum of 25mm [1"] at crossovers.
- .17 Bend conduits cold, so that conduit at any point is not flattened more than 1/10th of its original diameter. Conduits bent more than this or kinked to be replaced.
- .18 Provide polypropylene pull cord in empty conduits to facilitate pulling wiring in future.
- .19 Where conduits become blocked, the use of corrosive agents is prohibited. Remove and replace blocked section.
- .20 Damaged conduits to be repaired or replaced.
- .21 Dry conduits out thoroughly before installing wiring. Swab out conduit and thoroughly clean internally before wires and cables are pulled.
- .22 Conduits shall not pass through structural members except as indicated.
- .23 Conduit sizes indicated on drawings are minimum only. Increase sizes as required to suit alternative wiring types, to comply with Code or for ease of conductor installation.
- .24 Conduits and ducts crossing building expansion joints shall have approved conduit expansion fittings to suit the type of conduit used.
- .25 Seal conduits with approved sealant where conduits are run between heated and unheated areas.
- .26 Seal openings with approved sealant where conduits, cables, or cable trays pierce fire separations.
- .27 Where conduits pass through walls, they shall be grouped and installed through openings. After all conduits are installed, wall openings shall be closed with material compatible with the wall construction and/or to meet any fire separation integrity.
- .28 Where drawings show conduit designations, these conduits shall be identified at each point of termination with labels.
- .29 Use "Condulet" fittings for power and telephone type conduit terminations in lieu of standard boxes where box support is not provided.

- .30 Provide necessary roof jacks or flashing where conduits pass through roof or watertight membranes. Apply approved sealant to maintain membrane integrity.
- .31 Use flexible metal conduit for connection to recessed luminaires without a prewired outlet box.
- .32 Use liquid tight flexible metal conduit for connection to motors sprinkler monitoring devices, and other vibrating equipment and transformers.
- .33 Use explosion proof flexible connection for connection to explosion proof motors.
- .34 Install conduit-sealing fittings in hazardous areas, isolation rooms and clean rooms. Fill with compound.

### **3.2 SURFACE CONDUITS**

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with minimum 1.5m [5'] clearance.
- .3 Conduits to be run in flanged portion of structural steel.
- .4 Group conduits wherever possible on suspended and/or surface channels.
- .5 Surface conduits will not be accepted in finished areas unless detailed.

### **3.3 EXPANSION JOINT CONDUIT FITTINGS**

- .1 Provide conduit expansion joint fittings at concrete expansion joint.

### **3.4 RIGID P.V.C. CONDUIT**

- .1 Use in accordance with the Canadian Electrical Code and Building Codes and as noted below:
- .2 Use as raceways for following applications
  - .1 In poured slab on grade concrete floors and walls and for underground runs exterior to the buildings unless otherwise noted.
  - .2 Wiring installed in areas subject to intermittent or continuous moisture but not surface mounted.
  - .3 Rigid PVC conduit shall not be surface mounted or exposed within buildings.
- .3 Do not use in return air plenums or for exit light circuits and emergency lighting.
- .4 Provide insulated ground wire in all rigid PVC conduits in accordance with the Canadian Electrical Code.
- .5 Where rigid PVC conduit is set in poured concrete, solvent joints must be completed and allowed to set as per manufacturer's instructions before pour.
- .6 Bend rigid conduit in strict accordance with manufacturer's directions. Distorted bends will not be accepted.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED REQUIREMENTS**

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

**1.2                REFERENCE STANDARDS**

- .1            CSA Group (CSA)
  - .1            CAN3-C17, Alternating - Current Electricity Metering.

**Part 2            Products**

**2.1                UTILITY METER**

- .1            To Utility's requirements and standards. It is the electrical contractor's responsibility to coordinate and follow the Utility's standards.

**Part 3            Execution**

**3.1                METERING INSTALLATION**

- .1            Install meters and instruments in locations acceptable to the utility, free from vibration and shock.
- .2            Make connections in accordance with diagrams.

**3.2                FIELD QUALITY CONTROL**

- .1            Conduct tests in accordance with Section 26 05 00 - Common Work Results for Electrical and in accordance with manufacturer's recommendations.

**3.3                PROTECTION**

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

**END OF SECTION**

**Part 1            General**

**1.1                RELATED WORK**

- .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                PLANT ASSEMBLY**

- .1        Install circuit breakers in panelboards before shipment from plant.
- .2        Install and prewire low voltage relays assemblies where indicated.
- .3        In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .4        All panelboards to be of a common manufacturer.

**1.3                FINISH**

- .1        Apply finishes in accordance with Section 26 05 00.
- .2        Panel finish in electrical and equipment rooms and closets to be standard ASA Grey baked enamel for normal power service. Confirm with Departmental Representative prior to shop finishing panels.
- .3        Panels in finished and/or public areas to be either as clause .2 above or prepared to accept painting to closely match surroundings as directed by the Departmental Representative. In the later instance, the final paint coat to be done by Division 09 but coordinated by the Electrical Division in particular for protection and masking of locks and sensitive parts. Confirm with Departmental Representative prior to paint finishing panels.

**Part 2            Products**

**2.1                PANELBOARDS, DOORS AND TRIMS**

- .1        Bus and breakers rated for 10 KA symmetrical, minimum, interrupting capacity.
- .2        Copper bus with full size neutral.
- .3        Minimum 20% spare capacity.
- .4        Mains, number of circuits and number and size of branch circuit breakers as indicated.
- .5        Provide all necessary connectors and mounting hardware in every space to facilitate installation of future breakers. Provide blank fillers for all spaces.
- .6        Concealed hinges and concealed trim mounting screws, hinged locking door with flush catch.
- .7        Panelboards to have flush doors. (Gasketed where required).
- .8        Provide two keys for each panelboard and key similar voltage panelboards alike.
- .9        Panel tubs to be typically 600mm [20"] wide.

- .10 Provide "sprinkler-proof" design in areas where sprinkler fire protection is installed. In any event, all surface mounted enclosures to be complete with sprinkler drip cover.
- .11 Provide door within door trims where indicated to facilitate ease of service maintenance Each tub trim cover to be hinged and self-supporting and to swing out to expose breaker cable terminations and wireways. Hinged trim shall be secured with cover screws on opening side by concealed machine screws. Hinged breaker cover shall be recessed into the hinged overall tub cover. Breaker cover shall have latch type closures. Submit details on shop drawings prior to manufacturing.
- .12 Feed through lugs as indicated.

## **2.2 BREAKERS**

- .1 All breakers to be bolt on type, moulded case, non-adjustable and non-interchangeable trip, single, two and three pole, 120/240V and with trip free position separate from "On" or "Off" positions.
- .2 Two and three pole breakers to have common simultaneous trip and able to be located in any circuit position within the panelboard. Minimum interrupting rating of breakers to be as follows:
  - .1 120/240V panelboards - 10,000 Amps at 250 volts.
- .3 Main breaker to be separately mounted at top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .4 Provide circuit breakers with indicated trip ratings as shown in the panelboard schedules.
- .5 Provide at least 10% spare 15 Amp single pole breakers whether indicated or not.
- .6 Provide GFI type breakers as indicated.
- .7 Provide AFCI type breakers as required by the Canadian Electrical Code, latest edition.

## **2.3 PANELBOARD IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00.
- .2 Nameplate for each panelboard size 5 (2 line) engraved as indicated and include panel designation and voltage/phase.
- .3 Complete circuit directory with typewritten card(s) located in slide-in plastic pocket(s) fixed to the back of the related door. Directory card to indicate the panel designation, mains size, voltage/phase and the location and load controlled of each circuit. Include a "letter sized" paper copy of each directory in the project maintenance manual.
- .4 Provide a plasticized typewritten information card fixed to the back of the each panel door. Information card to indicate the panel designation and location, feeder type and size and locations of any controlling contactors and feeder pullboxes. Include a "letter sized" paper copy of each information card in the project maintenance manual.

## **2.4 STANDARD OF ACCEPTANCE**

- .1 Eaton Cutler Hammer Type Pow-R Line 1a
- .2 Schneider Type NQOD
- .3 Siemens Canada.



**Part 3            Execution**

**3.1                INSTALLATION**

- .1      Locate panelboards as indicated and mount securely, plumb true and square, to adjoining surfaces.
- .2      Connect loads to circuits as indicated.
- .3      Connect neutral conductors to common neutral bus with respective neutral identified.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED WORK**

- .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                REFERENCES**

- .1            Canadian Standards Association (CSA International) – most recent version
  - .1            CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
  - .2            CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
  - .3            CSA-C22.2 No.55, Special Use Switches.
  - .4            CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

**Part 2            Products**

**2.1                SWITCHES**

- .1            20 A, 120 V, single pole, double pole, three-way, four-way switches as indicated, white commercial grade.
- .2            Switches shall be “Decora” style.
- .3            Switches of one manufacturer throughout project.
- .4            Provide 3 way switches/dimmers as required and as shown.

**2.2                RECEPTACLES – GENERAL**

- .1            Duplex receptacles, CSA type 5-15R, 125 V, 15 A, U ground, white commercial grade.
- .2            T-Slot duplex receptacles, CSA type 5-20R, 125 V, 20 A, U ground, white commercial grade.
- .3            Use tamper resistant receptacles where required by Code and as indicated.
- .4            Receptacles shall be ‘Decora’ style.
- .5            Receptacles of one manufacturer throughout project.

**2.3                RECEPTACLES – PARTICULAR APPLICATION**

- .1            Ground Fault Interrupter type to be 15 Amp, 125 volt duplex receptacles to be 2 pole, 3 wire, U ground, impact resistant nylon face, complete with breaker and reset button. white commercial grade.
- .2            Ground Fault Interrupter located outside within 2.5m of final grade shall come with wet location cover plates.

- .3 Use tamper resistant receptacles where required by Code and as indicated.
- .4 Receptacles of one manufacture throughout project.
- .5 Surge Protective type to be T slot 5-20R, 125 volt duplex receptacles to be 2 pole, 3 wire, blue face, parallel blade, U ground, impact resistant nylon face audible and LED indicator.
- .6 All other single outlet and special purpose receptacles to be similar to the grade and series indicated above. Confirm ampacity, voltage and pin configuration prior to installation.

## **2.4 INTERVAL TIMERS**

- .1 Range: 0-30 minutes.
- .2 Digital without hold feature.
- .3 Single pole 120 volt, 20 Amp contacts to open at end of timing cycle.
- .4 Finished to match switches in colour.

## **2.5 COVER PLATES**

- .1 Cover plates for devices shall match device in color (white in color). In service rooms, shops and other like applications, provide stamped steel cover plates.
- .2 Wall plates to be flush mounting with "positive bow" feature to ensure that all edges of plate are flush with wall or surface box when installed.
- .3 All plates to be bevelled type with smooth rolled outer edge and smooth face. Exposed sharp edges are not acceptable.
- .4 Cover plates for all wiring devices to be from one manufacturer throughout project.

## **Part 3 Execution**

### **3.1 INSTALLATION GENERAL**

- .1 Mount wiring devices to height specified in Section 26 05 00 or as indicated.
- .2 Upper edge of plates located on separate outlets immediately alongside one another to be at exactly the same height above finished floor.
- .3 All plates to be installed parallel or perpendicular to building lines.

### **3.2 INSTALLATION PARTICULAR**

- .1 Switches:
  - .1 Install single throw switches with handle in "UP" position when switch closed.
  - .2 Install switches in gang type outlet box when more than one switch is required in one location.
  - .3 Install on latch side of door; coordinate with Department Representative's drawings prior to install.

- 
- .2 Receptacles:
- .1 Install all receptacles in the vertical plane unless otherwise noted.
  - .2 Generally install the 5-15/20R U ground pin down unless otherwise noted. Neutral up when receptacle in mounted horizontal.
  - .3 Install receptacles vertically in gang type outlet box when more than one receptacle is required in one location.
  - .4 Install receptacles near mechanical equipment mounted on the roof as per the CEC. Provide wet location rated cover plates.
  - .5 Surge suppression duplex receptacles to be provided for all communication and computer terminal equipment backboards and cabinets including fire alarm, telephone, public address, door security, nurse call, central dictation, RF television, security television, etc. Provide dedicated neutral conductors for each surge suppression receptacle.
  - .6 Ground fault interrupter duplex receptacles to be used whenever within 1.5 meters of all sinks or water sources.
  - .7 Utilize tamper resistant receptacles in public areas and in all areas dedicated for children.
- .3 Cover plates:
- .1 Install suitable common cover plates where wiring devices are grouped.
  - .2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
  - .3 Provide wet location cover plates which provide a seal whether or not a plug is inserted into the receptacle.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED REQUIREMENTS**

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

**1.2                REFERENCES**

- .1            CSA International – most recent version
  - .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).

**Part 2            Products**

**2.1                BREAKERS GENERAL**

- .1            Moulded-case circuit breakers, Circuit breakers, ground-fault circuit-interrupters,; to CSA C22.2 No. 5
- .2            Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation. Breakers to be arc fault type in residential locations as per the requirements of the Canadian Electrical Code.
- .3            Plug-in moulded case circuit breakers: quick- make, quick-break type, for manual and automatic operation.
- .4            Common-trip breakers: with single handle for multi-pole applications.
- .5            Circuit breakers with interchangeable trips.
- .6            Circuit breakers to have minimum 10kAIR symmetrical RMS interrupting capacity rating at 240V.
- .7            Moulded case circuit breakers shall be of one manufacturer and match distribution equipment manufacturer.

**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. To be arc fault type in residential applications where required by code.

**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.

**3.2 INSTALLATION**

- .1 Install circuit breakers as indicated.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

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

**Part 2 Products**

**2.1 GROUND FAULT CIRCUIT INTERRUPTER RECEPTACLE**

- .1 Self-contained with 15A, 120V circuit interrupter and receptacle complete with
  - .1 Solid state ground-sensing device
  - .2 Facility for testing and reset
    - .1 Cover plate as specified in Section 26 27 26 - Wiring Devices & Cover Plates
    - .2 CSA Class A certified

**2.2 CIRCUIT BREAKER-TYPE GROUND FAULT INTERRUPTER**

- .1 Single- or Two- pole ground fault circuit interrupter for 15/20/30/40A, 120/ 208V, 1-phase operation as indicated on drawings and/or panelboard schedules and complete with test and reset facilities.
- .2 Sensitivity 10 mA.
- .3 2-pole units to have indication and provision for remote indication.
- .4 Circuit breakers to have thermal and magnetic trip units and to be integral to the panelboard.
- .5 Circuit breakers to be of similar construction and of same manufacturer as the non-ground fault units in the same panelboard.

**2.3 GROUND FAULT PROTECTION PANEL**

- .1 120, 1 -pole circuit breaker to supply power to 2 circuits and complete with
  - .1 Standard circuit breaker with overload and short circuit protection
  - .2 Ground current sensing device to detect to 5mA ground leakage and trip the breaker
  - .3 Power pack with control transformer to provide tripping power
  - .4 Facilities for testing and reset
  - .5 CSA Enclosure 3 surface mounted
  - .6 Ground fault trip indicator light
  - .7 CSA Class A approved

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**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Do not ground neutral on load side of ground fault relay.
- .2 Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.
- .3 All exterior-mounted receptacles, pool pumps, and pool lighting circuits shall be protected by ground fault circuit interrupters.
- .4 Provide self-contained GFCI type receptacles where indicated.
- .5 For the protection of persons using, pools containing electrical devices, etc., supply and install Ground Fault Circuit Interrupter (GFCI) breakers in the branch wiring to all electrical equipment associated with these "wet" areas.
- .6 If the manufacturer of the panelboard being used throughout this project has available a Type A GFCI, designed to replace normal circuit breakers in the panel boards, such a device may be used. Alternately, a separate approved GFCI shall be used.

**3.2 FIELD QUALITY CONTROL**

- .1 Arrange and pay for field testing of ground fault equipment by contractor before commissioning service.
- .2 Submit report of tests to Departmental Representative and a certificate that system as installed meets criteria specified herein.
- .3 Demonstrate simulated ground fault tests.

**END OF SECTION**



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**Part 1            General**

**1.1                RELATED WORK**

- .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                REFERENCES**

- .1            Canadian Standards Association (CSA International):
  - .1            CAN/CSA C22.2 No.4, Enclosed Switches.
  - .2            CSA C22.2 No.39, Fuseholder Assemblies.

**Part 2            Products**

**2.1                DISCONNECT EQUIPMENT**

- .1            “Heavy Duty” class, enclosed manual air break switches in non-hazardous locations: to CSA C22.2 No.4
- .2            Fuseholder assemblies to CSA C22.2 No.39.
- .3            Fusible and non-fusible disconnect switch in CSA enclosure.
- .4            Provision for padlocking in off switch position.
- .5            Fuses as indicated. Allow for Class J or L for general circuits, Class RK5 for transformer, motor or other high inrush current circuits
- .6            Fuseholders in each switch suitable without adaptors, for type of fuse as indicated.
- .7            Quick-make, quick-break action.
- .8            ON-OFF switch position indication on switch enclosure cover.
- .9            Weatherproof as required.
- .10          NEMA-3 rated disconnect for roof top.

**2.2                EQUIPMENT IDENTIFICATION**

- .1            Indicate name of load controlled on size 4 name plate to Section 26 05 00.

**2.3                STANDARD OF ACCEPTANCE**

- .1            Cutler Hammer – Heavy Duty
- .2            Schneider - Heavy Duty
- .3            Siemens - Heavy Duty

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Provide and locate safety disconnect switches to isolate individual items of equipment in accordance with Canadian Electrical Code CSA 22.1 whether indicated on not on the contract drawings.
- .2 Install disconnect switches complete with fuses where indicated or required.
- .3 All disconnect switches for elevator machine rooms shall be fused in accordance with the equipment supplier's requirements.
- .4 Provide and locate safety disconnect switches to isolate individual items of equipment in accordance with Canadian Electrical Code CSA 22.1 whether indicated on not on the contract drawings.

**3.2 MOTOR PLUG/RECEPTACLE AND QUICK DISCONNECTS**

- .1 Motor quick disconnects do not negate the requirement for a switched safety disconnect as specified in this Division. A separate disconnect is still required unless the Departmental Representative has given a special pre-approved circumstance.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED WORK**

- .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                REFERENCES**

- .1            CAN/CSA C22.1, Canadian Electrical Code, Part I - most recent version
- .2            CAN/CSA C22.2 No.9.0, General Requirements for Luminaires.
- .3            IESNA Illuminating Engineering Society of North America - Lighting Handbook – most recent version
- .4            IES RP-33 Lighting for the Exterior Environment

**1.3                ADDITION OF ACCEPTABLE MANUFACTURERS**

- .1            Not applicable.

**1.4                INTENT**

- .1            Provide lighting fixtures and accessories for all outlets as listed in the Luminaire Schedule and as shown on drawings.
- .2            Lighting fixtures shall be structurally well designed and constructed, using new parts and materials of the highest residential grade available.
- .3            Bond all lighting equipment to grounding system.
- .4            Verify all ceiling types and finishes before ordering fixtures and provide fixtures suitable for mounting in or on ceilings being installed in each area, as specified. Where fixture types specified are not suitable for ceiling being installed, obtain written instructions from the Departmental Representative before ordering fixtures.
- .5            Fixtures of the same or similar type shall be supplied by the same manufacturer.
- .6            Electrical contractor shall supply and install all luminaires complete with lamps, mounting brackets, lenses, drivers (dimming or otherwise) and all necessary accessories in accordance with luminaire types shown on drawings and listed in Luminaire Schedule unless otherwise noted.
- .7            Supply and install complete and proper support and hangers for all luminaires in ceiling space where required for proper support of outlet boxes and luminaire hanger assemblies.

**Part 2            Products**

**2.1                LED DRIVERS**

- .1            LED drivers shall be fully dimmable, Energy Star compliant, maximum THD of 20%, power factor to be greater than .95, have high voltage regulation and have internal surge protection.

- .2 LED lit luminaires shall meet the LM-79 and LM-80 test protocols (70% output at 50,000 hours), a minimum efficacy of 90 watts per lumen and shall meet or exceed ENERGY STAR SSL standards to ensure lumen and color consistency between luminaires.

## **2.2 LEDS**

- .1 LEDs in fixtures shall be 4 step Binning or better.
- .2 LEDs shall be CRI 90 or higher.
- .3 Fixtures shall be designed to allow for replacement of LED boards.

## **2.3 FIXTURES**

- .1 Provide fixtures as indicated on the Luminaire Schedule.
- .2 All fixtures shall comply with CSA Standard C22.2 No.9. Accessories and components shall comply with relevant CSA Standards applicable to accessory or components.
- .3 Recessed down light luminaires shall be of the approved pre-wired type with junction box forming an integral part of luminaires assembly with access facility to the satisfaction of the electrical inspection authority. Supply and install all necessary plaster rings, supports, etc. required for complete and proper installation.
- .4 Except where otherwise noted in the Luminaire Schedule, depth of recessed fixtures shall not exceed 150 mm, including mounting yokes, or bridges and the distance from the back face of the diffuser or lens to the centre of the lamp shall be not less than 75 mm. Design of reflector and lamp position shall be to provide high efficiency, even brightness and lack of lamp lines.
- .5 Fixtures shall be constructed of not less than code gauge steel. All metal parts shall be thoroughly cleaned and finished in high reflectance baked white enamel over corrosion-resistant primer. Reflecting surfaces and exposed surface shall have not less than two coats of baked white enamel with reflectance of not less than 85%.
- .6 All fixture diffusers, lens panels, lens frames, etc., shall be securely and adequately supported and shall be removable without the use of tools for cleaning.
- .7 Where recessed LED luminaires are to be mounted in drywall ceilings or type of ceilings requiring frames, supply drywall frames for the recessed luminaires and turn frames over to the general contractor for installation.

## **Part 3 Execution**

### **3.1 VERIFICATION OF CONDITIONS**

- .1 Confirm all ceiling depths against the final architectural ceiling plans and sections to ensure that recessed fixtures can be installed in all ceiling conditions and advise the Departmental Representative immediately of any discrepancies prior to ordering of the fixtures or proceeding with the work.

### **3.2 INSTALLATION - GENERAL**

- .1 Lighting fixtures shall be installed as indicated on architectural reflected ceiling plans, Electrical Drawings, and per approved shop drawings.

- .2 Verify locations and spacing of lighting fixtures with reflected ceiling plans and notify Departmental Representative of any variance or conflict between the plans and field conditions. Do not proceed until conflict has been resolved.
- .3 Work shall be coordinated with other trades. Lighting fixture locations shall have priority over locations of ducts, diffusers, sprinklers, smoke detectors, and other non-structural obstructions.
- .4 All fixtures shall be supported directly from the building structural members or from bridging attached to the structural members by rod hangers and inserts. Provide all necessary hardware and blocking to ensure that fixtures hang true.
- .5 Lighting fixtures shall be adequately supported and braced to satisfy seismic codes. Refer to Section 26 05 05 Seismic Restraints.
- .6 Mount wall fixtures at elevations specified or as shown on Architectural or Electrical Drawings. Where no elevation is shown, confirm mounting height with the Departmental Representative prior to rough-in.

