Public Works and Government Services Canada

Requisition Number: _____

MERX I.D. Number: _____

SPECIFICATIONS for:

Project no. R.075647.001
Kluane National Park Headquarters
Trades Building

Haines Junction, Yukon

APPROVED BY:

_____ _____
Regional Manager, AES Date

_____ _____
Construction Safety Coordinator Date

TENDER:

_____ _____
Project Manager Date

Real Property Services Branch, Professional and Technical Services, Pacific Region
219 - 800 Burrard Street, Vancouver, B.C. V6Z 2V8

PWGSC Project No: R.075647.001

Professional Seals & Permits to Practice

Professionals of Record:

Stantec Architecture Ltd.
202-107 Main Street
Whitehorse, Yukon Territory
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1. **Architect:**
   John Berg, AIBC, NWTAA

KNPHQ - TRADES BUILDING

NORTHWEST TERRITORIES ASSOCIATION OF ARCHITECTS
003
JOHN BERG
ARCHITECT
INCORPORATED 2001

144902525

Signature

2. **Structural Engineer:**
   Mike White, P.Eng

PROFESSIONAL
YUKON
MICHAEL J. WHITE
TERRITORY
144902525
ENGINEER
March 21, 2018

PERMIT TO PRACTICE
STANTEC ARCHITECTURE LTD.
Signature
Date Mar. 21/18
PERMIT NUMBER: PP315
Association of Professional Engineers of Yukon
144902525

Engineer's Seal

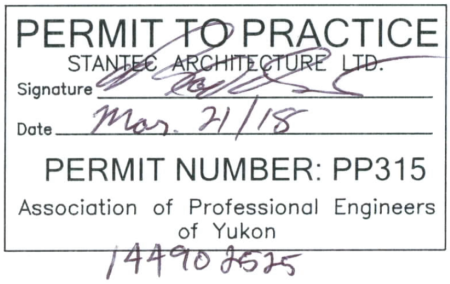
Permit to Practice

Professionals of Record:

Stantec Architecture Ltd.
202-107 Main Street
Whitehorse, Yukon Territory
Y1A 2A7

3. Mechanical Engineer:
Sandy Birrell, P.Eng

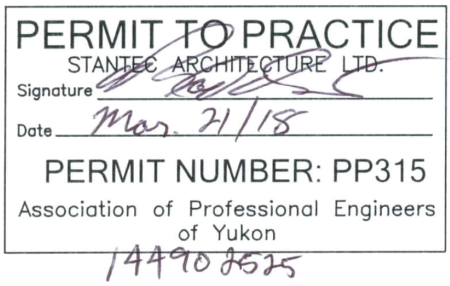
Engineer's Seal



Permit to Practice

4. Electrical Engineer:
Jordan Youngs, P.Eng

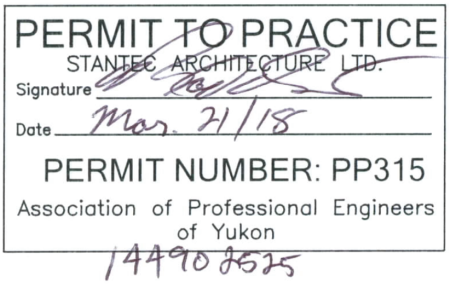
Engineer's Seal



Permit to Practice

5. Civil Engineer:
Arlen Foster, P.Eng

Engineer's Seal



Permit to Practice

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Part 1 General

1.1 SECTION INCLUDES

.1 Hereinafter is a list of drawings forming the Contract Documents inconjunction with this specification manual for the the new Trades Building at the Kluane National Park Headquarters in Haines Junction, Yukon.

.1 ARCHITECTURAL DRAWINGS:

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END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-25.20-95, Surface Sealer for Floors.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for concrete finishes and include product characteristics, performance criteria, physical size, finish and limitations.

.1 Provide two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for concrete floor treatment materials. Indicate VOC content in g/L.

1.3 ENVIRONMENTAL REQUIREMENTS

.1 Temporary lighting:

.1 Minimum 1200 W light source, placed 2.5 m above floor surface, for each 40 sq m of floor being treated.

.2 Electrical power:

.1 Provide sufficient electrical power to operate equipment normally used during construction.

.3 Work area:

.1 Make work area water tight protected against rain and detrimental weather conditions.

.4 Temperature:

.1 Maintain ambient temperature of not less than 10 degrees C from 7 days before installation to at least 48 hours after completion of work and maintain relative humidity not higher than 40% during same period.

.5 Moisture:

.1 Ensure concrete substrate is within moisture limits prescribed by flooring manufacturer.

.6 Safety:

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

.7 Ventilation:

.1 Ventilate enclosed spaces in accordance with Section 01 50 00 - Temporary Facilities and Controls.

.2 Provide continuous ventilation during and after coating application.

1.4 DELIVERY, STORAGE AND HANDLING

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

Part 2 Product

2.1 PERFORMANCE REQUIREMENTS

.1 Product quality and quality of work in accordance with Section 01 61 00 - Common Product Requirements.

.2 Submit written declaration that components used are compatible and will not adversely affect finished flooring products and their installation adhesives.

2.2 SEALING COMPOUNDS

.1 Surface sealer: to CAN/CGSB-25.20, acrylic co-polymer, Type 1 - solvent-based, clear.

.2 Finish: colourless, abrasion-resistant, water-proof. Medium sheen.

.3 Surface sealers are not manufactured or formulated with mercury hexavalent chromium and their compounds .

.4 Acceptable Product: Sikafloor-3S Concrete Sealer, Densifier, Liquid Surface Hardener by Sika Canada Inc.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that slab surfaces are ready to receive work and conditions are as recommended by manufacturer's written instructions.

3.2 PREPARATION OF SLAB

.1 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radiused edges unless otherwise indicated.

.2 Saw cut control joints to CAN/CSA-A23.1, 24 hours maximum after placing of concrete.

3.3 APPLICATION

.1 After floor treatment is dry, seal control joints and joints at junction with vertical surfaces with sealant.

.2 Apply floor treatment in accordance with Sealer manufacturer's written instructions.

.3 Clean over spray. Clean sealant from adjacent surfaces.

3.4 CLEANING

.1 Progress and Final Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

3.5 PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 05 51 29 - Metal Stairs.

.3 Section 09 91 23 - Interior Painting

.4 Section 09 91 13 - Exterior Painting

1.2 REFERENCES

.1 ASTM International

.1 ASTM A53/A53M-07, 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.

.2 CSA International

.1 CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CSA W59-M03(R2008), Welded Steel Construction (Metal Arc Welding) Metric.

.3 Environmental Choice Program

.1 CCD-047-98(R2005), Architectural Surface Coatings.

.2 CCD-048-98(R2006), Surface Coatings - Recycled Water-borne.

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

.1 Material Safety Data Sheets (MSDS).

.5 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - current edition.

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

.2 Submit two copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.1 For finishes, coatings, primers, and paints applied on site: indicate VOC concentration in g/L.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Territory of Yukon, Canada.

.2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.4 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

Part 2 Product

2.1 MATERIALS

.1 Steel sections and plates: to CSA G40.20/G40.21, Grade 300W.

.2 Steel pipe: to ASTM A53/A53M standard weight, paint finish.

.3 Welding materials: to CSA W59.

.4 Welding electrodes: to CSA W48 Series.

.5 Bolts and anchor bolts: to ASTM A307.

.6 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

2.2 FABRICATION

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws or as indicated.

.3 Where possible, fit and shop assemble work, ready for erection.

.4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 FINISHES

.1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m² to CAN/CSA-G164.

.2 Shop coat primer: to CAN/CGSB-1.181.

.3 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181.

.4 Paint finish: see Sections 09 91 13 Exterior Painting and 09 91 23 Interior Painting.

2.4 ISOLATION COATING

.1 Isolate aluminum from following components, by means of bituminous paint:

.1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.

.2 Concrete.

.3 Wood.

2.5 SHOP PAINTING

.1 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.2 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.

.3 Clean surfaces to be field welded; do not paint.

2.6 PIPE RAILINGS

.1 Steel pipe: 42 mm nominal outside diameter, formed to shapes and sizes as indicated.

.2 Hot-dipped galvanized finish exterior pipe railings, handrails.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for metal fabrications 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 ERECTION

.1 Do welding work in accordance with CSA W59 unless specified otherwise.

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Provide suitable means of anchorage acceptable to Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.4 Exposed fastening devices to match finish and be compatible with material through which they pass.

.5 Supply components for work by other trades in accordance with shop drawings and schedule.

.6 Make field connections with bolts to CSA S16. or field weld.

.7 Deliver items over for casting into concrete together with setting templates to appropriate location and construction personnel.

.8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces with primer after completion of:

.9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

3.3 PIPE RAILINGS

.1 Install pipe railings as indicated.

.2 Set railing standards in concrete. Grout to fill hole. Trowel surface smooth and flush

with adjacent surfaces.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by metal fabrications installation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 05 50 00 - Metal Fabrications.

.3 Section 09 91 13 - Exterior Painting

.4 Section 09 91 23 - Interior Painting

1.2 REFERENCES

.1 American National Standards Institute/National Association of Architectural Metal Manufacturers (ANSI/NAAMM)

.1 ANSI/NAAMM MBG 531-00, Metal Bar Grating Manual.

.2 ASTM International

.1 ASTM A53/A53M-07, 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 A325M-09, Standard Specification for Structural Bolts, Steel, Heat Treated, 830 MPa Minimum Tensile Strength Metric.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.

.2 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.4 CSA International

.1 CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CSA W59-03(R2008), Welded Steel Construction (Metal Arc Welding).

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

.1 Material Safety Data Sheets (MSDS).

.6 National Association of Architectural Metal Manufactures (NAAMM)

.1 AMP 510-92, Metal Stair Manual.

.7 The Society for Protective Coatings (SSPC)

.1 Systems and Specifications Manual, Volume 2, 2008 Edition.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for ladders 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 Territory of Yukon, Canada.

.2 Indicate construction details, sizes of steel sections and thickness of steel sheet.

1.4 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certifications: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect stairs from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Product

2.1 SYSTEM DESCRIPTION

.1 Design metal stair, balustrade and landing construction and connections to NBC vertical and horizontal live load requirements.

.2 Detail and fabricate stairs to NAAMM Metal Stairs Manual.

2.2 MATERIALS

.1 Steel sections and plates: to CSA G40.20/G40.21 Grade 300 W. Painted.

.2 Steel pipe: to ASTM A53/A53M, standard weight, painted. Size as indicated on drawings.

.3 Metal grating: to ANSI/NAAMM MBG 531, steel, safety grating.

.4 Welding materials: to CSA W59.

.5 Bolts: to ASTM A307.

2.3 FABRICATION

.1 Fabricate in accordance with NAAMM, Metal Stair Manual.

.2 Weld connections where possible, otherwise bolt connections. Countersink exposed fastenings, cut off bolts flush with nuts. Make exposed connections of same material, colour and finish as base material on which they occur.

.3 Accurately form connections with exposed faces flush:

.1 Make mitres and joints tight.

.2 Make risers of equal height.

.4 Grind or file exposed welds and steel sections smooth.

.5 Shop fabricate stairs in sections as large and complete as practicable.

2.4 PLATE/GRATING STAIRS

.1 Form steel grating treads and landings from metal safety grating to profile indicated and secure to stringers and supports as indicated. Form landings of steel grating and reinforce as required.

2.5 PIPE/TUBING BALUSTRADES

.1 Construct balusters and handrails from steel pipe.

.2 Cap and weld exposed ends of balusters and handrails.

.3 Terminate at abutting wall with end flange.

2.6 FINISHES

.1 Shop coat primer: to CAN/CGSB-1.40.

.2 Paint Colour: to match 'Tricycle Red' #2000-20 by Benjamin Moore.

2.7 SHOP PAINTING

.1 Clean surfaces in accordance with Steel Structures Painting Council Manual Volume 2.

.2 Apply one coat of shop primer except interior surfaces of pans.

.3 Apply two coats of primer of different colours to parts inaccessible after final assembly.

.4 Use primer as prepared by manufacturer without thinning or adding admixtures. Paint on dry surfaces, free from rust, scale, grease, do not paint when temperature is below 7 degrees C.

.5 Do not paint surfaces to be field welded.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for metal stairs and ladders 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 OF STAIRS

.1 Install in accordance with NAAMM, Metal Stair Manual.

.2 Install plumb and true in exact locations, using welded connections wherever possible to provide rigid structure. Provide anchor bolts, bolts and plates for connecting stairs to structure.

.3 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

.4 Do welding work in accordance with CSA W59 unless specified otherwise.

.5 Touch up shop primer to bolts, welds, and burned or scratched surfaces at completion of erection.

3.3 CLEANING

.1 Perform cleaning as soon as possible after installation to remove construction and accumulated environmental dirt.

.2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by metal stairs installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 07 92 10 - Joint Sealants

.3 Section 08 11 00 - Metal Doors and Frames

.4 Section 09 21 16 - Gypsum Board Assemblies

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.

.2 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction and amendment.

.2 CSA International

.1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

.2 CSA O121-08, Douglas Fir Plywood.

.3 CSA O141-05(R2009), Softwood Lumber.

.4 CSA O151-09, Canadian Softwood Plywood.

.3 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2010.

.4 The Truss Plate Institute of Canada

.1 Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses 2007.

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 characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by General Contractor.

1.4 QUALITY ASSURANCE

.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood and wood based composite panels in accordance with CSA and ANSI standards.

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

Part 2 Product

2.1 FRAMING AND STRUCTURAL MATERIALS

.1 Lumber, including strapping: SPF No. 2, moisture content 19% (S-dry) or less in accordance with following standards:

.1 CAN/CSA O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Light-frame trusses in accordance with "Truss Design and Procedures for Light Metal Connected Wood Trusses", The Truss Plate Institute of Canada.

.3 Soffit boards: SPF No. 1, moisture content 19% (S-dry) or less, to CAN/CSA 0141.

.4 Furring, blocking, nailing strips, grounds, curbs, fascia backing and sleepers:

.1 Board sizes: "Standard" or better grade.

.2 Dimension sizes: "Standard" light framing or better grade.

2.2 PANEL MATERIALS

.1 Interior Plywood: G1S plywood conforming to CSA O121, 16 mm, unless indicated otherwise.

.2 Douglas fir plywood (DFP): to CSA O121, standard construction.

.3 Canadian softwood plywood (CSP): to CSA O151, standard construction.

2.3 ACCESSORIES

.1 Exterior wall sheathing paper: to CAN/CGSB-51.32 spunbonded olefin type impregnated .

.2 Polyethylene film: to CAN/CGSB-51.34, Type 1, 0.15 mm thick or as indicated.

.3 Expansion Board: 13mm ashpalt impregnated board.

.4 Air seal: closed cell polyurethane or polyethylene.

.5 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

.6 General purpose adhesive: to CSA O112.9.

.7 Nails, spikes and staples: to CSA B111.

.8 Insect screen: black, nylon.

2.4 FASTENERS

.1 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.

.2 Fastener Finishes:

.1 Galvanizing: to ASTM A123/A123M, use galvanized fasteners.

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 INSTALLATION

.1 Comply with requirements of NBCC 2015, supplemented by the following paragraphs;

.2 Install members true to line, levels and elevations, square and plumb.

.3 Install furring and blocking as required to space-out and support wall and ceiling finishes, facings, fascia, soffit, siding electrical equipment mounting boards, and other work as required.

.4 Install furring to support siding applied vertically where there is no blocking and

where sheathing is not suitable for direct nailing.

.1 Align and plumb faces of furring and blocking to tolerance of 1:600.

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

.6 Install fascia backing, nailers, curbs and other wood supports as required and secure using steel fasteners.

.7 Box out for exterior penetrations - provide recessed metal boxes to suit penetrations.

.8 At interior wall and roof intersections, lap ceiling air/vapour barrier minimum of 300mm on to wall air/vapour barrier. Continuously seal overlap with acoustic sealant (two rows of sealants) and staple through sealant.

.9 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.

.10 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

.11 Secure roof snow stops to truss members.

.12 Countersink bolts where necessary to provide clearance for other work.

.13 Foam-in-place insulation to exterior metal door frames and around protrusions through the exterior wall envelope to achieve and maintain continuity of the air/ vapour barrier.

.14 Extend Fire Resistant Rated walls to u/s of roof deck (typical) and seal smoketight.

3.3 CLEANING

.1 Progress and Final Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by rough carpentry installation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

.2 01 35 29.06 - Health and Safety Requirements

.3 06 10 00 - Rough Carpentry

.4 07 62 00 - Sheet Metal Flashing and Trim

1.2 REFERENCES

.1 CSA International:

.1 CAN/CSA O80 Series-08, Wood Preservation.

.2 CSA O86 Consolidation-09, Engineering Design in Wood.

.3 CSA O141-05(R2009), Softwood Lumber.

.4 CSA S307-M1980(R2001), Load Test Procedure for Wood Roof Trusses for Houses and Small Buildings.

.5 CSA S347-99(R2009), Method of Test for Evaluation of Truss Plates Used in Lumber Joints.

.2 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2010.

.3 National Research Council (NRC)/Institute for Research in Construction (IRC) - Canadian Construction Materials Centre (CCMC)

.1 CCMC-on-line edition, Registry of Product Evaluations.

.4 Truss Plate Institute of Canada (TPIC)

.1 TPIC - 2007, Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses (Limit States Design).

1.3 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 Territory of Yukon, 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 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.

.4 Provide certification that trusses meet requirements of CSA S307 and CSA S347.

.5 Indicate arrangement of webs or other members to accommodate ducts and other specialties.

.6 Show location of lateral bracing for compression members.

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

.8 Instructions: submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Qualifications:

.1 Fabricator for trusses to show evidence of quality control program such as provided by regional wood truss associations, or equivalent.

.2 Fabricator for welded steel connections to be certified in accordance with CSA W47.1.

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

Part 2 Product

2.1 DESIGN REQUIREMENTS

.1 Design light metal plate connected wood trusses in accordance with TPIC truss design procedures for wood truss chords and webs in accordance with engineering properties in CSA O86.

.2 Design light metal plate connected wood trusses in accordance with TPIC truss design procedures for truss joint designs to test engineering properties in accordance with CSA S347 and listed in CCMC Registry of Product Evaluations.

.3 Design trusses, bracing in accordance with CSA O86.1 for building locality as ascertained by NBC, Climatic Information for Building Design in Canada.

.4 Limit live load deflection to 1/360th of span where gypsum board ceilings are hung directly from trusses.

.5 Limit live load deflections to 1/180th of span unless otherwise specified or indicated.

.6 Provide camber for trusses as indicated.

2.2 MATERIALS

.1 Lumber: SPF species, No.2 grade, softwood, 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 approved 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 approved 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 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.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

.2 06 10 00 - Rough Carpentry

.3 07 62 00 - Sheet Metal Flashing and Trim

.4 08 11 00 - Metal Doors and Frames

1.2 REFERENCES

.1 Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)

.1 Architectural Woodwork Quality Standards, 1st edition, 2009.

.2 ASTM International

.1 ASTM A123/A123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.3 CSA International

.1 CSA B111-74(R2003), Wire Nails, Spikes and Staples.

.2 CSA O121-08, Douglas Fir Plywood.

.3 CSA O141-05(R2009), Softwood Lumber.

.4 CSA O151-09, Canadian Softwood Plywood.

.4 National Lumber Grades Authority (NLGA)

.1 Standard Grading Rules for Canadian Lumber 2010.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit product data and shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Certifications: submit certificates signed by manufacturer certifying materials comply with specified performance characteristics and physical properties.

1.4 QUALITY ASSURANCE

.1 Lumber by grade stamp of agency certified by Canadian Lumber Standards Accreditation Board (CLSAB).

.2 Plywood and wood based composite panels to CSA and ANSI standards.

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wood products from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Product

2.1 WOOD MATERIALS

.1 Softwood lumber: S4S, moisture content 19% or less in accordance with following standards:

.1 CSA O141.

.2 CAN/CSA-Z809 or FSC or SFI certified.

.3 NLGA Standard Grading Rules for Canadian Lumber.

.4 AWMAC custom grade, moisture content as specified.

.5 Machine stress-rated lumber is acceptable.

.6 Hardwood lumber: S4S, birch, moisture content 19% or less in accordance:

.1 National Hardwood Lumber Association (NHLA).

.2 AWMAC premium grade, moisture content as specified.

.3 CAN/CSA-Z809 or FSC or SFI certified.