### 3.3 **INSTALLATION AND SUPPORTS**

- .1 Provide complete and proper support for all fixtures, fixture hangers, etc., including headers in ceiling space, where required, for proper support of outlet boxes and fixture hanger assemblies.
- .2 Support fixtures as shown on the drawings, level, plumb and true with the structure and other equipment in a horizontal or vertical position as intended. Wall or side bracket mounted fixture housings shall be rigidly installed and adjusted to give a neat flush fit to the surface on which it is mounted.
- .3 All hangers, supports, fastenings or accessory fittings shall be protected against corrosion. Care shall be taken during the installation to assure that insulation and corrosion protection is not damaged.
- .4 Self-aligning seismically rated ball joint hangers shall be used for rod suspended fixtures. Ceiling canopies or hood assemblies intended to cover the suspension attachments shall be installed to fit tightly to the ceiling without restricting the alignment of the hanger. Support fixtures by hangers and mounting arrangements which will not cause the fixture frame, housing, sides or lens frame to be distorted; or prevent complete alignment of several fixtures in a row.
- .5 The suspension length of all ceiling mounted suspended types of lighting fixtures as listed in the Fixture Schedule shall be the overall length from the ceiling to the lowest point of the fixture body, reflector or glassware in its hanging position.
- .6 Metal inserts, expansion bolts or toggle bolts in concrete slabs for stems which do not carry wiring must be accurately located in relation to the outlet boxes, to allow perfect alignment and spacing of suspension stems.
- .7 Where fixtures are surface mounted on the underside of an inverted tee bar ceiling, the fixture shall be supported either directly from the building structure by means of rod hangers and inserts or by means of metal angle headers, supported from the tee bar framing structure above the tile. Fixtures shall be supported from the quarter points.
- .8 All recessed fixtures to be installed so that they are removable from below to gain access to outlet box or prewired fixture box. Connect all recessed fixtures to boxes with flexible

- conduit and approved fixture wire. Provide approved drywall enclosures in insulated ceilings. Volume of enclosure to comply with Electrical Code.
- .9 Install fixture lenses as late as possible to protect from dirt and dust. Remove and clean or replace lenses to the satisfaction of the Departmental Representative.
  - .10 Provide and install all conduit, boxes, wire and make emergency power connection to all units and to unit controllers. Refer to architectural reflected ceiling plans for locations prior to conduit installation. Obtain all specialty backboxes, switches, controllers, etc. from contractor and coordinate installation as required.
  - .11 Where drivers are to be remotely located, they shall be racked together and labelled with size 3 lamicaid. Label shall bear the driver number which has a corresponding location on an adjacent floor plan reference drawing. Labels and floor plans shall be provided by electrical contractor. Floor plans shall measure 280mm x 430mm (11"x17") and shall be framed and laminated.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED WORK**

- .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                REFERENCES**

- .1            Canadian Electrical Code (CEC)
- .2            BICSI Telecommunications Distribution Methods Manual (TDMM), latest edition
- .3            ANSI/TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises
- .4            ANSI/TIA-568-C.1 Commercial Building Telecommunications Cabling Standard
- .5            ANSI/TIA -568-C.2 Balanced Twisted Pair Telecommunications Cabling & Components Standard
- .6            ANSI/TIA-568-C.3 Optical Fibre Cabling Components Standard
- .7            ANSI/TIA-569-D Telecommunications Pathways and Spaces Standard
- .8            ANSI/TIA -606-B Administration Standard for Commercial Telecommunications Infrastructure.
- .9            ANSI/TIA-607-B Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

**1.3                PRODUCT DATA**

- .1            Submit product data in accordance with Section 26 05 00.

**1.4                LABOUR**

- .1            The communications contractor must comply with all job-site requirements for the duration of the project.
- .2            The communications contractor agrees to use only trade person who are fully trained, qualified and experienced on the installation, termination and testing of the structured cabling solution. The communications contractor must be an approved installer of the specific structured cabling solution.

**Part 2            Products**

**2.1                UNIFORMITY OF MANUFACTURE**

- .1            Unless otherwise specifically called for in the specifications, uniformity of manufacture shall be maintained for similar products throughout the work.

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**Part 3 Execution**

**3.1 COORDINATION WITH OTHER DIVISIONS**

- .1 Examine the specifications and drawings of all divisions and become fully familiar with their work. Coordinate work with all trades and make changes to facilitate a satisfactory installation.
- .2 Lay out the work and equipment with due regard to architectural, structural, mechanical, electrical and A/V features. Architectural and structural drawings take precedence over the telecommunications drawings regarding locations of walls, doors, equipment and the location and heights of outlets.
- .3 Coordinate with all Divisions installing and services, and ensure that there are no conflicts.
- .4 Install anchors, bolts, pipe sleeves, hanger inserts, etc. in ample time to prevent delays.

**3.2 LOCATION OF OUTLETS**

- .1 Telecommunications drawings are, unless otherwise indicated, drawn to scale and approximate distances and dimensions may be obtained by scaling. Figured dimensions shall govern over scaled dimensions. Where exact dimensions and details are required, refer to Architectural and Structural drawings.
- .2 Unless otherwise specified or shown, install products in accordance with recommendations and ratings of manufacturers.

**3.3 SEPARATION OF SERVICES**

- .1 Maintain separation between electrical wiring system and building piping, ductwork, etc. so that wiring system is isolated (except at approved connections to such systems) to prevent galvanic corrosion.
- .2 In particular, contact between dissimilar metals, such as copper and aluminum, in damp or wet locations is not permitted.
- .3 Do not support wiring from pipes, ductwork, etc. Hangers for suspended ceilings may be used for the support of wiring only when approval is obtained from the Departmental Representative and the ceiling installer, and approved clips or hangers are used.

**3.4 EQUIPMENT IDENTIFICATION**

- .1 Colour code exposed conduits, junction and pull boxes and metallic sheathed cables with paint or plastic tape (27mm wide band) at 15 metre intervals. Refer to Section 26 05 00.

**3.5 MOUNTING HEIGHTS**

- .1 Refer to section 26 05 00 Common Work Results for general mounting heights specification.

**3.6 SERVICE PENETRATIONS IN NON-RATED SEPARATIONS**

- .1 All cabling, wiring, conduits, cable trays, etc. passing through non-rated fire separations and non-rated walls and floors shall be tightly fitted and sealed on both sides of the



separation with caulking or silicon sealant to prevent the passage of smoke and/or transmission of sound.

**3.7 CONDUIT SLEEVES**

- .1 Vertical floor penetration sleeves shall extend 102mm above finished floor level.
- .2 The space between the sleeve and the conduit shall be filled with approved permanently resilient, non-flammable and weatherproof silicone base compound and ensure that the seal is compatible with the floor and ceiling finishes.
- .3 Located and position sleeves exactly prior to construction of walls and floors.
- .4 Failure to comply with the above requirements shall be remedied at this Division's expense.

**END OF SECTION**

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**Part 1 General**

**1.1 RELATED SECTIONS**

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

**1.2 REFERENCES**

- .1 ANSI/TIA 607-B Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
- .2 ANSI/TIA-606-B Administration Standard for the Commercial Telecommunications Infrastructure.

**1.3 SYSTEM DESCRIPTION**

- .1 The facility shall be equipped with a Telecommunications Bond as per utility standards. Bond to be used to ground all telecommunications equipment and other associated hardware.

**Part 2 Products**

**2.1 TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)**

- .1 Predrilled copper bus-bar, listed by NRTL, electro-tin plated with holes 8 mm diameter for use with standard-sized lugs to: ANSI/TIA 607-B.
- .2 Dimensions 6mm thick, 100 mm wide, 300 mm long to: ANSI/TIA 607-B.

**2.2 BONDING CONDUCTOR FOR TELECOMMUNICATIONS**

- .1 #6 AWG copper conductor, green insulated to: ANSI/TIA 607-B.

**2.3 WARNING LABELS**

- .1 Non-metallic warning labels in English and French to: ANSI/TIA 607-B. Identify labels with wording "If this connector is loose or must be removed, please call the building telecommunications manager".

**Part 3 Execution**

**3.1 BONDING CONDUCTORS GENERAL**

- .1 When placed in ferrous metallic conduit or EMT longer than 1 m, bond to each end of conduit or EMT using grounding bushing 6 AWG copper conductor.

**3.2 BONDING TO TMGB**

- .1 Bond metallic raceways in telecommunications entrance to TMGB using #6 AWG green insulated copper conductor.

**3.3 LABELLING**

- .1 All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables and bus bars shall be identified and labelled in accordance with the System Documentation Section of this specification.
- .2 Apply additional administrative labels to: ANSI/TIA-606B.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED WORK**

- .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                REFERENCES**

- .1            Canadian Electrical Code (CEC)
- .2            BICSI Telecommunications Distribution Methods Manual (TDMM), most recent edition

**1.3                GENERAL REQUIREMENTS**

- .1            The system, when complete, must be free of all interference from cross-talk, hum, switch and relay noise, etc.
- .2            Personnel installing communications cabling shall be trained and conversant with communications cabling practices required for this project. Proof of certification with the Manufacturer must be provided prior to commencement of work.
- .3            The system shall be certified, by a contractor designated and trained by the manufacturer of being capable to do so and shall provide written confirmation of this fact.

**1.4                SCOPE OF WORK**

- .1            The scope of work includes new horizontal Cat6 cable, connectors, communications outlets, patch panels, cover plates, patch cords, and supporting cross-connect and terminating hardware, testing the entire system.
- .2            The following is a list of components required for supply and installation:
  - .1            Copper horizontal cabling system
  - .2            Patch panels and rack in garage room.
  - .3            Labeling and testing of all copper cabling systems installed.
- .3            All structured cabling components shall be of the same manufacturer and will be supplied by one of the recognized industry leader. The cable may be supplied by a manufacturer other than the component manufacturer as long as the complete system is warranted by the manufacturer.

**1.5                SYSTEM DESCRIPTION**

- .1            A complete telecommunications wiring system with conduits for telecommunication utility service entrance to a main and central telecom box.
  - .1            Provision of horizontal cabling, copper, terminations, connectors, racks, patch panels, communication bonding system, and CATV cables.
- .2            This Contract includes provision of a complete structured wiring system, including but not necessarily limited to:
  - .1            CATV Cabling
  - .2            Telephone Cabling

- .3 Horizontal wiring to communications outlets.
- .4 Rack-mounted patch panels inside telecom smart box. Refer to drawing details.
- .3 This Contract includes all necessary hardware, connections and testing for a complete functional standards-compliant system. The test results shall be to the satisfaction of the Department Representative and the Manufacturer responsible for the System Warranty.
- .4 The communication system shall comprise all components specified, implied or otherwise necessary to constitute a fully operational system.

## **1.6 WARRANTY/SERVICE**

- .1 A system warranty shall be provided covering the installed cabling system against defects in workmanship, components, and performance, and follow-on support after project completion.

## **Part 2 Products**

### **2.1 GENERAL**

- .1 All products must be from the same manufacturer and capable of being certified as a complete system under full warranty by the manufacturer. The selection of material types, fixing, and workmanship shall be to provide a robust installation with an operational life equal to or in excess of 25 years. This warranty shall be direct from the system / cabling manufacturer and supported by the local cabling Contractor.
- .2 Coordinate with the local telecom utility for typical CATV splitters and other required components.

### **2.2 STANDARD OF ACCEPTANCE**

- .1 Panduit
- .2 Belden
- .3 Leviton (Network Solutions)
- .4 TE Connectivity

### **2.3 PATCH PANELS**

- .1 As per the drawing details.

### **2.4 WORK AREA MODULAR JACK & FACEPLATE**

- .1 General - Eight-position modular jack ("RJ-45"), type T568A Category 6 to: ANSI/TIA-568-C.2:
  - .1 Mounted in compatible single gang faceplate, angle entry, 4 port positions per faceplate.
  - .2 Blank inserts for unused port positions within the faceplate.
  - .3 Each wall outlet shall be capable of accommodating a minimum of four RJ-45 connectors.

- .4 Provide surface box mounted to modular furniture base track or install in mid-span.

### **Part 3 Execution**

#### **3.1 GENERAL**

- .1 Do not install Communication room equipment until room is clean and painted. All walls to have fire resistant 19mm (3/4") plywood installed up to eight feet high.
- .2 Utilize cabling to manufacturer's recommended requirements; do not bend or strain cables beyond recommended limits. Cables installed outside of manufacturer's recommended limits will be replaced at no cost to the Departmental Representative.
- .3 Cable raceway and management systems shall not be filled greater than the CEC maximum fill for the particular raceway type. Paint all junction box covers blue.

#### **3.2 INSTALLATION OF HORIZONTAL DISTRIBUTION CABLES AND OUTLETS**

- .1 Install horizontal cables in free air or cable trays from telecommunication box to individual work-area jacks.
- .2 Terminate horizontal cabling in patch panels in the telecommunication box.
- .3 Cables shall be installed in continuous lengths from origin to destination (no splices) unless specifically addressed in this document and shall not be longer than 90m.
- .4 Harness slack cable in cabinets, racks, and wall-mounted termination and cross-connection hardware.
- .5 The cable's minimum bend radius and maximum pulling tension shall not be exceeded.
- .6 The cabling system and support hardware shall be installed so that it does not obscure any valves, boxes, or other systems or equipment.
- .7 Cables shall not be attached to ceiling grid or lighting support wires.
- .8 Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor prior to final acceptance at no cost to the Contractor.
- .9 Cables shall be identified by a self-adhesive label in accordance with the System Documentation Section of this specification.
- .10 The cable label shall be applied to the cable behind the patch panel termination no more than 150mm from the end of cable.
- .11 The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
- .12 There shall be no use of tie wraps on any network cabling. All cables shall be wrapped with Velcro-type strapping where such restraint is necessary.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 01 45 00 Quality Control
- .2 Section 02 41 99 Demolition of Civil Works
- .3 Section 31 22 13 Rough Grading
- .4 Section 31 23 33.01 Excavating, Trenching and Backfilling
- .5 Section 32 11 23 Aggregate Base Courses
- .6 Section 33 11 16 Site Water Utility Distribution Piping

**1.2 SUBMITTALS**

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Submit name of professional engineer retained by the Contractor for geotechnical testing review and approval by Departmental Representative.
  - .2 Submit name of testing laboratory retained by Contractor for materials testing for review and approval by Departmental Representative.
  - .3 Inform Departmental Representative at least 4 weeks prior to beginning Work, of proposed source of fill materials and provide access for sampling.
  - .4 Submit geotechnical quality assurance information and test results within 1 week of undertaking.

**1.3 GEOTECHNICAL QUALITY ASSURANCE**

- .1 Retain and pay for the services of a qualified independent geotechnical testing agency under the supervision of a registered professional engineer, and pay the cost of testing services for quality control including, but not limited to, the following:
  - .1 Sieve analysis of sands and aggregates to be supplied
  - .2 Standard proctor density curves for backfill materials
  - .3 Standard proctor density curves for approved borrow materials
  - .4 Compaction control tests for backfill and embankment material including the following:
    - .1 Trench bedding (service) - once per road crossing
    - .2 Trench backfill (service) - once per road crossing
    - .3 Trench bedding (mainline) - once per every 75m of trench at 1.0m vertical lifts with min. one between manholes.
    - .4 Trench backfill (mainline) - once per every 75m of trench at 1.0m vertical lifts with min. one between manholes.
    - .5 Granular base (curbs) - once per 50 lineal metres
    - .6 Granular base (sidewalks) - once per 50 lineal metres
  - .5 Concrete mix design and testing

- .6 Concrete strength tests (minimum three specimen cylinders in accordance with CSA a23.1) for the following:
  - .1 Curb and gutter - once per 150 lineal metres (minimum one per day during concrete placing)
  - .2 Sidewalk - once per 150 lineal metres (minimum one per day during concrete placing)
- .7 Asphalt mix design and testing
- .8 Asphalt tests for the following:
  - .1 Aggregate gradation tests - one per each 300 tonnes of production (minimum once per day during asphalt placement)
  - .2 Marshall test - three briquettes for every 300 tonnes of production (minimum once per day during asphalt placement)
  - .3 Compaction - one core for each 500m<sup>2</sup>.
- .2 When site excavated material granular backfill is proposed for use as backfill the contractor shall employ a professional geotechnical engineer with experience in geotechnical engineering for performance of in-place density and sieve testing. The site material shall fall within one of the granular backfill material specifications as per Section 31 23 33.01.

#### **1.4 SURVEY**

- .1 The Contractor is to retain a qualified surveyor to complete:
  - .1 A pre-construction survey of any site features not already surveyed
  - .2 All site layout, both vertical and horizontal, for pipes, manholes, underground features, curbs, sidewalks, roads, ditches, and surface features.
  - .3 All as-constructed locations of utilities and surface features.
- .2 A copy of the as-constructed survey and drawing markups are to be compiled and provided to the Departmental Representative within 10 days of construction completion.

#### **Part 2 Products**

##### **2.1 NOT USED**

- .1 Not used.

#### **Part 3 Execution**

##### **3.1 NOT USED**

- .1 Not used.

**END OF SECTION**



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**Part 1            General**

**1.1                RELATED SECTIONS**

- .1        Section 31 23 33.01 Excavating, Trenching and Backfilling.
- .2        Section 01 35 43 Environmental Procedures
- .3        Section 31 22 13 Rough Grading

**1.2                REFERENCES**

- .1        U.S. Environmental Protection Agency (EPA)/Office of Water
  - .1        EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

**1.3                DEFINITIONS**

- .1        Clearing consists of cutting off trees and brush vegetative growth to not more than specified height above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.
- .2        Close-cut clearing consists of cutting off standing trees, brush, scrub, roots, stumps and embedded logs, removing at, or close to, existing grade and disposing of fallen timber and surface debris.
- .3        Clearing isolated trees consists of cutting off to not more than specified height above ground of designated trees, and disposing of felled trees and debris.
- .4        Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter and disposing of fallen timber and surface debris.
- .5        Grubbing consists of excavation and disposal of stumps and roots boulders and rock fragments of specified size to not less than specified depth below existing ground surface.

**1.4                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.

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**1.5 QUALITY ASSURANCE**

- .1 Do construction occupational health and safety in accordance with Section (01 35 30 Health and Safety Requirements.
- .2 Safety Requirements: worker protection.
  - .1 Workers must wear gloves, respirators dust masks, eye protection, protective clothing when applying herbicide materials.
  - .2 Workers must not eat, drink or smoke while applying herbicide material.
  - .3 Clean up spills of preservative materials immediately with absorbent material and safely discard to landfill.

**1.6 STORAGE AND PROTECTION**

- .1 Prevent damage to fencing, trees, landscaping, natural features, bench marks, existing buildings, existing pavement, utility lines, site appurtenance, water courses, root systems of trees which are to remain.
  - .1 Repair damaged items to approval of Departmental Representative.
  - .2 Replace trees designated to remain, if damaged, as directed by Departmental Representative.

**1.7 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling in accordance with Section (01 74 19 Construction Waste and Disposal.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Bituminous based paint of standard manufacture specially formulated for tree wounds.
- .2 Herbicide: effective for killing annual and perennial weeds, and bamboo grass, by being absorbed through roots and foliage.
  - .1 Spray applied on non-crop land areas.
  - .2 Type to be approved by the Department Representative.
- .3 Soil Material for Fill:
  - .1 Excavated soil material: free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, deleterious, or objectionable materials.
  - .2 Remove and store soil material for reused.

**Part 3 Execution**

**3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

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

### **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.

### **3.3 APPLICATION**

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

### **3.4 CLEARING**

- .1 Clearing includes felling, trimming, and cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within cleared areas.
- .2 Clear as indicated by Departmental Representative, by cutting at height of not more than 300mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 1000mm 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.
- .5 Apply herbicide in accordance with manufacturer's label to top surface of stumps designated not to be removed.

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**3.5 ISOLATED TREES**

- .1 Cut off isolated trees as indicated by Departmental Representative at height of not more than 300mm above ground surface.
- .2 Grub out isolated tree stumps.
- .3 Prune individual trees as indicated.
- .4 Trim trees designated to be left standing within cleared areas of dead branches 4cm or more in diameter; and trim branches to heights as indicated.
- .5 Cut limbs and branches to be trimmed close to bole of tree or main branches.
- .6 Paint cuts more than 3cm in diameter with approved tree wound paint.

**3.6 UNDERBRUSH CLEARING**

- .1 Clear underbrush from areas as indicated at ground level to within 150mm of ground surface.

**3.7 GRUBBING**

- .1 Remove and dispose of roots larger than 7.5cm in diameter, matted roots, and designated stumps from indicated grubbing areas.
- .2 Grub out stumps and roots to not less than 200mm below ground surface.
- .3 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25m<sup>3</sup>.
- .4 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.

**3.8 REMOVAL AND DISPOSAL**

- .1 Remove cleared and grubbed materials off site to disposal area as indicated Departmental Representative.
- .2 Cut timber greater than 125 mm diameter to 2000 mm lengths and stockpile as indicated. Stockpiled timber becomes property of Departmental Representative.
- .3 Dispose of cleared and grubbed materials offsite to a disposal site approved by the Departmental Representative.
- .4 Stockpile cleared and grubbed vegetative material on site as directed by Departmental Representative.
- .5 Remove diseased trees identified by Departmental Representative and dispose of this material to approval of Departmental Representative.

**3.9 FINISHED SURFACE**

- .1 Leave ground surface in condition suitable for immediate grading operations to approval of Departmental Representative.

**3.10 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**

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**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1            Section 02 41 99 Demolition of Civil Works
- .2            Section 31 05 00 Common Works Results – Earthworks, Exterior Improvements and Utilities
- .3            Section 31 23 33.01 Excavating, Trenching and Backfilling

**1.2                REFERENCES**

- .1            ASTM International
  - .1            ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m<sup>3</sup>).

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Not used.

**1.4                EXISTING CONDITIONS**

- .1            Known underground and surface utility lines and buried objects are as indicated on site plan.
- .2            Refer to dewatering in Section 31 23 33.01 - Excavating, Trenching and Backfilling.

**Part 2            Products**

**2.1                MATERIALS**

- .1            Fill material in accordance to Section 31 23 33.01.
- .2            Excavated or graded material existing on site suitable to use as fill for grading work if approved by Departmental Representative and a qualified geotechnical engineer retained by the contractor.

**Part 3            Execution**

**3.1                EXAMINATION**

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

**3.2                STRIPPING OF TOPSOIL**

- .1            Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected as determined by Departmental Representative.

- .2 Commence topsoil stripping of areas as indicated after area has been cleared of surface features and removed from site.
- .3 Strip topsoil to depths as directed by Departmental Representative. Avoid mixing topsoil with subsoil.
- .4 Stockpile in locations as directed by Departmental Representative. Stockpile height not to exceed 2 m.
- .5 Dispose of unused topsoil to location as directed by Departmental Representative.

### **3.3 GRADING**

- .1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.
- .2 Rough grade to depths below finish grades as shown in Contract Drawings
- .3 Slope rough grade away from building at minimum 2%.
- .4 Grade ditches to depth as indicated in Contract Drawings.
- .5 Prior to placing fill over existing ground, scarify surface to depth of 150 mm minimum before placing fill over existing ground. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.
- .6 Compact filled and disturbed areas to modified maximum dry density to ASTM D698, as follows:
  - .1 90% under landscaped areas.
  - .2 95% under paved and walk areas.
- .7 Do not disturb soil within branch spread of trees or shrubs to remain.

### **3.4 TESTING**

- .1 Refer to Section 01 45 00 – Quality Control and Section 31 05 00 Common Works Results – Earthworks, Exterior Improvements, and Utilities for geotechnical testing requirements.

### **3.5 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse or recycling in accordance with Section 01 74 19 – Construction Waste and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.6 PROTECTION**

- .1 Protect existing site features including fencing, trees, landscaping, natural features, bench marks, buildings, pavement, surface or underground utility lines which are to remain. If damaged, restore to original or better condition unless directed otherwise.
- .2 Maintain access roads to prevent accumulation of construction related debris on roads.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 02 41 99 Demolition of Civil Works.
- .2 Section 31 05 00 Common Works Results – Earthworks, Exterior Improvements, and Utilities
- .3 Section 32 11 23 Aggregate Base Courses.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C117-04, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C136-05, 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 (12,400 ft-lbf/ft<sup>3</sup>) (600 kN- m/m<sup>3</sup>).
  - .5 ASTM D1557-02e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>) (2,700 kN- m/m<sup>3</sup>).
  - .6 ASTM D4318-05, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 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 CSA-A23.1/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
- .4 U.S. Environmental Protection Agency (EPA)/Office of Water
  - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

**1.3 DEFINITIONS**

- .1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.
  - .1 Rock: solid material in excess of 1.00m<sup>3</sup>, and which cannot be removed by means of heavy duty mechanical excavating equipment available on site. 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 Topsoil:
  - .1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
  - .2 Material reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and free from cobbles, stumps, roots, and other objectionable material larger than 25 millimeters in any dimension.
- .4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .5 Borrow material: material obtained from locations outside area to be graded and required for construction of fill areas or for other portions of Work.
- .6 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.
- .7 Unsuitable materials:
  - .1 Weak, chemically unstable, and compressible materials.
  - .2 Frost susceptible materials:
    - .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136: Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
    - .2 Table:

Sieve Designation	% Passing
2.00 mm	100
0.10 mm	45 - 100
0.02 mm	10 - 80
0.005 mm	0 - 45
    - .3 Coarse grained soils containing more than 20 % by mass passing 0.075 mm sieve.
- .8 Unshrinkable fill: very weak mixture of cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

#### 1.4 EXCAVATION AND DISPOSAL

- .1 Contractor to submit to Departmental Representative for review and approval, location of proposed disposal facility prior to disposal of any material.

#### 1.5 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Quality Control: in accordance with Section 01 45 00 - Quality Control:
  - .1 Submit name of professional engineer retained by the Contractor for design and review of temporary works related to underpinning and bracing of existing structure and excavations for review and approval by Departmental Representative.
  - .2 Submit to Departmental Representative testing inspection results report as described in PART 3 of this Section.
- .3 Inform Departmental Representative at least 3 weeks prior to beginning Work, of proposed source of fill materials and provide access for sampling.

## **1.6 QUALITY ASSURANCE**

- .1 Qualification Statement: submit proof of insurance coverage for professional liability for professionals retained by Contractor.
- .2 Submit design and supporting data for excavations at least 2 weeks prior to beginning Work. Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Province of British Columbia, Canada.
- .3 Keep design and supporting data on site.
- .4 Do not use soil material until written report of soil test results are reviewed and approved by Departmental Representative.
- .5 Health and Safety Requirements:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

## **1.7 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction Waste and Disposal.
- .2 Divert materials from landfill to local facility for reuse.

## **1.8 EXISTING CONDITIONS**

- .1 Carefully examine existing mapping of site utilities prior to excavation.
- .2 Buried services:
  - .1 Before commencing work verify location of buried services on and adjacent to site by either soil hydrovactor excavation or hand-digging methods.
  - .2 Remove obsolete buried services within 2 m of foundations: cap cut-offs.
  - .3 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
  - .4 Prior to beginning excavation Work, notify applicable Departmental Representative establish location and state of use of buried utilities and structures. Clearly mark such locations to prevent disturbance during Work.
  - .5 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
  - .6 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing.
  - .7 Record location of maintained, re-routed and abandoned underground lines.
  - .8 Confirm locations of recent excavations adjacent to area of excavation.
- .3 Existing buildings and surface features:
  - .1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, pavement, survey benchmarks 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.
  - .3 Where required for excavation, cut roots or branches as directed by Departmental Representative.

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**Part 2 Products**

**2.1 MATERIALS**

- .1 Gravel to be composed of inert, durable material, reasonably uniform in quality and free from soft or disintegrated particles. In absence of satisfactory performance records over a five year period for particular source of material, soundness to be tested according to ASTM C88 or latest issue. Maximum weight average losses for course and fine aggregates to be 30% when magnesium sulphate is used after five cycles.
- .2 All crushed gravel when tested according to ASTM C136 and ASTM C117 to have a generally uniform gradation and 60% of the material passing each sieve must have one or more fractured faces. Determination of amount of fractured material shall be in accordance with BC Ministry of Transportation and Highways Specification I-11, Fracture Count for Coarse Aggregate, Method 'A', which determines fractured faces by count. The Plasticity Index for crushed gravel to not exceed 6.0.
- .3 Granular base and sub-base to MMCD (Master Municipal Contract Documents 2009, British Columbia), Section 31 05 17 – Aggregates and Granular Materials.
- .4 Granular pipe bedding to MMCD (Master Municipal Contract Documents 2009, British Columbia), Section 31 05 17 – Aggregates and Granular Materials.
- .5 Drain rock to MMCD (Master Municipal Contract Documents 2009, British Columbia), Section 31 05 17 – Aggregates and Granular Materials.
- .6 Structural fill to be in approved by a geotechnical engineer and be in conformance to the Geotechnical Report. Structural fill should consist of clean imported granular fill containing less than 5% silt and clay sizes.
- .7 Portions of the excavated site material may be suitable for re-use as structural fill. Clean granular material, if any, encountered on the site should be stockpiled separately for review by the geotechnical engineer.

**Part 3 Execution**

**3.1 SURVEY**

- .1 Refer to Section 31 05 00 - Common Works Results – Earthworks, Exterior Improvements, and Utilities for survey requirements.

**3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- .1 Refer to Section 01 35 43 – Environmental Procedures for additional information.
- .2 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control drawings, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
- .3 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .4 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

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**3.3 SITE PREPARATION**

- .1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

**3.4 PREPARATION/PROTECTION**

- .1 Protect existing features in accordance with applicable local regulations.
- .2 Keep excavations clean, free of standing water, and loose soil.
- .3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative.
- .4 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .5 Protect buried services that are required to remain undisturbed.

**3.5 STRIPPING OF TOPSOIL**

- .1 Begin topsoil stripping of areas as indicated after area has been cleared of brush, weeds, grasses and removed from site.
- .2 Strip topsoil to depths as indicated.
  - .1 Do not mix topsoil with subsoil.
- .3 Stockpile in locations as directed by Departmental Representative.
  - .1 Stockpile height not to exceed 3m and should be protected from erosion.
- .4 Dispose of unused topsoil as directed by Departmental Representative.

**3.6 STOCKPILING**

- .1 Stockpile fill materials in areas designated by Departmental Representative.
  - .1 Maximum stockpile height: 3m.
  - .2 Stockpile granular materials in manner to prevent segregation.
  - .3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

**3.7 SHORING, BRACING AND UNDERPINNING**

- .1 Contractor is responsible for the protection and temporary support of all project excavations.
- .2 Contractor to retain and pay for services of professional geotechnical engineer registered in the Province of British Columbia for design and review of temporary works related to underpinning and bracing of existing structure and excavations.
- .3 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 35 30 - Health and Safety Requirements and WorkSafe BC.
  - .1 Where conditions are unstable, Contractor to retain and pay costs for geotechnical engineer to review condition and provide recommendations
- .4 Construct temporary Works to depths, heights and locations as indicated by Contractor's geotechnical engineer.

- .5 During backfill operation:
  - .1 Unless otherwise indicated or directed by Departmental Representative, remove sheeting and shoring from excavations.
  - .2 Do not remove bracing until backfilling has reached respective levels of such bracing.
  - .3 Pull sheeting in increments that will ensure compacted backfill is maintained at elevation at least 500 mm above toe of sheeting.
- .6 When sheeting is required to remain in place, cut off tops at elevations as indicated.
- .7 Upon completion of substructure construction:

- .1 Remove cofferdams, shoring and bracing.

### **3.8 DEWATERING AND HEAVE PREVENTION**

- .1 Keep excavations free of water while Work is in progress.
- .2 Provide for Departmental Representative 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 runoff areas or containment facilities 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.
- .6 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, watercourses or drainage areas.

### **3.9 EXCAVATION**

- .1 All or any existing underground utilities are not necessarily shown on the Contract Drawings. Existing Underground utilities shall be located and all utility companies contacted, prior to installing any new underground services.
- .2 Test holes may be required to be excavated to determine exact depths of existing utilities. Any discrepancy in elevation or location shall be referred to the Departmental Representative prior to construction.
- .3 Advise Departmental Representative at least 7 days in advance of excavation operations. Excavate to lines, grades, elevations and dimensions as indicated.
- .4 All trenches to conform to WorkSafeBC Guidelines and Regulations.
  - .1 Any costs associated with trench certification and shoring are to be paid by the Contractor.
- .5 Remove concrete, masonry, paving, walks, demolished foundations and rubble and other obstructions encountered during excavation offsite.
- .6 Excavation must not interfere with bearing capacity of adjacent foundations and slabs. Contractor to notify Departmental Representative immediately where undermining of

slabs of foundations occurs. Contractor responsible for devising and executing a remediation plan for filling all voids associated with undermining of slabs and foundations.

- .7 Do not disturb soil within branch spread of trees or shrubs that are to remain.
  - .1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw, as directed by the project Arborist.
  - .2 Provide 24 hours' notice to Departmental Representative of need for Arborist on site.
- .8 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 30 m of trench in advance of installation operations. No more than 5 m of trench may be exposed at end of day's operation and must be securely covered. Road plates are to be used to cover exposed excavations in areas of vehicular travel.
- .9 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.
- .10 Restrict vehicle operations directly adjacent to open trenches.
- .11 Do not obstruct flow of surface drainage or natural watercourses.
- .12 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
  - .1 Subgrade for paved areas to be reviewed and approved by the Contractor's geotechnical engineer prior to placement of fill materials.
  - .2 Any soft/loose areas identified should be excavated and replaced with structural fill placed and compacted in 200mm lifts to 95% Modified Proctor Maximum Dry Density, or as directed by Geotechnical Engineer.
- .13 Correct unauthorized over-excavation as follows:
  - .1 Fill with granular base material to not less than 95% Modified Proctor Density.
- .14 Maintain subgrade surface in condition conforming to this section until succeeding material is applied or until subgrade is accepted by the Departmental Representative, including any dewatering required.
- .15 Hand trim, make firm and remove loose material and debris from excavations.
  - .1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.
  - .2 Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.

### **3.10 ROADWAY EXCAVATION, EMBANKMENT AND COMPACTION**

- .1 Not Applicable

### **3.11 BEDDING AND SURROUND OF UNDERGROUND SERVICES**

- .1 Place and compact granular material for bedding and surround of underground services as indicated.
- .2 Place bedding and surround material in unfrozen condition.

### **3.12 BACKFILLING**

- .1 Do not proceed with backfilling operations until completion of following:

- .1 Departmental Representative has inspected and approved installations.
- .2 Departmental Representative has inspected and approved of construction below finish grade.
- .3 Inspection, testing, approval, and recording location of underground utilities.
- .4 Removal of concrete formwork.
- .5 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 Backfill materials:
  - .1 Boulevards and easements: for areas not subject to vehicle or building loading and outside ditch lines, backfill with approved native material except as shown otherwise on Contract Drawings. Compact to 90% modified proctor density.
  - .2 Roads, foundations, buildings, driveways, concrete walks: backfill with imported granular material. Place backfill material in uniform layers not exceeding 150 mm compacted to 95% Modified Proctor Maximum Dry Density thickness up to grades indicated. Compact each layer before placing succeeding layer.
- .5 Backfilling around installations:
  - .1 Do not backfill around or overcast-in-place concrete within 24 hours after placing of concrete.
  - .2 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 150mm.
  - .3 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:
    - .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Departmental Representative.
- .6 All structural fill should extend beyond footing and hard surfaced areas so that compact/dense native soils, or approved structural fill are present within an area extending one metre laterally from the edge of the foundation and then at a 1H:1V (Horizontal:Vertical) downward projection.
- .7 Place unshrinkable fill in areas as indicated.
- .8 Consolidate and level unshrinkable fill with internal vibrators.
- .9 Install drainage system in backfill as indicated.

### **3.13 TESTING**

- .10 Refer to Section 01 45 00 – Quality Control for geotechnical testing requirements and Section 31 05 00 - Common Works Results – Earthworks, Exterior Improvements, and Utilities.

### **3.14 RESTORATION**

- .1 Existing underground utilities may need to be lowered or rose to suit the final design grades in accordance with minimum and maximum cover requirements for each utility.

- .2 Upon completion of Work, remove waste materials and debris in accordance to Section 01 74 19 - Construction Waste and Disposal, trim slopes, and correct defects as directed by Departmental Representative.
- .3 Replace topsoil in accordance with Section 32 91 19.13 Topsoil Placement and Grading.
- .4 Reinstate lawns to elevation which existed before excavation in accordance with Section 32 92 19.16 Hydraulic Seeding.
- .5 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.
- .6 Restore surface to match existing.
  - .1 Minimum topsoil depth: 100mm
  - .2 Minimum asphalt thickness: 75mm
- .7 Clean and reinstate areas affected by Work as directed by Departmental Representative.
- .8 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.
- .9 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

**END OF SECTION**



**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 31 05 00 Common Works Results – Earthworks, Exterior Improvements, and Utilities
- .2 Section 31 23 33.01 Excavating, Trenching and Backfilling

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM C117-04, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - .3 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .4 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft<sup>3</sup>) (600kN-m/m<sup>3</sup>).
  - .5 ASTM D1557-09, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft<sup>3</sup>) (2,700kN-m/m<sup>3</sup>).
  - .6 ASTM D1883-07e2, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
  - .7 ASTM D4318-10, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 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 DELIVERY, STORAGE AND HANDLING**

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

**1.4 ACTION AND INFORMATION SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
  - .1 Submit proposed source and sieve analysis of all aggregate materials 2 weeks prior to commencing work.

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**Part 2 Products**

**2.1 MATERIALS**

- .1 Granular base and sub-base to Section 31 23 33.01.

**Part 3 Execution**

**3.1 PREPARATION**

- .1 Temporary Erosion and Sedimentation Control:
- .1 Refer to Section 01 35 43 – Environmental Procedures for additional information.
  - .2 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction, sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
  - .3 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
  - .4 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

**3.2 PLACEMENT AND INSTALLATION**

- .1 Place granular base after sub-base and subgrade surface is inspected and approved in writing by Departmental Representative.
- .2 Placing:
- .1 Construct granular base to depth and grade in areas indicated.
  - .2 Ensure no frozen material is placed.
  - .3 Place material only on clean unfrozen surface, free from snow and ice.
  - .4 Begin spreading base material on crown line or on high side of one-way slope.
  - .5 Place material using methods which do not lead to segregation or degradation of aggregate.
  - .6 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.
    - .1 Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
  - .7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
  - .8 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .3 Compaction Equipment:
- .1 Ensure compaction equipment is capable of obtaining required material densities.

- .2 Compacting:
  - .1 Compact to density not less than 95% Modified Proctor Density.
  - .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
  - .3 Apply water as necessary during compacting to obtain specified density.
  - .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved in writing by Departmental Representative.
  - .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
  
- .4 Proof rolling:
  - .1 For proof rolling use standard roller of 45,400 kg gross mass with four pneumatic tires each carrying 11,350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm.
  - .2 Obtain written approval from Departmental Representative to use non-standard proof rolling equipment.
  - .3 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
  - .4 Where proof rolling reveals areas of defective subgrade:
    - .1 Remove base, sub-base and subgrade material to depth and extent as directed by Departmental Representative.
    - .2 Backfill excavated subgrade with common material and compact.
    - .3 Replace sub-base material and compact.
    - .4 Replace base material and compact in accordance with this Section.
  - .5 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent as directed by Departmental Representative and replace with new materials in accordance with this section at no extra cost.
  - .6 At the discretion of the Departmental Representative, nuclear densometer testing may be utilized for compaction testing rather than proof rolling. Location and frequency of densometer tests to be approved by the Departmental Representative.

### 3.3 TESTING

- .1 Refer to Section 31 05 00 - Common Works Results – Earthworks, Exterior Improvements, and Utilities for geotechnical testing requirements.
- .2 Contractor shall notify Departmental Representative in advance of planned testing.
- .3 Contractor to pay costs for uncovering and making good work that is covered before required inspection or testing is completed and approved by Departmental Representative.
- .4 Provide Departmental Representative with 2 copies of testing and commissioning reports as soon as they are available.

**3.4 SITE TOLERANCES**

- .1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

**3.5 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**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 31 05 00 Common Works Results – Earthworks, Exterior Improvements, and Utilities
- .2 Section 32 11 23 Aggregate Base Courses

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM D1557-12e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
  - .2 Canadian General Standards Board (CGSB)
    - .1 CAN/CGSB-1.5 – M91 (March 1999), Low Flash Petroleum Spirits Thinner.
    - .2 CAN/CSGB-1.74 – 2001, Alkyd Traffic Paint.
  - .3 Master Municipal Contract Documents (MMCD), Platinum Edition Volume II - 2009, British Columbia. Contractor to maintain a copy on-site at all times.

**1.3 SAMPLES AND SUBMITTALS**

- .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit asphalt mix design to Departmental Representative for review at least 1 week prior to commencing work.

**1.4 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction Waste and Disposal.
- .2 Place materials defined as hazardous or toxic in designated containers.
- .3 Divert unused aggregate materials from landfill to facility for reuse as approved by Department Representative.
- .4 Dispose of unused paint and paint thinner materials at official hazardous material collections site as approved by Department Representative.
- .5 Do not dispose of unused paint thinner material into sewer system, into streams, lakes, onto ground or in other location where it will pose health environmental hazard.
- .6 Divert unused asphalt from landfill to facility capable of recycling materials.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Prime coat: N/A
- .2 Tack coat: CAN/CGCB – 16.2, Grade SS-1
- .3 Asphalt cement: CGSB – 16.3-M 90, Grade 80-100

- .4 Asphalt concrete: MMCD Upper Course #1 and 2
- .5 Traffic paint: yellow and white to CAN/CGSB-1.74.
- .6 Paint thinner: to CAN/CGSB-1.5.

**Part 3 Execution**

**3.1 FOUNDATIONS**

- .1 Foundations for roadways and parking lots comprise:
  - .1 compacted granular subbase, thickness as shown in Contract Drawings.
  - .2 compacted granular base, thickness as shown in Contract Drawings.
- .2 Compaction: compact each lift of granular material to 95% modified Proctor density. Maximum lift thickness: 150 mm.

**3.2 PAVEMENT THICKNESS**

- .1 Pavement thickness for roadways and parking lots is to be as specified in the Contract Drawings with the following gradation (MMCD 32 12 16):
  - .1 Patching and in-fill adjacent to curbs and sidewalks: MMCD Upper Course #2
  - .2 Temporary ATB access: MMCD Upper Course #1.
  - .3 Fire lane south of the ATB: MMCD Upper Course #1 in two lifts.

**3.3 PAVEMENT CONSTRUCTION**

- .1 Construction of asphalt concrete to MMCD 32 12 16 – Hot-Mix Asphalt Concrete Paving.
- .2 Surface preparation to MMCD 32 12 16 – Hot-Mix Asphalt Concrete Paving

**3.4 TESTING**

- .1 Refer to Section 01 45 00 – Quality Control and Section 31 05 00 - Common Works Results – Earthworks, Exterior Improvements, and Utilities for geotechnical testing requirements.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 03 30 00.09 Cast-In-Place Concrete – Short Form.
- .2 Section 31 05 00 Common Works Results – Earthworks, Exterior Improvements, and Utilities
- .3 Section 31 23 33.01 Excavating, Trenching and Backfilling.
- .4 Section 32 11 23 Aggregate Base Courses.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM C117-04, Standard Test Method for Materials Finer than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D260-86(2001), Standard Specification for Boiled Linseed Oil.
  - .4 ASTM D1557-12e1, Modified Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>(2,700 kN-m/m<sup>3</sup>)).
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-3.3-99(March 2004), Kerosene, Amend. No. 1, National Standard of Canada.
  - .2 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
  - .3 CAN/CGSB-19.24-M90, Multicomponent, Chemical-Curing Sealing Compound
- .3 Canadian Standards Association (CSA International)
  - .1 CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CSA-G30.5-M1983 (R1998), Welded Steel Wire Fabric for Concrete Reinforcement
- .4 Master Municipal Contract Documents (MMCD), Platinum Edition Volume II - 2009, British Columbia. Contractor to maintain a copy on-site at all times.

**1.3 SUBMITTALS**

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
  - .1 Submit concrete mix designs 2 weeks prior to construction.

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

- .1 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction Waste and Disposal.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Concrete mixes and materials: in accordance with Section 03 30 00.09 - Cast-in-Place Concrete – Short Form and:
  - .1 Hand-formed and hand-placed concrete:
    - Slump: 80mm
    - Air entrainment: 5-8%
    - Max. aggregate size: 20mm
    - Min. cement content: 335 kg/m<sup>3</sup>
    - Min. 28 day strength: 32 MPa
  - .2 Extruded concrete:
    - Slump: 0-25mm
    - Air entrainment: 6-9%
    - Max. aggregate size: 10mm
    - Fineness modulus: 2.1 to 2.4
    - Min. cement content: 335 kg/m<sup>3</sup>
    - Min. 28 day strength: 32 MPa
- .2 Reinforcing steel: in accordance with Drawings.
  - .1 Welded steel wire fabric to CSA G30.5-M1983 (R1998)
- .3 Joint filler and Curing Compound: in accordance with Section 03 30 00.09 - Cast-in-Place Concrete – Short Form.
- .4 Joint sealer to CAN/CGSB-19.24-M90, Type 1, Class B
- .5 Granular base: material to following requirements:
  - .1 Granular base to MMCD (Master Municipal Contract Documents 2009, British Columbia), Section 31 05 17.
- .6 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water-soluble soap.
- .7 Fill material:
  - .1 Granular material as specified on contract drawings
- .8 Curing compound: to be spray applied, liquid type conforming to ASTM C309 containing a fugitive dye, applied in accordance with manufacturer's recommendations, or other during methods such as sheet material and burlap mats, subject to Departmental Representative approval.



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**Part 3 Execution**

**3.1 GRADE PREPARATION**

- .1 Do grade preparation work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Construct embankments using excavated material free from organic matter or other objectionable materials.
  - .1 Dispose of surplus and unsuitable excavated material in approved location off site.
- .3 Place fill in maximum 300 mm layers and compact to at least 95% Modified Proctor Density in compliance with ASTM D1557.

**3.2 GRANULAR BASE**

- .1 Obtain Departmental Representative's approval of subgrade before placing granular base.
- .2 Place granular base material to lines, widths, and depths as indicated.
- .3 Compact granular base in maximum 300 mm layers to at least 95% Modified Proctor Density in compliance with ASTM D1557.

**3.3 FORMWORK**

- .1 Use flexible forms for all curves less than 60m radius
- .2 Set forms to line and grade as shown on Contract Drawings free from waves or irregularities in line or grade
- .3 Adequately brace forms to maintain specified tolerances after concrete is placed.
- .4 Treat forms lightly with approved form release agent and remove surplus agent.

**3.4 CONCRETE**

- .1 Obtain Departmental Representative approval of granular base prior to placing concrete.
- .2 Do not place concrete when air temperature appears likely to fall below 5 degrees Celsius within 24 hours unless specified precautions are taken and approved.
- .3 Do concrete work in accordance with Section 03 30 00.09 - Cast-in-Place Concrete – Short Form.
- .4 Immediately after floating, give sidewalk surface uniform broom finish to produce regular corrugations not exceeding 2 mm deep, by drawing broom in direction normal to center line.
- .5 Provide edging as indicated with 10 mm radius edging tool.

**3.5 TOLERANCES**

- .1 Finish surfaces to within 3 mm in 3 m as measured with 3 m straightedge placed on surface.

**3.6 EXPANSION AND CONTRACTION JOINTS**

- .1 Install tooled transverse contraction joints after floating, when concrete is stiff, but still plastic, at intervals of 3 m.
- .2 Install expansion joints at intervals of 9 m.
- .3 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.

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**3.7 ISOLATION JOINTS**

- .1 Install isolation joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.
- .2 Use 13mm pre-molded hardboard joint material to form isolation joints joint filler in isolation joints.
- .3 Seal isolation joints with sealant noted on drawings.

**3.8 CURING**

- .1 Cure concrete by adding moisture continuously in accordance with CSA- A23.1/A23.2 to exposed finished surfaces for at least 1 day after placing, or sealing moisture in by curing compound as directed by Departmental Representative.
- .2 Where burlap is used for moist curing, place two pre-wetted layers on concrete surface and keep continuously wet during curing period of at least 7 days.
- .3 Apply curing compound evenly to form continuous film, in accordance with manufacturer's requirements.

**3.9 BACKFILL**

- .1 Allow concrete to cure for 7 days prior to backfilling.
- .2 Backfill to designated elevations with material as directed by Departmental Representative.
  - .1 Compact and shape to required contours as indicated.

**3.10 TESTING**

- .1 Refer to Section 01 45 00 – Quality Control for geotechnical testing requirements and Section 31 05 00 - Common Works Results – Earthworks, Exterior Improvements, and Utilities.

**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                RELATED REQUIREMENTS**

- .1            32 92 19.16 – Hydraulic Seeding

**1.2                REFERENCES**

- .1            Master Municipal Contract Documents (MMCD), Platinum Edition Volume II - 2009, British Columbia. Contractor to maintain a copy on-site at all times.
- .2            Section 01 35 43 – Environmental Procedures
- .3            Agriculture and Agri-Food Canada
  - .1            The Canadian System of Soil Classification, Third Edition, 1998.
- .4            Canadian Council of Ministers of the Environment (CCME)
  - .1            PN1340, Guidelines for Compost Quality.

**1.3                SUBMITTALS**

- .1            Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Inform DCC Representative at least 2 weeks prior to beginning Work, of proposed source of fill materials and provide access for sampling.

**1.4                QUALITY ASSURANCE**

- .1            Keep design and supporting data on site.
- .2            Do not use soil material until written report of soil test results are reviewed and approved by DCC Representative.
- .3            Health and Safety Requirements:
  - .1            Do construction occupational health and safety in accordance with Section 01 35 30 - Health and Safety Requirements.

**1.5                WASTE MANAGEMENT AND DISPOSAL**

- .1            Separate waste materials in accordance with Section 01 74 19 – Construction Waste and Disposal.
- .2            Divert unused soil amendments from landfill to official hazardous material collections site approved by DCC 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            Part 2 Products**

**2.1                NATIVE TOPSOIL**

- .1            On-site native topsoil may be used, provided it meets standard set for imported topsoil and can be modified to meet requirements set out for specified growing medium.

- .2 If testing shows on-site soil to be suitable for landscaping, a sufficient quantity of stripped topsoil to be stockpiled within designated areas as specified by DCC Representative.
- .3 Do not handle topsoil while in a wet or frozen condition or in any manner in which structure is adversely affected.