.2 Panel Material: urea-formaldehyde free

.1 Douglas fir plywood (DFP): to CSA O121, standard construction.

.2 Birch veneer plywood: thickness as noted on drawings, factory finished, clear stain, rotary cut, custom grade.

2.2 FINISH MATERIALS

.1 Laminated plastic for flatwork: to NEMA LD3. Located at countertops and backsplashes at vanity in Barrier-Free Washroom and coffee counter in Office.

.1 High Pressure Decorative Laminate

.1 The plastic laminate shall meet the requirements for High Pressure Decorative Laminate as set forth by AWMAC Manual.

.2 Grade: thickness to be the alloawable range for the application.

.3 Finish and Colour: to be selected from manufacturer's sytandard range of colours and patterns. Smooth. matt finish. To be approved by Departmental Representative.

2.3 ACCESSORIES

.1 Nails and staples: to CSA B111; galvanized to ASTM A123/A123M for exterior work, interior humid areas and for treated lumber; stainless steel finish elsewhere.

.2 Wood screws: steel, type and size to suit application.

.3 Splines: wood.

.4 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

.1 Sealants: VOC limit 30 g/L maximum to SCAQMD Rule 1168

.5 Laminated Plastic Adhesive:

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

.6 Clear Wood Finishes (factory fnish) for Millwork: VOC limit 350 g/L maximum GS-11.

.1 Paints: VOC limit 50 g/L maximum to GS-11.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for wood products installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative .

3.2 INSTALLATION

.1 Do finish carpentry to Quality Standards of (AWMAC).

.2 Scribe and cut as required, fit to abutting walls, and surfaces, fit properly into recesses and to accommodate piping, columns, fixtures, outlets, or other projecting, intersecting or penetrating objects.

.3 Form joints to conceal shrinkage.

3.3 CONSTRUCTION

.1 Fastening:

.1 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.

.2 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.

.3 Set finishing nails to receive filler. Where screws are used to secure members, countersink screw in round smooth cut hole and plug with wood plug to match material being secured.

.4 Replace items of finish carpentry with damage to wood surfaces including hammer and other bruises.

.2 Standing and running trim:

.1 Cut right angle joints of casing with mitred joints.

.2 Fit backs of casing snugly to wall surfaces to eliminate cracks at junction of base and casing with walls.

.3 Install door and window trim in single lengths without splicing.

.3 Interior and exterior frames:

.1 Set frames with plumb sides and level heads and secure.

.4 Panelling:

.1 Secure panelling and perimeter trim using counter sunk screws plugged with matching wood plugs.

.5 Millwork:

.1 Do architectural woodwork to Quality Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), except where specified otherwise.

.2 Install prefinished millwork at locations shown on drawings. Position accurately, level, plumb straight.

.3 Fasten and anchor millwork securely. Provide heavy duty fixture attachments for wall mounted millwork.

.4 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets or other projecting, intersecting or penetrating objects.

.5 At junction of plastic laminate counter back splash and adjacent wall finish, apply small bead of sealant.

.6 Site apply laminated plastic to units as indicated. Adhere laminated plastic over entire surface. Make corners with hairline joints. Use full sized laminate sheets. Make joints only where indicated. Slightly bevel arises.

.7 For site application, offset joints in plastic laminate facing from joints in core.

3.4 CLEANING

.1 Progress and Final Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by finish carpentry installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C423-02a, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.2 ASTM C518-04, Standard Test Method for Steady-State Flux Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

.3 ASTM E605-93(2000), Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members.

.2 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S102-03, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC-S703-01, Standard for Cellulose Fibre Insulation (CFI) for Buildings.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets including VOC's for adhesives and primers.

.3 Samples:

.1 Submit duplicate mm samples of exposed insulation for approval of texture and colour.

.4 Test Reports:

.1 Submit test reports, verifying qualities of insulation meet or exceed requirements of this specification, in accordance with Section 01 45 00 - Quality Control.

.5 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

.6 Manufacturers' Field Reports: submit copies of manufacturers field reports, within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

1.4 QUALITY ASSURANCE

.1 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.2 Mock-up:

.1 Erect mock-up in accordance with Section 01 45 00 - Quality Control.

.2 Apply insulation to approximately 10 m²area of surfaces of mock-up matching surface to be treated.

.3 Mock-up will be used:

.1 To judge workmanship, substrate preparation, operation of equipment and material application.

.4 Locate where indicated .

.5 Allow 24 hours for inspection of mock-up before proceeding with work.

.6 When accepted, mock-up will demonstrate minimum standard of quality required for this work.Approved mock-up may not remain as part of finished work. Remove mock-up and dispose of materials when no longer required and when directed by Departmental Representative .

.3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

.1 Verify project requirements.

.2 Review installation conditions.

.3 Review manufacturer's instructions and warranty requirements.

.4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials.

1.6 SITE CONDITIONS

.1 Site Environmental Requirements:

.1 Safety: comply with requirements of Workplace Hazardous Materials

Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.

.2 Ventilation:

.1 Ventilate area to receive insulation by introducing fresh air and exhausting air continuously during and 24hours after application to maintain non-toxic, unpolluted, safe working conditions.

.2 Ventilate area of work as directed by Departmental Representative by use of approved portable supply and exhaust fans.

.3 Ventilate enclosed spaces in accordance with Section 01 50 00 - Temporary Facilities and Controls.

.4 Provide continuous ventilation during and after insulation application. Run ventilation system 24 hours per day during installation; provide continuous ventilation for 7 days after completion of insulation installation.

Part 2 Product

2.1 MATERIALS

.1 Insulation: pure cellulose fibres, chemically impregnated to resist mould, mildew and fire, without an internal binder which does not react with base surface and adjacent materials. Applied and cured insulation to conform to following requirements:

.1 Cellulose fibre insulation: to CAN/ULC-S703.

.2 RSI factor: R-3.72/inch at coverage density = 22.91 kg/m3 minimum to ASTM C518.

.3 Density: as per manufacturer according to ASTM E605.

.4 Surface burning characteristics: to CAN/ULC-S102.

.1 Flame spread: FSC 25.

.2 Smoke density developed: SD50.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PREPARATION

.1 Protection:

.1 Provide temporary enclosures to prevent spray from contaminating air beyond application area.

.2 Protect adjacent surfaces and equipment from damage by over spray, fall-out, and dusting of insulation materials.

3.3 APPLICATION

.1 Apply insulation only when surfaces and ambient temperatures are within manufacturers' prescribed limits.

.2 Apply insulation to clean dry surfaces.

.3 Apply primer as recommended by manufacturer.

.4 Apply insulation in thickness as indicated.

3.4 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C591-01, Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.

.2 ASTM C612-04, Standard Specification for Mineral Fibre Block and Board Thermal Insulation.

.3 ASTM E96/E96M-05, Standard Test Methods for Water Vapour Transmission of Materials.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 71-GP-24M-77(R1983), Adhesive, Flexible, for Bonding Cellular polystyrene Insulation.

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.

.2 CAN/ULC-S702-97, Standard for Thermal Insulation, Mineral Fibre, for Buildings.

.3 CAN/ULC-S704-03, Standard for Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.

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

.1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 33 00 - Submittal Procedures. Indicate VOC's insulation products and adhesives.

.2 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Convene pre-installation meeting one week prior to beginning work of this Section in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart .

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordinate with other building subtrades.

.4 Review manufacturer'sinstallation instructions and warranty requirements.

.4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

Part 2 Product

2.1 BELOW GRADE INSULATION

.1 Extruded polystyrene (XPS): to CAN/ULC-S701, with maximum water absorption of 0.7% in accordance with ASTM D2824, minimum 5 year aged R-value R5.0 per 1" (RSI = 0.88)

.1 Type: 4.

.2 Thickness: as indicated.

.3 Edges: Butt.

.4 Acceptable Product: Terrafoam Platinum by Beaver Plastics.

2.2 FOUNDATION WALL INSULATION

.1 Concrete faced Rigid Polystyrene: to CAN/ULC-S701;

.1 Type: 4

.2 Compressive strength: minimum 241 kPa to ASTM 1621.

.3 Facer: 8 mm thick latex-modified concrete.

.1 Finish: slightly broom finish.

.4 Edges: tongue and groove on 1220mm edge and butt edge on 610mm side.

.5 Size: 610 mm x 1219 mm.

.6 Thickness: as indicated.

.7 Acceptable Product: CFI Wall Panels by Tech-Crete.

2.3 EXTERIOR WALL INSULATION

.1 Extruded polystyrene (XPS): to CAN/ULC-S701, with maximum water absorption of 0.7% in accordance with ASTM D2824, minimum 5 year aged R-value R5.0 per 1" (RSI = 0.88);

.1 Type: 2

.2 Thickness: as indicated.

.3 Edges: square.

.4 Acceptable Product: Terrafoam Platinum by Beaver Plastics.

2.4 ADHESIVE FOR POLYSTYRENE

.1 Adhesive (for polystyrene): to CGSB 71-GP-24.

.1 Type: as recommended by manufacturer for application on this project.

.2 VOC emission: zero.

2.5 ACCESSORIES

.1 Insulation at Foundation Walls: Galvanized Steel to ASTM A123/A123M-08 - Zinc-Coated (Galvanized), Z275 to G90 coating designation, preformed as supplied by manufacturer, complete with corrosion proof masonry fasteners.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 WORKMANSHIP

.1 Install insulation after building substrate materials are dry.

.2 Install insulation to maintain continuity of thermal protection to building elements and spaces.

.3 Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.

.4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from CAN/CGA-B149.1 and CAN/CGA-B149.2 type B vents.

.5 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.

.6 Offset both vertical and horizontal joints in multiple layer applications.

.7 Do not enclose insulation until it has been inspected and approved by Departmental Representative.

3.3 EXAMINATION

.1 Examine substrates and immediately inform Departmental Representative in writing of defects.

.2 Prior to commencement of work ensure:

.1 Substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.

3.4 RIGID INSULATION INSTALLATION

.1 Apply Type adhesive to polystyrene by notched trowel in accordance with manufacturer's recommendations.

.2 Imbed insulation boards into vapour barrier type adhesive, applied as specified, prior to skinning of adhesive.

.3 In addition to adhesive, install mineral fibre insulation boards with insulation clips and disk, 2 per 600 x 1200 mm board minimum, fit boards tight, cut off fastener spindle 3 mm beyond disk.

.4 Leave insulation board joints unbonded over line of expansion and control joints. Bond a continuous 150 mm wide 0.15 mm modified bituminous membrane over expansion and control joints using compatible adhesive and primer before application of insulation.

3.5 PERIMETER FOUNDATION INSULATION

.1 Exterior application: extend boards as indicated. Install on exterior face of perimeter foundation wall as per manufacturer's recommendations.

.2 Under slab application: extend boards as indicated. Lay boards on level compacted fill.

3.6 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

.2 06 10 00 - Rough Carpentry

.3 07 92 00 - Joint Sealants

.4 09 21 16 - Gypsum Board Assemblies

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C553-02, Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.

.2 ASTM C1320-05, Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.

.2 Canadian Standards Association (CSA International)

.1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S702-1997, Standard for Mineral Fibre Insulation.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.

.2 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 Remove from site and dispose of packaging materials.

Part 2 Product

2.1 INSULATION

.1 Batt and blanket mineral fibre: to CAN/ULC S702.

.1 Type: 1.A, preformed friction fit with no membrane, formaldehyde-free.

.2 Thickness: as indicated.

2.2 ACCESSORIES

.1 Nails: galvanized steel, length to suit insulation plus 25 mm, to CSA B111.

.2 Staples: 12 mm minimum leg.

.3 Tape: as recommended by manufacturer.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSULATION INSTALLATION

.1 Install insulation to maintain continuity of acoustical protection to building elements and spaces and to ASTM C1320.

.2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

.3 Do not compress insulation to fit into spaces.

.4 In sound control assemblies, acoustically seal periphery of wall and all penetrations through the wall.

.5 Do not enclose insulation until it has been inspected and approved by Departmental Representative.

3.3 CLEANING

.1 Upon completion of installation, remove surplus materials, rubbish, tools and

equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 01 35 29.06 - Health and Safety Requirements

.3 Section 07 92 00 - Joint Sealants

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.33-M89, Vapour Barrier Sheet, Excluding Polyethylene, for Use in Building Construction.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include:

.1 Product characteristics.

.2 Performance criteria.

.3 Limitations.

.3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).

.4 Quality assurance submittals:

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

.2 Instructions: submit manufacturer's installation instructions and comply with written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

1.4 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

Part 2 Product

2.1 SHEET WEATHER BARRIER

.1 Exterior Walls: exterior wall sheathing paper to CAN/CGSB-51.34, 0.10 mm thick.

.2 Roof: roof sheathing paper, single layer of 15lb asphalt saturated felt.

2.2 ACCESSORIES

.1 Sealant: compatible with vapour retarder materials, recommended by vapour retarder manufacturer. To Section 07 92 00 - Joint Sealants.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that surfaces and conditions are ready to accept the Work of this section.

.2 Ensure that all surfaces are clean, dry, sound, smooth, continuous and comply with weather barrier manufacturer's requirements.

.3 Report any unsatisfactory conditions to the Departmental Representative.

.4 Do not start work until deficiencies have been corrected. Commencement of Work implies acceptance of conditions.

3.2 PREPARATION

.1 Remove loose or foreign matter which might impair adhesion of materials.

.2 Ensure all substrates are clean of oil or excess dust.

.3 ensure metal closures are free of sharp edges and burrs.

3.3 INSTALLATION

.1 Ensure services are installed and inspected prior to installation of retarder.

.2 Use sheets of largest practical size to minimize joints.

.3 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

3.4 EXTERIOR SURFACE OPENINGS

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

3.5 PERIMETER SEALS

.1 Seal perimeter of sheet vapour barrier as follows:

.1 Apply continuous bead of sealant to substrate at perimeter of sheets.

.2 Lap sheet over sealant and press into sealant bead.

.3 Install staples through lapped sheets at sealant bead into wood substrate.

.4 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.6 LAP JOINT SEALS

.1 Seal lap joints of sheet vapour barrier as follows:

.1 Attach first sheet to substrate.

.2 Apply continuous bead of sealant over solid backing at joint.

.3 Lap adjoining sheet minimum 150 mm and press into sealant bead.

.4 Install staples through lapped sheets at sealant bead into wood substrate.

.5 Ensure that no gaps exist in sealant bead. Smooth out folds and ripples occurring in sheet over sealant.

3.7 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 06 10 00 - Rough Carpentry.

.3 Section 07 21 13 - Board Insulation

.4 Section 07 92 00 - Joint Sealants

.5 Section 08 50 00 - Windows

1.2 REFERENCES

.1 ASTM International

.2 Canadian General Standards Board (CGSB)

.3 The Master Painters Institute (MPI)

.4 Underwriters Laboratories' of Canada (ULC)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for cementitious materials and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements. Indicate VOC's for cementitious materials.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by Contractor.

.1 Indicate dimensions, wall openings, head, jamb, sill and mullion detail, materials and finish, anchor details, compliance with design criteria and requirements of related work.

.4 Samples:

.1 Submit duplicate 300mm x 300mm mm samples of wall system, representative of materials, finishes and colours.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section with manufacturer's

written instructions.

1.5 ENVIRONMENTAL REQUIREMENTS

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

Part 2 Product

2.1 DESIGN REQUIREMENTS

.1 Design composite building panel wall to provide for thermal movement of component materials caused by ambient temperature range of 70 degrees C without causing buckling, failure of joint seals, undue stress on fasteners or other detrimental effects.

.2 Include expansion joints to accommodate movement in wall system and between wall system and building structure, caused by structural movements, without permanent distortion, damage to infills, racking of joints, breakage of seals, or water penetration.

.3 Design members to withstand dead load and wind loads as calculated in accordance with NBC and applicable Municipal/Territorial regulations, to maximum allowable deflection of 1/180 of span.

.4 Provide for positive drainage of condensation occurring within wall construction and water entering at joints, to exterior face of wall in accordance with NRC "Rain Screen Principles".

.5 Design wall system to accommodate specified erection tolerances of structure.

.6 Maintain following installation tolerances:

.1 Maximum variation from plane or location shown on approved shop drawings: 10 mm/m of length and up to 20 mm/100 m maximum.

.2 Maximum offset from true alignment between two adjacent members abutting end to end, in line: 0.75 mm.

2.2 COMPOSITE CEMENTITIOUS PANEL

.1 Material Properties: non-combustible glass fibre reinforced concrete panels, Class A;

.2 Panel Description:

.1 Length and Width: as indicated on drawings.

.2 Panel Thickness: 13 mm.

.3 Colour: Polar White painted #2061-30 'Bermuda Blue' by Benjamin Moore.

.4 Texture: sandblasted (FE).

.5 Fastening method: exposed fasteners, attached to rainscreen system.

.6 Acceptable Product: fibreC by Rieder

.3 Sealants: as recommended by manufacturer..

.4 Fasteners: aluminum, purpose made, self tapping.

.5 Gaskets: soft pliable vinyl extruded profile.

2.3 FABRICATION

.1 Fabricate reinforced cementitious panels and accossory items in accordance with manufacturer's recommendations and approved submittals.

.2 Fabricate panel profiles and sizes as indicated.

.3 All cutting of panels shall be completed under controlled interior shop conditions using saw tables and blades as recommended by the manufacturer.

.4 Drill holes in panels as per manufacturer's recommendations.

.5 Open joint installation: Cut panels under nominal size to provide 8 mm wide joint after installation.

.6 Corners to be open with 8 mm clear gap, as per manufacturer's details.

.7 Brake form metal flashings to profile required, in maximum lengths.

Part 3 Execution

3.1 EXAMINATION

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

3.2 INSTALLATION

.1 Protect surface of metals in contact with concrete, mortar, plaster or other cementitious surface with isolation coating.

.2 Touch up building framing members with primer as required.

.3 Install head and sill flashings, edge trim, cap pieces and fillers.

.4 Install cap/trim pieces after panels are centred in framing opening, corner mullions and control/expansion joints as indicated.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning. Final

.2 Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

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

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 07 21 13 - Board Insulation

.3 Section 07 26 00 - Vapour Retarders

.4 Section 07 62 00 - Sheet Metal Flashing and Trim

.5 Section 07 92 00 - Joint Sealants

.6 Section 08 11 14 - Metal Doors and Frames

.7 Section 08 36 13.02 - Sectional Metal Doors and Frames

.8 Section 08 50 00 - Windows

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B18.6.3-2011, Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series).

.2 ASTM International

.1 ASTM D2369-10e1, Test Method for Volatile Content of Coatings.

.2 ASTM D5116-10, Standard Guide For Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products.

.3 SMACNA - Architectural Sheet Metal Manual

.4 Environmental Choice Program (ECP)

.1 CCD-045-95, Sealants and Caulking Compounds.

.5 Green Seal Environmental Standards (GS)

.1 GS-36-11, Standard for Commercial Adhesives.

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 metal siding and metal liner and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 43 - Environmental Procedures.

.1 Indicate VOC's for caulking materials during application and curing.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Territory of Yukon, Canada.

.2 Indicate dimensions, profiles, attachment methods, schedule of wall elevations, trim and closure pieces, fascia, metal furring, and related work.

.4 Samples:

.1 Submit duplicate 300 mm x 300 mm mm samples of siding and liner material, of colour and profile specified.

.5 Warranty:

.1 Provide twenty (20) year metal siding manufacturer's warranty.

1.4 QUALITY ASSURANCE

.1 Conform to SMACNA Manual for sizing components for rainfall intensity determined by a storm occurence of 1 in 10 years.

.2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect metal siding from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Product

2.1 STEEL CLADDING AND COMPONENTS

.1 Exterior Metal Siding: to CAN/CGSB-93.4, Type vertical, ASTM A792 Grade 33 with designation Az50 (AZM150) for Galvalume material.

.1 Finish coating: Galvalume Plus.

.2 Thickness: 0.76 mm (22 GA) base metal thickness.

.3 Profile: 7/8" Corrugated

.2 Fascia facings and exposed trim: to CAN/CGSB-93.4-92:

.1 Finish coating: Galvalume Plus.

.2 Thickness: 0.76 mm ((22 GA) base metal thickness.

.3 Profile: as per drawings and manufacturer's standard as indicated.

.3 Metal Liner: fabricated from AZ275 Galvanized sheet steel conforming to ASTM A653M Grade 230;

.1 Finish coating: Galvanized.

.2 Thickness: 0.91 mm base metal thickness.

.3 Profile: non-ribbed.