## **2.2 IMPORTED TOPSOIL**

- .1 Imported topsoil to be friable loam, neither heavy clay nor of very light sandy nature, containing minimum of 4% organic matter for clay loams and 2% for sand loams, to a maximum of 20% by volume. To be free from subsoil, roots, noxious grass, weeds, toxic materials, stones over 30 mm, foreign objects, and with an acidity rang (pH) of 5.5 to 7.5. To be free from crabgrass, couchgrass, equisetum or noxious weeds or seeds or parts thereof.
- .2 Freedom of rock or debris to be such that 95 – 100% of particles pass a 25 mm sieve and 85 – 100% pass a 9.5mm sieve.
- .3 Population of any single species of plan pathogenic nematode to not exceed 1000

## **2.3 SOURCE QUALITY CONTROL**

- .1 Advise DCC Representative of sources of topsoil and manufactured topsoil to be utilized with sufficient lead time for testing.
- .2 Contractor is responsible for amendments to supply topsoil as specified.
- .3 If Contractor uses the topsoil stripped and stockpiled from the site, it is Contractors responsibility to screen the topsoil if required to ensure compliance with specifications.
- .4 Soil testing by recognized testing facility for PH, P and K, and organic matter.
- .5 Testing of topsoil will be carried out by testing laboratory meeting Provincial standards.
- .6 Topsoil for seeded areas: salvaged and screened topsoil.

## **2.4 SOIL AMENDMENTS**

- .1 Fertilizer:
  - .1 Fertility: major soil nutrients present in following amounts:
  - .2 Nitrogen (N): 20 to 40 micrograms of available N per gram of topsoil.
  - .3 Phosphorus (P): 40 to 50 micrograms of phosphate per gram of topsoil.
  - .4 Potassium (K): 75 to 110 micrograms of potassium per gram of topsoil.
  - .5 Calcium, magnesium, sulfur and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.
  - .6 Ph value: 6.5 to 8.0.
- .2 Peatmoss:
  - .1 Derived from partially decomposed species of Sphagnum Mosses.
  - .2 Elastic and homogeneous, brown in colour.
  - .3 Free of wood and deleterious material which could prohibit growth.

- .4 Shredded particle minimum size: 5 mm.
- .3 Sand: washed coarse silica sand, medium to coarse textured.
- .4 Organic matter: compost Category A, B in accordance with CCME PN1340, unprocessed organic matter, such as rotted manure, hay, straw, bark residue or sawdust, meeting the organic matter, stability and contaminant requirements.
- .5 Use composts meeting Category B requirements for land fill reclamation and large scale industrial applications.
- .6 Limestone:
  - .1 Ground agricultural limestone.
  - .2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.

### **Part 3**

### **Part 3 Execution**

#### **3.1**

#### **STRIPPING OF TOPSOIL**

- .1 Begin topsoil stripping of areas to be re-graded as indicated on contract drawings after area has been cleared of brush, grasses and rocks (75mm and over) and removed from site.
- .2 Strip topsoil to required depths as indicated or as directed by DCC Representative.
  - .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 DCC Representative.
  - .1 Stockpile height not to exceed 2m.
  - .2 Protect stockpile from adverse weather conditions, contamination from invasive plant material, and compaction.
  - .3 Avoid placing stockpile in low areas where natural drainage or storm water could pond, or erode these materials during inclement weather.
- .4 Dispose of unused topsoil in an environmentally responsible manner and as directed by DCC Representative.

#### **3.2**

#### **PREPARATION OF EXISTING GRADE**

- .1 Verify that grades are correct.
  - .1 If discrepancies occur, notify the DCC Representative and do not commence work until instructed by the DCC Representative.
- .2 Grade and loosen soil, eliminating uneven areas and low spots, ensuring positive drainage. Add topsoil as required.
- .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.

### **3.3 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL**

- .1 Place topsoil after the DCC Representative has accepted subgrade.
- .2 Spread topsoil during dry weather.
- .3 Spread topsoil over unfrozen subgrade free of standing water.
- .4 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.
- .5 Spread topsoil in uniform depth not exceeding 100 mm at each layers.
- .6 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

### **3.4 FINISH GRADING**

- .1 Fine grade entire topsoiled area to contours and elevations as indicated or directed by the DCC Representative.
- .2 Finish grade shall be flush with the adjacent pavement.
- .3 Ensure transitions from slopes to level areas are smooth and even.
- .4 Grade to eliminate rough spots and low areas and ensure positive drainage.
  - .1 Prepare loose friable bed by means of cultivation and subsequent raking.
- .5 Consolidate topsoil to required bulk density using equipment accepted by DCC Representative.
  - .1 Leave surfaces smooth, uniform and firm against deep footprinting.

### **3.5 SEEDING**

- .1 To Section 32 92 19.16 – Hydraulic Seeding

### **3.6 ACCEPTANCE**

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

### **3.7 SURPLUS MATERIAL**

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

### **3.8 CLEANING**

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

- .2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.
  - .1 Clean and reinstate areas affected by Work.

END OF SECTION

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1        Section 32 91 19.13 – Topsoil Placement and Grading.

**1.2                SUBMITTALS**

- .1        Product Data.
  - .1        Submit product data in accordance with Section 01 33 00 – Submittal Procedures.
  - .2        At least two weeks prior to commencing work submit to DCC Representative product data and certification that the products meet the requirements for this section:
    - .1        Seed.
    - .2        Mulch.
    - .3        Tackifier.
    - .4        Fertilizer.

**1.3                QUALITY ASSURANCE**

- .1        Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2        Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

**1.4                DELIVERY AND STORAGE**

- .1        Deliver and store grass seed in original containers showing:
  - .1        Analysis of seed mixture.
  - .2        Percentage of pure seed.
  - .3        Year of production.
  - .4        Net mass.
  - .5        Date when tagged and location.
  - .6        Name and address of distributor.
- .2        Deliver wood fibre mulch and tackifier in moisture-proof containers indicating manufacturer, content and net air-dry mass.
- .3        Supply fertilizer to the contract site in shrink wrapped or other suitable moisture proof containers, with guaranteed chemical analysis clearly shown on each container.
- .4        Provide to DCC Representative before and as a condition of use, a shipping bill issued by the supplier of the material, designating the supplier, the manufacturer, the type of material, and a certification of the net weight or volume of material in each container.



- .5 Protect all materials as required during transportation and storage.
- .6 Store the materials onsite only where and as directed and accepted by DCC Representative.
- .7 Take precautions to prevent damage of stored materials by vandalism or weathering.
- .8 Any material which has become wet or otherwise damaged during delivery or storage, or does not meet the requirements specified, shall be rejected and the Contractor shall immediately remove rejected material from the project area.

## **1.5 SCHEDULING**

- .1 Schedule hydraulic seeding to coincide with preparation of soil surface.

## **1.6 WASTE MANAGEMENT AND DISPOSAL**

- .1 Divert unused fertilizer from landfill to official hazardous material collections site.
- .2 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**

- .1 Seed: "Canada pedigreed grade" in accordance with Government of Canada Seeds Act and Regulations.
  - .1 Grass mixture: "Certified", "Canada No. 1" in accordance with Government of Canada "Seeds Act" and "Seeds Regulations".
  - .2 Mixture composition:
    - .1 45% Creeping Red Fescue.
    - .2 30% Kentucky Bluegrass.
    - .3 15% Timothy.
    - .4 10% Annual Rye.
- .2 Mulch: specially manufactured for use in hydraulic seeding equipment, non-toxic, water activated, green colouring, free of germination and growth inhibiting factors with following properties:
  - .1 Type I mulch:
    - .1 Made from wood cellulose fibre.
    - .2 Organic matter content: 99%-100%.
    - .3 Value of pH: 4.8.
    - .4 Potential water absorption: 320%.
    - .5 The material used for mulching shall be a natural wood fibre specially prepared for use in hydroseeding equipment.
    - .6 Contain no growth or germination inhibiting properties.

- .7 Capable of dispensing in water to form a homogeneous slurry.
- .8 Capable of forming an absorptive mat ground cover allowing water percolation.
  
- .3 Tackifier:
  - .1 The tackifier shall be one of:
    - .1 Free flowing non-corrosive biodegradable organic powder produced from a natural plant gum.
    - .2 Water dilatable liquid dispersion containing polyvinyl acetate tepolymer emulsion.
    - .3 Accepted equivalent by DCC Representative.
- .4 Water: free of impurities that would inhibit germination and growth.
- .5 Fertilizer:
  - .1 To Canada "Fertilizers Act" and "Fertilizers Regulations".
  - .2 Complete synthetic, slow release with 35% of nitrogen content in water-insoluble form.
  - .3 Recommended fertilizer mix ratio: N-P-K = 1:4:2.

### **Part 3 Execution**

#### **3.1 EQUIPMENT**

- .1 Hydro Seeders: Capable of thoroughly mixing water, seed, fertilizer and pulverized wood fibre and of uniformly spraying the mix at designated rate.
- .2 Equipment for hydroseeding, mulch and fertilizing shall be capable of mixing the seed, fertilizer, mulch and tackifier as herein described, and evenly distributing the mixtures for efficient treatment of the selected areas.
- .3 The equipment shall have a build-in agitation system with an operating capacity sufficient to agitate, suspend and homogeneously mix a slurry of materials in the amounts specified.
- .4 The slurry tank shall have working capacity of at least 4500 litres, and the pump shall be capable of maintaining a continuous, non-fluctuating stream of solution. Distribution lines shall be of large enough diameter to prevent blockage, and the discharge lines shall be equipped with appropriate nozzles.
- .5 The equipment shall be capable of hydroseeding to the extremities of all areas designated for hydroseeding.

#### **3.2 WORKMANSHIP**

- .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 the DCC Representative.
- .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 Protect seeded areas from trespass until plants are established.
- .5 Do not seed when prepared topsoil is covered with frost, snow or standing water. Proceed with seeding operations only during favourable weather conditions in accordance with sound horticultural practices.
- .6 Clean areas or items as requested by the DCC Representative.

### **3.3 PREPARATION OF SURFACES**

- .1 Fine grade areas to be seeded free of humps and hollows. Ensure areas are free of deleterious and refuse materials.
- .2 Ensure areas to be seeded are moist to depth of 150 mm before seeding.
- .3 Obtain DCC Representative's acceptance of grade and topsoil depth before starting to seed.

### **3.4 HYDROSEEDING OPERATIONS**

- .1 Preparation of Slurry:
  - .1 Measure quantities of materials by weight or weight calibrated volume measurement. Supply equipment required for this work.
  - .2 Charge required water into seeder. Add material into hydraulic seeder under agitation. Pulverize mulch and charge slowly into seeder.
  - .3 After all materials are in the seeder and well mixed, charge tackifier into seeder and mix thoroughly to complete slurry.
    - .1 Slurry Application:
      - .1 Hydraulic seeding equipment:
        - .1 Slurry tank.
      - .2 Agitation system for slurry to be capable of operating during charging of tank and during seeding, consisting of recirculation of slurry and/or mechanical agitation method.
      - .3 Capable of seeding by 50 m hand operated hoses and appropriate nozzles.
      - .4 Tank volume to be certified by certifying authority and identified by authorities "Volume Certification Plate".
      - .5 Slurry mixture applied per hectare.
        - .1 Seed: 300 kg.
        - .2 Mulch: 1,350 kg.
        - .3 Tackifier: 340 kg.

- .4 Water: as required to form recommended slurry.
- .5 Fertilizer: 275 kg.
- .6 Thoroughly mix seed, fertilizer, mulch and tackifier and uniformly distribute the mixture with the hydroseeder over the area indicated or designated by the DCC Representative.
- .7 Apply slurry uniformly, at optimum angle of application for adherence to surfaces and germination of seed.
  - .1 Using correct nozzle for application.
  - .2 Using hoses for surfaces difficult to reach and to control application.
- .8 Blend application 300 mm into adjacent grass areas or sodded areas or previous applications to form uniform surfaces.
- .9 Re-apply where application is not uniform.
- .10 Remove slurry from items and areas not designated to be sprayed.
- .11 Protect seeded areas from trespass satisfactory to the DCC Representative.
- .12 Remove protection devices as directed by the DCC Representative.

### **3.5 PROTECTION**

- .1 Protect seeded areas from trespass until plants are established.
- .2 Remove protection devices as directed by the DCC Representative.

### **3.6 ACCEPTANCE**

- .1 Seeded areas will be accepted by the DCC Representative provided that:
  - .1 Grass is uniformly established.
  - .2 Seeded areas are free of rutted, eroded, bare or dead spots.
  - .3 Areas have been mown at least twice.
- .2 Areas seeded in fall will achieve final acceptance in following spring, one month after start of growing season provided acceptance conditions are fulfilled.

### **3.7 MAINTENANCE DURING WARRANTY PERIOD**

- .1 Perform following operations from time of acceptance until end of warranty period:
  - .1 Repair and reseed dead or bare spots to satisfaction of DCC Representative.

### **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**

- .1 Section 03 30 00. Cast-In-Place Concrete –
- .2 Section 31 05 00 Common Works Results – Earthworks, Exterior Improvements, and Utilities
- .3 Section 31 23 33.01 – Excavating Trenching and Backfilling

**1.2 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A48/A48M-00, Standard Specification for Gray Iron Castings.
  - .2 ASTM C117-04, Standard Test Method for Materials Finer than 75- $\mu\text{m}$  (No. 200) Sieve in Mineral Aggregates by Washing.
  - .3 ASTM C136-05, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .4 ASTM C139-05, Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
  - .5 ASTM C478M-06, Standard Specification for Precast Reinforced Concrete Manhole Sections Metric.
  - .6 ASTM D1557-12e1, Modified Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>(2,700 kN-m/m<sup>3</sup>)).
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2 CAN/CSA-A3000-03(R2005), Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
    - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.
    - .2 CSA-A3002-03, Masonry and Mortar Cement.
  - .3 CAN/CSA-A165 Series-04, CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3).
  - .4 CAN/CSA-G30.18-M92(R2002), Billet Steel Bars for Concrete Reinforcement.
  - .5 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .5 Master Municipal Contract Documents (MMCD), Platinum Edition Volume II - 2009, British Columbia. Contractor to maintain a copy on-site at all times.

### **1.3 SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Submit shop drawings for stormwater treatment manhole including pollutant removal calculations.

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

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
  - .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 – Construction Waste and Disposal.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Cast-in-place concrete:
  - .1 In accordance with Section 03 30 00.09 - Cast-in-Place Concrete – Short Form.
  - .2 Cement: to CAN/CSA-A3001, Type GU.
  - .3 Concrete mix design to produce minimum 27.6 MPa minimum compressive strength at 28 days and containing 25mm maximum size coarse aggregate, with water/cement ratio to CAN/CSA-A23.1.
    - .1 Air entrainment to CAN/CSA-A23.1, class C-3 exposure.
  - .4 Supplementary cementing materials: with minimum 20% Type F fly ash replacement, by mass of total cementitious materials to CAN/CSA A3001.
  - .5 Concrete reinforcement: in accordance with Drawings.
- .2 Precast manhole units: to ASTM C478M, circular.
  - .1 Top sections eccentric cone or flat slab top type with opening offset for vertical ladder installation.
  - .2 Monolithic bases to be approved by Departmental Representative.

- .3 Precast catch basin sections: to ASTM C139 and ASTM C478M.
- .4 Joints: made watertight using rubber rings, bituminous compound, epoxy resin cement.
- .5 Mortar:
  - .1 Masonry Cement: to CAN/CSA-A3002.
- .6 Ladder rungs: to CAN/CSA-G30.18, No.25M billet steel deformed bars, hot dipped galvanized to CAN/CSA-G164.
  - .1 Rungs to be safety pattern (drop step type).
- .7 Adjusting rings: to ASTM C478M.
- .8 Concrete Brick: to CAN3-A165 Series.
- .9 Drop manhole pipe: same as sewer pipe.
- .10 Galvanized iron sheet: approximately 2 mm thick.
- .11 Steel gratings, I-beams and fasteners: as indicated.
- .12 Frames, gratings, covers to dimensions as indicated and following requirements:
  - .1 Metal gratings and covers to bear evenly on frames.
    - .1 Frame with grating or cover to constitute one unit.
    - .2 Assemble and mark unit components before shipment.
  - .2 Gray iron castings: to ASTM A48/A48M, strength class 30B.
  - .3 Castings: coated with two applications of asphalt.
  - .4 Manhole frames and covers: cover cast with perforations and complete with two 25 mm square lifting holes.
  - .5 Catch basin frames and covers: ASTM A48 and to withstand H20 loading.
  - .6 Size: 762mm clear diameter.
- .13 Catchbasins as shown on MMCD standard drawing S11.
- .14 Lawnbasins as shown on MMCD standard drawing S12.
- .15 Stormwater treatment manhole:
  - .1 Stormwater treatment manhole to be a hydrodynamic oil/grit separator with concrete components conforming to this specification.
  - .2 All internal components to be type 316 or 316L stainless steel conforming to ASTM F 1267-01.
  - .3 Stormwater treatment manhole to be capable of removing 80% of TSS annually based on a mean particle size of 50 micron for a 100% impervious catchment of 0.4 ha.
  - .4 The unit shall be capable of capturing and retaining 100 percent of pollutants greater than or equal to 3/16 of an inch regardless of the pollutant's specific gravity (i.e.: floatable and neutrally buoyant materials) for flows up to the device's rated-treatment capacity. The SWTD shall be designed to retain all previously captured pollutants addressed by this subsection under all flow conditions.

- .5 The SWTD shall be capable of capturing and retaining total petroleum hydrocarbons. The SWTD shall be capable of achieving a removal efficiency of 92 and 78 percent when the device is operating at 25 and 50 percent of its rated-treatment capacity. These removal efficiencies shall be based on independent third-party research for influent oil concentrations representative of storm water runoff ( $20 \pm 5$  mg/L). The SWTD shall be greater than 99 percent effective in controlling dry-weather accidental oil spills.
- .6 The unit shall be designed with a sump chamber for the storage of captured sediments and other negatively buoyant pollutants in between maintenance cycles.
- .16 Granular bedding and backfill: in accordance with Section 31 23 33.01 Excavating Trenching and Backfilling.
- .17 Unshrinkable fill: in accordance with Section 31 23 33.01 Excavating, Trenching and Backfilling.

### **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 EXCAVATION AND BACKFILL**

- .1 Excavate and backfill in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling and as indicated.

#### **3.3 CONCRETE WORK**

- .1 Do concrete work in accordance with Section 03 30 00.0 - Cast-in-Place Concrete –
- .2 Place concrete reinforcement in accordance with Drawings.
- .3 Position metal inserts in accordance with dimensions and details as indicated.

#### **3.4 INSTALLATION**

- .1 Construct units in accordance with details indicated, plumb and true to alignment and grade.
- .2 Complete units as pipe laying progresses.
  - .1 Maximum of three units behind point of pipe laying will be allowed.
- .3 Dewater excavation to approval of Departmental Representative and remove soft and foreign material before placing concrete base.
- .4 Cast bottom slabs directly on undisturbed ground.
- .5 Set precast concrete base on 150 mm minimum of granular bedding compacted to 95% Modified Proctor Density to ASTM D1557.



- .6 Precast units:
  - .1 Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base.
  - .2 Make each successive joint watertight with rubber ring gaskets, bituminous compound, cement mortar, epoxy resin cement, or combination of these materials.
  - .3 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.
  - .4 Plug lifting holes with concrete plugs set in cement mortar or mastic compound.
- .7 For sewers:
  - .1 Place stub outlets and bulkheads at elevations and in positions indicated.
  - .2 Bench to provide smooth U-shaped channel.
    - .1 Side height of channel to be 0.75 times full diameter of sewer.
    - .2 Slope adjacent floor at 1 in 20.
    - .3 Curve channels smoothly.
    - .4 Slope invert to establish sewer grade.
- .8 Compact granular backfill to 95% Modified Proctor Density to ASTM D1557.
- .9 Place unshrinkable backfill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .10 Installing units in existing systems:
  - .1 Where new unit is installed in existing run of pipe, ensure full support of existing pipe during installation, and carefully remove that portion of existing pipe to dimensions required and install new unit as specified.
  - .2 Make joints watertight between new unit and existing pipe.
  - .3 Where deemed expedient to maintain service around existing pipes and when systems constructed under this project are ready for operation, complete installation with appropriate break-outs, removals, redirection of flows, blocking unused pipes or other necessary work.
- .11 Set frame and cover to required elevation on no more than three courses of concrete rings.
  - .1 Make brick joints and join brick to frame with cement mortar.
  - .2 Parge and make smooth and watertight.
- .12 Place frame and cover on top section to elevation as indicated.
  - .1 If adjustment required use concrete ring.
- .13 Clean units of debris and foreign materials.
  - .1 Remove fins and sharp projections.
  - .2 Prevent debris from entering system.

### **3.5 ADJUSTING TOPS OF EXISTING UNITS**

- .1 Remove existing gratings, frames and store for re-use at locations designated by Departmental Representative.
- .2 Sectional units:
  - .1 Raise or lower straight walled sectional units by adding or removing precast sections as required.
  - .2 Raise or lower tapered units by removing cone section, adding, removing, or substituting riser sections to obtain required elevation, then replace cone section.
    - .1 When amount of raise is less than 600 mm use standard manhole module or grade rings.
- .3 Monolithic units:
  - .1 Raise monolithic units by roughening existing top to ensure proper bond and extend to required elevation with mortared brick course for 150 mm or less alteration.
  - .2 Lower monolithic units with straight wall by removing concrete to elevation indicated for rebuilding.
  - .3 When monolithic units with tapered upper section are lowered more than 150 mm, remove concrete for entire depth of taper plus as much straight wall as necessary, then rebuild upper section to required elevation with cast-in-place concrete.
  - .4 Install additional manhole ladder rungs in adjusted portion of units as required.
    - .1 Re-use existing gratings, frames.
    - .2 Re-set gratings and frames to required elevation on not more than 3 courses of brick.
      - .1 Make brick joints and join brick to frame with cement mortar, parge and trowel smooth.
      - .2 Re-set gratings and frames to required elevation on full bed of cement mortar, parge and trowel smooth.

### **3.6 SEALING OVER EXISTING UNITS**

- .1 Cut galvanized iron sheet to extend 50 mm beyond opening of existing manhole or catch basin grating.
  - .1 Center iron sheet over existing grating and spot or stitch weld to grating.
  - .2 Fill with cast-in-place concrete.

### **3.7 FIELD QUALITY CONTROL**

- .1 In accordance with Section 01 45 00 – Quality Control and Section 31 05 00 Common Works Results – Earthworks, Exterior Improvements, and Utilities.

### **3.8 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 31 05 00 Common Works Results – Earthworks, Exterior Improvements, and Utilities
- .2 Section 32 11 23 – Aggregate Base Courses.
- .3 Section 31 23 33.01 – Excavating, Trenching and Backfilling.

**1.2 REFERENCES**

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - .1 ANSI/AWWA B300-10, Standard for Hypochlorites.
  - .2 ANSI/AWWA B303-10, Standard for Sodium Chlorite.
  - .3 ANSI/AWWA C207-07, Standard for Steel Pipe Flanges for Waterworks Service, 4 Inch through 144 Inch (100 mm through 3,600 mm).
  - .4 ANSI/AWWA C208-07, Standard for Dimensions for Fabricated Steel Water Pipe Fittings.
  - .5 ANSI/AWWA C500-09, Standard for Metal-Seated Gate Valves for Water Supply Service.
  - .6 ANSI/AWWA C651-05, Standard for Disinfecting Water Mains.
  - .7 ANSI/AWWA C800-05, Standard for Underground Service Line Valves and Fittings.
  - .8 ANSI/AWWA C900-07, Standard for Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Transmission and Distribution.
  - .9 AWWA C901, Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) through 3 In. (76 mm), for Water Service
- .2 ASTM International
  - .1 ASTM A123/A123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .2 ASTM A307-10, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
  - .3 ASTM B88M-05(2011), Standard Specification for Seamless Copper Water Tube Metric.
  - .4 ASTM C117-04, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .5 ASTM C136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .6 ASTM D698-07e1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- .3 American Water Works Association (AWWA)/Manual of Practice
  - .1 AWWA M17-2006, Installation, Field Testing, and Maintenance of Fire Hydrants.

- .4 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.
- .5 CSA International
  - .1 CAN/CSA-B137 Series-09, Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).
    - .1 CAN/CSA-B137.1-09, Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.
    - .2 CAN/CSA-B137.3-09, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.
  - .2 CSA G30.18-09, Carbon and Steel Bars for Concrete Reinforcement.
- .6 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S520-07, Standard for Fire Hydrants.
  - .2 CAN/ULC-S543-09, Standard for Internal-Lug, Quick Connect Couplings for Fire Hose.