.4 Size: 800 mm wide interlocking sections, 2440 mm height.

.5 Fasteneres: exposed

.6 Acceptable products: L-800SR Liner by Vicwest.

2.2 FASTENERS

.1 Nails: CSA B111. Screws: ASME B18.6.3. Purpose made , Electro zinc plated hex head dish bonded seal self-drilling screws.

2.3 CAULKING

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

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

2.4 WOOD STRAPPING

.1 Wood strapping: see Section 06 10 00 - Rough Carpentry.

2.5 SHEATHING PAPER

.1 Exterior wall sheathing paper: to CAN/CGSB-51.32, spunbond olefin type as indicated.

2.6 ACCESSORIES

.1 Exposed trim: inside corners, outside corners, cap strip, drip cap, undersill trim, starter strip and window/door trim of same material, colour as cladding, with fastener holes pre-punched. Use preformed corner pieces by manufacturer only.

.2 Flat stock base: colour matched, 0.76mm base for mechanical and electrical boxes, piping and fixtures.

Part 3 Execution

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied .

3.2 MANUFACTURER'S INSTRUCTIONS

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

3.3 INSTALLATION

.1 Install cladding and liner in accordance with CGSB 93.5, and manufacturer's written instructions.

.2 Install one layer exterior wall sheathing paper horizontally by stapling, lapping edges 150 mm.

.3 Install wood strapping as indicated.

.4 Provide recessed flat stock metal base, complete with 'J' trim, for mechanical and electrical penetrations. Do not mount electrical boxes and fixtures directly on corrugated cladding.

.5 Install continuous starter strips, inside and outside corners, edgings, drip, cap, sill and window/door opening flashings as indicated.

.6 Maintain joints in exterior cladding and liner, true to line, tight fitting, hairline joints.

.7 Attach components in manner not restricting thermal movement.

.8 Caulk junctions with adjoining work with sealant. Do work in accordance with Section 07 92 00 - Joint Sealants.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by preformed metal siding installation.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

.1 ASTM International

.1 ASTM A653/A653M-15e1, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM D2369-10-2015e1, Test Method for Volatile Content of Coatings.

.3 ASTM D2832-92, 2016, Standard Guide for Determining Volatile and Non-Volatile Content of Paint and Related Coatings.

.2 CSA Group

.1 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.

.3 National Building Code of Canada 2015

.1 CCMC - Registry of Product Evaluations.

1.2 ACTION AND INFORMATION SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for metal roofing and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS to Health and Safety Requirements.

.3 Indicate low VOC's content for sealant materials.

.3 Shop Drawings:

.1 Submit drawings signed and reviewed by general contractor that certifies the steel roofing meets project requirements.

.2 Indicate dimensions, profiles, attachment methods, heat resistant water barrier, snowguards, schedule of trim and closure pieces, roof penetrations, fascia and related work.

.4 Samples:

.1 Submit duplicate 400mm x 400mm samples of roofing material and heat resistant water barrier.

1.3 QUALITY ASSURANCE

.1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.

.2 Installer Qualifications: minimum three (3) years documented experience with products specified.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - CLOSEOUT SUBMITTALS

.2 Operation and Maintenance Data: submit operation and maintenance date for installed products for incorporation into manual.

.3 Warranty Documentation: submit warranty documents, c/w twenty (20) year warranty certificate by manufacturer. All required roofing inspection expenses / costs to be the contractor's responsibility.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 01 61 00 - COMMON PRODUCTS requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location, off ground and in accordance with manufacturer's recommendations.

.2 Store and protect steel roofing from damage. Replace defective or damaged materials with new material.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Steel Roofing: Pre-finished steel with factory applied Weather - XL (SMP) finish:

.1 Class F1S.

.2 Colour: as selected from manufacturer's standard range.

.3 Specular gloss: 30 units, +/- 5 to ASTM 523.

.4 Coating thickness: 200 micrometres minimum.

.5 Resistance to accelerated weathering for chalk rating of 8, colour fade (5) units or less and erosion rate less than 20% to ASTM D822 as follows:

.1 Outdoor exposure period 5000 hours minimum.

.2 Humidity resistance exposure period 5000 hours minimum.

.6 Acceptable Product: Tradition 100 standing seam roofing, by VicWest.

.2 Steel fascia facings adn exposed trim: Fabricated from commercial grade to ASTM A652M with Z275 zinc coating:

.1 Profile: as per accepted product specified above.

.2 Finish Coating: factory pre-coated with fluorocarbon paint finish, two (2) coat system dry paint file thickness of 0.025mm.

.3 Colour: As selected by Departmental Representative.

.4 Gloss: Medium.

.5 Thickness: 0.610mm.

.3 Fasteners: screws, colour matched, to ASME B18.63 non-corrosive, purpose made.

.4 Sealants: in accordance with Section 07 92 00 - Joint Sealants. Low VOC.

.5 High Temperature Water Barrier Underlay:

.1 Acceptable Product: Blueskin 200 HT by Henry.

.6 Snowguards:

.1 Acceptable Product: DualGard (CCD) c/w required attachments and clips components, length to suit, by S-5 Metal Roof Innovations Ltd.

.2 Quantity and location: as per contract drawings.

.3

2.2 ACCESSORIES

.1 Exposed trim: inside corners, outside corners, cap strip, drip cap, undersill trim, starter strip to be same colour as roofing, with pre-punched holes for fasteners. Hem exposed edges on underside 12mm, mitre and seal.

.2 Isolation coating: alkali resistant bituminous paint.

.3 Plastic cement: to CAN/CGSB - 37.5.

Part 3 EXECUTION

3.1 EXAMINATION

.1 Verification of Conditions: very conditions of plywood substrate is acceptable in accordance with manufacturer's written instructions.

.1 Inform Departmental Representative of unacceptable conditions immediately

upon discovery.

.2 Proceed with installation only when unacceptable conditions remedied.

3.2 PREPARATION

.1 Clean surfaces throughly prior to installation.

.2 Repair substrate flaws or defects before installing water barrier membrane.

.3 Prepare surfaces to methods recommended by manufacturere's instructions.

.4 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installion instructions, and datasheets.

3.3 INSTALLATION STANDING SEAM ROOFING

.1 Use 300mm x 22mm panel with snap-on cap over high temperature water barrier membrane. Install as per manufacturer's written instructions.

.2 Fold lower end of each pan under 20mm.

.3 Slit fold 25mm away from corner to form tab where pan turns up to make standing seam.

.4 Fold upper end of each pan over 50mm.

.5 Hook 20mm fold on lower end of upper pan into 50mm fold on upper end of underlying pan.

.6 Apply sheet metal roofing beginning at eaves. Loose back pans to valley flashing and edge strips at eaves and gable rakes.

.7 Finish standing seams 25mm high on flat surfaces. Bend up one side edge 40mm and other 45mm.

.8 Make first fold 6mm wide, single fold and second fold 12mm wide, providing locked portion of standing seam with 5 plies in thickness.

.9 Folder lower ends of seams at eaves over, at 45 degrees angle.

.10 Terminate standing seams at ridge and hips by turning down in tapered fold.

.11 Form valleys of sheets not exceeding 3m in length. Lap joints 150mm in direction of flow.

.12 Extend valley sheet minimum 150mm under roofing sheets.

.13 At valley line, double fold valley and roofing sheets and secure with cleats spaced as required.

.14 Attach components in manner not restricting thermal movement.

.15 Caulk junctions with adjoining work with sealant as per Section 07 92 00 - Joint

Sealants.

.16 Install snowguards clipped to standing seams, as per manufacturer's written instructions.

3.4 CLEANING AND PROTECTION

.1 Progress Cleaning: Leave Work Area clean at end of each day, as per Section 01 74 00 - Cleaning.

.2 Protect installed products and components from damage during construction.

.3 Repair damage to adjacent materials caused by roof installation.

Part 4

4.1 ASSEMBLY

Part 5

5.1 WASTE MANAGEMENT

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 06 10 00 - Rough Carpentry.

.3 Section 07 92 00 - Joint Sealants.

.4 Section 07 62 00 - Sheet Metal Flashing and Trim: Supply of metal flashings and trim associated with cementitious siding for placement by this section.

.5 Section 08 11 13 - Metal Doors and Frames

.6 Section 09 91 13 - Exterior Painting.

1.2 REFERENCES

.1 ASTM C 920 - Standard for Elastomeric Joint Sealants.

.2 ASTM C 1185 - Standard Test Methods for Sampling and Testing Non-Asbestos Fibre Cement Flat Sheet, Roofing and Siding Shingles and Clapboards.

.3 ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.

.4 ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Construction.

.5 ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.

1.3 SUBMITTALS

.1 In accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: Manufacturer's data sheets on each product to be used, including:

.1 Preparation instructions and recommendations.

.2 Storage and handling requirements and recommendations.

.3 Installation methods, including nailing patterns.

.4 Manufacturer's requirements for vapor retarders, primer, paint, etc.

.3 Samples: Submit two (2) samples, 12 x 12 inch in size illustrating surface texture and colour.

1.4 DELIVERY, STORAGE, AND PROTECTION

.1 Store products off the ground, on a flat surface, and under a roof or separate waterproof covering, as per manufacturer's recommendations.

1.5 WARRANTY

.1 Provide a 15 year limited warranty on Finish.

.2 Provide a 25 year limited warranty on Substrate.

.3 Provide a 5 year 100% labour and replacement warranty.

.4 Manufacturing defects include: buckling, cracking, chipping.

.5 Register manufacturer's warranty, made out in Owner's name, with copy to Owner.

Part 2 Products

2.1 PRODUCTS

.1 Horizontal Siding: Lap Siding of high-density wood composite material, with deep wood-grain texture, prefinished;

.1 Thickness: 9.5 mm

.2 Nominal Width: 228.6 mm

.3 Length: 3660 mm

.4 Style: lap siding.

.5 Texture: wood grain.

.6 Finish: Factory applied by manufacturer.

.7 Colour: 'Cedar'.

.8 Fastening system: hidden nail.

.9 Acceptable product: Ced-R-Vue by CanExel

.2 Corner Trim: preformed metal corner pieces ; colour to match metal cladding. To be provided by metal cladding manufacturer.

2.2 ACCESSORIES

.1 Nails: Corrosion resistant type; #8, non-staining, of size and strength to securely and rigidly retain the work as per manufacturer's recommendations.

.2 Sheet Metal Flashing: minimum 26 GA hot-dipped galvanized steel sheet or coated aluminum.

.3 Sealant/Primer: FibreTect Sealant/Primer.

.4 Field Finish Paint: 100 percent Acrylic latex as per Section 09 91 00.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that substrate surfaces are ready to receive work.

3.2 INSTALLATION - BOARD SIDING

.1 Install in accordance with manufacturer's instructions and drawing details, particularly for local wind and snow loads.

.2 Joints in Horizontal Siding: Avoid joints in lap siding except at corners; where joints are inevitable stagger joints between successive courses. Mitre horizontal joints tight at 45 degrees. leave a 5 mm gap between siding pieces.

.3 Installation on strapping: Leave space at top and bottom open; top may be behind soffit; at bottom install insect screen over opening by wrapping a strip of screen over bottom end of vertical strapping.

.4 Screw in a minimum penetration of 3/8" past the nailing flange.

.5 Allow space between both ends of siding boards that butt against trim for thermal movement; seal joint between board and trim with exterior grade sealant.

.6 Touch-up all field cut edges before installing with colour-matched touch-up paint, provided by manufacturer. Unsightly touch-up will require removal and replacement of affected siding.

.7 Install sheet metal flashing above door and window casings. Refer to Section 07 62 00.

.8 Install corner boards and trim. leave 5 mm space wherever siding butts against corner boards and trim. Use colour co-ordinated sealant at gaps.

.9 Do not install siding less than 150mm (6") from the top of grade and concrete aprons or 25mm (1") from other surfaces where water may collect.

.10 After installation, seal all joints except lap joints of lap siding. Seal around all penetrations. Paint all exposed cut edges with colour-matched paint provided by manufacturer..

3.3 PREPARATION FOR SITE FINISHING

.1 At completion of work, remove debris caused by siding installation from project site.

.2 Touch-up, repair or replace damaged products prior to Substantial Completion.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 01 45 00 - Quality Control

.3 Section 06 10 00 - Rough Carpentry

.4 Section 06 17 53 - Shop-Fabricated Roof Trusses

.5 Section 07 46 26- Hardboard Siding

.6 Section 07 92 00 - Joint Sealants

.7 Section 08 11 00 - Metal Doors and Frames

1.2 REFERENCES

.1 The Aluminum Association Inc. (AAI)

.1 AAI-Aluminum Sheet Metal Work in Building Construction-2002.

.2 American Society for Testing and Materials International (ASTM)

.1 ASTM A653/A653M-07, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 Canadian Roofing Contractors Association (CRCA)

.4 Canadian General Standards Board (CGSB)

.5 Canadian Standards Association (CSA International)

.1 AAMA/WDMA/CSA 101/I.S.2/A440-2008, Standard/Specification for Windows, Doors, and Unit Skylights.

.2 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

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

.1 Material Safety Data Sheets (MSDS).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit product data, shop drawings and samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.

1.4 DELIVERY, STORAGE AND HANDLING

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

Part 2 Product

2.1 SHEET METAL MATERIALS

.1 Aluminum-zinc alloy coated steel sheet: to ASTM A792/A792M, commercial quality, grade 33 with AZ150 coating, extra smooth surface, not chemically treated for paint finish, 0.61 mm base metal thickness.

.1 Colour: chosen from manufacturer's standard stock of colours. To match adjacent material colour.

.2 Trim Items: Metal flashings and trim shall be factory or field formed from the same material, 0.72 mm (22 gauge). Flashing finishes to match adjacent surface.

2.2 ACCESSORIES

.1 Isolation coating: alkali resistant bituminous paint.

.2 Plastic cement: to CAN/CGSB 37.5.

.3 Underlay for metal flashing: No. 15 perforated asphalt felt to CSA A123.3.

.4 Sealants: Low VOC sealants as recommended by Metal-Span Rollforming Corp.

.5 Hexhead fasteners: CSA B111. Screws: ANSI B18.6.4. Purpose made aluminum alloy, cadmium plated steel. Screw head colour to match cladding material.

.6 Cleats: of same material, and temper as sheet metal, minimum 50 mm wide. Thickness 0.9 mm.

.7 Fasteners: of same material as sheet metal, to CSA B111, ring thread flat head roofing nails of length and thickness suitable for metal flashing application.

.8 Washers: of same material as sheet metal, 1 mm thick with rubber packings.

.9 Touch-up paint: as recommended by prefinished material manufacturer.

2.3 FABRICATION

.1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details.

.2 Fabricate aluminum flashings and other sheet aluminum work in accordance with AAI-Aluminum Sheet Metal Work in Building Construction.

.3 Form pieces in 2400 mm maximum lengths. Make allowance for expansion at joints.

.4 Hem exposed edges on underside 12 mm. Mitre and seal corners with sealant.

.5 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.6 Apply isolation coating to metal surfaces to be embedded in concrete or mortar.

2.4 METAL FLASHINGS

.1 Form flashings, copings and fascias to profiles indicated of 0.61mm thick galvanized steel.

.2 Trim items: Metal flashings and trim shall be factory or field formed from the same material, gauge and finish as the roofing panels.

2.5 EAVES TROUGHS AND DOWNPIPES

.1 Down spouts: spiral galvalume piping, 152mm diameter, 0.76mm thick (22 gauge).

.2 Gutter: Formed galvalume metal gutter. 0.76mm thick (22 gauge).

.3 Sizes and profiles as indicated on drawings.

.4 Provide goosenecks, end caps, downspout outlets, gutter and downspout straps, support brackets and necessary fastenings. Galvalume finish.

.5 Hexhead fasteners: CSA B111. Screws: ANSI B18.6.4. Purpose made aluminum alloy, cadmium plated steel. Fastener head colour to match downspout material.

.6 Splash Pads: Precast concrete type, 457 x 914 mm splash pads from , 20 MP at 28 days with min. 5% air entrainment.

2.6 SNOW GUARDS

.1 Two pipe Snow Guard: aluminum, with stainless steel base plate.

.2 Acceptable product: PP125 Two Pipe Snow Guard by Alpine Snowguards.

Part 3 Execution

3.1 INSTALLATION

.1 Install sheet metal work in accordance with manufacturer's printed instructions and industry standards.

.2 Use concealed fastenings except where approved before installation.

.3 Provide underlay under sheet metal. Secure in place and lap joints 100 mm.

.4 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs.

.1 Flash joints using S-lock forming tight fit over hook strips, as detailed.

.5 Lock end joints and caulk with sealant.

.6 Install surface mounted reglets true and level, and caulk top of reglet with sealant.

3.2 EAVES TROUGHS AND DOWNPIPES

.1 Install eaves troughs and secure to building at 750 mm on centre with eaves trough spikes through spacer ferrules.

.1 Slope eaves troughs to downpipes as indicated.

.2 Seal joints watertight.

.2 Install downpipes and provide goosenecks back to wall.

.1 Secure downpipes to wall with straps at 1800 mm on centre; minimum two straps per downpipe.

.3 Install splash pans as indicated.

3.3 SNOW GUARDS

.1 Install snow guard in locations as shown and as per manufacturer's instructions.

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

.3 Leave work areas clean, free from grease, finger marks and stains.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Requirements for supply and installation of the following, as required for complete and proper installation:

.1 Fire Stopping and smoke seal systems.

1.2 GENERAL DESCRIPTION OF WORK IN THIS SECTION

.1 Only tested firestopping and smoke seal systems shall be used.

.2 Provide fire stopping per NBC Part 3 and other applicable codes and standards.

.3 In the case of inconsistency between the requirements of this article and the requirements elsewhere, the more stringent requirements apply.

1.3 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 35 29 - Health and Safety Requirements.

.3 Section 01 45 00 - Quality Control.

.4 Section 01 78 00 - Closeout Submittals.

.5 Section 01 74 00 - Cleaning.

.6 Section 01 74 19 - Construction and Demolition Waste Management and Disposal.

.7 Section 01 78 00 - Closeout Submittals.

.8 Section 09 21 16 - Gypsum Board Assemblies.

.9 Divisions 22, 23, and 26.

1.4 REFERENCES

.1 Underwriter's Laboratories of Canada (ULC)

.1 ULC-S115, Fire Tests of Fire stop Systems.

.2 CAN/ULC-S102, Standard Method of Test for Surface Burning Characteristics of building Materials and Assemblies.

.3 UL 1479, Standard for Fire Tests of Penetration Firestops.

.2 American Society for Testing and Materials (ASTM International):

.1 ASTM E1966, Standard Test Method for Measuring Compressive Properties of Thermal Insulations.

.2 ASTM E814 - 13a, Standard Test Method for Fire Tests of Penetration Firestop Systems.

.3 ASTM E84 - 15b, Standard Test Method for Surface Burning Characteristics of Building Materials.

.4 ASTM E 2174-14b, Standard Practice for On-Site Inspection of Installed Firestops.

.5 Material Safety Data Sheet (MSDS)

.3 National Fire Protection Association (NFPA):

.1 NFPA 101: Life Safety Code

1.5 DEFINITIONS

.1 Fire Stop Material:

.1 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 Firestopping:

.1 Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke and hot gases through penetrations in, or construction joints between fire rated wall and floor assemblies.

.3 Single Component Fire Stop System:

.1 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.

.4 Multiple Component Fire Stop System:

.1 Exact group of firestop materials that are identified within listed systems design to create on site fire stop system.

.5 Tightly fitted (ref: NBCC 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 building 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.

1.6 SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets .

.3 Shop Drawings:

.1 Submit shop drawings to show location, proposed material, and method of installation.

.2 Construction details should accurately reflect actual job conditions.

.3 Manufacturers engineering judgment identification number and drawing details when not ULC or cUL system is available for an application. Engineered judgment must include both project name and contractor's name who will install firestop system as described in drawings.

.4 Quality assurance submittals: Submit the following in accordance with Section 01 45 00 - Quality Control.

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

.2 Manufacturer's Instructions: Submit manufacturer's installation instruction and special handling criteria, installation sequence and cleaning procedures.

.4 Operation and Maintenance Data:

.1 Supply maintenance data in accordance with Section 01 78 00 - Closeout Submittals.

.5 Letter or Assurance:

.1 At Substantial Performance provide letter of assurance for firestopping installation sealed by engineer registered in the Yukon Territory.