### **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 and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Pipe certification to be on pipe.

### **1.4 CLOSEOUT SUBMITTALS**

- .1 Not used.

### **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 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations.
  - .2 Store and protect water distribution piping from nicks, scratches, and blemishes.

### **1.6 SCHEDULING OF WORK**

- .1 Schedule Work to minimize interruptions to existing services.
- .2 Submit schedule of expected interruptions for approval and adhere to interruption schedule as approved by Departmental Representative.
- .3 Notify Departmental Representative and occupants minimum of 24 hours in advance of interruption in service.
- .4 Notify fire department of planned or accidental interruption of water supply to hydrants.
- .5 Provide and post "Out of Service" sign on hydrant not in use.

- .6 Advise local police department of anticipated interference with movement of traffic.

## **1.7 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Not used

## **Part 2 Products**

### **2.1 PIPE, JOINTS AND FITTINGS**

- .1 Polyvinyl chloride pressure pipe: to AWWA C900, DR 18 (pressure class 235 psi), gasket bell end, cast iron outside diameter.
  - .1 Joints: push-on integrally thickened bell and spigot type to ASTM D3139 with single elastomeric gasket to ASTM F477.
- .2 PVC injection-moulded fittings shall be DR18, conforming to AWWA C907 and certified to CSA B137.2. PVC compound is 12454B according to ASTM D1784.
- .3 Bolts to be carbon steel, Grade B to ASTM A307, heavy hex style, zinc plated to ASTM B633. Bolt sizes to AWWA C110
- .4 Nuts and washers: to be carbon steel, Grade A, to ASTM A563. Washers to be flat hardened steel to ASTM F436. Nuts and washers to be zinc plated to ASTM B633.
- .5 Tie rods to be continuous threaded, quenched and tempered alloyed steel to ASTM A354, Grade BC. To be zinc plated to ASTM B633. Tie rods to be minimum 19mm diameter or greater.
- .6 Couplings:
  - .1 Minimum pressure class: 225 psi
  - .2 To AWWA C219, with compression gaskets.
  - .3 Epoxy coated to AWWA C213
  - .4 Stainless steel bolts and nuts to ASTM F593.

### **2.2 VALVES AND VALVE BOXES**

- .1 Valves to open counter clockwise.
- .2 Gate valves: to AWWA C500 with working pressure of 250 psi, standard iron body, bronze mounted wedge valves with non-rising stems, stem seal to be O-ring type, joints as shown in the Contract Drawings.
- .3 Cast iron valve boxes:
  - .1 Base to be large round type.
  - .2 Top of box to be marked "WATER".

### **2.3 SERVICE CONNECTIONS**

- .1 Underground services line valves and fittings 19 to 50mm to AWWA C800 suitable for 1035 kPa working pressure
- .2 HDPE pressure pipe: to CSA-B137.1 and AWWA C901, minimum pressure rating 200 psi.
- .3 Corporation stops to be bronze to ASTM B62, AWWA thread inlet, compression type outlet

- .4 Curb stops to be bronze to ASTM B62, compression type, inverted key, ball or cylinder type construction utilizing rubber O-ring seals.
  - .1 All fitting and valve connections on polyethylene to have solid fluted stiffening liners manufactured from stainless steel to ANSI T304 designed for the appropriate type and ID of pipe.
- .5 Service valve boxes:
  - .1 Curb stop valve boxes on 25mm diameter and smaller services to be telescoping assembly comprised of threaded cast iron top with bronze pentagon centre plug, 25 NPS iron pipe, cast iron base allowing threaded insertion of 25 NPS pipe and accommodation for curb stop valve and 14mm diameter steel operating rod attached to curb stop valve with bronze cotter pin.
- .6 Service connections for PVC pipe:
  - .1 Service connections less than 100 mm: corporation stop, tapped to main using AWWA threads, complete with stainless service saddle. Service saddle to consist of circumferential band type complete with side bars and fingers, keeper bar, stud bolts, nuts, washers and gaskets.
  - .2 Service connections 100 mm and over: use tee fitting or tapping valve and sleeve.
- .7 Tee connections: for services above 100mm. Tee connections to be fabricated of same material and to same standards as specified pipe fittings and to have ends matching pipe to which they are joined.

## **2.4 PIPE BEDDING AND SURROUND MATERIAL**

- .1 Granular material to: Section 31 23 33.01 – Excavating, Trenching and Backfilling
- .2 Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks: to Section 03 30 00.09 - Cast-in-Place Concrete – Short Form.

## **2.5 BACKFILL MATERIAL**

- .1 As per Section 31 23 33.01 - Excavating, Trenching and Backfilling.

## **2.6 PIPE DISINFECTION**

- .1 Sodium hypochlorite, Calcium hypochlorite to AWWA B300 to disinfect water mains.
- .2 Disinfect water mains in accordance with AWWA C651.
- .3 Dechlorinate flushed water with ascorbic acid dechlorination product.

## **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 distribution piping installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate and inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .2 Proceed with installation only after unacceptable conditions have been remedied.

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### **3.2 PREPARATION**

- .1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation.
  - .1 Inspect materials for defects.
  - .2 Remove defective materials from site.

### **3.3 TRENCHING**

- .1 Do trenching work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Ensure trench depth allows coverage over pipe of 1.5 m minimum from finished grade.

### **3.4 GRANULAR BEDDING**

- .1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated below bottom of pipe.
- .2 Do not place material in frozen condition.
- .3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.
- .4 Shape transverse depressions in bedding as required to suit joints.
- .5 Compact each layer full width of bed to 95% minimum of corrected maximum dry density.
- .6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling with compacted bedding material.

### **3.5 PIPE INSTALLATION**

- .1 Terminate and cap building water service 1m outside building wall opposite point of connection to main with allowances made for testing and disinfection.
  - .1 Install coupling necessary for connection to building plumbing.
  - .2 If plumbing is already installed, make connection; otherwise cap or seal end of pipe and place temporary marker to locate pipe end.
- .2 Lay pipes to AWWA C600 manufacturer's standard instructions and specifications.
  - .1 Do not use blocks except as specified.
- .3 Join pipes in accordance with manufacturer's recommendations.
- .4 Bevel or taper ends of PVC pipe to match fittings.
- .5 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
- .6 Lay pipes on prepared bed, true to line and grade.
  - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
  - .2 Take up and replace defective pipe.
  - .3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.
- .7 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.

- .8 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
- .9 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
  - .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .10 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .11 Align pipes before jointing.
- .12 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
- .13 Avoid displacing gasket or contaminating with dirt or other foreign material.
  - .1 Remove disturbed or contaminated gaskets.
  - .2 Clean, lubricate and replace before jointing is attempted again.
- .14 Complete each joint before laying next length of pipe.
- .15 Minimize deflection after joint has been made.
- .16 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
- .17 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
- .18 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
- .19 Do not lay pipe on frozen bedding.
- .20 Do hydrostatic and leakage test and have results approved by Departmental Representative before completing surface works.
- .21 Backfill remainder of trench.

### **3.6 VALVE INSTALLATION**

- .1 Install valves to manufacturer's recommendations at locations as indicated.
- .2 Support valves located in valve boxes or valve chambers by means of bedding same as adjacent pipe. Valves not to be supported by pipe.

### **3.7 SERVICE CONNECTIONS**

- .1 Terminate building water service 1m outside building wall.
  - .1 Install coupling necessary for connection to building plumbing.
  - .2 If plumbing is already installed, make connection, otherwise cap or seal end of pipe and place temporary marker to locate pipe end.
- .2 Do not install service connections until satisfactory completion of hydrostatic, leakage tests, and disinfection of water main.
- .3 Employ only competent workmen equipped with suitable tools to carry out tapping of mains, cutting and flaring of pipes.



- .4 Place temporary location marker at ends of plugged or capped unconnected water lines.
  - .1 Each marker to consist of a stake extending from pipe end at pipe level to 60 mm above grade.
  - .2 Paint exposed portion of stake blue with designation "WATER SERVICE LINE".

### **3.8 THRUST BLOCKS AND RESTRAINED JOINTS**

- .1 For thrust blocks: do concrete Work in accordance with Section 03 30 00.09 - Cast-in-Place Concrete – Short Form.
- .2 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated or as directed by Departmental Representative.
- .3 Keep joints and couplings free of concrete.
- .4 Do not backfill over concrete within 48 hours after placing.
- .5 For restrained joints: use restrained joints as shown in Contract Documents.

### **3.9 HYDROSTATIC AND LEAKAGE TESTING**

- .1 Do tests in accordance with AWWA Standards.
- .2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
- .3 Notify Departmental Representative at least 48 hours in advance of proposed tests.
  - .1 Perform tests in presence of Departmental Representative.
- .4 Where section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete.
- .5 When testing is done during freezing weather, protect hydrants, valves, joints and fittings from freezing.
- .6 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.
- .7 Open valves.
- .8 Expel air from main by slowly filling main with potable water.
  - .1 Install corporation stops at high points in main where no air-vacuum release valves are installed.
  - .2 Remove stops after satisfactory completion of test and seal holes with plugs.
- .9 Fill asbestos cement pipe and concrete pipe at least 24 hours before testing to allow water absorption by pipe material.
- .10 Apply leakage test pressure of 1380 kPa minimum after complete backfilling of trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of 2 hours.
- .11 Define leakage as amount of water supplied in order to maintain test pressure for 2 hours.
- .12 Do not exceed allowable leakage, including lateral connections.
- .13 Locate and repair defects if leakage is greater than amount specified.
- .14 Repeat test until leakage is within specified allowance for full length of water main.

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**3.10 PIPE SURROUND AND BACKFILL**

- .1 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround, cover, and backfill pipes as per Section 31 23 33.01 – Excavating, Trenching, and Backfilling

**3.11 PAINTING OF HYDRANTS**

- .1 After hydrant flow tests, paint caps and ports to meet colour selections approved by authority having jurisdiction.

**3.12 FLUSHING AND DISINFECTING**

- .1 Complete all flushing and disinfection to AWWA C651
- .2 Flushing and disinfecting operations: witnessed by Departmental Representative.
  - .1 Notify Departmental Representative at least 5 days in advance of proposed date when disinfecting operations will begin.
  - .2 Complete disinfection works concurrent with pressure test.
- .3 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 0.8 m/s, within pipe until foreign materials have been removed and flushed water is clear and a minimum of one pipe volume has been flushed.
- .4 Provide connections and pumps for flushing as required with approved and certified backflow prevention device.
- .5 Open and close valves, hydrants and service connections to ensure thorough flushing.
- .6 When flushing has been completed introduce strong solution of chlorine of minimum 25 mg/L free chlorine into water main and ensure that it is distributed throughout entire system.
- .7 Rate of chlorine application to be proportional to rate of water entering pipe.
- .8 Chlorine application to be close to point of filling water main and to occur at same time.
- .9 Operate valves, hydrants and appurtenances while main contains chlorine solution.
- .10 Flush line to remove chlorine solution after 24 hours.
- .11 Measure chlorine residuals at extreme end of pipe-line being tested.
  - .1 After 24 hours, take further samples to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.
- .12 Perform bacteriological tests on water main, after chlorine solution has been flushed out.
  - .1 Take samples in accordance with AWWA C651.
  - .2 Should contamination remain or recur during this period, repeat disinfecting procedure.
  - .3 Contractor to coordinate, deliver and pay for all testing
- .13 Take water samples at service connections, in suitable sequence, to test for chlorine residual.

**3.13 TIE-INS**

- .1 Provide a shutdown and tie-in plan to the Departmental Representative for review 5 days prior to any planned shutdowns.
- .2 All water service tie-ins to be completed after-hours. Timing to be confirmed with Departmental Representative

- .3 Provide a temporary sump and pump for trench de-watering, including any water discharged from watermains. Dirty water shall not enter watermains or services during the tie-in.
- .4 Provide clean, square cuts on any watermains or services free of burrs.
- .5 Clean, swab and disinfect any materials used for the tie-in per AWWA C651.
- .6 Install all couplers, valves, and fittings per manufacturer's recommendation.
- .7 When tie-in is complete, slowly fill the watermain and purge air. Flush the line until water runs clear and is free of additional disinfectant. Visually observe all exposed joints for leaks and rectify in a timely manner.

**3.14 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 in accordance with Section 01 74 19 - Construction Waste and Disposal.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 31 05 00 Common Works Results – Earthworks, Exterior Improvements, and Utilities
- .2 Section 32 11 23 – Aggregate Base Courses.
- .3 Section 31 23 33.01 Excavating, Trenching and Backfilling.

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM C117-04, Standard Test Method for Material Finer Than 75  $\mu\text{m}$  (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D698-07e1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400  $\text{ft}^4\text{-lbf/ft}^3$  (600  $\text{kN-m/m}^3$ )).
  - .4 ASTM D2680-01(2009), Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
  - .5 ASTM D3034-08, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- .2 Master Municipal Contract Documents (MMCD), Platinum Edition Volume II - 2009, British Columbia. Contractor to maintain a copy on-site at all times.
- .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 CSA International
  - .1 CSA A3000-08, Cementitious Materials Compendium.
  - .2 CSA A257 Series-09, Standards for Concrete Pipe and Manhole Sections.
  - .3 CSA B1800-11, Thermoplastic Non-pressure Pipe Compendium.
    - .1 CSA B182.1-11, Plastic Drain and Sewer Pipe and Pipe Fittings.
    - .2 CSA B182.2-11, PSM Type Polyvinylchloride PVC Sewer Pipe and Fittings.
    - .3 CSA B182.11-11, Standard Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.
- .5 U.S. Environmental Protection Agency (EPA) / Office of Water
  - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Not used.

**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 in accordance with manufacturer's recommendations.
  - .2 Store and protect pipes from damage.
  - .3 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 PLASTIC PIPE**

- .1 Type PSM Polyvinyl Chloride (PVC): to CSA B182.2.
  - .1 Standard Dimensional Ratio (SDR), 100mm diameter and less: SDR28, greater than 100mm: SDR 35.
  - .2 Gasket and integral bell system.
  - .3 Nominal lengths: 4 m.

### **2.2 SERVICE CONNECTIONS**

- .1 Plastic pipe: PVC DR 28 to CSA B182.1, with push-on joints.

### **2.3 PIPE BEDDING AND SURROUND MATERIALS**

- .1 As indicated on drawings and in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling
- .2 Concrete mixes and materials for bedding, cradles, encasement, supports: in accordance with Section 03 30 00.1 - Cast-in-Place Concrete – 1

### **2.4 BACKFILL MATERIAL**

- .1 As indicated on drawings and in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Unshrinkable fill: in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Temporary Erosion and Sedimentation Control as per Section 31 23 33.01 – Excavating, Trenching, and Backfilling
- .2 Clean pipes and fittings of debris and water before installation and remove defective materials from site.
- .3 Clean and dry pipes and fittings before installation.

### **3.2 TRENCHING**

- .1 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Protect trench from contents of sewer or sewer connection.

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### 3.3 GRANULAR BEDDING

- .1 Place bedding in unfrozen condition.
- .2 Place granular bedding material in uniform layers not exceeding 300 mm compacted thickness to depth as indicated.
- .3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
  - .1 Do not use blocks when bedding pipes.
- .4 Shape transverse depressions as required to suit joints.
- .5 Compact each layer full width of bed to at least 95 % Modified Proctor Density to ASTM D155.
- .6 Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with lean mix concrete compacted bedding material.

### 3.4 INSTALLATION

- .1 Lay and join pipe in accordance with manufacturer's recommendations and to approval of Departmental Representative.
- .2 Handle pipe using methods approved by 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 inverts 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 Joint deflection permitted within limits recommended by pipe manufacturer.
- .6 Water to flow through pipes during construction only as permitted by 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 CAN/CSA-B1800.
- .9 When any stoppage of Work occurs, restrain pipes as directed by Departmental Representative, to prevent "creep" during down time.
- .10 Plug lifting holes with Departmental Representative approved prefabricated plugs, set in shrinkage compensating grout.
- .11 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.
- .12 Make watertight connections to manholes.
  - .1 Use shrinkage compensating grout when suitable gaskets are not available.
- .13 Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes.

.1 Joint to be structurally sound and watertight.

.14 Temporarily plug open upstream ends of pipes with removable watertight concrete, steel or plastic bulkheads.

### 3.5 PIPE SURROUND

.1 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated.

.1 Leave joints and fittings exposed until field testing is completed.

.2 Hand place surround material in uniform layers not exceeding 300 mm compacted thickness as indicated.

.1 Do not dump material within 3 m of pipe.

.3 Place layers uniformly and simultaneously on each side of pipe.

.4 Compact each layer full width of bed to at least 95 % Modified Proctor Density to ASTM D155.

.5 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

### 3.6 BACKFILL

.1 Place backfill material in unfrozen condition.

.2 Place backfill material, above pipe surround, in uniform layers not exceeding 300 mm compacted thickness up to grades as indicated.

.3 Compact each layer full width of bed to at least 95 % Modified Proctor Density to ASTM D155.

.4 Place unshrinkable backfill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

### 3.7 SERVICE CONNECTIONS

.1 Install pipe to CSA B182.1 and to manufacturer's instructions and specifications.

.2 Maintain grade for 100mm diameter sewers at 2% unless directed otherwise by Departmental Representative.

.3 Service connections to main sewer: standard Wye fitting or approved saddles.

.1 Do not use break-in and mortar patch-type joints.

.4 Service connection pipe: not to extend into interior of main sewer.

.5 Make up required horizontal and vertical bends from 45 degrees bends or less, separated by straight section of pipe with minimum length of 4 pipe diameters.

.1 Use long sweep bends where applicable.

.6 Plug service laterals with watertight caps or plugs.

.7 Place location marker at ends of plugged or capped unconnected sewer lines.

.1 Each marker: stake extending from pipe end at pipe level to 0.6 m above grade.

.2 Paint exposed portion of stake red.

### 3.8 FIELD TESTING

.1 Not used

**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.

**END OF SECTION**



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**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 31 05 00 Common Works Results – Earthworks, Exterior Improvements, and Utilities
- .2 Section 32 11 23 – Aggregate Base Courses.
- .3 Section 31 23 33.01 – Excavating, Trenching and Backfilling.

**1.2 REFERENCES**

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
  - .1 ANSI/AWWA C800-05, Standard for Underground Service Line Valves and Fittings.
  - .2 AWWA C901, Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) through 3 In. (76 mm), for Water Service
- .2 ASTM International
  - .1 ASTM C117-04, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D698-07e1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- .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 CSA International
  - .1 CAN/CSA-B137 Series-09, Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).
    - .1 CAN/CSA-B137.1-09, Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.

**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 and include product characteristics, performance criteria, physical size, finish and limitations.
  - .2 Pipe certification to be on pipe.

**1.4 CLOSEOUT SUBMITTALS**

- .1 Not used.

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

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations.
  - .2 Store and protect piping from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## **1.6 SCHEDULING OF WORK**

- .1 Schedule Work to minimize interruptions to existing services.
- .2 Submit schedule of expected interruptions for approval and adhere to interruption schedule as approved by Departmental Representative.
- .3 Notify Departmental Representative and occupants minimum of 24 hours in advance of interruption in service.

## **1.7 MAINTENANCE MATERIAL SUBMITTALS**

- .1 Not used

## **Part 2 Products**

### **2.1 PIPE, JOINTS AND FITTINGS**

- .1 HDPE pressure pipe: to CSA-B137.1 and AWWA C901, minimum pressure rating 160 psi.

### **2.2 VALVES AND VALVE BOXES**

- .1 Valves to open counter clockwise.
- .2 Underground services line valves and fittings 19 to 50mm to AWWA C800 suitable for 1035 kPa working pressure
- .3 Corporation stops to be bronze to ASTM B62, AWWA thread inlet, compression type outlet
- .4 Curb stops to be bronze to ASTM B62, compression type, inverted key, ball or cylinder type construction utilizing rubber O-ring seals.
  - .1 All fitting and valve connections on polyethylene to have solid fluted stiffening liners manufactured from stainless steel to ANSI T304 designed for the appropriate type and ID of pipe.
- .5 Service valve boxes:
  - .1 Curb stop valve boxes on 25mm diameter and smaller services to be telescoping assembly comprised of threaded cast iron top with bronze pentagon centre plug, 25 NPS iron pipe, cast iron base allowing threaded insertion of 25 NPS pipe and accommodation for curb stop valve and 14mm diameter steel operating rod attached to curb stop valve with bronze cotter pin.
- .6 Tee connections: for services above 100mm. Tee connections to be fabricated of same material and to same standards as specified pipe fittings and to have ends matching pipe to which they are joined.

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**2.3 PIPE BEDDING AND SURROUND MATERIAL**

- .1 Granular material to: Section 31 23 33.01 – Excavating, Trenching and Backfilling
- .2 Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks: to Section 03 30 00.1 – Cast-in-Place Concrete –

**2.4 BACKFILL MATERIAL**

- .1 As per Section 31 23 33.01 - Excavating, Trenching and Backfilling.

**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 distribution piping installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate and inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .2 Proceed with installation only after unacceptable conditions have been remedied.

**3.2 PREPARATION**

- .1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation.
  - .1 Inspect materials for defects.
  - .2 Remove defective materials from site.

**3.3 TRENCHING**

- .1 Do trenching work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Ensure trench depth allows coverage over pipe of 1.5 m minimum from finished grade.

**3.4 GRANULAR BEDDING**

- .1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated below bottom of pipe.
- .2 Do not place material in frozen condition.
- .3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.
- .4 Shape transverse depressions in bedding as required to suit joints.
- .5 Compact each layer full width of bed to 95% minimum of corrected maximum dry density.
- .6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling with compacted bedding material.

**3.5 PIPE INSTALLATION**

- .1 Terminate and cap building service 1m outside building wall opposite point of connection to main with allowances made for testing.
  - .1 Install coupling necessary for connection to building plumbing.

- .2 If plumbing is already installed, make connection; otherwise cap or seal end of pipe and place temporary marker to locate pipe end.
- .2 Place temporary location marker at ends of plugged or capped unconnected pressure sewer lines.
  - .1 Each marker to consist of a stake extending from pipe end at pipe level to 60 mm above grade.
  - .2 Paint exposed portion of stake blue with designation "PRESSURE SEWER SERVICE LINE".
- .3 Lay pipes to AWWA C600 manufacturer's standard instructions and specifications.
  - .1 Do not use blocks except as specified.
- .4 Join pipes in accordance with manufacturer's recommendations.
- .5 Bevel or taper ends of pipe to match fittings.
- .6 Lay pipes on prepared bed, true to line and grade.
  - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
  - .2 Take up and replace defective pipe.
- .7 Do not exceed permissible curvature (minimum bending radius) as recommended by pipe manufacturer.
- .8 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
  - .1 Whenever work is stopped, protect open end of pipe laid to prevent entry of foreign materials.
- .9 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .10 Align pipes before jointing.
- .11 Do not lay pipe on frozen bedding.
- .12 Perform hydrostatic and leakage test and have results approved by Departmental Representative before completing surface works.
- .13 Backfill remainder of trench.

### **3.6 VALVE INSTALLATION**

- .1 Install valves to manufacturer's recommendations at locations as indicated.
- .2 Support valves located in valve boxes or valve chambers by means of bedding same as adjacent pipe. Valves not to be supported by pipe.

### **3.7 HYDROSTATIC AND LEAKAGE TESTING**

- .1 Perform tests in accordance with AWWA M55 – no leakage allowed.
- .2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
- .3 Notify Departmental Representative at least 48 hours in advance of proposed tests.
  - .1 Perform tests in presence of Departmental Representative.

- .4 Where section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete.
- .5 When testing is done during freezing weather, protect hydrants, valves, joints and fittings from freezing.
- .6 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.
- .7 Open valves.
- .8 Expel air from main by slowly filling main with potable water.
  - .1 Install corporation stops at high points in main where no air-vacuum release valves are installed.
  - .2 Remove stops after satisfactory completion of test and seal holes with plugs.
- .9 Apply leakage test pressure of 680 kPa (100 psi) minimum after complete backfilling of trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of 2 hours.
- .10 Define leakage as amount of water supplied in order to maintain test pressure for 2 hours.
- .11 Locate and repair defects if leakage is observed or pressure drop is greater than allowable amount.
- .12 Repeat test until zero leakage is observed and pressure drop is within specified allowance for full length of pressure sewer.

**3.8 PIPE SURROUND AND BACKFILL**

- .1 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround, cover, and backfill pipes as per Section 31 23 33.01 – Excavating, Trenching, and Backfilling

**3.9 TIE-INS**

- .1 Tie-ins to be completed using tapping saddles into the existing gravity sewer, without interrupting sewage flows from existing facility.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 31 05 00 Common Works Results – Earthworks, Exterior Improvements, and Utilities
- .2 Section 32 11 23 – Aggregate Base Courses.
- .3 Section 31 23 33.01 Excavating, Trenching and Backfilling.

**1.2 REFERENCES**

- .1 Master Municipal Contract Documents (MMCD), Platinum Edition Volume II - 2009, British Columbia Contractor to maintain a copy on-site at all times.
- .2 ASTM International
  - .1 ASTM C117-04, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM C443M-10, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).
  - .4 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>(600 kN- m/m<sup>3</sup>)).
  - .5 ASTM D1557-12e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
  - .6 ASTM D1056-07, Standard Specification for Flexible Cellular Materials- Sponge or Expanded Rubber.
  - .7 ASTM D2680-01(2009), Standard Specification for Acrylonitrile- Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
  - .8 ASTM D3034-08, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
  - .9 ASTM F405-05, Standard Specification for Corrugated Polyethylene (PE) Tubing and Fittings.
  - .10 ASTM F794-03(2009), Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
  - .11 ASTM A760, Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1-M89, Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
  - .3 CAN/CGSB-34.9-94, Asbestos-Cement Sewer Pipe.

- .4 CSA International
  - .1 CAN/CSA-A3000-08, Cementitious Materials Compendium.
  - .2 CAN/CSA-B1800-06, Thermoplastic Non-pressure Pipe Compendium - B1800 Series.
  - .3 CSA G401-07, Corrugated Steel Pipe Products.
- .5 U.S. Environmental Protection Agency (EPA) / Office of Water
  - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

### **1.3 SCHEDULING**

- .1 Schedule Work to minimize interruptions to existing services and to maintain existing flow during construction.
- .2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

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

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's recent test data and certification that materials to be incorporated in to the works are representative and meet the requirements for this section. Include manufacture's drawings where pertinent
- .3 Certification to be marked on pipe.

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

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in accordance with manufacturer's recommendations.
  - .2 Store and protect pipes from damage.
  - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan Waste Reduction Work plan related to Work of this Section.
  - .1 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, packaging materials as specified in Construction Waste Management Plan Waste Reduction Work plan in accordance with Section 01 74 19 - Construction Waste and Disposal.

## **Part 2 Products**

### **2.1 PLASTIC PIPE**

- .1 Type PSM Poly Vinyl Chloride (PVC): to ASTM D3034 CAN/CSA-B182.2.

- .1 Standard Dimensional Ratio (SDR), 100mm diameter and less: SDR28, greater than 100mm: SDR 35.
- .2 Locked-in Separate gasket and integral bell system.
- .3 Nominal lengths: 4.6 m.
- .2 Corrugated polyethylene pipe: high density to ASTM F667 ASTM F405 BNQ- 3624-115.

## **2.2 CORRUGATED STEEL PIPE**

- .1 Pipe to CSA G401, except external helical corrugation pattern to be 19mm x 19mm x 190mm as described in AASHTO M36 or ASTM A760.
- .2 Pipe material: galvanized Type II
- .3 Pipe wall thickness: in accordance with manufacturer's recommendations given minimum and maximum cover limits and condition.
- .4 Couplers: hugger band type complete with O-ring gasket. Coupler to be 500mm wide.
- .5 Maximum installed vertical deflection not to exceed 5% of base inside diameter. Maximum installed horizontal deflection not to exceed 3% of base inside diameter.

## **2.3 PIPE BEDDING AND SURROUND MATERIAL**

- .1 As indicated on drawings and in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling
- .2 Concrete mixes and materials for bedding, cradles, encasement, supports in accordance with Section 03 30 00.0 - Cast-in-Place Concrete –

## **2.4 BACKFILL MATERIAL**

- .1 As indicated on drawings and in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Unshrinkable fill: in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Clean pipes and fittings of debris and water before installation and remove defective materials from site to approval of Departmental Representative.

### **3.2 TRENCHING**

- .1 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Protect trench from contents of sewer.

### **3.3 GRANULAR BEDDING**

- .1 Place bedding in unfrozen condition.
- .2 Place granular bedding material in uniform layers not exceeding 300 mm compacted thickness to depth as indicated.



- .3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
- .4 .1 Do not use blocks when bedding pipes.
- .5 Shape transverse depressions as required to suit joints.
- .6 Compact each layer full width of bed to at least 95 % Modified Proctor Density to ASTM D155.
- .7 Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with lean mix concrete compacted bedding material.

### 3.4 **INSTALLATION**

- .1 Install culverts in accordance with MMCD 33 42 13 – Pipe Culverts
- .2 Lay and join pipe in accordance with manufacturer's recommendations and to approval of Departmental Representative.
- .3 Handle pipe using methods approved by Departmental Representative.
  - .1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
- .4 Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points.
  - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
- .5 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
- .6 Joint deflection permitted within limits recommended by pipe manufacturer.
- .7 Water to flow through pipes during construction only as permitted by Departmental Representative.
- .8 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .9 Install plastic pipe and fittings in accordance with CAN/CSA-B1800.
- .10 When any stoppage of Work occurs, restrain pipes as directed by Departmental Representative, to prevent "creep" during down time.
- .11 Plug lifting holes with Departmental Representative approved prefabricated plugs, 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 catch basins.
  - .1 Use shrinkage compensating grout when suitable gaskets are not available.
- .14 Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes.
  - .1 Joint to be structurally sound and watertight.

- .15 Temporarily plug open upstream ends of pipes with removable watertight concrete, steel or plastic bulkheads.

### 3.5 PIPE SURROUND

- .1 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated.
  - .1 Leave joints and fittings exposed until field testing is completed.
- .2 Hand place surround material in uniform layers not exceeding 300 mm compacted thickness as indicated.
  - .1 Do not dump material within 3 m of pipe.
- .3 Place layers uniformly and simultaneously on each side of pipe.
- .4 Compact each layer full width of bed to at least 95 % Modified Proctor Density to ASTM D155.
- .5 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

### 3.6 BACKFILL

- .1 Place backfill material in unfrozen condition.
- .2 Place backfill material, above pipe surround, in uniform layers not exceeding 300 mm compacted thickness up to grades as indicated.
- .3 Compact each layer full width of bed to at least 95 % Modified Proctor Density to ASTM D155.
- .4 Place unshrinkable backfill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

### 3.7 SERVICE CONNECTIONS

- .1 Install pipe to CSA B182.1 and to manufacturer's instructions and specifications.
- .2 Maintain grade for 100mm diameter sewers at 2% unless directed otherwise by Departmental Representative.
- .3 Service connections to main sewer: standard Wye fitting or approved saddles.
  - .1 Do not use break-in and mortar patch-type joints.
- .4 Service connection pipe: not to extend into interior of main sewer.
- .5 Make up required horizontal and vertical bends from 45 degrees bends or less, separated by straight section of pipe with minimum length of 4 pipe diameters.
  - .1 Use long sweep bends where applicable.
- .6 Plug service laterals with watertight caps or plugs.
- .7 Place location marker at ends of plugged or capped unconnected sewer lines.
  - .1 Each marker: stake extending from pipe end at pipe level to 0.6 m above grade.
  - .2 Paint exposed portion of stake green.

**3.8 FIELD TESTS AND INSPECTIONS**

- .1 Provide means of access to permit Departmental Representative to do inspections.
- .2 Repair or replace pipe, pipe joint or bedding found defective.
- .3 Remove foreign material from sewers and related appurtenances by flushing with water.
- .4 Television and photographic inspections:
  - .1 Carry out inspection of installed sewers by closed circuit television camera, photographic camera or by other related means. Contractor will pay for costs of tests. Work to be completed to Pipeline Assessment Certification Program (PACP) standards.
  - .2 Submit reports to Departmental Representative within 10 working days of completion of the field work on a continuous basis as the inspection area or pipeline types are finalized.
  - .3 Submit inspection report, digital video on DVD-R and corresponding digital report on CD-R to Departmental Representative for review.

**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.

**END OF SECTION**

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**Part 1            General**

**1.1                RELATED REQUIREMENTS**

- .1        This Section of the Specifications forms part of the Contract Documents and shall be read, interpreted and coordinated with all other parts.
- .2        Coordinate utility installation and connection requirements with BC Hydro.

**1.2                REFERENCE STANDARDS**

- .1        CSA Group (CSA)
  - .1        CAN/CSA-C83, Communication and Power Line Hardware.
- .2        Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1        Safety Data Sheets (SDS).

**1.3                MATERIAL**

- .1        Service mast: rigid heavy duty, galvanized steel, suitable for attachment of support clamps, insulator rack, weatherhead, service drop fittings.
- .2        Service mast support devices: As per BC Hydro standards.
- .3        Service tap support: suitable for preformed grip or other attachment for spun cables to approval of supply authority.
- .4        Weatherhead: to approval of supply authority
- .5        Rigid steel galvanized conduit, fittings: in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .6        Service drop conductors and supporting cable: in accordance with Section 26 05 21 - Wires and Cables 0-1000 V, copper, type ACWU75 or TECK90, size and number of conductors as indicated.
- .7        Weatherproof metre socket: in accordance with Section 26 09 23.01 - Metering and Switchboard Instruments and approval of supply authority.

**Part 2            Execution**

**2.1                MANUFACTURER'S INSTRUCTIONS**

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

**2.2                INSTALLATION**

- .1        Install service mast and weatherhead as per BC Hydro Overhead standards.
- .2        Install metre socket and conduit.

- .3 Install service drop conductors allowing sufficient conductor length for connection to service equipment.
- .4 Allow sufficient conductor length for connection to supply by power supply authority.
- .5 Allow sufficient conductor length for drip loops.
- .6 Make grounding connections in accordance with Section 26 05 28 - Grounding - Secondary.

**2.3 FIELD QUALITY CONTROL**

- .1 Site Tests:
  - .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
  - .2 Perform additional tests if required by authority having jurisdiction.

**END OF SECTION**

## APPENDIX A

Geotechnical Site Assessment Report  
(Rev .01)  
Proposed Residential Sites-  
New Aiyansh RCMP Detachment  
Wood Environment and Infrastructure Solutions  
13 October 2020



# **Geotechnical Site Assessment Report (Rev.01)**

Proposed Residential Sites - New Aiyansh RCMP  
Detachment  
117 Nass Rd, New Aiyansh, BC  
Wood File: KA21195  
PSPC Project Number R.112456.001

Prepared for:

**Public Services and Procurement Canada (PSPC)**  
Vancouver, BC

13 October 2020



# Geotechnical Site Assessment Report (Rev.01)

Proposed Residential Sites - New Aiyansh RCMP Detachment

117 Nass Rd (Nisga'a Hwy 113), New Aiyansh, BC

Wood File: KA21195

PSPC Project Number R.112456.001

## Prepared for:

Public Services and Procurement Canada (PSPC)  
Vancouver, BC

## Prepared by:

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**13 October 2020**

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## Executive Summary

The proposed residential sites are located in the New Aiyansh RCMP compound approximately 500 m north of the Village of New Aiyansh. The area is on an upland, about 800 m east of the Nass Valley floodplain. The Nisga'a Lava Beds, which cover the floodplain, do not extend onto the upland.

The drilled site is underlain by a thick glaciomarine deposit on top of glacial outwash sediments. There is stiff to hard native clay at foundation level which we expect will be favourable for support of the proposed structures on shallow foundations and slab-on-grade.

Perched groundwater can be expected from the sandy material atop the clay and the contractor should be prepared to remove shallow groundwater and surface water from foundation areas and service trenches with conventional sumps and pumps.

Drainage of the site is important. Conventional perimeter foundation drainage is recommended for the residence. The drains should be connected into the local drainage system down gradient of the garage.

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## 1.0 Introduction

Wood Environment & Infrastructure Solutions (Wood) was commissioned by Public Services and Procurement Canada (PSPC) for geotechnical engineering services regarding two prospective sites of a proposed residence planned for the RCMP detachment grounds in New Aiyansh, BC, located as shown in Figure 1. The work is being done in conjunction with a garage site located elsewhere on the RCMP grounds.

The scope of geotechnical services for this project was described in the Wood proposal dated March 16, 2020 and revised August 25, 2020. Authorization to proceed with the scope of services relating to the garage was obtained from PSPC on June 15, 2020 under the Standing Offer No.: EZ899-181755/003/TPV.

This report presents results from field work, laboratory testing, and analysis, and provides geotechnical recommendations for the proposed garage building. The proposed garage site is discussed under separate cover.

## 2.0 Project Details

The proposed one to two storey residence will be located in the New Aiyansh RCMP compound, east of the existing detachment building. There are two prospective sites for the residence:

- In an undeveloped area to the northwest of the detachment building, and
- In the lawn area directly north of the attachment.

The residence will be about 10 m × 15 m in plan area. It will be a wood framed structure constructed with conventional shallow footings and a slab-on grade. The lower floor level of the residence may be below grade such that the residence could have a basement.

The RCMP detachment layout is provided in Figure 2 and shows the locations of the existing RCMP buildings, residences, roads and parking areas. Geotechnical aspects of design and construction of the proposed garage will be discussed under separate cover.

## 3.0 Exploration and Testing

A geotechnical subsurface investigation was completed at the site on September 15, 2020. Prior to the field work, we were provided topographical survey information of the site, prepared by the client. In the field, borehole locations were located relative to existing features that were previously surveyed by the client. In addition, utility information from BC One Call and client drawings were reviewed. Borehole locations were cleared of potential buried services by CMH Underground Utilities Ltd. We had intended to drill a borehole near the west residential site but were unable to clear the water service leading to the hydrant located near the residence's northeast corner.

Two boreholes, BH20-01 and BH 20-02 were advanced to depths of 19.8 m and 6.1 m respectively in the garage area. Another borehole, BH 20-03, was drilled in the area of the residences. Boreholes were drilled using a solid stem auger drill rig, owned and operated by Blue Max Drilling Ltd. The location of the boreholes is shown in Figure 2. At BH 20-03, Standard Penetration Tests were done at 1.5 m intervals to the drilled depth of 6.1 m. At BH 20-01, Standard Penetration Tests (SPT) were conducted at 1.5 m intervals to a depth of 8.6 m. Drilling and sampling from the auger then proceeded from 8.6 m to 16.8 m. From 16.8 m, a Dynamic Cone Penetration Test was done to the bottom of the borehole at 19.8 m in order to determine the bottom of the glaciomarine clay. BH 20-02, also in the garage area, was drilled and sampled with solid stem augers to a depth of 6.1 m.

No piezometers were installed during drilling.

During drilling, a Wood representative recorded the subsurface conditions encountered in each borehole and obtained grab and split spoons samples. The samples were submitted to Wood's Surrey Civil Engineering Laboratory to determine soil index properties such as moisture content and Atterberg Limits. Borehole logs are presented in Appendix A, and geotechnical laboratory test results are summarized on the borehole logs.

#### 4.0 Site Conditions

The site is located in the RCMP compound off of Nisga'a Highway 113, about 500 m north of the Village of New Aiyansh. It is located on the glacial upland, about 800 m east of the Nass River floodplain. In this area, the floodplain has been covered by the Nisga'a lava beds, the result of a volcanic eruption in about 1750. The lava beds do not extend to the subject site.

The RCMP compound, shown in Figure 1, consists of a rectangularly shaped access road leading north from Nisga'a Highway 113. The detachment building is in the middle of the rectangle and is bounded by a parking lot to the south and a lawn area, across a laneway, to the north. The proposed residential sites are located on the lawn area north of the detachment building and in the wooded area to the west across the access road. Existing residences are located to the north of and across the road from the lawn area. The area surrounding the compound is wooded. A DFO compound containing buildings and a residence, is located to the west of the RCMP compound.

Overall, the site has a gentle slope from north down to the south. The surface of the lawn area was damp and ditches contained minor water. The west site is in a wooded area. The area between the forest and access road is covered with long grass and contains a water service leading to a hydrant.



**Photo 1: Looking northwest at Proposed Residence Site 2.**  
*Proposed Site 1 is located in the wooded area to the west of the road.*

## 4.1 Subsurface Conditions

Surficial geology information for the area is found in Geological Survey of Canada, Open File 3901, *Surficial Geology of the Nass Valley*, S McQuaig, 2003. The site is expected to be underlain by a glaciomarine blanket. The file includes information from a borehole drilled in the vicinity of the site which encountered clay to a depth of 24 m, then a glacial outwash deposit comprised of interbedded sand, gravel, silt and clay to a depth of 41 m. Lodgement till was encountered below a depth of 41 m.

Our boreholes did encounter a thick deposit of clay down to a depth of 17 m. The underlying material, of greater relative density than the clay, was likely the glacial outwash deposit.

We expect that clay, overlain by a surficial organic layer will be encountered during construction. The upper 300 to 500 mm of the clay was found to be sandy and may contain groundwater during wet times of year.

Hard, brown, medium plastic clay with trace sand was encountered to the drilled depth of 6.1 m. The colour of the clay tended to grey at a depth of about 4.5 m. Moisture content increased with increasing depth as did plasticity. Strength decreased somewhat with depth, however, the clay was stiff and over consolidated throughout its depth.

A borehole drilled at the nearby garage site encountered the bottom of the clay at a depth of 17.7 m, beneath which was a compact to dense more granular material.

## 4.2 Groundwater Conditions

The borehole drilled at the residential site was dry. New Aiyansh has a very wet climate and we expect that perched groundwater will be present on top of the clay for most of the year.

## 5.0 Comments and Recommendations

### 5.1 Overview

The site is underlain by stiff to hard native clay at foundation level which we expect will be favourable for support of the proposed structures on shallow foundations and slab-on-grade.

Perched groundwater can be expected from the surface materials and the contractor should be prepared to remove shallow groundwater and surface water from foundation areas and service trenches with conventional sumps and pumps.

Drainage of the site is important. Conventional perimeter foundation drainage is recommended for the residence. The drains should be connected into the local drainage system down gradient of the building.

### 5.2 Site Preparation

All existing vegetation, topsoil and fill should be stripped from the building footprint exposing undisturbed native soils. The building footprint should be excavated down to at least bottom of design footing elevations, and further if required to expose undisturbed native bearing soils. Structural fill should be placed and compacted over native bearing soils to underside of building footing elevations, if required.

Native soils are cohesive and can be softened by groundwater or surface water and/or construction activities during wet weather. Subgrade disturbance of the clay due to construction activities should be avoided. Depending on the consistency of the clay at the time of construction, clay softened by water may need to be over-excavated and replaced with structural fill. As a protective measure, a structural fill layer can be installed at the footing level to reduce risk of subgrade softening due to wet weather and

construction activity. The structural fill layer should be at least 150 mm thick. Alternatively, a concrete mudslab could be considered for protection of the subgrade from surface water.

More discussions on structural fill can be found in Section 5.3 below.

The exposed subgrade should be reviewed by the Geotechnical Engineer of Record to confirm bearing suitability immediately prior to placement of structural fill and/or foundations.

### 5.3 Structural Fill

Structural fill is defined as fill material used to develop site grades beneath foundations, floor slabs, and other hard-surfaced areas. Structural fill should consist of clean imported granular fill, that will not degrade from exposure to water, freeze-thaw cycles or handling, spreading or compacting, that contains less than five percent silt and clay sizes. All imported granular materials must be free draining and meet PSPC requirements and/or municipal standards such as MMCD<sup>1</sup>. In our opinion the existing site materials contain much more than five percent fines and are not suitable for re-use as structural fill. Site materials can be used as backfill of trenches or other applications beneath landscaped areas.

Structural fill material beneath foundations should be placed in lifts not exceeding 200 mm loose thickness. It should be compacted to at least 100% of Standard Proctor Maximum Dry Density (SPMDD) as determined by ASTM D698. The Geotechnical Engineer of Record should provide inspection, observation and compaction testing during placement and compaction of the structural fill on the site.

The placed structural fill should extend beyond footing areas at least one metre laterally from the edge of the foundations and then at a 1H: 1V (Horizontal: Vertical) downward projection to stiff/dense native soil.

The Geotechnical Engineer of Record should review the suitability of structural fill adjacent to or below other materials. For example, a uniform coarse material such as broken rock or drain rock must not be placed adjacent to a fine-grained cohesive soil such as the native clay on site without an approved intermediary filter material or geotextile.

PSPC specifications for base and subbase materials, are provided below:

**Table 1: Granular Subbase  
(for trench backfill and subbase beneath hard surfaces)**

Sieve Designation (mm)	Percent Passing
75	100
37.5	60 to 100
19	35 to 80
9.5	26 to 60
4.75	20 to 40
2.0	15 to 30
0.425	5 to 28
0.075	0 to 8

<sup>1</sup> Master Municipal Construction Documents.

**Table 2: Granular Base  
(for pavement and garage slab base)**

Sieve Designation (mm)	Percent Passing
19	100
12.5	75 to 100
4.75	40 to 70
2.00	23 to 50
0.425	7 to 25
0.075	3 to 8

#### 5.4 Excavation and Dewatering

Temporary excavations greater than 1.2 m deep and steeper than 3/4H:1V requiring worker entry must be shored or flattened in accordance with WorkSafe BC regulations. Should groundwater or surface water inflows soften/loosen the overburden material, flatter slopes than those recommended by WorkSafe BC may be required.

Accumulation of surface water can be expected during periods of extended wet weather. Accordingly, temporary site drainage requirements should be assessed by the contractor in relation to the excavation depths and foundation construction schedule.

The contractor should determine temporary dewatering requirements based on their proposed construction methodology and sequencing.

A perched water table, groundwater seepage and/or surface water should be expected during wet weather and wet times of the year. The contractor should be prepared to handle such water with conventional sumps and pumps for shallow excavations. Sloughing is to be expected from excavation slopes in wet fill, organic or wet sand/silt soil.

Perimeter foundation drainage is recommended around any buildings or structures that have a slab on grade that is not more than 0.3 m higher than the surrounding exterior grade where grades slope away from the building. The residence, which we expect will have a floor elevation close to or below the surrounding grade, should be provided with standard perimeter footing drains that discharge to an approved storm drainage system. Drains should consist of minimum 150 mm diameter perforated PVC pipe, covered in about 300 mm of drain rock, all wrapped in non-woven geotextile such as Nilex 4551 or equivalent.

#### 5.5 Frost Considerations

The base of exterior footings and footings in unheated areas should have at least 1,000 mm of cover for frost protection. Similar minimum or equivalent insulated cover should be provided above buried services including pressured water lines. The ground surface should be graded such that surface water is shed away from building areas so as to avoid ponded water which can contribute to frost lens formation. As noted above, perimeter foundation drains are recommended for residence.

## 5.6 Foundations

The native stiff to hard clay or structural fill placed over such will be suitable for foundation support of the proposed structure. Foundations should be designed using factored bearing capacity values of 150 kPa SLS and 200 kPa ULS.

Spread and strip footings should have minimum widths of 600 and 450 mm respectively. Considering the above, total and differential settlements are expected to be less than 25 mm and 19 mm respectively.

As stipulated by the National Building Code of Canada (NBCC 2015) and British Columbia Building Code (BCBC 2018), the Geotechnical Engineer of Record must review bearing surfaces prior to the placement of foundations and structural fill beneath foundations to confirm the bearing surface is properly prepared and is suitable for support of the structure.

## 5.7 Slabs on Grade

To avoid the capillary rise of moisture to the underside of the concrete slab, the slab on grade floor should be underlain by a minimum 150 mm thick layer of clean 19 mm minus crushed granular base material compacted to at least 100% SPMDD. The placement of a polyethylene sheeting vapor barrier should be considered, and use should be determined based on occupancy and floor finish. American Concrete Institute (ACI) publication 360R-10 *Guide to Design of Slabs-on-Ground*, 2010, should be followed for slab detailing, including moisture barrier provisions.

## 5.8 Seismic Considerations

The National Building Code of Canada (NBCC) requires that structures be designed to resist collapse when subjected to "strong shaking", defined as ground motions with a return period of 1 in 2,475 years (or two percent probability of exceedance in 50 years).

A secondary objective of the code is to limit damage to buildings caused by low to moderate shaking. NBCC has adopted the use of foundation factors dependent on analysis of ground motion histories adjusted for local site conditions, characterized based on the average shear wave velocity and relative density of the earth materials in the uppermost 30 m. Based on the presence of stiff clay underlain by relatively dense glacial outwash deposits in the upper 30m, the site should be classified as Site Class D in conformance with Table 4.1.8.4 A of the 2015 NBCC.

The geotechnical characterization of seismic site response is based on published ground motions and assumed subsurface stratigraphy and does not consider potential focusing effects of topography. If it is found that seismic forces govern the design and small changes in the values used significantly alter the design requirements, site-specific analysis may be warranted.