1.7 QUALITY ASSURANCE

.1 Installer qualifications:

.1 Contractor with experience in fire stopping installations with five (5) years documented experience or is registered in good standing with the Fire stop Contractors International Association (FCIA).

.2 Pre-Installation Meeting:

.1 Convene pre-installation meeting one week prior to beginning work of this

Section, with Contractor to:

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Co-ordination with other building sub-trades.

.4 Review manufacturer's installation instructions and warranty requirements.

1.8 SEQUENCING AND SCHEDULING

.1 Sequence works to permit installation of the fire stopping and smoke seal materials after adjacent work is complete and before closure of spaces.

1.9 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery:

.1 Deliver materials to the project in original, unopened packages and labeled to clearly identify product name, manufacturer and ULC markings.

.2 Deliver in accordance with manufacturer's written instructions.

.3 Storage and Handling:

.1 Store and handle in strict compliance with manufacturer's recommendations.

.2 Store materials in a clean dry area, indoor until ready for installation.

.3 Replace defective or damaged materials with new.

.4 Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

.5 Do not use damaged or expired materials.

1.10 WASTE MANAGEMENT AND DISPOSAL

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

.2 Place materials defined as hazardous or toxic in designated containers.

.3 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, and regional regulations.

1.11 PROJECT CONDITIONS

.1 Conform to manufacturer's written recommendations with regard to temperature,

relative humidity and substrate moisture content.

Part 2 Product

2.1 FIRESTOPPING GENERAL

.1 Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items (if any) penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

.2 Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and for the designated fire resistance rated systems.

.3 Firestop sourced from one manufacturer for all applications to ensure compatibility.

2.2 ACCEPTABLE MANUFACTURERS

.1 Subject to compliance with through penetration firestop systems and joint systems listed in the ULC Fire Resistance Directory - Volume III or UL Products Certified for Canada (cUL) Directory, provide products that meet the testing requirements in Part 1.

.2 Fire stopping and smoke seal systems: in accordance with CAN-ULC-S115.

.1 Materials (asbestos-free) 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.

.3 Use only firestop products that have been ULC or cUL tested for specific fire-rated construction conditions confirming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

.4 Service Penetration Assemblies: Certified by this standard and used by ULC Guide No. 40 U19.

.5 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115.

.6 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.

.1 Fire-resistance rating of installed fire stopping assembly not less than the fire-resistance rating of floor or wall system being penetrated.

.7 Service penetration assemblies: certified by ULC in accordance with CAN4-S115-M85 (current edition) and listed in ULC Guide No. 40 U19.

.8 Firestopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal; do not use a cementitious or rigid seal at such locations.

.9 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

.10 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 jurisdictions.

.11 Pre-formed mineral wood designed to fit flutes of metal profile deck

.12 Sealants for vertical joints: non-sagging.

.13 Intumescent sealants or caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed flexible cable or cable bundles and plastic pipe.

.14 Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles.

.15 Non-curing, re-penetratable intumescent putty or foam materials for use with flexible cable or cable bundles.

.16 Non-curing, intumescent putty pad for use with cUL/ULC listed metallic and specified non-metallic outlet boxes.

.17 Sealants or caulking materials used for openings between structurally separate sections of wall and floors will be tested for movement.

.18 For penetrations through a Fire Separation wall, provide a firestop system with an F rating as determined by ULC or cUL as indicated below:

Fire Resistance Rating	Required ULC or cUL F Rating of Firestopping Assembly
45 minutes	45 minutes
1 hour	45 minutes
2 hours	1.5 hours

.1 For combustible pipe penetrations through a Fire Separation provide a firestop system with an F Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.

.19 For penetrations through a Fire Wall or horizontal Fire Separation provide a firestop with an FT Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.

.20 Provide a firestop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction joint assembly.

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 Verify penetrations are properly sized and in suitable condition for application of materials.

.3 Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

.4 Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping adhesives.

.5 Comply with manufacturers recommendations for tempaerature and humidity conditions before, during and after installation of firestopping.

.2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.3 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces; remove stains on adjacent surfaces.

.4 Do not apply firestop materials to surfaces previously painted or treated with other coatings. Perform tests to ensure that materials are compatible.

3.3 INSTALLATION

.1 Regulatory requirements: Install firestop materials in accordance with ULC Fire Resistance Directory or UL Products Certified for Canada. (cUL).

.2 Install firestopping and smoke seal material and components in accordance with manufacturer's cerified tested system listing.

.3 Seal holes or voids made by through penetrations, poke-through termination devices, and un-penetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.4 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.5 Tool or trowel exposed surfaces to neat finish.

.6 Remove excess compound promptly as work progresses and upon completion.

.7 Maintain integrity of fire separation.

.8 Cure firestop sealant in accordance with manufacturer's written recommendations. Do not paint sealant until proper curing has taken place.

3.4 SEQUENCES OF OPERATION

.1 Proceed with installation only when submittals have been reviewed by Consultant.

3.5 FIELD QUALITY CONTROL

.1 Contractor to appoint an agency to inspect fireproofing.

.2 Fireproofing inspection agency to include letter of assurance complete with seal from Engineer registered in the Yukon Territory.

.3 Contractor to pay for cost of testing and costs incurred for additional tests and inspections if defects are revealed.

.4 Field Reviews:

.1 Notify fireproofing inspection agency when ready for review and prior to concealing or enclosing firestopping materials and service penetration assemblies.

.2 Fireproofing inspection agency to examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

.3 Keep areas of work accessible until inspection by fireproofing inspection agency.

.4 Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, Standard Practice for On-Site Inspection of Installed Fire Stops or other recognized standard.

.5 Perform under this section patching and repairing of firestopping caused by cutting or penetrating existing firestop systems already installed by other trades.

.6 The firestop contractor is to supply documentation, including photographs of installation of each system component, for each application addressed. This documentation is to identify each penetration and joint location on the entire project. The documentation Form for through penetrations is to include:

.1 A sequential location number.

.2 Project Name.

.3 Date of Installation.

.4 Detailed description of the penetrations location.

.5 Tested System or Engineered Judgment Number.

.6 Type of assembly penetrated.

.7 A detailed description of the size and type of penetrating item.

.8 Size of opening.

.9 Number of sides of assemblies addressed.

.10 Hourly rating to be achieved.

.11 Installers name.

.7 Copies of these documents are to be provided to the General Contractor at the completion of the project and included in the current O&M Manuals.

3.6 CLEANING

.1 Progress Cleaning:

.1 Leave work area clean at end of each day.

.2 Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

.2 Final Cleaning:

.1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers in accordance with Section 01 74 00 - Cleaning.

.2 Remove temporary dams after initial set of firestopping and smoke seal materials.

3.7 PROTECTION

.1 Protect installed products and accessories from damage during construction.

.2 Repair damage to adjacent materials caused by fire stopping installation.

3.8 SCHEDULE

.1 Firestop and smoke seal at:

.1 Penetrations through fire-resistance rated concrete and gypsum board partitions and walls.

.2 Penetrations through fire-resistance rated floors and ceilings.

.3 Around mechanical and electrical assemblies penetrating fire assemblies.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 01 45 00 - Quality Control.

.3 Section 01 61 00 - Common Product Requirements.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CGSB 19-GP-5M-1984, Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).

.2 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.

.3 CGSB 19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).

.4 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.

.2 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.

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

.1 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's instructions, printed product literature and data sheets for joint sealants and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Manufacturer's product to describe:

.1 Caulking compound.

.2 Primers.

.3 Sealing compound, each type, including compatibility when different

sealants are in contact with each other.

.3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 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 with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

1.5 SITE CONDITIONS

.1 Ambient Conditions:

.1 Proceed with installation of joint sealants only when:

.1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer or are above 4.4 degrees C.

.2 Joint substrates are dry.

.3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.2 Joint-Width Conditions:

.1 Proceed with installation of joint sealants only where 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 interfering with adhesion are removed from joint substrates.

1.6 ENVIRONMENTAL REQUIREMENTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Health Canada.

.2 Ventilate area of work as directed by Departmental Representative by use of approved portable supply and exhaust fans.

Part 2 Product

2.1 SEALANT MATERIALS

.1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.2 When low toxicity caulks are not possible, confine usage to areas which off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.

.3 Where sealants are qualified with primers use only these primers.

.4 Sealants and caulking compounds must:

.1 meet or exceed all applicable governmental and industrial safety and performance standards; and

.2 be manufactured and transported in such a manner that all steps of the process, including the disposal of waste products arising therefrom, will meet the requirements of all applicable governmental acts, by laws and regulations including, for facilities located in Canada, the fisheries Act and the Canadian Environmental Protection Act (CEPA).

.5 Sealant and caulking compounds must not be formulated or manufactured with: aromatic solvents, fibrous talc or asbestos, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium, barium or their compounds, except barium sulfate.

.6 Sealant: not containing a total of volatile organic compounds in excess of 5% by weight, asbestos-free sealant, compatible with systems materials and as recommended by system manufacturer. Use least toxic sealants, adhesives, sealers, and finishes necessary to comply with requirements of this section.

.7 Sealant and caulking compounds must be accompanied by detailed instructions for proper application so as to minimize health concerns and maximize performance, and information describing proper disposal methods.

.8 In the selection of the products and materials of this section preference will be given to those with the following characteristics: Water based, water soluble, water clean-up, non-flammable, Biodegradable, low Volatile Organic Compound (VOC) content, manufactured without compounds which contribute to ozone depletion in the upper atmosphere, manufactured without compounds which contribute to smog in the lower atmosphere, does not contain methylene chloride, does not contain chlorinated hydrocarbons.

.9 The manufacturing process must adhere to Lifecycle Assessment Standards as per ISO 14040/14041 LCA Standards (to be published by 1998), CSA Z760-94 LCA Standards.

2.2 SEALANT MATERIAL DESIGNATIONS

.1 Sealants acceptable for use on this project must be listed on CGSB Qualified Products List issued by CGSB Qualification Board for Joint Sealants. Where sealants are qualified with primers use only these primers.

.1 Sealant Type 1: silicone base, one part moisture curing sealant to CAN 2-19.13-M82. colour to be selected: to be used with joint back-up bond breaker and primer. Acceptable product Dow Corning 790.

.2 Sealant Type 2: silicone base, one component, to CAN 2-19.18-M82 solvent curing, white paintable. Acceptable product Dow Corning 8644 paintable sealant.

.3 Sealant Type 3: silicone base, one part mildew and fungus resistant, to CAN/CGSB-19.22-M89. Acceptable product Dow Corning 786 mildew resistant sealant.

.4 Sealant Type 4: Silicone base, one component to CAN/CGSB-19.22-M89 acoustic sealant and bedding compound. Acceptable product Tremco acoustic sealant.

.5 Sealant Type 5: Urethanes two part, self-levelling: to CAN/CGSB-19.24, Type 1, Class B, colour to match surface, from manufacturer's standard range.

.6 Colours to be selected from the standard manufacturer's range.

.2 Preformed compressible and non-compressible back-up materials:

.1 Polyethylene, urethane, neoprene or vinyl foam:

.1 Extruded closed cell foam backer rod.

.2 Size: oversize 30 to 50 %.

.2 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/m³ density, or neoprene foam backer, size as recommended by manufacturer.

.3 Bond breaker tape:

.1 Polyethylene bond breaker tape which will not bond to sealant.

2.3 SEALANT SELECTION

.1 Perimeters of exterior openings where frames meet exterior facade of building , exterior joints between dissimilar materials: sealant type: 1.

.2 Seal interior perimeters of exterior openings as detailed on drawings: sealant type: 2.

.3 Interior control and expansion joints in floor surfaces: sealant type: 5.

.4 Perimeters of interior frames, as detailed and itemized: sealant type: 2.

.5 Exposed interior control joints in drywall: sealant type: 2.

2.4 JOINT CLEANER

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

.2 Primer: in accordance with sealant manufacturer's written recommendations.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for joint sealants installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate 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 PROTECTION

.1 Protect installed Work of other trades from staining or contamination.

3.3 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.

3.4 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.

3.5 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.

3.6 MIXING

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

3.7 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.

3.8 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 -

Cleaning. .1 Leave Work area clean at end of each day.

.2 Clean adjacent surfaces immediately.

.3 Remove excess and droppings, using recommended cleaners as work progresses.

.4 Remove masking tape after initial set of sealant.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.9 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by joint sealants installation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 01 35 29.06 - Health and Safety Requirements

.3 Section 01 77 00 - Closeout Procedures

.4 Section 07 21 13 - Board Insulation

.5 Section 07 26 00 - Vapour Retarders

.6 Section 07 46 13 - Preformed Metal Siding

.7 Section 07 46 26 - Hardboard Siding

.8 Section 07 62 00 - Sheet Metal Flashing and Trim

.9 Section 07 92 10 - Joint Sealants

.10 Section 08 71 10 - Door Hardware

.11 Section 09 91 13 - Exterior Painting

.12 Section 09 91 23 - Interior Painting

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A653/A653M-06a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 Canadian Standards Association (CSA International)

.1 CSA-G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W59-03, Welded Steel Construction (Metal Arc Welding).

.3 Canadian Steel Door Manufacturers' Association (CSDMA)

.1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frames, 2000.

.2 CSDMA, Selection and Usage Guide for Commercial Steel Doors, 1990.

.4 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S701-01, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.2 CAN/ULC-S702-97, Standard for Thermal Insulation, Mineral Fibre, for Buildings.

1.3 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -45 degrees C to 35 degrees C.

.2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Provide product data: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Provide shop drawings: in accordance with Section 01 33 00 - Submittal Procedures.

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Territory of Yukon, Canada.

.2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, louvred, arrangement of hardware and finishes.

.3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings reinforcing finishes.

.4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

.5 Submit test and engineering data, and installation instructions.

.3 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.

1.5 DELIVERY, STORAGE AND HANDLING

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

Part 2 Product

2.1 MATERIALS

.1 Hot dipped galvanized steel sheet: to ASTM A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.

.2 Composites: balance of core materials used in conjunction with lead: in accordance with manufacturers' proprietary design.

2.2 DOOR CORE MATERIALS

.1 Honeycomb construction:

.1 Structural small cell, 20.0 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m³ minimum sanded to required thickness.

.2 Stiffened: face sheets laminated, honeycomb core.

.3 Temperature rise rated (TRR): core composition to limit temperature rise on unexposed side of door to 250 degrees C at 30 minutes. Core to be tested as part of a complete door assembly, in accordance with CAN4-S104, NFPA 252, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

.4 Exterior Doors: Bonded core: urethane or isocyanurate board insulation to CGSB 51-GP-21M, bonded to door skins, with no metal to metal contact except at edges.

.1 Polyurethane: to CAN/ULC-S704-2001 rigid, modified poly/isocyanurate, closed cell board. Density 32 kg/m³.

2.3 ADHESIVES

.1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.

.2 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.

.3 Lock-seam doors: fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.

2.4 PRIMER

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

2.5 PAINT

.1 Field paint steel doors and frames in accordance with Sections 09 91 13 and 09 91 23. Protect weatherstrips from paint. Provide final finish free of scratches or other blemishes.

2.6 ACCESSORIES

.1 Door silencers: single stud rubber/neoprene type.

.2 Exterior caps: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

.3 Door bottom seal: Refer to Section 08 71 10 - Door Hardware.

.4 Metallic paste filler: to manufacturer's standard.

.5 Sealant: Refer to Section 07 92 00 - Joint Sealants.

.6 Sprayfoam insulation: Canister type sprayfoam. Acceptable product: Frothpak foam FPR by Dow Chemical.

2.7 FRAMES FABRICATION GENERAL

.1 Fabricate frames in accordance with CSDMA specifications.

.2 Fabricate frames to profiles and maximum face sizes as indicated.

.3 Exterior frames: 1.2 mm welded type construction.

.4 Interior frames: 1.2 mm welded type construction.

.5 Blank, reinforce, drill and tap frames for mortised, templated hardware, using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.

.6 Protect mortised cutouts with steel guard boxes.

.7 Prepare frame for door silencers, 3 for single door, 2 at head for double door.

.8 Manufacturer's nameplates on frames and screens are not permitted.

.9 Conceal fastenings except where exposed fastenings are indicated.

.10 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

.11 Insulate exterior frame components with polyurethane insulation.

2.8 FRAME ANCHORAGE

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.

.4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

2.9 FRAMES: WELDED TYPE

.1 Welding in accordance with CSA W59.

.2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.

.3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.

.4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.

.5 Securely attach floor anchors to inside of each jamb profile.

.6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

.7 Securely attach lead to inside of frame profile from return to jamb soffit (inclusive) on door side of frame only.

2.10 DOOR FABRICATION GENERAL

.1 Doors: swing type, flush, with provision for louvre openings as indicated.

.2 Exterior doors: honeycomb construction. Interior doors: honeycomb construction.

.3 Fabricate doors with longitudinal edges locked seam. Seams: visible.

.4 Doors: manufacturers' proprietary construction, tested and/or engineered as part of a fully operable assembly, including door, frame, gasketing and hardware in accordance with ASTM .

.5 Blank, reinforce, drill doors and tap for mortised, templated hardware .

.6 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.

.7 Reinforce doors where required, for surface mounted hardware. Provide flush PVC top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.

.8 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.9 Manufacturer's nameplates on doors are not permitted.

2.11 DOORS: HONEYCOMB CORE CONSTRUCTION

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

.2 Form face sheets for interior doors from 1.6 mm sheet steel with core laminated under pressure to face sheets.

2.12 THERMALLY BROKEN DOORS AND FRAMES

.1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.

.2 Thermal break: rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.

.3 Fabricate thermally broken frames separating exterior parts form interior parts with

continuous interlocking thermal break.

.4 Apply spray-foam insulation.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION GENERAL

.1 Install doors and frames to CSDMA Installation Guide.

3.3 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Caulk perimeter of frames between frame and adjacent material.

.6 Maintain continuity of vapour retarder.

3.4 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.

.2 Provide even margins between doors and jambs and doors and finished floor and thresholds .

.3 Adjust operable parts for correct function.

3.5 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 01 35 29.06 - Health and Safety Requirements

.3 Section 01 77 00 - Closeout Procedures

.4 Section 07 21 13 - Board Insulation

.5 Section 07 21 16 - Blanket Insulation

.6 Section 07 26 00 - Vapour Retarders

.7 Section 07 46 13 - Preformed Metal Siding

.8 Section 07 92 10 - Joint Sealants

.9 Section 08 71 10 - Door Hardware

1.2 REFERENCES

.1 Aluminum Association (AA)

.1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes.

.2 ASTM International

.1 ASTM A1008/A1008M-10, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

.2 ASTM D523-08, Standard Test Method for Specular Gloss.

.3 ASTM D822-01(2006), Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

.3 Environmental Choice Program (ECP)

.1 CCD-016-97(R2005), Thermal Insulation.

.2 CCD-047-98(R2005), Architectural Surface Coatings.

.4 Green Seal Environmental Standards (GS)

.1 GS-11-2008, 2nd Edition, Paints and Coatings.

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 doors, hardware, and accessories and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate sizes, service rating, types, materials, operating mechanisms, glazing locations and details, hardware and accessories, required clearances and electrical connections.

.2 Include elevations, sections and details of door, track, hardware and operating components, dimensions, gauges, finishes and relationship of door, track hardware and operating components to agjacent construction.

.4 Verification samples: for each finish product specified, two sample, minimum size 150 mm square representing actual product, colour and pattern.

.5 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.6 Manufacturers Reports:

.1 Manufacturer's Field Reports: submit manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in Part 3 - FIELD QUALITY CONTROL.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for sectional metal doors for incorporation into manual.

1.5 QUALITY ASSURANCE

.1 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.2 Installer qualifications: authorized representative of the manufacturer with minimum five years documented experience.

.3 Products requiring electrical connection: Listed and classified by the Underwriters Laboratories, Inc./ULC/CSA acceptable to authority having jurisdiction as suitable for purposed specified.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory

packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry, warm, venitlated weathertight location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect sectional metal doors, hardware and accessories from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Product

2.1 DOORS

.1 Sectional Insulated Steel Door;

.1 Door Assembly: metal/foam/metal sandwich panel construction. Doors comply with ANSI/DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors.

.2 Size: See Drawings. Door is to be 25 mm higher than the finished door opening and extend 25 mm beyond jamb on either side of finished door opening width.

.3 Section Joints: 6.3 mm ship-lap.

.4 Section Thickness: 44.5 mm (1 3/4") .

.5 R-Value: R16.4.

.6 Exterior Surface: Multi-Rib pattern with a non-repeating random surface texture.