Peak Ground Acceleration (PGA) of 0.068 g should be used for this site. The 2015 National Building Code Seismic Hazard Calculation is presented in Appendix B.

## 5.9 Buried Services

All subgrade should be properly prepared and field review should be conducted by the Geotechnical Engineer of Record prior to placing fill/bedding materials, conduit and related structures. Any soft/loose areas identified should be excavated and replaced with structural fill placed and compacted as recommended in the section "Fill" and/or as per standards. Since perched groundwater is expected at the site, seepage into subsurface structures such as manholes and duct banks should be anticipated unless special provisions are provided to waterproof these structures.



MMCD specifications for pipe and duct bedding and surround material is shown in Table 3.

**Table 3: MMCD Granular Pipe Bedding and Surround Material  
(for the fill zone within 300 mm of pipes or ducts)**

Sieve Designation (mm)	Type 1: Percent Passing	Type 2: Percent Passing (to be used in dry condition)
25	100	100
12.5	90 to 100	90 to 100
12.5	65 to 85	70 to 100
9.5	50 to 75	
4.75	25 to 50	40 to 70
2.36	10 to 35	25 to 52
1.18	6 to 26	15 to 38
0.600	3 to 17	6 to 27
0.300		3 to 20
0.075	0 to 5	0 to 8

### 5.10 Water Soluble Sulphates

Water soluble sulphate tests were done on samples from BH 20-01 and BH 20-03 as shown in Table 4 below.

**Table 4: Water Soluble Sulphate Test Results**

Location	Depth (m)	Water Soluble Sulphate (%)
Proposed Garage BH 20-01	1.2	0.014
Proposed Residence BH 20-03	1.5 to 1.95	0.016

According to Table 3 of CSA A23.1-19, the sulphate concentrations shown above are low and no special measures related to concrete are required.

## 6.0 Construction Quality Control

The recommendations provided in this report are based on Wood's current understanding of the physical attributes of the site, the intended use of the site, the proposed structural layout, and on the assumptions that the work will be carried out by an experienced contractor in a manner consistent with good engineering practice, and that an appropriate level of geotechnical field review will be conducted by the Geotechnical Engineer of Record during construction of the development.

Provision should be made for the Geotechnical Engineer of Record to review the final site grading and drainage plans, and site preparation and foundation requirements contained in construction specifications. The Geotechnical Engineer of Record will conduct geotechnical testing and field review during site preparation works.

The testing and field review will include:

- Field review of subgrade for building shallow foundations prior to placing any fill or footings;
- Review and testing of materials intended for use as structural fills;
- Compaction testing of structural fills; and
- Review of drainage installations prior to backfilling and final site grading.

## 7.0 Closure

This report was prepared exclusively for Public Services and Procurement Canada by Wood Environment & Infrastructure Solutions (Wood). The information, conclusions and estimates contained in this report are based exclusively on: i) information available at the time of preparation, ii) the accuracy and completeness of data supplied by the Client or by third parties as instructed by the Client, and iii) the assumptions, conditions and qualifications/limitations set forth in this report.

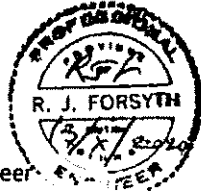
Wood trusts this meets your immediate requirements. If you have questions or require further information, please contact us.

Respectfully submitted,

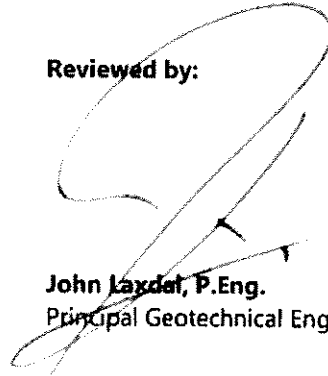
**Wood Environment & Infrastructure Solutions,**  
a Division of Wood Canada Limited



**Bob Forsyth, P.Eng.**  
Associate Geotechnical Engineer



Reviewed by:



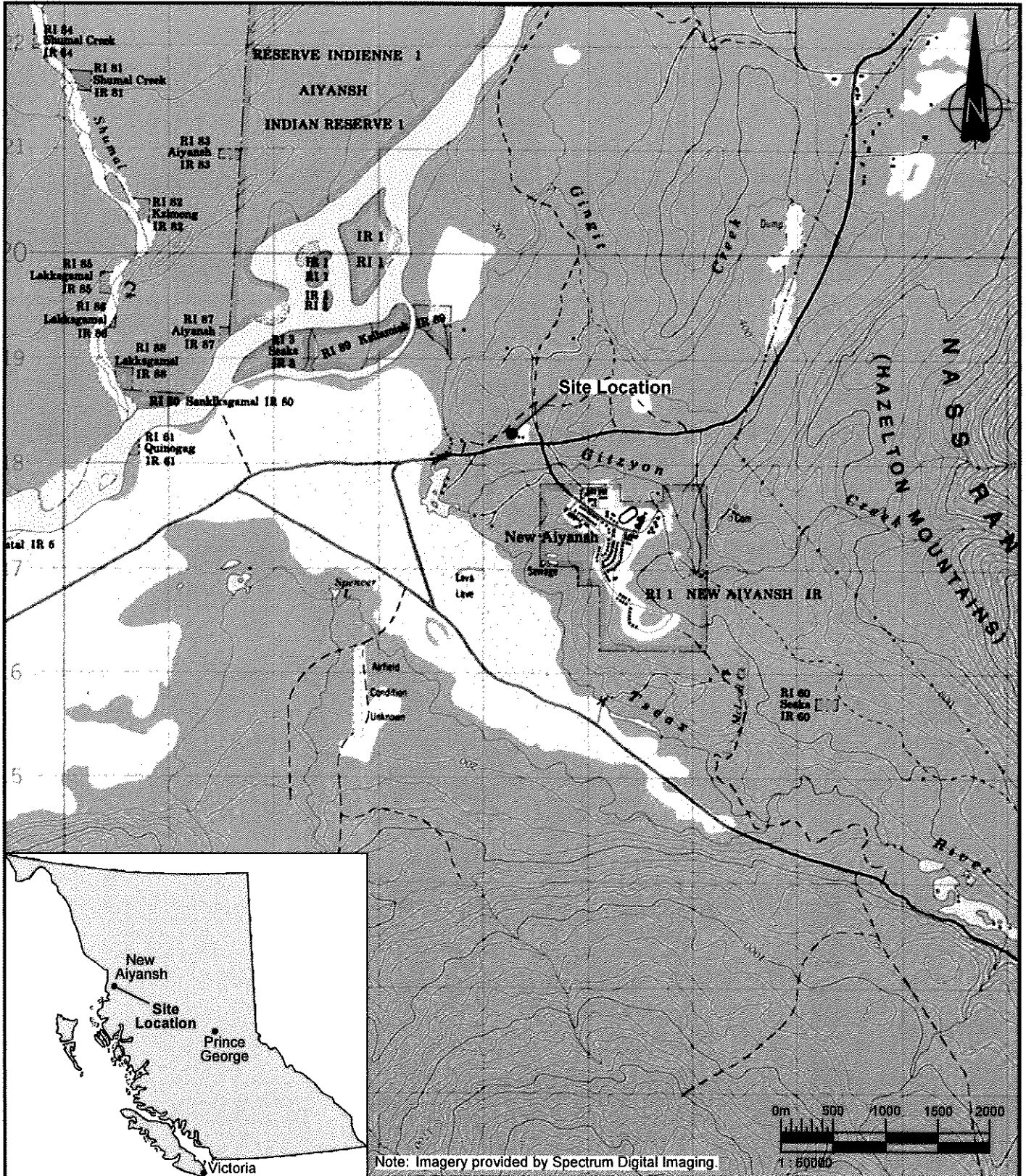
**John Jaydal, P.Eng.**  
Principal Geotechnical Engineer



**wood.**

**Figures**



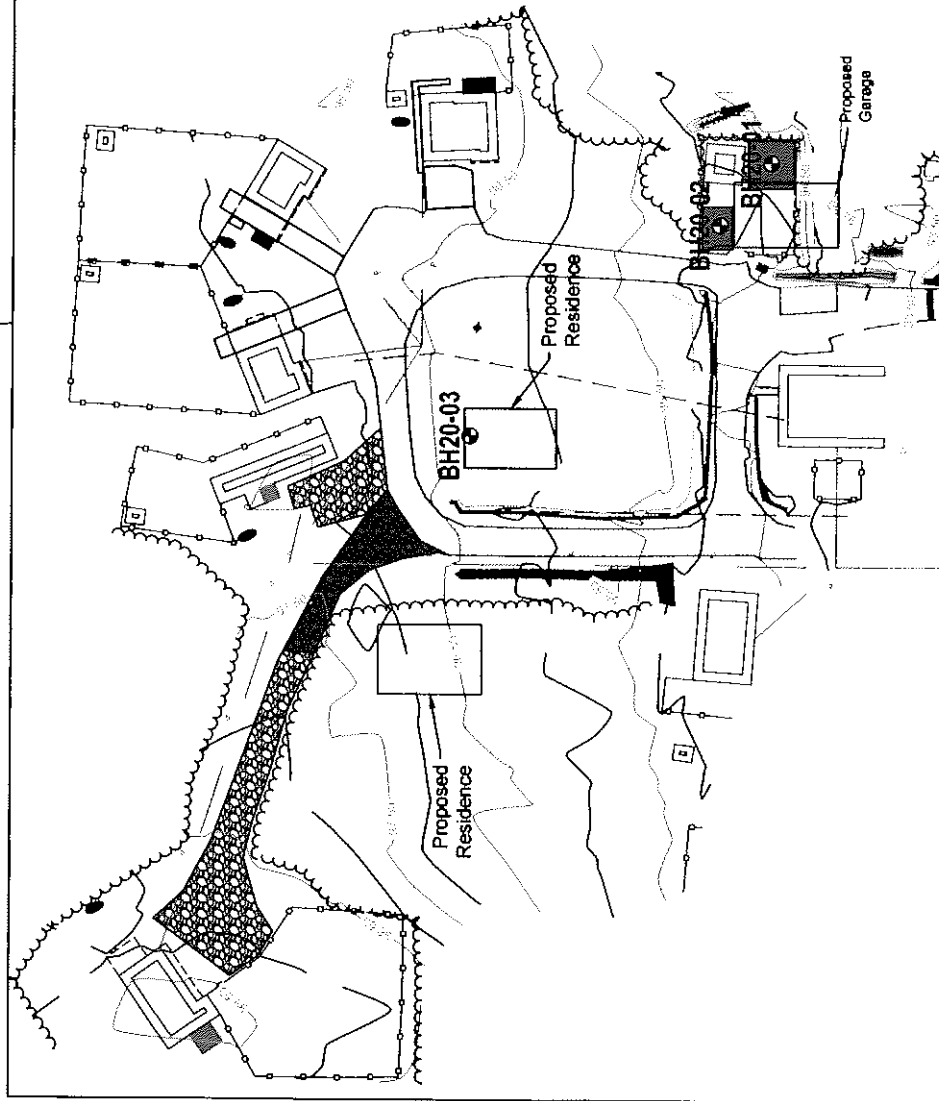


	<b>CLIENT:</b> Public Services and Procurement Canada Services Publics et Approvisionnement Canada Geomatics Services Services de Geomatique	<b>DWN BY:</b> BB	<b>TITLE:</b> SITE LOCATION PLAN	<b>DATE:</b> OCTOBER 2020
	<b>wood</b> Environment & Infrastructure Solutions a Division of Wood Canada Limited (Wood) Unit 110 - 18568 96th Avenue Surrey, BC, CANADA V4N 3P9 Tel. (604) 295-8657	<b>CHK'D BY:</b> BF	<b>PROJECT:</b> RCMP COMPACT DETACHMENT LOT 1 PLAN PRP10005 NEW AIYANSH, BC	<b>PROJECT NO.:</b> KA21195
		<b>DATUM:</b> NAD 27		<b>REV. NO.:</b> A
		<b>PROJECTION:</b> UTM Zone 9		<b>FIGURE 1</b>
<b>SCALE:</b> 1:50 000				



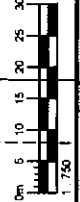
REM SW 1/4 DL 4011

RW PLAN PRP14731



0° 13' 47.13" 41'

180.33890.376



<b>wood.</b> Borehole Location Note: 1. Geographic Photo of Borehole Location. Coordinates provided by Terra Approach - 2020 Sept 21, 2020 Location: 48.941, -119.941 (NAD 83, UTM Zone 18Q)	<b>wood.</b> CLIENT Public Services and Procurement Canada Services Publics et Approvisionnement Canada Géomatiques Services Services de Géomatique Wood Environment & Infrastructure Solutions a Division of Wood Canada Limited (Wood) Suite 100, 10000 144th Street, Delta, BC, CANADA V4M 2P9 Tel: (604) 295-9827	Drawn by: BB Checked by: BF Date: 1/15/20	DATE: OCTOBER 2020 PROJECT NO.: KAC1169 REV. NO.: A FIGURE 2
		TITLE: SITE PLAN PROJECT: RCMP COMPACT DETACHMENT LOT 1 PLAN PRP10005 NEW AYANSH, BC	Scale: 1/750 Product Code: UTM Zone 9

This drawing was originally produced in colour.

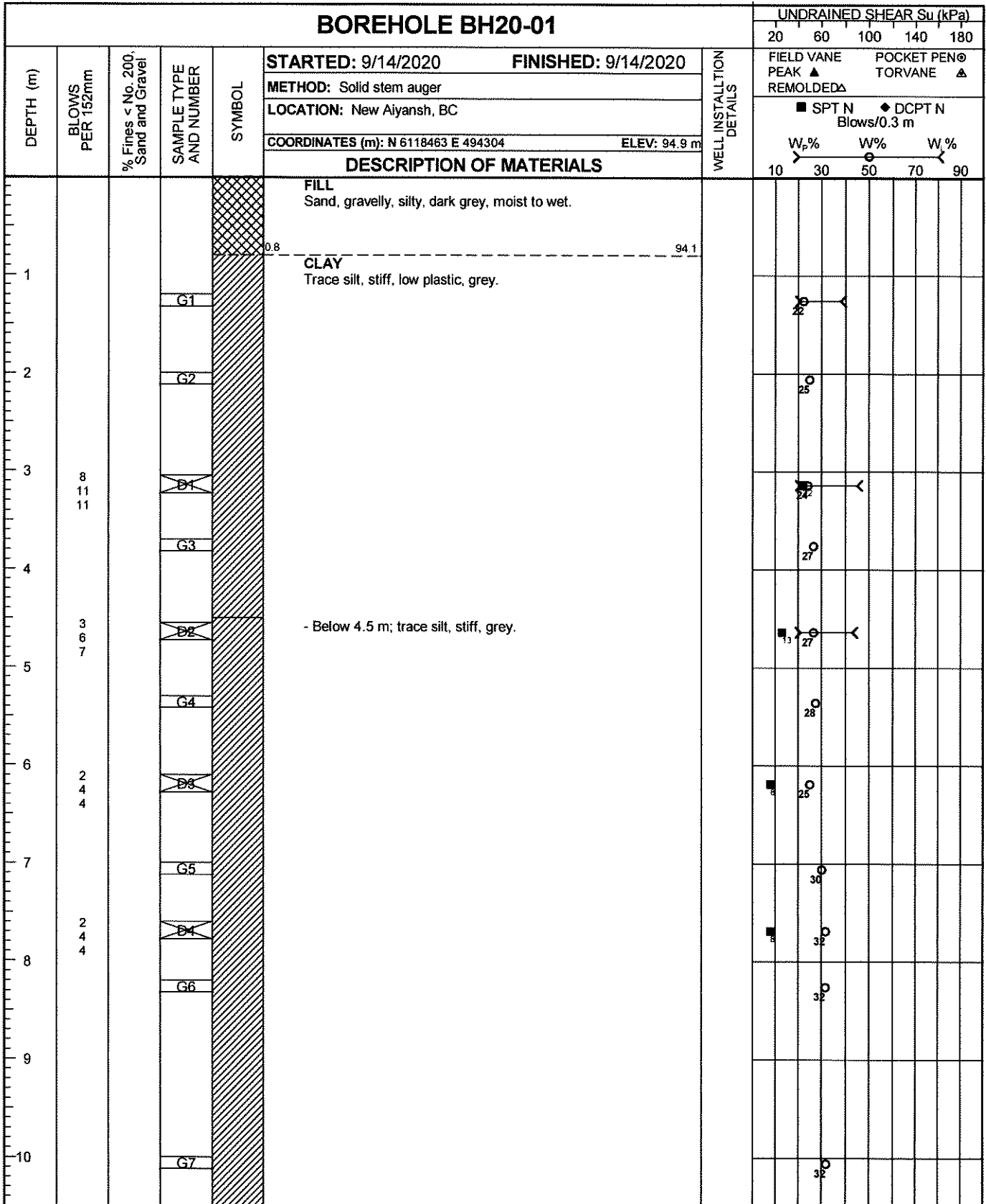


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**Appendix A  
Borehole Logs**



# BOREHOLE BH20-01



WOOD  
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18568 - 96 Avenue, Unit 110  
Surrey, B.C. V4N 3P9

PROJECT NO.: KA21195	
PROJECT: RCMP Detachment Proposed Garage	
LOCATION: New Aiyansh, BC	
LOGGED BY: RF	REVIEWED BY: JL
SHEET 1 OF 2	BOREHOLE No. BH20-01



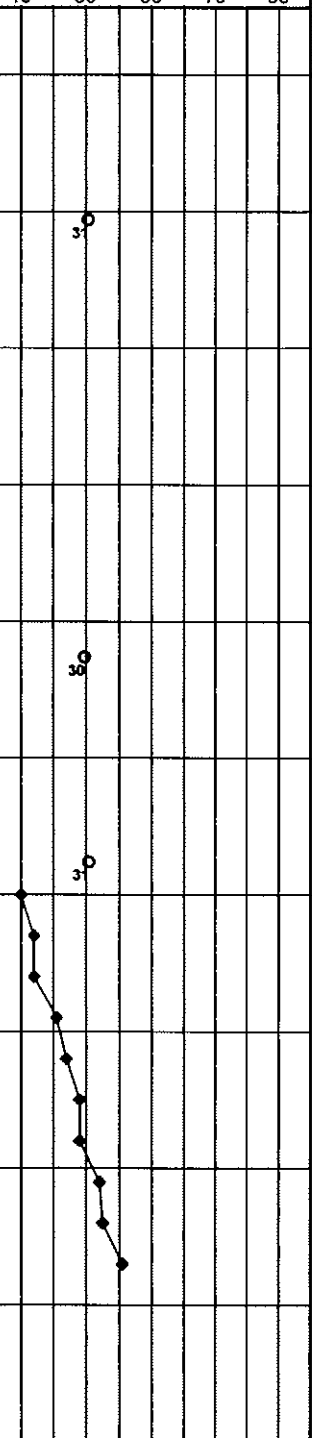
# BOREHOLE BH20-01

UNDRAINED SHEAR  $S_u$  (kPa)  
20 60 100 140 180

DEPTH (m) | BLOWS PER 152mm | % Fines < No. 200, Sand and Gravel | SAMPLE TYPE AND NUMBER | SYMBOL | **STARTED: 9/14/2020** | **FINISHED: 9/14/2020** | **METHOD: Solid stem auger** | **LOCATION: New Aiyansh, BC** | **COORDINATES (m): N 8118463 E 484304** | **ELEV: 94.9 m**

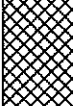
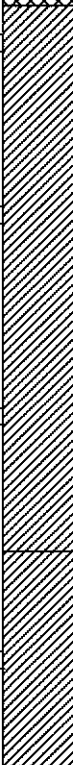

WELL INSTALLATION DETAILS  
FIELD VANE PEAK ▲ POCKET PEN@ TORVANE ▲  
REMODEDED  
■ SPT N ◆ DCPT N  
Blows/0.3 m  
W<sub>p</sub>% W% W<sub>L</sub>%  
10 30 50 70 90

DEPTH (m)	BLOWS PER 152mm	% Fines < No. 200, Sand and Gravel	SAMPLE TYPE AND NUMBER	SYMBOL	DESCRIPTION OF MATERIALS
11					CLAY Trace silt, stiff, low plastic, grey. (continued)
12			G8		
13					
14					
15			G9		
16					
17			G10		
17.7					[GLACIAL OUTWASH] Compact to dense. Inferred by DCPT blows/foot.
18					
19					
19.8					END OF HOLE - Minor seepage encountered at base of fill - Backfilled with cuttings, upper meter sealed with bentonite
20					
21					



**WOOD**  
Environment & Infrastructure Solutions  
18568 - 96 Avenue, Unit 110  
Surrey, B.C. V4N 3P9

PROJECT NO.: KA21195  
PROJECT: RCMP Detachment Proposed Garage  
LOCATION: New Aiyansh, BC  
LOGGED BY: RF | REVIEWED BY: JL  
SHEET 2 OF 2 | BOREHOLE No. BH20-01

BOREHOLE BH20-02						UNDRAINED SHEAR $S_u$ (kPa)							
						20	60	100	140	180			
DEPTH (m)	BLOWS PER 152mm	% Fines < No. 200 Sand and Gravel	SAMPLE TYPE AND NUMBER	SYMBOL	STARTED: 9/14/2020	FINISHED: 9/14/2020	WELL INSTALLATION DETAILS	FIELD VANE PEAK ▲		POCKET PEN@ TORVANE ▲			
					METHOD: Solid stem auger			REMOVED@		SPT N			
					LOCATION: New Aiyansh, BC			Blows/0.3 m		DCPT N			
					COORDINATES (m): N 6118476 E 494285			ELEV: 95.1 m		W <sub>p</sub> %			
					DESCRIPTION OF MATERIALS					W%			
								10	30	50	70	90	
					FILL Sand, gravel, and clay, compact, moist to wet.								
1			G1		CLAY Trace gravel, stiff to hard, low plastic, mottled grey brown.	0.8	94.3						
2			G2										
3			G3										
4			G4										
5					- Below 4.6 m; stiff, grey.								
6					END OF HOLE - Minor seepage encountered at base of fill - Backfilled with cuttings, upper meter sealed with bentonite	6.1	89.0						
7													
8													
9													
10													
 <b>WOOD</b> Environment & Infrastructure Solutions 18568 - 96 Avenue, Unit 110 Surrey, B.C. V4N 3P9						PROJECT NO.: KA21195							
						PROJECT: RCMP Detachment Proposed Garage							
						LOCATION: New Aiyansh, BC							
						LOGGED BY: RF			REVIEWED BY: JL				
						SHEET 1 OF 1			BOREHOLE No. BH20-02				

# BOREHOLE BH20-03

UNDRAINED SHEAR $S_u$ (kPa)				
20	60	100	140	180
FIELD VANE PEAK ▲	POCKET PENOM TORVANE ▲			
REMOVED				
■ SPT N		◆ DCPT N		
Blows/0.3 m				
W <sub>p</sub> %		W %		W %
10	30	50	70	90

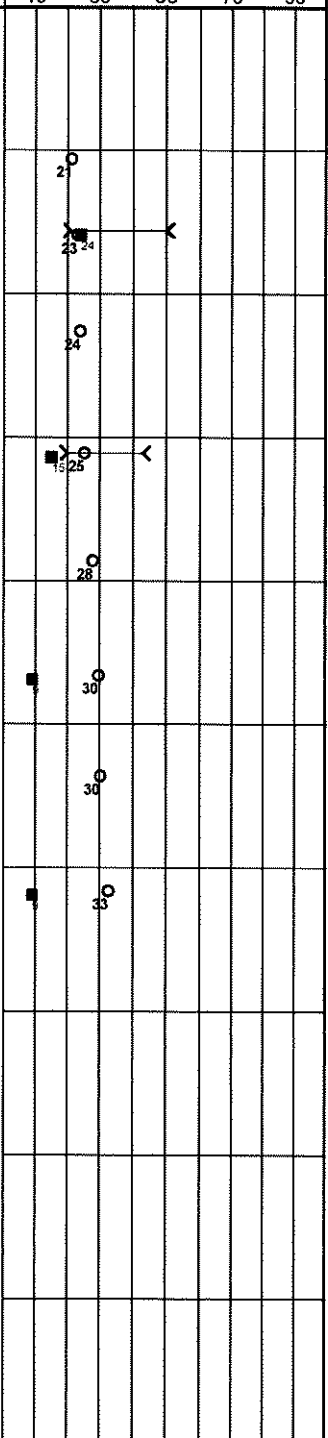
DEPTH (m)	BLOWS PER 152mm	% Fines < No. 200 Sand and Gravel	SAMPLE TYPE AND NUMBER	SYMBOL	STARTED: 9/14/2020	FINISHED: 9/14/2020
					METHOD: Solid stem auger	
					LOCATION: New Aiyansh, BC	
					COORDINATES (m): N 6118523 E 494244	ELEV: 96.3 m

WELL INSTALLATION DETAILS

DESCRIPTION OF MATERIALS				
1			G1	0.3
2	5 10 14		G2 D1	
3			G3	
4			G4 D2	
5	3 4 5		G5 D3	
6			G6 D4	6.6
7				89.8

- At 4.5 m; stiff, grey.