.7 Exterior Steel: Pre-painted 0.41 mm, hot-dipped galvanized.

.8 Interior Surface: Rib pattern with a non-repeating random surface texture.

.9 Interior Steel: Pre-painted 0.41 mm, hot-dipped galvanized.

.10 End Stiles: End caps - 16 GA (1.6 mm) hot-dipped galvanized steel.

.11 Standard Springs: 10,000 cycles.

.12 Full Vision Sections: Type FV full vision aluminum glazing section;

.1 Colour: To match door panel colour.

.2 Glazing: 12.7 mm (1/2") tempered glass.

.13 Colour: Silver/Silver

.14 Wind Load Design: ANSI/DASMA 102 Standards to meet applicable codes.

.15 Hardware: Zinc-coated steel hinges and fixtures. Ball bearing rollers with hardened steel races.

.16 Lock: Interior mounted slide lock on handchain operated doors only.

.17 Seals:

.1 Standard continuous, replaceable dual seals between sections.

.2 Standard bottom seal: on handchain operated doors only.

.3 Top seal: 101.6mm (4") PVC/vinyl.

.4 Jamb seal: Dual fin vinyl/aluminum.

.18 Track: provide track as recommended by manufacturer to suit loading required and clearances available.

.19 Operation:

.1 Manual: Handchains at doors D107.4 and D106.2.

.2 Electric: EHJ Jackshaft at doors D109.2 and D108.2.

.20 Acceptable Product: Thermatite Series, T175-MR by Richards-Wilcox Canada.

2.2 HARDWARE

.1 Hardware: include all required hardware and zinc-plated fasteners;

.1 Hinges: Linear style 11 GA (3 mm) zinc coated steel.

.2 Track: Hi- lift hardware with 75 mm (3") high size minimum, roll-formed from 2.0 mm (14 GA) galvanized steel.

.3 Continuous Angle Mount: adjustable to ensure weather tight seal and serviceability, 2.4 mm core thickness continuous galvanized steel angle.

.4 Horizontal Track Curve:

.5 Rollers: full floating, 75 mm (3") steel, with 10 ball bearings and zinc plated stem.

.6 Roller brackets: Fabricated from 14 GA (2.0mm) thick commercially glavanized steel. Graduated type design to suit the slope in the vertical track to ensure weather tight seal.

.2 Counter-balance System:

.1 Spring assembly: oil tempered torsion spring with manufacturers standard brackets.

.1 Minimum 10,000 cycles

.2 Shaft: 25 mm diameter solid galvanized keyed steel.

.3 Spring: Sized to suit cycles.

.4 Wire Rope: Aircraft type 7x9 construction with safety factor of 5:1 minimum.

2.3 ACCESSORIES

.1 Overhead horizontal track and operator supports: galvanized steel, type and size to suit installation.

.2 Track guards: 5 mm thick formed sheet 1500 mm high track and fender guards.

.3 Pusher springs.

.4 One horizontal sliding lock bolts on interior (for handchain doors only).

.5 Weatherstripping:

.1 Sills: bulb type full width extruded neoprene weatherstrip.

.2 Jambs and head: extruded aluminum and arctic grade vinyl weatherstrip to manufacturer's standard.

.6 Finish ferrous hardware items with minimum zinc coating of 300 g/m² to CAN/CSA-G164.

2.4 MANUAL OPERATORS

.1 Equip doors D107.4 and D 106.2 for operation by:

.1 Hand, two handles on inside face of door.

.2 Chain hoist with galvanized steel chain.

.2 Cable fail safe device (safety brackets).

.1 Able to stop door immediately if cable breaks on door free fall. Braking capacity 500 kg.

2.5 ELECTRICAL OPERATOR

.1 For doors D108.2 and D109.2;

.2 Electrical jack shaft side mounted type operator.

.1 Acceptable Product: Doorlec EHJ

.3 Electrical motors, controller units, remote pushbutton stations, relays and other electrical components: to CSA approval with CSA enclosure type .

.4 Power supply: 3 phase, 60 Hz.

.1 Motor: 2 horse power.

.5 Controller units with integral motor reversing starter, 3 heater elements for overload protection, including and control relays as applicable.

.6 Operation:

.1 Remote pushbutton stations: flush mounted, in locations, with "OPEN-STOP-CLOSE" "SECURITY LOCKOUT" designations on keyed station pushbuttons in English and French, key operated.

.7 Safety switch: combination roll rubber with limit switches for full length of bottom rail of bottom section of door, to reverse door to open position when coming in contact with object on closing cycle.

.8 For jack shaft operators:

.1 Provide floor level disconnect device to allow for manual operation in event of power failure.

.2 Equip Operator with:

.1 Electrical interlock switch to disconnect power to operator when in manual operation.

.2 Built-in chain hoist for manual operation in event of power failure.

.9 Door speed: 150 mm per second.

.10 Control transformer: for 24 VAC control voltage.

.11 Mounting brackets: galvanized steel, size and gauge to suit conditions.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for sectional metal doors 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 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Install doors and hardware in accordance with manufacturer's instructions.

.3 Rigidly support rail and operator and secure to supporting structure.

.4 Touch-up steel doors with primer where galvanized finish damaged during fabrication.

.5 Install operator including electrical motors, controller units, pushbutton stations, relays and other electrical equipment required for door operation.

.6 Lubricate and adjust door operating components to ensure smooth opening and closing of doors.

.7 Adjust weatherstripping to form a weather tight seal.

.8 Adjust doors for smooth operation.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Obtain written reports from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product within 3 days of review.

.2 Submit 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 Ensure manufacturer's representative is present before and during critical periods of installation.

.4 Schedule site visits to review Work at stages listed:

.1 After delivery and storage of products, and when preparatory Work on which Work of this Section depends is complete, but before installation begins.

.2 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of Work, after cleaning is carried out.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning. .1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.1 Remove traces of primer; clean doors and frames.

.2 Clean glass and glazing materials with approved non-abrasive cleaner.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by sectional metal door installation.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 01 77 00 - Closeout Procedures

.3 Section 07 26 00 - Vapour Retarders

.4 Section 07 46 13 - Preformed Metal Siding

.5 Section 07 62 00 - Sheet Metal Flshing and Trim

.6 Section 07 92 10 - Joint Sealants

1.2 REFERENCES

.1 CSA Group

.1 AAMA/WDMA/CSA 101/I.S.2/A440-11, NAFS - North American Fenestration Standard for Windows, Doors, and Skylights.

.2 CSA A440S1-09, Canadian Supplement to AAMA/WDMA/CSA 101/1.S.2/A440, NAFS - North American Fenestration Standard for Windows, Doors, and Skylights.

.3 CAN/CSA-A440.4-07(R2012), Window, Door, and Skylight Installation

.4 CAN/CSA-A440.2/A440.3-09, Fenestration energy performance/User guide to CSA A440.2, Fenestration energy performance.

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 windows 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 Territory of Yukon, Canada.

.2 Indicate materials and details in full size scale for head, jamb and sill, profiles of components, interior and exterior trim elevations of unit, anchorage details, description of related components and exposed finishes fasteners, and caulking. Indicate location of manufacturer's nameplates.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 77 00 - Closeout Procedures.

.2 Operation and Maintenance Data: submit operation and maintenance data for windows for incorporation into manual.

1.5 QUALITY ASSURANCE

.1 Certifications: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Handle work in this section in accordance with AAMA CW-10.

.3 Protect prefinished surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

Part 2 Product

2.1 MATERIALS

.1 Materials: to CAN/CSA-A440-08 supplemented as follows:

.2 All exterior windows : PVC windows by same manufacturer.

.3 Acceptable Product: Northerm PVC Windows, 3500 Series, Commercial Frame.

.4 Main frame: vinyl.

.5 Glass: Triple glazed, 2 coats low-E, 2 argon-filled cavities. Exterior pane to be laminated glass for added security.

.6 Fixed U-factor: 0.13 (0.73)

.7 Fixed SHGC: 0.24

.8 Fixed VT: 0.42

.9 Spray foam insulation: expanding closed-cell to fill gaps and maintain continuity of air/vapour barrier.

.10 Sealants:

.1 VOC limit 250 g/L maximum to SCAQMD Rule 1168.

2.2 WINDOW TYPE AND CLASSIFICATION

.1 Type:

.1 Fixed: with interior removable triple glazing insulated units.

.2 Classification rating: to CAN/CSA-A440-08:

.1 Air tightness: A3

.2 Water tightness: B7

.3 Wind load resistance: C5

.4 Forced Entry: F2.

.5 Glazing: G2

.6 Design pressure: DP100-fixed.

2.3 FABRICATION

.1 Fabricate in accordance with CAN/CSA-A440-08 supplemented as follows:

.2 Fabricate units square and true with maximum tolerance of plus or minus 1.5 mm for units with a diagonal measurement of 1800 mm or less and plus or minus 3 mm for units with a diagonal measurement over 1800 mm.

.3 Face dimensions detailed are to suit maximum rough opening sizes indicated. Coordinate with site dimensions.

.4 Brace frames to maintain squareness and rigidity during shipment and installation.

2.4 VINYL FINISHES

.1 Vinyl finishes: in accordance with CAN/CSA-A440-08, including appendices, supplemented as follows:

.1 Colour to be grey on the exterior and white on the interior. Manufacturer's standard colours.

2.5 GLAZING

.1 Sealed insulated glass units: to CAN/CGSB-12.8-97, triple glazed ;

.1 Glass: to CAN/CGSB-12.3

.2 Glass thickness: 5 mm each light

.3 Inter-cavity space thickness: 12 mm.

.4 Glass coating: Low-E, two coats.

.5 Inert gas fill: argon, both cavities.

.6 Security: outer glazing layer to be Laminated Glazing, c/w Armour coating by Northerm.

2.6 AIR BARRIER AND VAPOUR RETARDER

.1 Equip window frames with site installed air barrier and vapour retarder material for sealing to building air barrier and vapour retarder as follows:

.1 Material: identical to, or compatible with, building air barrier and vapour retarder materials to provide required air tightness and vapour diffusion control throughout exterior envelope assembly.

.2 Material width: adequate to provide required air tightness and vapour diffusion control to building from interior.

.3 Provide sprayfoam insulation to fill in gaps between window frame and wall framing.

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.

.2 Verify verify dimensions, tolerances and method of attachement with other work. Verify wall openings are ready to receive work of this section.

3.2 INSTALLATION

.1 Window installation:

.1 Install in accordance with CSA-A440/A440.1.

.2 Arrange components to prevent abrupt variation in colour.

.3 Installation to be performed by experienced installers in accordance with manufacturer's instructions and CSA-A44.1.

.4 Window shall be plumb and square after installation is complete and sealed to both interior and exterior walls with high-quality sealant around the perimeter of the frame.

.5 If perimeter cavity is to be foamed, provide additional anchorage to prevent bowing.

.6 Installers to make all necessary final adjustments to ensure normal and smooth operation of window.

.7 Provide alignment attachments and shims to permanently fasten system to building structure.

.8 Align assembly plumb and level, free of warp or twist. Maintain assembly

dimensional tolerances and align with adjacent work.

.9 Install sill flashings.

.10 Coordinate attachment and seal of perimeter air barrier and vapour retarder materials.

.11 Pack sprayfoam insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

.12 Install perimeter sealant to method required to acheive performance criteria.

.2 Sill installation:

.1 Install metal sills with uniform wash to exterior, level in length, straight in alignment with plumb upstands and faces. Use one piece mm lengths at each location.

.2 Cut sills to fit window opening.

.3 Secure sills in place with anchoring devices located at ends joints of continuous sills and evenly spaced 600 mm on centre in between.

.4 Maintain 6 to 9 mm space between butt ends of continuous sills. For sills over 1200 mm in length, maintain 3 to 6 mm space at each end.

.3 Caulking:

.1 Seal joints between windows and window sills with sealant. Bed sill expansion joint cover plates and drip deflectors in bedding compound. Caulk between sill upstand and window-frame. Caulk butt joints in continuous sills.

.2 Apply sealant in accordance with Section 07 92 00 - Joint Sealants. Conceal sealant within window units except where exposed use is permitted by Departmental Representative.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.2 Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

.3 Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.

.4 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 08 11 00 - Metal Doors and Frames.

1.2 REFERENCES

.1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)

.1 ANSI/BHMA A156.1-2000, American National Standard for Butts and Hinges.

.2 ANSI/BHMA A156.4-2000, Door Controls - Closers.

.3 ANSI/BHMA A156.5-2001, Auxiliary Locks and Associated Products.

.4 ANSI/BHMA A156.6-2005, Architectural Door Trim.

.5 ANSI/BHMA A156.8-2005, Door Controls - Overhead Stops and Holders.

.6 ANSI/BHMA A156.13-2002, Mortise Locks and Latches Series 1000.

.7 ANSI/BHMA A156.18-2006, Materials and Finishes.

.2 Canadian Steel Door and Frame Manufacturers' Association (CSDMA)

.1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for door hardware and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Hardware List:

.1 Submit contract hardware list in accordance to Section 01 33 00 - Submittal Procedures.

.2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.

.4 Manufacturer's Instructions: submit manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for door hardware for incorporation into manual.

1.5 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.3 Pre-installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

.4 Storage and Handling Requirements:

.1 Store materials in a locked, clean and dry location and in accordance with manufacturer's recommendations .

.2 Store and protect door hardware from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Product

2.1 HARDWARE ITEMS

.1 Use one manufacturer's products only for similar items.

2.2 DOOR HARDWARE

.1 All hardware listed is Schlage, "A" Series. Contractor to submit product information for approval if alternate is desired.

.2 Hinges: type, number and sizes to suit door application. Use non-removable pins for out swinging exterior doors.

.3 Lock and Latch sets: Schlage 'A' series with Levon Lever set. 626 Satin chromium plated finish.

.1 Locksets: A70PD - Outer lever locked or unlocked by key from outside, inner lever always free.

.4 Strikes: box type, normal projection.

.5 Door bottom seal: adjustable sweep and 4- seal door seal of arctic grade vinyl, surface mounted with drip cap and closed ends.

.6 Threshold/sill: full width of door opening, low profile, aluminum extruded finish, serrated surface, with interlocking lip and related door cap.

.1 Maximum vertical height of 1/2" on entry doors.

.7 Door Closer: LCN surface mounted "Smoothee", series 4110 cush-n-stop, equipped with hold open arm adjustable from 85 to 100 degrees, equipped with fusible link (where noted), finished in silver bronze lacquer and equipped with all arms and brackets for mounting in over door application. All closers on exterior doors to be climate control type.

.8 Weatherstripping: Arctic grade neoprene for all exterior doors.

.9 Fasteners: as required to complete hardware installation, and to match finish of hardware.

.10 Keying: To requirements of Owner. Co- ordinate with Division 16 for security system provisions

.11 Door Cap: manufactures end seal for all hollow steel doors.

2.3 FASTENINGS

.1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.

.2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.3 Exposed fastening devices to match finish of hardware.

.4 Use fasteners compatible with material through which they pass.

2.4 KEYING

.1 Doors, padlocks and cabinet locks to be keyed alike in groups. Prepare detailed keying schedule in conjunction with Departmental Representative.

.2 Supply keys in duplicate for every lock in this Contract.

.3 Supply 2 master keys for each master key or grand master key group.

.4 Stamp keying code numbers on keys and cylinders.

.5 Supply construction cores.

.6 Hand over permanent cores and keys to Departmental Representative.

Part 3 Execution

3.1 INSTALLATION

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

.2 Supply metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.

.3 Supply manufacturers' instructions for proper installation of each hardware component.

.4 Install hardware to standard hardware location dimensions in accordance with CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction).

.5 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.6 Install key control cabinet.

.7 Use only manufacturer's supplied fasteners.

.1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

.8 Remove construction cores when directed by Departmental Representative.

.1 Install permanent cores and ensure locks operate correctly.

3.2 ADJUSTING

.1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.

.2 Lubricate hardware, operating equipment and other moving parts.

.3 Adjust door hardware to ensure tight fit at contact points with frames.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacturer's instructions.

.2 Remove protective material from hardware items where present.

.3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by door hardware installation.

3.5 SCHEDULE

.1 Hardware Group #1: Double Doors 100:

.1 2 ea - Continuous Hinge - GSH-CH951xD.H.- 32D

.2 1 ea - Lockset - LH8707xL811- 32D .

.3 1 set - Auto Bolts - LH610M - 26D

.4 2 ea - Door Closer - LH8016-CSA40 - 26D.

.5 1 ea - Coordinator - LHSMC-52 w/20" Filler 2/MB2 - CP.

.6 2 ea - Kickplate - GSH80A-254xD.W. - 32D.

.7 1 ea - Thresholds - DS5000xD.W. - AL.

.8 1 set - Gasketing - DS130 1/D.W. 2/D.H. - AL.

.9 2 ea - Door Sweep - DS138xD.W. - AL

.2 Hardware Group #2: Door 101:

.1 3 ea - Hinges - CB1391 114x101mm - 32D.

.2 1 ea - Latchset - LH8701 x L811 - 625.

.3 1 ea - Door Closer - LH8016 - 26D.

.4 1 ea - Kickplate - GSH80A-10 x D.W. - 32D

.5 1 ea - Floor Stop - GSH209B - 26D.

.6 1 set - Gasketing - DS130 1/D.W. 2/D.H. - AL.

.7 2 ea - Door Sweep - DS138xD.W. - AL

.3 Hardware Group #3: Doors 102, 103, 104:

.1 1 ea - Continuous Hinge - GSH-CH951xD.H. - 32D.

.2 1 ea - Lockset - LH8707xL811 - 32D.

.3 1 ea - Door Closer - LH8016-CSA40 - 26D.

.4 1 ea - Kickplate - GSH80A-254xD.W. - 32D.

.5 1 ea - Threshold - DS5000xD.W. - AL.

.6 1 set - Weatherstrip - DS130 1D/W 2D/H - AL

.7 1 ea - Door Sweep - DS138 x D.W. - AL

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 06 10 00 - Rough Carpentry

.3 Section 07 21 16 - Blanket Insulation

.4 Section 07 84 00 - Fire Stopping

.5 Section 07 92 00 - Joint Sealants

.6 Section 08 11 00 - Metal Doors and Frames

.7 Section 09 91 23 - Interior Painting

1.2 REFERENCES

.1 Aluminum Association (AA)

.1 AA DAF 45-03(R2009), Designation System for Aluminum Finishes.

.2 ASTM International

.1 ASTM C475-02(2007), Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.2 ASTM C840-08, Standard Specification for Application and Finishing of Gypsum Board.

.3 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.

.4 ASTM C1047-09, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.5 ASTM C1396/C1396M-09a, Standard Specification for Gypsum Wallboard.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.2 CAN/CGSB-71.25-M88, Adhesive, for Bonding Drywall to Wood Framing and Metal Studs.

.4 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC-S102-07, Standard Method of Test of Surface Burning Characteristics of Building Materials and Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 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 gypsum board assemblies materials level off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect gypsum board assemblies from nicks, scratches, and blemishes.

.3 Protect from weather, elements and damage from construction operations.

.4 Handle gypsum boards to prevent damage to edges, ends or surfaces.

.5 Replace defective or damaged materials with new.

1.5 AMBIENT CONDITIONS

.1 Maintain temperature 10 degrees C minimum, 21 degrees C maximum for 48 hours prior to and during application of gypsum boards and joint treatment, and for 48 hours minimum after completion of joint treatment.

.2 Apply board and joint treatment to dry, frost free surfaces.

.3 Ventilation: ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

Part 2 Product

2.1 MATERIALS

.1 Standard board: to ASTM C1396/C1396M Type X, 15.9 mm thick, 1200 mm wide x maximum practical length, ends square cut, edges squared.

.2 Metal furring runners, hangers, tie wires, inserts, anchors: to ASTM A653M, Z180 Zinc coating.

.3 Nails: to ASTM C514.

.4 Steel drill screws: to ASTM C1002.

.5 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, ABS, 0.5

mm base thickness, perforated flanges, one piece length per location.

.6 Sealants: in accordance with Section 07 92 00 - Joint Sealants.

.1 Acoustic sealant: in accordance with Section 07 92 00 - Joint Sealants.

.7 Polyethylene: to CAN/CGSB-51.34, Type 2.

.8 Insulating strip: rubberized, moisture resistant, 3 mm thick cork strip, 12 mm wide, with self sticking permanent adhesive on one face, lengths as required.

.9 Joint compound: to ASTM C475, asbestos-free.

.10 Corner guards: 16 GA stainless steel, type 304, flush, adhesive mounted.

.1 Leg length: 50.8mm x 50.8mm at top, tapering to 88.9mm x88.9mm at the bottom.

.2 Angle: 90 degree angle with 3mm corner radius.

.3 Finish: #4 satin.

.4 Length: 1070mm long.

.5 Locations: at all outside corners at interior.

2.2 FINISHES

.1 Texture finish: asbestos-free standard white texture coating and primer-sealer, recommended by gypsum board manufacturer.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for gypsum board assemblies 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 ERECTION

.1 Do application and finishing of gypsum board to ASTM C840 except where specified otherwise.

.2 Do application of gypsum sheathing to ASTM C1280.

.3 Install work level to tolerance of 1:1200.

.4 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles .

.5 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.

.6 Install wall furring for gypsum board wall finishes to ASTM C840, except where specified otherwise.

.7 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.8 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

3.3 APPLICATION

.1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical and mechanical work have been approved.

.2 Apply single layer gypsum board to metal furring or framing using screw fasteners, screw fasteners. Maximum spacing of screws 300 mm on centre.

.1 Single-Layer Application:

.1 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.

.2 Double-Layer Application:

.1 Install gypsum board for base layer and exposed gypsum board for face layer.

.2 Apply base layers at right angles to supports unless otherwise indicated.

.3 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.

.3 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, in partitions where perimeter sealed with acoustic sealant.

.4 Install gypsum board on walls vertically to avoid end-butt joints. At high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.

.5 Install gypsum board with face side out.

.6 Do not install damaged or damp boards.

.7 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.4 INSTALLATION

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm on centre.

.2 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.

.3 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.

.4 Splice corners and intersections together and secure to each member with 3 screws.

.5 Install access doors to electrical and mechanical fixtures specified in respective sections.

.1 Rigidly secure frames to furring or framing systems.

.6 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.

.7 Gypsum Board Finish: finish gypsum board walls to following levels in accordance with AWCI Levels of Gypsum Board Finish:

.1 Levels of finish:

.1 Level 3: embed tape for joints and interior angles in joint compound and apply two separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.

.2 Level 4: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.

.8 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.9 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.

.10 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.11 Completed installation to be smooth, level or plumb, free from waves and other

defects and ready for surface finish.

.12 Apply one coat of white primer sealer over surface to be textured. When dry apply textured finish in accordance with manufacturer's instructions.

.13 Mix joint compound slightly thinner than for joint taping.

.14 Apply thin coat to entire surface using trowel or drywall broad knife to fill surface texture differences, variations or tool marks.

.15 Allow skim coat to dry completely.

.16 Remove ridges by light sanding or wiping with damp cloth.

3.5 CLEANING

.1 Progress and Final Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

3.6 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by gypsum board assemblies installation.

3.7 SCHEDULES

.1 Construct fire rated assemblies to NBC assemblies criteria and where indicated on drawings.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 01 61 00 - Product Requirements

.3 Section 06 20 00 - Finish Carpentry

.4 Section 09 21 16 - Gypsum Board Assemblies

.5 Mechanilcal installations

.6 Electrical installations

1.2 REFERENCES

.1 ASTM International

.1 ASTM C635/C635M-07, Standard Specifications for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.

.2 ASTM C636/C636M-08, Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

.3 ASTM E1477-98a(2008), Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-92.1-M89, Sound Absorptive Prefabricated Acoustical Units.

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

.1 Material Safety Data Sheets (MSDS).

.4 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC-S102-2007, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

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 ceiling panels and ceiling suspension system and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Territory of Yukon, Canada.

.2 Submit reflected ceiling plans for special grid patterns as indicated.

.3 Indicate lay-out, and lateral bracing and accessories.

.4 Samples:

.1 Submit for review and acceptance of each unit.

.2 Submit duplicate full size samples of each type acoustical units.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store materials inside, level, under cover. Protect from weather, damage from construction operations and other causes, in accordance with manufacturer's printed instructions.

.3 Handle materials to prevent damage to edges or surfaces. Protect metal accessories and trim from being bent or damaged.

.4 Store and protect acoustic ceiling materials from nicks, scratches, and blemishes.

.5 Replace defective or damaged materials with new.

Part 2 Product

2.1 COMPONENTS

.1 Acoustic units for suspended ceiling system: to CAN/CGSB-92.1.

.1 Fire rating: , Class A .

.2 Flame spread rating of 25 or less in accordance with CAN/ULC-S102.

.3 Smoke developed 50 or less in accordance with CAN/ULC-S102.

.4 Edge type: square.

.5 Colour: white.

.6 Size 610mm x 1220mm x 19mm mm thick.

.7 Shape: flat.

.8 Texture: fine, non-directional.

.2 Acoustical Suspension:

.1 Intermediate duty system to ASTM C635.

.2 Basic materials for suspension system: commercial quality cold rolled steel, zinc coated.

.3 Suspension system: non fire rated, two directional exposed tee bar grid.

.4 Exposed tee bar grid components: shop painted satin sheen, white colour. Components die cut. Main tee with double web, rectangular bulb and 25 mm rolled cap on exposed face. Cross tee with rectangular bulb; web extended to form positive interlock with main tee webs; lower flange extended and offset to provide flush intersection.

.5 Hanger wire: galvanized soft annealed steel wire, 3.6 mm diameter for access tile ceilings.

.6 Hanger inserts: purpose made.

.7 Accessories: splices, clips, wire ties, retainers and wall moulding reveal, to complement suspension system components, as recommended by system manufacturer.

.3 Performance/Design Criteria:

.1 Maximum deflection: 1/360th of span to ASTM C635 deflection test.

2.2 ACCESSORIES

.1 Touch-up paint: in accordance with manufacturer's recommendations for surface conditions:

.1 Paint: VOC limit 250 g/L maximum to SCAQMD Rule 1113.

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 prior to acoustical ceiling installation.

.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 Installation: in accordance with ASTM C636 except where specified otherwise.

.2 Suspension System:

.1 Erect ceiling suspension system after work above ceiling has been inspected by Departmental Representative.

.2 Secure hangers to overhead structure using attachment methods as indicated.

.3 Install hangers spaced at maximum 1200 mm centres and within 150 mm from ends of main tees.

.4 Lay out system according to reflected ceiling plan.

.5 Install wall moulding to provide correct ceiling height.

.6 Completed suspension system to support super-imposed loads, such as lighting fixtures and diffusers.

.7 Support at light fixtures with additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.8 Interlock cross member to main runner to provide rigid assembly.

.9 Ensure finished ceiling system is square with adjoining walls and level within 1:1000.

.3 Acoustic Panels:

.1 Install acoustical panels and tiles in ceiling suspension system.

.2 Co-ordinate ceiling work with work of other sections such as interior lighting, fire protection communication, and intrusion and detection systems.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 -

Cleaning. .1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.4 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by acoustical ceiling installation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 01 78 00 - Closeout Submittals

.3 Section 09 21 16 - Gypsum Board Assemblies

1.2 REFERENCES

.1 ASTM International

.1 ASTM D 2240: Standard Test Method for Rubber Property-Durometer Hardness.

.2 ASTM D 5116: Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.

.3 ASTM G 21: Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

.2 National Fire Protection Association.

.1 NFPA 101: Code for Safety to Life from Fire in Buildings and Structures.

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 flooring, adhesive, primer, sealer, and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Samples:

.1 Submit for review and acceptance of each unit.

.2 Samples will be returned for inclusion into work.

.3 Submit duplicate 300 x 300 mm sample pieces of sheet material.

.4 Submit duplicate full size samples of each type of tile.

.5 Submit 300 mm long base and edge strips.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for resilient flooring for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect resilient flooring from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.6 SITE CONDITIONS

.1 Ensure high ventilation rate, with maximum outside air, during installation.

.1 Vent directly to outside.

.2 Do not let contaminated air recirculate through a district or whole building air distribution system.

.3 Maintain extra ventilation for 1 month minimum after building occupation.

Part 2 Product

2.1 MATERIALS

.1 Resilient base: continuous, top set, complete with premoulded end stops and external corners:

.1 Type: rubber, 3.0 mm thick.

.2 Style: cove.

.3 Height: 165 mm.

.4 Lengths: cut lengths minimum 2400 mm.

.5 Colour: #24 - 'Vapor Grey' CG, Traditional Wall Base by Johhnstone or match.

.6 Locations: In all rooms except for Vehicle Bays #108 and 109.

.2 Primers and adhesives: of types recommended by resilient flooring manufacturer for specific material on applicable substrate, above, on or below grade.

.1 Adhesives: VOC limit 150 g/L maximum to SCAQMD Rule 1168.

.2 Primer: in accordance with manufacturer's recommendations for surface conditions:

.1 VOC limit: 100 g/L maximum to SCAQMD Rule 1113

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 PREPARATION

.1 Prepare for installation in accordance with manufacturer's written recommendations.

3.3 APPLICATION: BASE

.1 Lay out base to keep number of joints at minimum.

.2 Clean substrate and prime with one coat of adhesive.

.3 Apply adhesive to back of base.

.4 Set base against wall and floor surfaces tightly by using 3 kg hand roller.

.5 Install straight and level to variation of 1:1000.

.6 Scribe and fit to door frames and other obstructions. Use premoulded end pieces at flush door frames.

.7 Cope internal corners using premoulded corner units for right angle external corners and formed straight base material for external corners of other angles.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning. .1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.1 Remove excess adhesive from floor, base and wall surfaces without damage.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Protect new floors in accordance with manufacturer's printed instructions.

.3 Repair damage to adjacent materials caused by resilient flooring installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Environmental Protection Agency (EPA)

.1 Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings).

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

.1 Material Safety Data Sheets (MSDS).

.3 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - February 2004.

.2 Standard GPS-1-05, MPI Green Performance Standard for Painting and Coatings.

.4 National Fire Code of Canada.

.5 Society for Protective Coatings (SSPC)

.1 Systems and Specifications, SSPC Painting Manual 2005.

1.2 QUALITY ASSURANCE

.1 Qualifications:

.1 Contractor: to have a minimum offive years proven satisfactory experience. When requested, provide list of last three comparable jobs including, job name and location, specifying authority, and project manager.

.2 Qualified journeypersons as defined by local jurisdiction to be engaged in painting work

.3 Apprentices: may be employed provided they work under direct supervision of qualified journeyperson in accordance with trade regulations.

.4 Conform to latest MPI requirements for exterior painting work including preparation and priming.

.5 Materials: in accordance with MPI Painting Specification Manual "Approved Product" listing and from a single manufacturer for each system used.

.6 paint materials such as linseed oil, shellac, and turpentine to be highest quality product of an approved manufacturer listed in MPI Painting Specification Manual and to be compatible with other coating materials as required.

.7 Retain purchase orders, invoices and documents to prove conformance with noted MPI requirements when requested by Departmental Representative .

.8 Standard of Acceptance:

.1 Walls: No defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Soffits: No defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Upon completion, submit records of products used. List products in relation to finish system and include the following:

.1 Product name, type and use.

.2 Manufacturer's product number.

.3 Colour numbers.

.4 MPI Environmentally Friendly classification system rating.

.5 Manufacturer's Material Safety Data Sheets (MSDS).

.4 Provide samples in accordance with Section 01 33 00 - Submittal Procedures.

.1 Submit duplicate mm sample panels of each paint with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards submitted on the following substrate materials:

.1 3 mm plate steel for finishes over metal surfaces.

.2 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.

.3 10 mm plywood for finishes over wood surfaces.

.2 When approved, samples shall become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.

.3 Submit full range of available colours where colour availability is restricted.

1.4 QUALITY CONTROL

.1 Provide mock-up in accordance with Section 01 45 00 - Quality Control.

.2 When requested by Departmental Representative or Paint Inspection Agency, prepare and paint designated surface, area, room or item to requirements specified herein, with specified paint or coating showing selected colours, number of coats, gloss/ sheen, textures and workmanship to MPI Painting Specification Manual standards for review and approval. When approved, surface, area, room and/or items shall become acceptable standard of finish quality and workmanship for similar on-site work.

1.5 MAINTENANCE

.1 Extra Materials:

.1 Submit maintenance materials in accordance with Section 01 77 00 - Closeout Procedures.

.2 Submit one, four litre can of each type and colour of finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

1.6 DELIVERY, STORAGE AND HANDLING

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

.1 Deliver and store materials in original containers, sealed, with labels intact.

.2 Labels: to indicate:

.1 Manufacturer's name and address.

.2 Type of paint or coating.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Provide and maintain dry, temperature controlled, secure storage.

.5 Observe manufacturer's recommendations for storage and handling.

.6 Store materials and supplies away from heat generating devices.

.7 Store materials and equipment in well ventilated area with temperature range 7 degrees C to 30 degrees C.

.8 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.9 Keep areas used for storage, cleaning and preparation, clean and orderly to

approval of Departmental Representative. After completion of operations, return areas to clean condition to approval of Departmental Representative.

.10 Remove paint materials from storage only in quantities required for same day use.

.11 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.12 Fire Safety Requirements:

.1 Provide one kg dry chemical fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

.2 Waste Management and Disposal:

.1 Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.

.2 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.3 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.4 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into the ground the following procedures shall be strictly adhered to:

.1 Retain cleaning water for water-based materials to allow sediments to be filtered out.

.2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.

.3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.

.4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.

.5 Empty paint cans are to be dry prior to disposal or recycling (where available).

.5 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

.6 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

1.7 AMBIENT CONDITIONS

.1 Heating, Ventilation and Lighting:

.1 Do not perform painting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10 degrees C for24 hours before, during and after paint application until paint has cured sufficiently.

.2 Where required, provide continuous ventilation for seven days after completion of application of paint.

.3 Co-ordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.

.4 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

.5 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities to be provided by General Contractor.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless specifically pre-approved by specifying body, Paint Inspection Agency and, applied product manufacturer, perform no painting work when:

.1 Ambient air and substrate temperatures are below 10 degrees C.

.2 Substrate temperature is over 32 degrees C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.

.4 Relative humidity is above 85 % or when dew point is less than 3 degrees C variance between air/surface temperature.

.5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.2 Perform no painting work when maximum moisture content of substrate exceeds:

.1 15% for wood.

.2 12% for plaster and gypsum board.

.3 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "cover patch test".

.4 Test concrete, masonry and plaster surfaces for alkalinity as required.

.3 Surface and Environmental Conditions:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits noted herein.

.3 Apply paint when previous coat of paint is dry or adequately cured.

.4 Apply paint finishes when conditions forecast for entire period of application fall within manufacturer's recommendations.

.5 Do not apply paint when:

.1 Temperature is expected to drop below 10 degrees C before paint has thoroughly cured.

.2 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's limits.

.3 Surface to be painted is wet, damp or frosted.

.6 Provide and maintain cover when paint must be applied in damp or cold weather. Heat substrates and surrounding air to comply with temperature and humidity conditions specified by manufacturer. Protect until paint is dry or until weather conditions are suitable.

.7 Schedule painting operations such that surfaces exposed to direct, intense sunlight are scheduled for completion during early morning.

.8 Remove paint from areas which have been exposed to freezing, excess humidity, rain, snow or condensation. Prepare surface again and repaint.

.9 Paint occupied facilities in accordance with approved schedule only. Schedule operations to approval of Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

Part 2 Product

2.1 MATERIALS

.1 Paint materials listed in latest edition of MPI Approved Products List (APL) are acceptable for use on this project.

.2 Paint materials for paint systems: to be products of single manufacturer.

.3 Only qualified products with E3 "Environmentally Friendly" ratings are acceptable for use on this project.

.4 Use only MPI listed L rated materials.

.5 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, to be as follows:

.1 Be water soluble .

.2 Be biodegradable .

.3 Be manufactured without compounds which contribute to ozone depletion in upper atmosphere.

.4 Be manufactured without compounds which contribute to smog in the lower atmosphere.

.5 Do not contain methylene chloride .

.6 Water-borne surface coatings must be manufactured and transported in a manner that steps of processes, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).

.7 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavelant chromium or their compounds.

.8 Water-borne surface coatings and recycled water-borne surface coatings must have flash point of 61.0 degrees C or greater.

.9 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:

.1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

.2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

.10 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes must meet a minimum "Environmentally Friendly" E2 rating.

.11 The following must be performed on each batch of consolidated post-consumer material before surface coating is reformulated and canned. These tests must be performed at a laboratory or facility which has been accredited by the Standards Council of Canada.

.1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.

.2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.

.3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.

2.2 COLOURS

.1 Colour Schedule:

.1 Metal Stair Railings and Structure: 'Bermuda Blue - #2061-30 by Benjamin Moore or to match.

.2 Metal Doors and Frames: 'Tricycle Red'-#2000-20 by Benjamin Moore or to match.

.3 Post and Beams at Entry: clear perservative stain.

.4 Posts, Beams and bottom chord of Trusses at Outside Storage: solid stain to match 'Gray Shower' - #2125-30 by Benjamin Moore.

.5 Cementitious Panels: refer to Section 07 44 56.

.6 All other miscellaneous exterior metal fabrications and flashings to be galvalume finish.

.7 Exterior Mechanical Grilles and Vents on walls: to match wall colour.

.2 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

.1 Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials is allowed only with Departmental Representative's written permission.

.2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.

.3 Add thinner to paint manufacturer's recommendations. Do not use kerosene or

organic solvents to thin water-based paints.

.4 Thin paint for spraying according in accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Departmental Representative.

.5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

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

Gloss Level Category/	Units @ 60 Degrees/	Units @ 85 Degrees/
G1 - matte finish	0 to 5	max. 10
G2 - velvet finish	0 to 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	85	

.2 Gloss level ratings of painted surfaces as specified .

2.5 EXTERIOR PAINTING SYSTEMS

.1 Metal Fabrications: bollards, etc.

.1 EXT 5.1B - Waterborne light industrial G8 coating (over inorganic zinc).

.2 Galvanized Metal: (not chromate passivated) For high contact / high traffic areas (doors, frames, railings, misc. steel, pipes, etc.). For low contact / low traffic areas (ducts, gutters, flashing, etc.)

.1 EXT 5.3A - Latex G5 finish.

.2 EXT 5.3B - Alkyd G5 finish.

.3 EXT 5.3C - Epoxy finish for use in high contact/high traffic areas.

.4 EXT 5.3H - Latex finish (over waterborne primer) for use in low contact/low traffic areas.

.3 Aluminum: sash, sills and frames, flashing, downpipes, etc.

.1 EXT 5.4C - Aluminum paint finish for exposed aluminum.

.2 EXT 5.4D - Bituminous finish for unexposed aluminum next to concrete, masonry, etc..

.3 EXT 5.4E - Epoxy finish.

.4 Dimension Lumber: columns, beams, trusses, etc. at outdoor storage.

.1 EXT 6.2B - Solid color, water based stain finish (over alkyd/oil primer).

.5 Dimensional Lumber: exposed posts and beams at entry.

.1 EXT 6.2G - Penetrating wood preservative, clear coating.

.6 Dressed Lumber: door and window frames, casings, battens, smooth facias, etc.

.1 EXT 6.3F - Varnish semi-gloss finish.

.7 Dressed Lumber: soffits

.1 EXT 6.3G - Clear (2 component) polyurethane finish.

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 EXAMINATION

.1 Exterior repainting work: inspected by MPI Accredited Paint Inspection Agency (inspector) acceptable to specifying authority and local Painting Contractor's Association. Painting contractor to notify Paint Inspection Agency minimum of one week prior to commencement of work and provide copy of project repainting specification and Finish Schedule.

.2 Exterior surfaces requiring repainting: inspected by both painting contractor and Paint Inspection Agency who will notify Departmental Representative in writing of defects or problems, prior to commencing repainting work, or after surface preparation if unseen substrate damage is discovered.

.3 Where assessed degree of surface degradation of DSD-1 to DSD-3 before preparation of surfaces for repainting is revealed to be DSD-4 after preparation, repair or replacement of such unforeseen defects discovered are to be corrected, as mutually agreed, before repainting is started.

.4 Where "special" repainting or recoating system applications (i.e. elastomeric coatings) or non-MPI listed products or systems are to be used, paint or coating manufacturer to provide as part of work, certification of surfaces and conditions for specific paint or coating system application as well as on site supervision, inspection and approval of their paint or coating system application as required at no additional cost to Departmental Representative.

3.3 PREPARATION

.1 Perform preparation and operations for exterior painting in accordance with MPI Maintenance Repainting Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

.3 Clean and prepare exterior surfaces to be painted in accordance with MPI Maintenance Repainting Manual requirements. Refer to the MPI Manual in regard to specific requirements and as follows:

.1 Remove dust, dirt, and surface debris by vacuuming,wiping with dry, clean cloths or compressed air.