**END OF HOLE**  
 - No seepage encountered  
 - Backfilled with cuttings, upper meter sealed with bentonite



**WOOD**  
 Environment & Infrastructure Solutions  
 18568 - 96 Avenue, Unit 110  
 Surrey, B.C. V4N 3P9

PROJECT NO.: KA21195
PROJECT: RCMP Detachment Proposed Residence
LOCATION: New Aiyansh, BC
LOGGED BY: RF      REVIEWED BY: JL
SHEET 1 OF 1      BOREHOLE No. BH20-03

The logo for the company 'wood.' is displayed in a bold, lowercase, sans-serif font. The text is black and positioned in the upper right corner of the page. The background of the page features a large, light gray, semi-circular graphic element with a fine dot pattern, which is partially obscured by the text and other elements.

**wood.**

**Appendix B**  
**2015 National Building Code Seismic**  
**Hazard Calculation**

# 2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836  
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

Site: 55.213N 129.090W

2020-09-22 17:36 UT

Probability of exceedance per annum	0.000404	0.001	0.0021	0.01
Probability of exceedance in 50 years	2 %	5 %	10 %	40 %
Sa (0.05)	0.074	0.045	0.031	0.012
Sa (0.1)	0.112	0.068	0.046	0.018
Sa (0.2)	0.138	0.088	0.061	0.025
Sa (0.3)	0.138	0.094	0.068	0.032
Sa (0.5)	0.133	0.096	0.072	0.037
Sa (1.0)	0.111	0.083	0.065	0.035
Sa (2.0)	0.080	0.060	0.046	0.024
Sa (5.0)	0.030	0.022	0.017	0.009
Sa (10.0)	0.011	0.008	0.006	0.003
PGA (g)	0.068	0.045	0.032	0.013
PGV (m/s)	0.186	0.138	0.103	0.047

**Notes:** Spectral ( $S_a(T)$ , where  $T$  is the period in seconds) and peak ground acceleration (PGA) values are given in units of  $g$  ( $9.81 \text{ m/s}^2$ ). Peak ground velocity is given in  $\text{m/s}$ . Values are for "firm ground" (NBCC2015 Site Class C, average shear wave velocity  $450 \text{ m/s}$ ). NBCC2015 and CSAS6-14 values are highlighted in yellow. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. **These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.**

## References

National Building Code of Canada 2015 NRCC no. 56190; Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

Structural Commentaries (User's Guide - NBC 2015: Part 4 of Division B)  
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites [www.EarthquakesCanada.ca](http://www.EarthquakesCanada.ca) and [www.nationalcodes.ca](http://www.nationalcodes.ca) for more information



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**Appendix C**  
**Limitations**



## Limitations

1. The work performed in the preparation of this report and the conclusions presented herein are subject to the following:
  - (a) The terms of the General Conditions of the Standing Offer (EX899-181755/003/TPV01) between Wood and Public Services and Procurement Canada (PSPC);
  - (b) The Scope of Services described in the Geotechnical Engineering Services Terms of Reference (TOR) for PSPC Project Number R.102554.001 dated January 9, 2019;
  - (c) Time and Budgetary limitations as described in our Contract; and,
  - (d) The Limitations stated herein.
2. **Standard of care:** Wood has prepared this report in a manner consistent with the level of skill and are ordinarily exercised by reputable members of Wood's profession, practicing in the same or similar locality at the time of performance, and subject to the time limits and physical constraints applicable to the scope of work, and terms and conditions for this assignment. No other warranty, guaranty, or representation, expressed or implied, is made or intended in this report, or in any other communication (oral or written) related to this project. The same are specifically disclaimed, including the implied warranties of merchantability and fitness for a particular purpose.
3. **Limited locations:** The information contained in this report is restricted to the site and structures evaluated by Wood and to the topics specifically discussed in it, and is not applicable to any other aspects, areas or locations.
4. **Information utilized:** The information, conclusions and estimates contained in this report are based exclusively on: i) information available at the time of preparation, ii) the accuracy and completeness of data supplied by the Client or by third parties as instructed by the Client, and iii) the assumptions, conditions and qualifications/limitations set forth in this report.
5. **Accuracy of information:** No attempt has been made to verify the accuracy of any information provided by the Client or third parties, except as specifically stated in this report (hereinafter "Supplied Data"). Wood cannot be held responsible for any loss or damage, of either contractual or extra-contractual nature, resulting from conclusions that are based upon reliance on the Supplied Data.
6. **Report interpretation:** This report must be read and interpreted in its entirety, as some sections could be inaccurately interpreted when taken individually or out-of-context. The contents of this report are based upon the conditions known and information provided as of the date of preparation. The text of the final version of this report supersedes any other previous versions produced by Wood.
7. **No legal representations:** Wood makes no representations whatsoever concerning the legal significance of its findings, or as to other legal matters touched on in this report, including but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and change. Such interpretations and regulatory changes should be reviewed with legal counsel.

8. **Decrease in property value:** Wood shall not be responsible for any decrease, real or perceived, of the property or site's value or failure to complete a transaction, as a consequence of the information contained in this report.
9. **No third party reliance:** This report is for the sole use of the party to whom it is addressed unless expressly stated otherwise in the report or Contract. Any use or reproduction which any third party makes of the report, in whole or in part, or any reliance thereon or decisions made based on any information or conclusions in the report is the sole responsibility of such third party. Wood does not represent or warrant the accuracy, completeness, merchantability, fitness for purpose or usefulness of this document, or any information contained in this document, for use or consideration by any third party. Wood accepts no responsibility whatsoever for damages or loss of any nature or kind suffered by any such third party as a result of actions taken or not taken or decisions made in reliance on this report or anything set out therein. including without limitation, any indirect, special, incidental, punitive or consequential loss, liability or damage of any kind.
10. **Assumptions:** Where design recommendations are given in this report, they apply only if the project contemplated by the Client is constructed substantially in accordance with the details stated in this report. It is the sole responsibility of the Client to provide to Wood changes made in the project, including but not limited to, details in the design, conditions, engineering or construction that could in any manner whatsoever impact the validity of the recommendations made in the report. Wood shall be entitled to additional compensation from Client to review and assess the effect of such changes to the project.
11. **Time dependence:** If the project contemplated by the Client is not undertaken within a period of 18 months following the submission of this report, or within the time frame understood by Wood to be contemplated by the Client at the commencement of Wood's assignment, and/or, if any changes are made, for example, to the elevation, design or nature of any development on the site, its size and configuration, the location of any development on the site and its orientation, the use of the site, performance criteria and the location of any physical infrastructure, the conclusions and recommendations presented herein should not be considered valid unless the impact of the said changes is evaluated by Wood, and the conclusions of the report are amended or are validated in writing accordingly.

Advancements in the practice of geotechnical engineering, engineering geology and hydrogeology and changes in applicable regulations, standards, codes or criteria could impact the contents of the report, in which case, a supplementary report may be required. The requirements for such a review remain the sole responsibility of the Client or their agents.

Wood will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.
12. **Limitations of visual inspections:** Where conclusions and recommendations are given based on a visual inspection conducted by Wood, they relate only to the natural or man-made structures, slopes, etc. inspected at the time the site visit was performed. These conclusions cannot and are not extended to include those portions of the site or structures, which were not reasonably available, in Wood's opinion, for direct observation.



13. **Limitations of site investigations:** Site exploration identifies specific subsurface conditions only at those points from which samples have been taken and only at the time of the site investigation. Site investigation programs are a professional estimate of the scope of investigation required to provide a general profile of subsurface conditions.

The data derived from the site investigation program and subsequent laboratory testing are interpreted by trained personnel and extrapolated across the site to form an inferred geological representation and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. Despite this investigation, conditions between and beyond the borehole/test hole locations may differ from those encountered at the borehole/test hole locations and the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies.

Final sub-surface/bore/profile logs are developed by geotechnical engineers based upon their interpretation of field logs and laboratory evaluation of field samples. Customarily, only the final bore/profile logs are included in geotechnical engineering reports.

Bedrock, soil properties and groundwater conditions can be significantly altered by environmental remediation and/or construction activities such as the use of heavy equipment or machinery, excavation, blasting, pile-driving or draining or other activities conducted either directly on site or on adjacent terrain. These properties can also be indirectly affected by exposure to unfavorable natural events or weather conditions, including freezing, drought, precipitation and snowmelt.

During construction, excavation is frequently undertaken which exposes the actual subsurface and groundwater conditions between and beyond the test locations, which may differ from those encountered at the test locations. It is recommended practice that Wood be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered at the test locations, that construction work has no negative impact on the geotechnical aspects of the design, to adjust recommendations in accordance with conditions as additional site information is gained and to deal quickly with geotechnical considerations if they arise.

Interpretations and recommendations presented herein may not be valid if an adequate level of review or inspection by Wood is not provided during construction.

14. **Factors that may affect construction methods, costs and scheduling:** The performance of rock and soil materials during construction is greatly influenced by the means and methods of construction. Where comments are made relating to possible methods of construction, construction costs, construction techniques, sequencing, equipment or scheduling, they are intended only for the guidance of the project design professionals, and those responsible for construction monitoring. The number of test holes may not be sufficient to determine the local underground conditions between test locations that may affect construction costs, construction techniques, sequencing, equipment, scheduling, operational planning, etc.

Any contractors bidding on or undertaking the works should draw their own conclusions as to how the subsurface and groundwater conditions may affect their work, based on their own investigations and interpretations of the factual soil data, groundwater observations, and other factual information.

15. **Groundwater and Dewatering:** Wood will accept no responsibility for the effects of drainage and/or dewatering measures if Wood has not been specifically consulted and involved in the design and monitoring of the drainage and/or dewatering system.
16. **Environmental and Hazardous Materials Aspects:** Unless otherwise stated, the information contained in this report in no way reflects on the environmental aspects of this project, since this aspect is beyond the Scope of Work and the Contract. Unless expressly included in the Scope of Work, this report specifically excludes the identification or interpretation of environmental conditions such as contamination, hazardous materials, wild life conditions, rare plants or archeology conditions that may affect use or design at the site. This report specifically excludes the investigation, detection, prevention or assessment of conditions that can contribute to moisture, mould or other microbial contaminant growth and/or other moisture related deterioration, such as corrosion, decay, rot in buildings or their surroundings. Any statements in this report or on the boring logs regarding odours, colours, and unusual or suspicious items or conditions are strictly for informational purposes
17. **Sample Disposal:** Wood will dispose of all uncontaminated soil and rock samples after 30 days following the release of the final geotechnical report. Should the Client request that the samples be retained for a longer time, the Client will be billed for such storage at an agreed upon rate. Contaminated samples of soil, rock or groundwater are the property of the Client, and the Client will be responsible for the proper disposal of these samples, unless previously arranged for with Wood or a third party.
18. **Effect of iron minerals:** This report does not address issues related to the discovery or presence of iron minerals, such as pyrite, or the effects of iron minerals, if any, in the soil or to be used in concrete. Should specific information be required, additional testing may be requested by the Client for which Wood shall be entitled to additional compensation.

**Wood Environment & Infrastructure Solutions,  
a Division of Wood Canada Limited**

## APPENDIX B

Geotechnical Letter With Clarifications to Oct 13 Geotechnical  
Report  
New Aiyansh  
Wood Environment and Infrastructure Solutions  
16 March 2021



Wood Environment & Infrastructure Solutions,  
a Division of Wood Canada Limited  
18568 96th Avenue, Unit 110  
Surrey, BC V4N 3P9  
Canada

T: 604-295-8657

[www.woodplc.com](http://www.woodplc.com)

**Wood File #: KA21195**

16 March 2021

**George Strazicich**, P.Eng., Struct. Eng.  
Structural Engineer, Professional and Technical Services  
Real Property Services / Public Services and Procurement Canada / Government of Canada  
219 – 800 Burrard St., Vancouver, B.C. V6Z 0B9

Email: [george.strazicich@pwgsc.gc.ca](mailto:george.strazicich@pwgsc.gc.ca)

Dear Mr. Strazicich,

**Re: Proposed Residence, New Aiyansh RCMP Detachment, New Aiyansh, BC  
PSPC Project No. R105689.001**

Further to our geotechnical report of October 13, 2020, 3 we have the following comments in response to your email of March 8, 2021, shown in italics below:

*“There are a couple of geotechnical questions that have just come up from the design team working on the new residence project. Please review the following and provide a supplemental memo to address the following questions:*

- 1. The new preferred location for the residence is identified as Location A on the attached plan. Location A is very near the boreholes recently drilled for the garage, but it is quite far away from the hole drilled at the previous residence location. Does this change the recommendations provided in your original report?*
- 2. The structural consultant has asked for the following additional information for Location A:*

*Please request from PSPC that the geotechnical consultant provide the pressure coefficients, pressure distributions, and formulae for the following:*

*Non-rigid walls (i.e., cantilevered retaining walls)*

- 1. Active soil pressure*
- 2. Active dynamic (seismic) soil pressure*
- 3. Surcharge soil pressure*

*Rigid walls (i.e., basement walls)*

- 1. Static at-rest soil pressure*
- 2. Dynamic (seismic) at-rest soil pressure*
- 3. Surcharge soil pressure*
- 4. Static passive soil pressure*
- 5. Dynamic (seismic) passive soil pressure*

Our response is as follows:

1. Our recommendations were intended for the former B1 location for the residence. There are boreholes in the garage area, about 15m to the south of the new A location which are consistent with the B1 location borehole. Native soil, comprised of stiff clay, was found to be present at shallow depth across the site. Wood considers that the borehole information can be used for design of the structure at the A location provided adequate inspection is carried out by Wood. The thickness and nature of fill materials, related to past development of the site, may vary. Uncontrolled fill material beneath building areas should be excavated and replaced with structural fill as per the recommendations included in our report.
2. Retaining walls should be backfilled with free draining granular fill, compacted to 95% of Standard Proctor Maximum Dry Density or greater as per our geotechnical report. (in accordance with our report, compaction requirements may vary depending on usage/loading at the wall crest).

Wall backfill should be provided with a drain at the base of the backfill. The drain should consist of 150 mm diameter, rigid, perforated PVC covered by 300 mm of drain rock all wrapped in non-woven geotextile such as Nilex 4551 or equivalent. The drain should direct water to a convenient outlet down gradient of the residence and/or wall. Considering drainage of the backfill, the retaining wall is not expected to be subject to hydrostatic pressure.

For a flexible wall that can allow slight movements, the active pressure distribution should be used. The at-rest pressure should be used for rigid walls. The seismic earth pressure should be added to the active or at-rest pressure distribution.

The following parameters can be used in retaining and foundation wall design.

Coefficient of active earth pressure,  $k_a = 0.26$

Coefficient of at rest earth pressure,  $k_o = 0.41$

Coefficient of seismic earth pressure,  $k_{ae} = 0.28$ , calculated using the NBCC 2015, Peak Ground Acceleration, PGA, for New Aiyansh of 0.068g (2% chance of seismic hazard in 50 years or 1:2475-year return period).

Unit weight of granular backfill,  $\gamma = 20 \text{ kN/m}^3$

Coefficient of passive earth pressure,  $K_p = 4.0$ .

The seismic component of passive earth pressure will tend to stabilize the wall and should be discounted.

Where the wall supports a road or driveway, a uniform vertical pressure of 16 kPa acting within 0.4H of the wall, where H is the wall height, can be added at the top of the wall backfill to represent loading due to the occasional passage of heavy vehicles such as garbage trucks. For lighter activities at the top of the wall a minimum surcharge pressure of 8 kPa should be considered.

Large compaction pressures against the wall can be avoided by using hand-held vibratory equipment to compact backfill within 0.4H of the wall.

A schematic presentation of earth pressures on retaining walls is shown in the attached diagrams. All earth pressures have a triangular distribution with resultant force due to active, at -rest or passive

pressure acting at a distance of 0.3H above the bottom of the wall. Seismic earth pressure can be approximated by an inverted triangular pressure distribution with resultant force acting a distance of 0.6H above the bottom of the wall.

This letter was prepared exclusively for Public Services and Procurement Canada by Wood Environment & Infrastructure Solutions (Wood). The information, conclusions and estimates contained herein are based exclusively on i) information available at the time of preparation, ii) the accuracy and completeness of data supplied by the Client or by third parties as instructed by the Client, and iii) the assumptions, conditions and qualifications/limitations set forth herein.

Wood trusts this meets your immediate requirements. If you have questions or require further information, please contact us.

Sincerely,

**Wood Environment & Infrastructure Solutions**  
a Division of Wood Canada Limited

Prepared by:



**Bob Forsyth, P.Eng.**  
Associate Geotechnical Engineer

Reviewed by:

A handwritten signature in blue ink, appearing to read "John Laxdal".

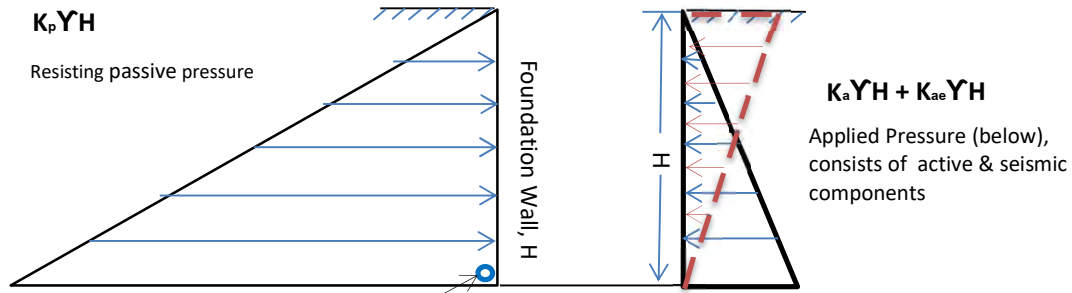
**John Laxdal, P.Eng.**  
Principal Geotechnical Engineer

Attachments

Attachment 1 - Figures 1 and 2: Lateral Earth Pressure Diagrams

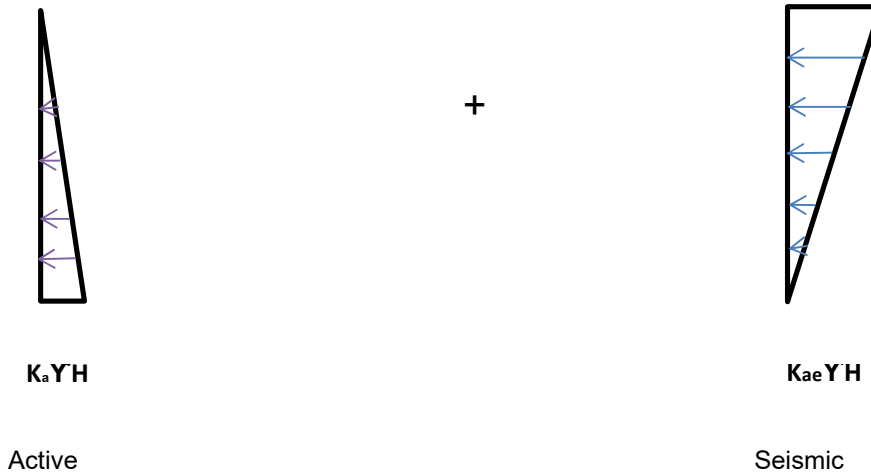
# Attachment 1 – Figures 1&2 - Lateral Earth Pressure Diagrams

## Flexible Walls



Note: Assume groundwater is drained by a foundation drainage system and hydrostatic pressure does not act on the wall.

## Applied Pressure



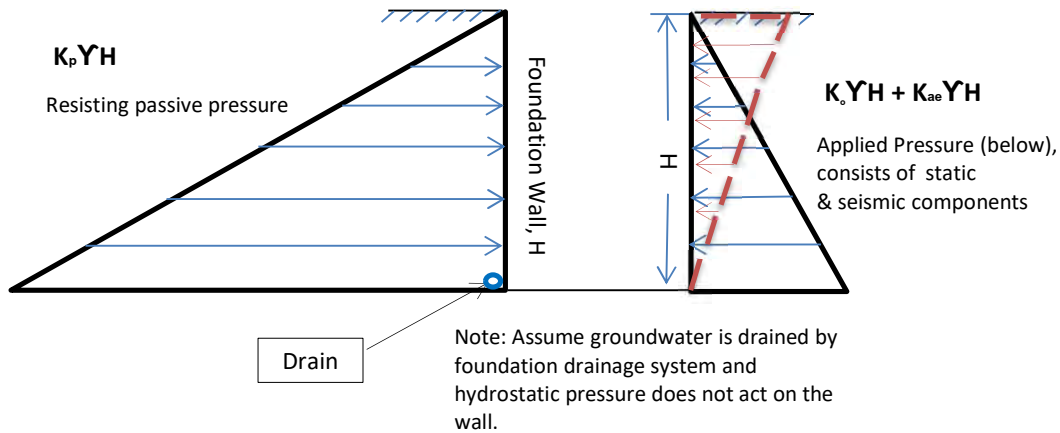
**Notes:**

- $K_a = 0.26$ , coefficient of active earth pressure
- $K_{ae} = 0.28$ , coefficient of seismic lateral earth pressure
- $K_p = 4.0$ , passive coefficient of lateral earth pressure
- $Y$  = unit weight of soil,  $20 \text{ kN/m}^3$  can be used for granular backfill
- $H$  = height of foundation wall
- 1. Assume flexible walls such that active conditions apply.
- 2. For passive, active and seismic pressure, resultant force acts  $0.3H$  above the base of the wall.
- 3. For seismic lateral earth pressures, resultant force acts  $0.6H$  above the base of the wall.

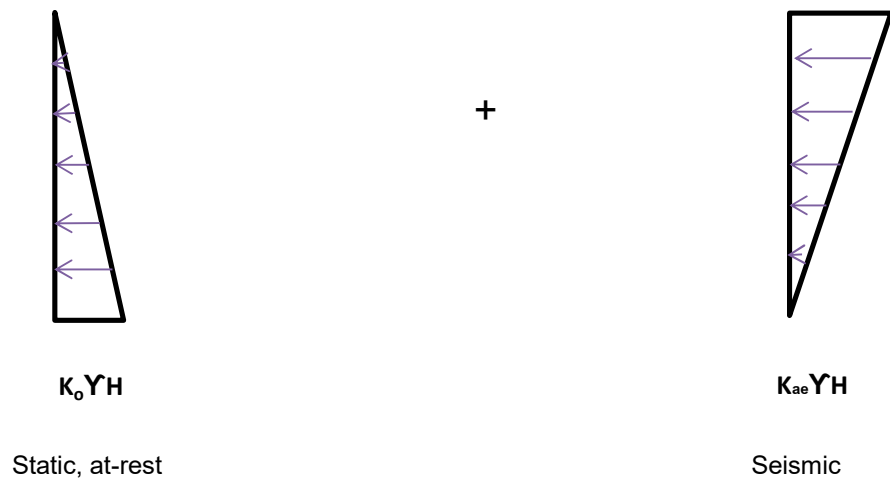
<b>wood.</b>	Environment & Infrastructure Solutions a Division of Wood Canada Limited	Client:  Public Works and Government Services Canada	
		Project No. KA21195	
Project: New Aiyansh RCMP Detachment New Aiyansh, BC		Design: BF	Rev. No. 0
Title: Lateral Earth Pressure Diagrams		Drafting: EDS	Date: 10-Mar-21
		Check: BF	Appendix C Fig. No. 1



## Rigid Walls



## Applied Pressure



**Notes:**

- $K_o = 0.41$ , coefficient of at-rest lateral earth pressure
- $K_{ae} = 0.28$ , Active coefficient of seismic lateral earth pressure
- $K_p = 4.0$ , passive coefficient of lateral earth pressure
- $Y$  = unit weight of soil, 20 kN/m<sup>3</sup> can be used for granular backfill of the wall
- $H$  = height of foundation wall

1. Assume a rigid structure and at-rest conditions apply.
2. The wall is to be installed with a drain at the base of the free draining granular backfill such that hydrostatic pressures do not act on the wall.
3. For passive, active and at rest pressure, resultant force acts 0.3H above the base of the wall.
4. For seismic lateral earth pressures, resultant force acts 0.6H above the base of the wall.

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		Check	BF
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		Appendix C Fig. No.	2