.2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly. Allow sufficient drying time and test surfaces using electronic moisture meter before commencing work.

.5 Use water-based cleaners in place of organic solvents where surfaces will be repainted using water based paints.

.6 Many water-based paints cannot be removed with water once dried. Minimize use of kerosene or such organic solvents to clean up water-based paints.

.4 Clean metal surfaces to be painted by removing rust, dirt, oil, grease and foreign substances in accordance with MPI requirements. Remove such contaminates from surfaces, pockets and corners to be repainted by brushing with clean brushes, blowing with clean dry compressed air, or brushing/vacuum cleaning as required.

.5 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before priming and between applications of remaining coats. Touch-up, spot prime, and apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.6 Do not apply paint until prepared surfaces have been accepted by Departmental Representative.

.7 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

3.4 EXISTING CONDITIONS

.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.

.2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Departmental Representative. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

.3 Maximum moisture content as follows:

.1 Wood: 15%.

3.5 PROTECTION

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore such surfaces 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 Remove light fixtures, surface hardware on doors, and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations.Store items and re-install after painting is completed.

.5 Move and cover exterior furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.6 As painting operations progress, place "WET PAINT" signs in pedestrian and vehicle traffic areas to approval of Departmental Representative.

3.6 APPLICATION

.1 Method of application to be as approved by Departmental Representative. Apply paint by air sprayer. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:

.1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.

.2 Work paint into cracks, crevices and corners.

.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.

.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple unless approved by Departmental Representative.

.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray Application:

.1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.

.2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

.3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.

.4 Brush out immediately runs and sags.

.5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers when no other method is practical in places of difficult access and when specifically authorized by Departmental Representative.

.5 Apply coats of paint as continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.7 Sand and dust between coats to remove visible defects.

.8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as projecting ledges.

.9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.7 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Unless otherwise specified, paint exterior exposed conduits, piping, hangers, duct work and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.

.2 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.3 Do not paint over nameplates.

.4 Paint fire protection piping red.

.5 Paint steel electrical light standards. Do not paint outdoor transformers and substation equipment.

3.8 FIELD QUALITY CONTROL

.1 Inspection:

.1 Field inspection of exterior painting operations to be carried out be independent inspection firm as designated by Departmental Representative.

.2 Advise Departmental Representative when each surface and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

.3 Co-operate with inspection firm and provide access to areas of work.

.2 Manufacturer's Field Services:

.1 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.9 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

.1 Remove paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.

3.10 RESTORATION

.1 Clean and re-install hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust to approval of Departmental Representative . Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Departmental Representative.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Department of Justice Canada (Jus)

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33

.2 Environmental Protection Agency (EPA)

.1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 - 1995, (for Surface Coatings).

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

.1 Material Safety Data Sheets (MSDS).

.4 Master Painters Institute (MPI)

.1 MPI Architectural Painting Specifications Manual, 2004.

.5 National Fire Code of Canada - 1995

.6 Society for Protective Coatings (SSPC)

.1 SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual.

.7 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34 .

1.2 QUALITY ASSURANCE

.1 Qualifications:

.1 Contractor: minimum of five years proven satisfactory experience. Provide list of last three comparable jobs including, job name and location, specifying authority, and project manager.

.2 Journeymen: qualified journeymen who have "Tradesman Qualification Certificate of Proficiency" engaged in painting work.

.3 Apprentices: working under direct supervision of qualified trades person in accordance with trade regulations.

.2 Mock-Ups:

.1 Construct mock-ups in accordance with Section 01 45 00 - Quality Control.

.1 Provide 300 mm x 300 mm mock-up. Prepare and paint designated surface, area, room or item (in each colour scheme) to specified requirements, with specified paint or coating showing selected

colours, gloss/sheen, textures.

.2 Mock-up will be used:

.1 To judge workmanship, substrate preparation, operation of equipment and material application and workmanship to MPI Architectural Painting Specification Manual standards.

.3 Locate where indicated

.4 Allow 24 hours for inspection of mock-up before proceeding with work.

.5 When accepted, mock-up will demonstrate minimum standard of quality required for this work.Approved mock-up may not remain as part of finished work. Remove mock-up and dispose of materials when no longer required and when directed by Consultant .

.3 Pre-Installation Meeting:

.1 Convene pre-installation meeting one week prior to beginning on-site installations in accordance with Section 01 32 16.07 - Construction Progress Schedules - Bar (GANTT) Chart .

.1 Verify project requirements.

.2 Review installation and substrate conditions.

.3 Coordination with other building subtrades.

.4 Review manufacturer's installation instructions and warranty requirements.

.4 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.3 SCHEDULING

.1 Submit work schedule for various stages of painting to Departmental Representative for review. Submit schedule minimum of 48 hours in advance of proposed operations.

.2 Obtain written authorization from Departmental Representative for changes in work schedule.

.3 Schedule painting operations to prevent disruption of occupants.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit product data and instructions for each paint and coating product to be used.

.2 Submit product data for the use and application of paint thinner.

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

.3 Samples:

.1 Submit full range colour sample chips to indicate where colour availability is restricted.

.2 Submit 200 x 300 mm sample panels of each clear coating with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:

.1 plate steel for finishes over metal surfaces.

.2 13 mm for finishes over gypsum board and other smooth surfaces.

.3 plywood for finishes over wood surfaces.

.3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.

.4 Test reports: submit certified test reports for paint from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.1 Lead, cadmium and chromium: presence of and amounts.

.2 Mercury: presence of and amounts.

.3 Organochlorines and PCBs: presence of and amounts.

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

.6 Manufacturer's Instructions:

.1 Submit manufacturer's installation application instructions.

.7 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.

.4 MPI Environmentally Friendly classification system rating.

1.5 MAINTENANCE

.1 Extra Materials:

.1 Deliver to extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Section 01 77 00 - Closeout Procedures.

.2 Quantity: provide one - one 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.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

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

.2 Acceptance at Site:

.1 Identify products and materials with labels indicating:

.1 Manufacturer's name and address.

.2 Type of paint or coating.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Storage and Protection:

.1 Provide and maintain dry, temperature controlled, secure storage.

.2 Store materials and supplies away from heat generating devices.

.3 Store materials and equipment in well ventilated area with temperature range 7 degrees C to 30 degrees C.

.5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.6 Keep areas used for storage, cleaning and preparation clean and orderly. After completion of operations, return areas to clean condition.

.7 Remove paint materials from storage only in quantities required for same day use.

.8 Fire Safety Requirements:

.1 Provide 9 kg fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.

.9 Waste Management and Disposal:

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Place materials defined as hazardous or toxic in designated containers.

.3 Handle and dispose of hazardous materials in accordance with TDGA, regulations.

.4 Ensure emptied containers are sealed and stored safely.

.5 Unused paint materials must be disposed of at official hazardous material collections site as approved by Departmental Representative.

.6 Paint, stain and wood preservative finishes and related materials (thinners, and solvents) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.

.7 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.8 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.9 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground follow these procedures:

.1 Retain cleaning water for water-based materials to allow sediments to be filtered out.

.2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.

.3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.

.4 Dispose of contaminants in approved legal manner in accordance with hazardous waste regulations.

.5 Empty paint cans are to be dry prior to disposal or recycling (where available).

.10 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

1.7 SITE CONDITIONS

.1 Heating, Ventilation and Lighting:

.1 Provide heating facilities to maintain ambient air and substrate temperatures above 10 degrees C for 24 hours before, during and after paint application until paint has cured sufficiently.

.2 Provide continuous ventilation for seven days after completion of application of paint.

.3 Coordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.

.4 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

.5 Provide minimum lighting level of 323 Lux on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless pre-approved written approval by Specifying body and product manufacturer, perform no painting when:

.1 Ambient air and substrate temperatures are below 10 degrees C.

.2 Substrate temperature is above 32 degrees C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.

.4 The relative humidity is under 85% or when the dew point is more than 3 degrees C variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3 degrees C below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint work.

.5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.6 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.

.2 Perform painting work when maximum moisture content of the substrate is below:

.1 15% for wood.

.2 12% for plaster and gypsum board.

.3 Surface and Environmental Conditions:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.

.3 Apply paint when previous coat of paint is dry or adequately cured.

.4 Additional interior application requirements:

.1 Apply paint finishes when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

.2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

Part 2 Product

2.1 MATERIALS

.1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.

.2 Provide paint materials for paint systems from single manufacturer.

.3 Only qualified products with E3 "Environmentally Friendly" rating are acceptable for use on this project.

.4 Conform to latest MPI requirements for interior painting work including preparation and priming.

.5 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.

.6 Linseed oil, shellac, and turpentine: highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.

.7 Provide paint products meeting MPI "Environmentally Friendly" E1, E3 ratings based on VOC (EPA Method 24) content levels.

.8 Use MPI listed materials having minimum E2 rating where indoor air quality (odour) requirements exist.

.9 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids:

.1 Water clean-up.

.2 non-flammable.

.3 Manufactured without compounds which contribute to ozone depletion in the upper atmosphere.

.4 Manufactured without compounds which contribute to smog in the lower atmosphere.

.5 Do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.

.10 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.

.11 Flash point: 61.0 degrees C or greater for water-borne surface coatings and recycled water-borne surface coatings.

.12 Ensure manufacture and process of both water-borne surface coatings and recycled water-borne surface coatings does not release:

.1 Matter in undiluted production plant effluent generating 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to natural watercourse or sewage treatment facility lacking secondary treatment.

.2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to natural watercourse or a sewage treatment facility lacking secondary treatment.

.13 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes to meet minimum "Environmentally Friendly" E2 rating.

2.2 COLOURS

.1 Colour Schedule: for all rooms in building;

.1 Concrete Floors: refer to Section 03 35 00 - Concrete Finishing.

.2 Interior Walls: 'White Ice' - #OC-58 by Benjamin Moore or match.

.3 Ceilings: 'White Ice' - #OC-58 by Benjamin Moore or match.

.4 Exterior Metal Doors and Frames: 'Tricycle Red'-#2000-20 by Benjamin Moore or to match.

.5 Interior Doors and Frames: 'Bermuda Blue - #2061-30 by Benjamin Moore or to match.

.2 Selection of colours from manufacturers full range of colours.

.3 Second coat in three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

.1 Perform colour tinting operations prior to delivery of paint to site. Obtain written approval from Departmental Representative for tinting of painting materials.

.2 Mix paste, powder or catalyzed paint mixes inaccordance with manufacturer's written instructions.

.3 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.

.4 Thin paint for spraying in accordance with paint manufacturer's instructions.

.5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

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

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

.2 Gloss level ratings of painted surfaces as noted on Finish Schedule.

2.5 INTERIOR PAINTING SYSTEMS

.1 Metal fabrications: railings:

.1 INT 5.1B - Waterborne light industrial G5 coating.

.2 Dimension lumber: columns, beams, exposed joists, underside of decking:

.1 INT 6.2A - Latex G5 finish (over alkyd primer).

.3 Dressed lumber: including doors, door and window frames, casings, mouldings:

.1 INT 6.3A - High performance architectural latex G5 finish.

.4 Plywood panels on walls and ceilings:

.1 INT 6.3A - High performance architectural latex G5 finish.

.5 Plywood Backboards: INT 6.4P - Pigmented, fire-retardant.

.6 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:

.1 INT 9.2A - Latex G5 finish (over latex sealer).

.2 INT 9.2B - High performance architectural latex G5 finish.

2.6 SOURCE QUALITY CONTROL

.1 Perform following tests on each batch of consolidated post-consumer material before surface coating is reformulated and canned. Testing by laboratory or facility which has been accredited by Standards Council of Canada.

.1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.

.2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.

.3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.

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.

.2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

.3 Maximum moisture content as follows:

.1 Stucco, plaster and gypsum board: 12%.

.2 Wood: 15%.

3.4 PREPARATION

.1 Protection:

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces 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.

.2 Surface Preparation:

.1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.

.2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of Departmental Representative.

.3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:

.1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.

.2 Wash surfaces with a biodegradable detergent and bleach where applicable

and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly.

.5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.

.6 Use trigger operated spray nozzles for water hoses.

.7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.

.4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.5 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

.1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.

.2 Apply wood filler to nail holes and cracks.

.6 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

.7 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes.

.8 Touch up of shop primers with primer as specified.

.9 Do not apply paint until prepared surfaces have been accepted by Departmental Representative

3.5 APPLICATION

.1 Method of application to be as approved by Departmental Representative. Apply paint by air sprayer. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:

.1 Apply paint in uniform layer using brush and/or roller type suitable for application.

.2 Work paint into cracks, crevices and corners.

.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.

.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.

.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray application:

.1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.

.2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

.3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.

.4 Brush out immediately all runs and sags.

.5 Use brushes and rollers to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.

.5 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.7 Sand and dust between coats to remove visible defects.

.8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

.9 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.6 MECHANICAL/ELECTRICAL EQUIPMENT

.1 Paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as indicated.

.2 Boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.

.3 Other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.

.4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.5 Do not paint over nameplates.

.6 Keep sprinkler heads free of paint.

.7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

.8 Paint fire protection piping red.

.9 Paint disconnect switches for fire alarm system and exit light systems in red enamel.

.10 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.11 Do not paint interior transformers and substation equipment.

.12 Paint plywood backboards behind electrical panels and circuit boards with two coats of fire-retardant paint.

3.7 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.

3.8 FIELD QUALITY CONTROL

.1 Interior painting and decorating work shall be inspected by a Paint Inspection Agency (inspector) acceptable to the specifying authority and local Painting Contractor's Association. Painting contractor shall notify Paint Inspection Agency a minimum of one week prior to commencement of work and provide a copy of project painting specification, plans and elevation drawings (including pertinent details) as well as a Finish Schedule.

.2 Interior surfaces requiring painting shall be inspected by Paint Inspection Agency who shall notify Departmental Representative and General Contractor in writing of defects or problems, prior to commencing painting work, or after prime coat shows defects in substrate.

.3 Where "special" painting, coating or decorating system applications (i.e. elastomeric coatings) or non-MPI listed products or systems are to be used, paint or coating

manufacturer shall provide as part of this work, certification of surfaces and conditions for specific paint or coating system application as well as on site supervision, inspection and approval of their paint or coating system application as required at no additional cost to Departmental Representative.

.4 Standard of Acceptance:

.1 Walls: no defects visible from a distance of 1000 mm at 90 degreesto surface.

.2 Ceilings: no defects visible from floor at 45 degrees degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

.5 Field inspection of painting operations to be carried out be independent inspection firm as designated by Departmental Representative.

.6 Advise Departmental Representative when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

.7 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Departmental Representative.

3.9 RESTORATION

.1 Clean and re-install hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust to approval of Departmental Representative. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCES

.1 ASTM International

.1 ASTM A167-99(2009), Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.2 ASTM B456-03, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

.3 ASTM A653/A653M-09, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 ASTM A924/A924M-09, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.81-M90, Air Drying and Baking Alkyd Primer for Vehicles and Equipment.

.2 CAN/CGSB-1.88-92, Gloss Alkyd Enamel, Air Drying and Baking.

.3 CGSB 31-GP-107MA-90, Non-inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.

.3 CSA International

.1 CAN/CSA-B651-12, Accessible Design for the Built Environment.

.2 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in the Yukon Territory of Canada.

.2 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.

1.4 CLOSEOUT SUBMITTALS

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

1.5 MAINTENANCE MATERIAL SUBMITTALS

.1 Tools:

.1 Provide special tools required for assembly, disassembly or removal for toilet and bath accessories in accordance with requirements specified in Section 01 78 00 - Closeout Submittals.

.2 Deliver special tools to Departmental Representative.

1.6 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect toilet and bathroom accessories from nicks, scratches, and blemishes .

.3 Replace defective or damaged materials with new.

Part 2 Product

2.1 MATERIALS

.1 Stainless steel sheet metal: to ASTM A167, Type 304, with satin finish.

.2 Stainless steel tubing: Type 304, commercial grade, seamless welded, 1.2 mm wall thickness.

.3 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory

manufacturer for component and its intended use.

2.2 COMPONENTS

.1 Toilet tissue dispenser: single roll type, surface mounted, chrome plated steel frame, capacity of 500 double ply roll, roll under spring tension for controlled delivery.

.2 Combination towel dispenser/waste receptacle: surface-mounted wall unit, approximately 355 mm wide, 713 mm high, 126 mm deep. Interior of 0.8 mm galvanized steel, exterior of 0.8 mm stainless steel. Suitable for dispensing folded paper towels. Removable galvanized steel waste receptacle, lockable access door with continuous full height stainless steel hinge.

.3 Soap dispenser: liquid push-in valve 102 mm spout, self contained 340 mL translucent polyethylene, stainless steel piston and valve assembly, tamper proof filler lock, surface mounted, exposed metal components chrome plated.

.4 Feminine napkin disposal bin: stainless steel, surface unit including rough-in frame, continuous hinged door, self closing, embossed with "napkin disposal", removable stainless steel receptacles fitted with spring clip for deodorizer block.

.5 Grab bars: 1.6 mm wall tubing of stainless steel, 38 mm diameter wall flanges, exposed screw attachment, flanges welded to tubular bar, provided with steel back plates and all accessories. Knurl bar at area of hand grips. Grab bar material and anchorage to withstand downward pull of 2.2 kN. Locations, mounting heights and sizes as shown on draiwngs.

.6 Mirror: wall mounted unit, 457mm x 762mm fixed framed mirror 6 mm, stainless steel frame.

2.3 FABRICATION

.1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.

.2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.

.3 Brake form sheet metal work with 1.5 mm radius bends.

.4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.

.5 Back paint components where contact is made with building finishes to prevent electrolysis.

.6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CAN/CSA-G164.

.7 Shop assemble components and package complete with anchors and fittings.

.8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.

.9 Provide steel anchor plates and components for installation on studding and building framing.

2.4 FINISHES

.1 Chrome and nickel plating: to ASTM B456, satin finish.

.2 Baked enamel: condition metal by applying one coat of metal conditioner to CGSB 31-GP-107Ma, apply one coat Type 2 primer to CAN/CGSB-1.81 and bake, apply two coats Type 2 enamel to CAN/CGSB-1.88 and bake to hard, durable finish. Sand between final coats. Colour selected from standard range by Departmental Representative.

.3 Manufacturer's or brand names on face of units not acceptable.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrates and surfaces to receive toilet and bathroom accessories previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's instructions prior to toilet and bathroom accessories installation.

.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 from Departmental Representative .

3.2 INSTALLATION

.1 Install and secure accessories rigidly in place as follows:

.1 Stud walls: install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.

.2 Install grab bars on built-in anchors provided by bar manufacturer.

.3 Use tamper proof screws/bolts for fasteners.

.4 Fill units with necessary supplies shortly before final acceptance of building.

3.3 ADJUSTING

.1 Adjust toilet and bathroom accessories components and systems for correct function and operation in accordance with manufacturer's written instructions.

.2 Lubricate moving parts to operate smoothly and fit accurately.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by toilet and bathroom accessories installation.

3.6 SCHEDULE

.1 Refer to drawings for locations and mounting heights for all washroom accessories.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-44.40-01, Steel Clothing Locker.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets for metal lockers and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in the Yukon Territory of Canada.

.2 Indicate on drawings: type and class of locker, thicknesses of metal, fabricating and assembly methods, assembled banks of lockers, trim,.

.4 Samples:

.1 Submit duplicate 50 x 50 mm samples of colour and finish on actual base metal.

.2 Samples will be returned for inclusion into work.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect metal lockers from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Product

2.1 MANUFACTURED UNITS

.1 Lockers: to CAN/CGSB-44.40, Type 1-Single full-height locker, Class 2 - A bank of two or more lockers, freestanding.

.1 Size: 381 mm wide x 381 mm deep x 1829 mm high, steel thickness No .24 MSG.

.2 Assembly: welded construction.

.3 Top: sloped.

.4 Doors: one-piece double-wall envelope construction, steel thickness No .20 MSG, door swing .

.5 Door handle: recessed handle steel with bright chromium finish.

2.2 ACCESSORIES

.1 Locking system: padlocks.

.2 Options: to CAN/CGSB-44.40, hanger rods, steel with chromium finish.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates and surfaces to receive metal lockers previously installed under other Sections or Contracts are acceptable for product installation in accordance with manufacturer's instructions prior to metal locker installation.

.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 from Departmental Representative .

3.2 INSTALLATION

.1 Assemble and install lockers in accordance with manufacturer's written instructions.

.2 Securely fasten lockers to grounds and nailing strips.

.3 Install wall trim around recessed locker banks.

.4 Install filler panels (false fronts) where indicated and where obstructions occur.

.5 Install finished end panels to exposed ends of locker banks.

3.3 ADJUSTING

.1 Adjust metal lockers for correct function and operation in accordance with manufacturer's written instructions.

.2 Lubricate moving parts to operate smoothly and fit accurately.

3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

3.5 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by metal locker installation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Do work in accordance with the recommendations and requirements of:

.1 National Fire Code of Canada.

.2 NFPA 10, Standard for Portable Fire Extinguishers.

.3 NFPA Standard on Clean Agent Fire Extinguishing Systems

1.2 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.3 MAINTENANCE DATA

.1 Provide maintenance data for incorporation into manual specified in Section 01 33 00 - Submittal Procedures.

1.4 RELATED WORK

.1 Section 23 05 00 - Common Work Results - Mechanical

Part 2 Products

2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHERS

.1 Stored pressure rechargeable type with hose and shut-off nozzle, ULC labeled.

.2 Capacity: See Drawing Schedule.

2.2 EXTINGUISHER BRACKETS

.1 Type recommended by extinguisher manufacturer.

2.3 IDENTIFICATION

.1 Identify extinguishers in accordance with recommendations of NFPA 10.

.2 Attach tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.

Part 3 Execution

3.1 INSTALLATION

.1 Install brackets and mount extinguishers per manufacturer's instructions and as indicated on the drawings.

.2 Mounting height: in no case shall the mounting height exceed 1.5m above finished floor to the top of the extinguisher for extinguishers with a gross weight up to and including 20kg. and 1.06m from finished floor to the top of the extinguisher for extinguishers with a gross weight over 20kg.

.3 Confirm and mark on tag serviceability prior to substantial.

END OF SECTION

Part 1 General

1.1 RELATED SECTION

.1 01 33 00 - Submittal Procedures

.2 01 78 10 - Closeout Submittals

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME).

.2 American Society for Testing and Materials International, (ASTM).

.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).

Part 2 Products

2.1 BALL VALVES

.1 50dia and smaller: Class 600, bronze body, full bore, forged brass ball, brass gland and PTFE Teflon seat, steel lever handle, screwed.

.2 63dia and larger: Class 125, flanged cast iron body, teflon fused solid ball, blow out proof stainless steel stem, teflon seats.

2.2 CHECK VALVES

.1 50dia and smaller: To MSS SP-80-1997, Class 125, 860 kPa, bronze body, bronze swing disc, Y-pattern, screw in cap, regrindable seat, screwed.

.2 63dia and larger: Class 125, 860 kPa, bronze body, bronze disc, lift type, vertical way, screwed ends.

2.3 DRAIN VALVES

.1 Minimum 13dia, class 600, bronze body, full bore, forged brass ball, brass gland and PTFE Teflon seat, steel lever handle, screwed, male hose end c/w cap and chain.

2.4 GLOBE VALVES

.1 Bronze body to MSS SP-80-1997, Class 125, 860 kPa, screwed bonnet, renewable teflon disc, swivel type disc holder, screwed or soldered.

.1 Lock shield handles as indicated.

2.5 STRAINERS

.1 50dia and smaller: Class 150, 1033 kPa, Y-pattern, screwed cap, stainless steel screen, bronze body, screwed.

.2 Strainers to be line size.

Part 3 Execution

3.1 INSTALLATION

.1 Install using stem valves in upright position with stem above horizontal unless otherwise approved by Departmental Representative.

.2 Remove internal parts before soldering.

.3 Install valves with unions or flanges as indicated at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

.4 Install to manufacturer's recommendations.

.5 Maintain proper clearance to permit service and maintenance.

.6 Should deviations beyond allowable clearances arise, request and follow Engineer's directive.

.7 Install specified valves at all branch take-offs and as indicated.

.8 Provide silent check valves in vertical pipes with downward flow and as indicated.

.9 Provide swing check valves on discharge of pumps as indicated.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.2 American Society for Testing and Materials (ASTM International)

.3 Canadian General Standards Board (CGSB)

.4 Thermal Insulation Association of Canada (TIAC)

.5 Underwriters Laboratories of Canada (ULC)

.6 Model National Energy Code for Buildings.

.7 ASHRAE 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings.

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:

.2 All components of insulation system to have maximum flame spread rating of 25 and maximum smoke developed rating of 50 in accordance with ASTM E 84-01, Test Method for Surface Burning Characteristics of Building Materials and CAN/ULC-S102.

2.2 TYPE A-3 INSULATION

.1 TIAC Code A-3: Rigid molded mineral fibre piping insulation with factory applied vapour retarder jacket to CAN/CGSB-51.9-92 and CGSB SI-GP-52M.

.2 Materials:

.1 Insulation: molded, heavy density one piece, inorganic glass fiber bonded with thermosetting resin.

.2 Jacket: white kraft paper bonded to aluminum foil and reinforced with glass fibers. 3. Lap seal: self adhesive.

.3 Temperature range: -29degC to 454degC

.4 Thermal Conductivity "k" shall not exceed 0.031 W/m. deg.C at 24 deg.C mean temperature when tested in accordance with ASTM C 335-95.

.5 Surface Burning Characteristics.

.1 To STM E84-98e, Test Method for Surface Burning Characteristics of Building Materials and ANSI/NFPA 255-2000, Burning Characteristics of Building Materials and CAN/ULC-S102-M88.

.2 UL Classified.

.3 Flame spread=25 as plain insulation or composite basis.

.4 Smoke developed=50 as plain insulation or composite basis.

.6 Vapour Transmission:

.1 ASTM E 96-00e1, Standard Test Methods for Water Vapor Transmission of Materials.

.2 Maximum: 0.02 perms.

.7 Resistance to Fungi and Bacteria:

.1 ASTM listed to not promote growth of fungi or bacteria.

2.3 PVC JACKETS

.1 Polyvinyl Chloride (PVC):

.1 One piece premoulded PVC jacketing to AC774.1K82 with 25 flame and 50 smoke rating to ASTM E 84-01.

.2 Gloss finish, UV resistant, premoulded for fitting applications, jacket for straight pipe runs.

.3 Temperature rating: max insulation surface temperature 60degC.

.4 Secure with PVC tape with manufactured supplied rivets. Tape only is not acceptable.

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 to be clean, dry, free from foreign material.

3.2 INSTALLATION (GENERAL)

.1 Install in accordance with TIAC National Standards and the requirements of ANSI/ NFPA 90A-1999 and ANSI/NFPA 90B-1999.

.2 Install all insulation systems including minimum insulation thicknesses to the most stringent requirements of ASHRAE 90.1-2001, Energy Standard for Buildings Except Low-Rise Residential Buildings and the Canadian National Energy Code for Buildings-1997 unless otherwise noted in the insulation schedule.

.3 Apply materials in accordance with manufacturers instructions and this specification.

.4 Seal and finish exposed ends as follows:

.1 PVC Jacketed insulation: PVC jacket termination.

.2 Unfinished insulation: insulation tape.

.3 Where insulation not provided at valves, fitting and trim delete insulation and finish away from studs and nuts to permit use of tools without damage to insulation.

.5 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.6 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

3.3 CONCEALED BALL VALVES

.1 Concealed ball valves: insulate all concealed ball valves using specified pipe insulation continuous over valve. Core out insulation as required to suit valve body dimensions or provide one size larger pipe insulation.

3.4 PIPING

.1 Insulate piping for full length as per insulation schedule except as follows:

.1 Insulate DWV vents from exterior building termination penetration, through attic and 1500 mm inside warm space of building.

.2 Insulation is not required for the following:

.1 All chrome plated exposed piping

.2 Flexible tubing systems from distribution manifolds to fixtures where applicable.

.3 Where insulation not provided at valves, fitting and trim delete insulation and finish away from studs and nuts to permit use of tools without damage to insulation.

.4 Fastenings- Type A3: secure insulation by tape at each end and center of each section, but not greater than 900 mm on centers.

3.5 PIPING INSULATION SCHEDULES

.1 Schedule:
[Note 1: Provide insulation for 1500mm inside building or to limit of uninsulated ceiling space].

APPLICATION		INSULATION TYPE	THICKNESS (mm)	JACKET
Rigid DCW (Exposed or Concealed)		A3	25	A3
Rigid DHW/R (Exposed or Concealed		A3	25	A3
DWV (Exposed or Concealed)		A3	25 [Note 1]	A3
All Piping in Vehicle Bays		A3	25	PVC

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate:

.1 Equipment including connections, piping, and fittings, and ancillaries, identifying factory and field assembled.

.2 Factory tested and certified performance and efficiency pump curves. Certified for horizontal operation in casing.

.3 Wiring as assembled and schematically.

.4 Dimensions, construction details and recommended installation.

Part 2 Products

2.1 DOMESTIC COLD WATER CIRCULATING PUMP P-1

.1 Polyether Imide (PEI) or stainless steel impeller, vent plug, bronze housing, universal flange connections, replaceable SS cartridge impeller assembly, ceramic bearings, suitable for drinking water.

.2 Capacity: See Drawing Schedule

.3 Control: See Sequence of Operations.

2.2 CONDENSATE PUMP P-2

.1 Construction: Plastic sump and pump c/w check valve and rubber feet, external test/ run lever and mounting bracket.

.2 Power: Cord connected. See Schedule.

.3 Capacity: See Schedule.

Part 3 Execution

3.1 INSTALLATION

.1 Do Work in accordance with CAN/CSA-B214.

.2 Provide air cock and drain connection. Install volute venting pet cock in accessible location.

.3 Install pressure gauge isolation ball valves and pressure gauges.

.4 Provide suction guides complete with strainer on inlet to all pumps except gear pumps, domestic hot water recirc pumps, sump pumps and condensate pumps.

.5 Decrease from suction line size with eccentric reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Support suction guide and discharge elbow from a floor stand with rubber and shear sandwich pad isolators or from above with hangers and spring isolators.

.6 In line circulators: install as indicated by flow arrows. Support at inlet and outlet flanges or unions. Install with bearing lubrication points accessible.

.7 Condensate Pump: Provide mounting bracket and mount immediately adjacent to HRV.

.8 Ensure that pump body does not support piping or equipment. Provide stanchions or hangers for this purpose. Refer to manufacturer's installation instructions for details.

3.2 START-UP

.1 Prestartup:

.1 Drain casing and bleed all air from volute and ensure pump full primed.

.2 Verify pump is level.

.3 Check nameplate is readily visible.

.2 Startup:

.1 Startup as recommended by manufacturer.

.2 Check rotation.

.3 Run pump for minimum 12hrs continuous operation.

.4 Ensure flow through parallel pumps is equally balanced.

.5 Verify seal performance, Clean strainers.

.6 Replace shaft seals if pump has been used to degrease system.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 10 - Closeout Submittals.

.3 Section 23 05 02 - Pipework Testing.

.4 Section 23 05 00 - Common Work Results - Mechancial.

.5 Section 23 05 01 - Installation of Pipework.

.6 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME).

.2 American Society for Testing and Materials International, (ASTM).

.3 American Water Works Association (AWWA).

.4 Canadian Standards Association (CSA International).

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

.6 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).

.7 National Research Council (NRC)/Institute for Research in Construction.

.8 Transport Canada (TC).

.9 ASME B16.15 Cast Bronze Threaded Fittings, Classes 125 and 250

.10 ANSI B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.

.11 ANSI B16.22, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

.12 ANSI B16.24, Bronze Pipe Flanges and Fittings, Class 150 and 300.

.13 ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

.14 ASTM B 88M, Specification for Seamless Copper Water Tube (Metric).

.15 MSS SP-80 , Bronze Gate, Globe, Angle and Check Valves.

Part 2 Products

2.1 PIPING

.1 Domestic hot, cold and recirculation systems, within building.

.1 General: Copper tube, hard drawn, type L: to ASTM B 88M-99.

2.2 FITTINGS

.1 50 dia and smaller:

.1 Cast bronze threaded fittings, Class 125: to ASME B16.15

.2 Cast copper, solder type: to ANSI B16.18.

.3 Wrought copper and copper alloy, solder type: to ANSI B16.22.

2.3 JOINTS

.1 Rubber gaskets, latex-free thickness to AWWA C111.

.2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.

.3 Solder: Lead-free.

.4 Teflon tape: for threaded joints.

.5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM flush seal gasket.

.6 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with the Canadian Plumbing Code.

.2 Install pipe work in accordance with Section 23 05 01 - Installation of Pipework, supplemented as specified herein.

.3 Piping supports and hangers in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.4 Assemble piping using fittings manufactured to ANSI standards.

.5 Install cold water piping below and away from hot piping so as to maintain temperature of cold water as low as possible..

.6 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.

.7 Lay copper tubing so that it is not in contact with dissimilar metal and will not be kinked or collapsed.

.8 Copper fixture supply pipes shall be secured to proper backing in the walls with wing back 90 degree elbows.

.9 Install flanges or unions and isolation valves to permit removal of equipment without disturbing piping systems, as required by sizing standard

.10 Install pipetite bushings where piping passes through steel studs.

.11 Connect to fixtures and equipment in accordance with manufacturers instructions unless otherwise indicated.

3.2 TESTING & CLEANING NEW & EXISTING PIPING

.1 Testing, flushing, cleaning and disinfection requirements apply to entire DW system in main building and washroom building.

3.3 PRESSURE TESTS

.1 Test system in accordance with Section 23 05 02 Pipework Testing supplemented as specified herein.

3.4 FLUSHING AND CLEANING

.1 Flush entire system for 8 h. Ensure outlets flushed for 2 h. Let stand for 24 h, then draw one sample off longest run. Submit to testing in approved laboratory for analysis and provide certification that all samples are clean of construction residues (copper, solder, etc).

.2 Obtain written approval from Departmental Representative.

3.5 PRE-START-UP INSPECTIONS

.1 Systems to be complete, prior to flushing, testing and start-up.

.2 Verify that system can be completely drained.

.3 Ensure that pressure booster systems are operating properly.

.4 Ensure that air chambers, expansion compensator are installed properly.

3.6 DISINFECTION

.1 Supply materials and test kit to carry out disinfection as follows:

.1 Fill piping system and tanks with chlorine/water solution with a strength of at least 50 mg/L. Ensure pipe is full and no air pockets remain.

.2 Leave solution in piping system for 24 hours, while maintaining a pressure of 175 kPa.

.3 After 24 hours sample and test the chlorine solution. If the chlorine residual is at least 25 mg/L, the disinfection will be considered successful. Flush

chlorine solution from the system. Protect against contamination of the disinfected system.

.2 If the chlorine residual is less than 25 mg/L, flush the system, clean any deleterious material, re-flush and disinfect again. Repeat until satisfactory

.3 If, in the opinion of the Departmental Representative, any component of the potable water system becomes contaminated after disinfection, it shall be flushed and disinfected again at no additional cost.

.4 Obtain water sample off longest run. Test in approved laboratory for bacteriological analysis and provide certification that all samples are suitable for human consumption prior to interim-occupancy inspection.

.5 Upon completion, provide laboratory test reports on water quality for approval by Departmental Representative.

3.7 START-UP

.1 Timing: Start up after all testing, flushing and cleaning and disinfection completed.

.2 Provide continuous supervision during start-up.

.3 Rectify start-up deficiencies.

.4 For startup requirements see Section 23 05 03 - Mechanical Start-Up.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 23 05 02 - PipeWork Testing

.3 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.2 REFERENCES

.1 ASTM International Inc.

.1 ASTM B 32-00e1, Specification for Solder Metal.

.2 ASTM B 306-02, Specification for Copper Drainage Tube (DWV).

.3 ASTM C 564-97, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

.2 Canadian Standards Association (CSA International).

.1 CSA B67, Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.

.2 CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.

.3 CSA-B125, Plumbing Fittings.

Part 2 Product

2.1 COPPER TUBE AND FITTINGS

.1 Above ground sanitary storm and vent Type DWV to: ASTM B 306-02.

.2 Fittings.

.1 DWV Cast brass: to CSA B125-01.

.2 DWV Wrought copper: to CSA B125-01.

.3 Solder: tin/antimony, 50:50, to ASTM B 32-00e1.

2.2 CAST IRON PIPING AND FITTINGS

.1 Buried sanitary and vent minimum NPS 2, to: CAN/CSA-B70. Acceptable only where indicated.

.2 Above ground sanitary and vent: to CAN/CSA-B70

.3 Joints: mechanical joints with neoprene compression gaskets and stainless steel

clamps.

Part 3 Execution

3.1 INSTALLATION

.1 In accordance with Section 23 05 01 - Installation of Pipework, the Canadian Plumbing Code, and as supplemented herein.

.2 Piping supports and hangers in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.3 Install piping parallel and close to walls to conserve headroom and space, and grade as indicated as per NPC.

.4 Use of cast iron/copper DWV piping is mandatory for the following locations:

.1 DWV vent through roof for min 1500 mm to roof penetration and through roof.

.2 In Vertical Shafts as defined by NBCC .

.5 Use of cast iron/copper DWV is acceptable in all other locations in the building with the following exceptions:

.1 Use of cast iron/copper DWV below grade is not acceptable unless otherwise noted.

3.2 TESTING

.1 Test system in accordance with Section 23 05 02 Pipework Testing supplemented as specified herein.

.2 Pressure test buried systems before backfilling

3.3 PERFORMANCE VERIFICATION

.1 Cleanouts: Prove freedom of access.

.2 Test to ensure traps are fully and permanently primed.

.3 Ensure that fixtures are properly anchored, connected to system and effectively vented.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.2 REFERENCES

.1 ASTM D 2564, Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Pipe and Fittings.

.2 CSA B181.2, PVC Drain, Waste and Vent Pipe and Pipe Fittings.

.3 CSA B181.12, Recommended Practice for the Installation of PVC Drain, Waste and Vent Pipe and Pipe Fittings.

Part 2 Product

2.1 PIPING AND FITTINGS

.1 For above ground and buried:

.1 General: certified fire resistant PVC

.2 Approvals: CSA B181.2 listed for use in noncombustible construction, ULC listed to CAN4-S102.2.

.3 Flame spread rating: less than 25.

.4 Smoke development rating: less than 50.

2.2 JOINTS

.1 Solvent cement:

.1 General: low VOC suitable for PVC pipe.

.2 Approvals: ASTM D-2564, SCAQMD Rule 1168/316A, Uniform Plumbing Code seal.

.3 Color: Gray

.4 Resin: PVC

.5 Max VOC Emissions: 510G/L per SCAQMD Rule 1168, Method 316A.

.2 Primer:

.1 General: low VOC suitable for PVC pipe.

.2 Approvals: ASTM D-F-656, SCAQMD Rule 1168/316A, Uniform Plumbing Code seal.

.3 Color: purple

.4 Max VOC Emissions: 650G/L per SCAQMD Rule 1168, Method 316A.

Part 3 Execution

3.1 INSTALLATION

.1 In accordance with Section 23 05 01 - Installation of Pipework, the Canadian Plumbing Code, and as supplemented herein.

.2 Piping supports and hangers in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.3 Install piping parallel and close to walls to conserve headroom and space, and grade as indicated as per NPC.

.4 Install PVC drain, waste and vent pipe and pipe fittings in accordance with CSA B181.12 and to the manufacturers listings..

.5 Provide specified fire stopping systems for piping thru fire rated walls and floors where required.

.6 Listed PVC DWV piping and fittings acceptable throughout building with the following exceptions:

.1 Use in Vertical Shafts as defined by NBCC not acceptable.

.2 DWV vent through roof for min 1500 mm to roof penetration and through roof.

.3 All electric and hydronic heat traced piping.

3.2 TESTING

.1 Test system in accordance with Section 23 05 02 Pipework Testing supplemented as specified herein.

.2 Pressure test buried systems before backfilling.

3.3 PERFORMANCE VERIFICATION

.1 Cleanouts: Prove freedom of access.

.2 Test to ensure traps are fully and permanently primed.

.3 Ensure fixtures are properly anchored, connected to system and effectively vented.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 10 - Closeout Submittals.

.3 Section 23 07 16 - Thermal Insulation for Equipment.

.4 Section 23 05 49 - Seismic Restrain Systems (SRS) - Type P2 Buildings

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.2 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

.3 ASHRAE 90.1 2013, Energy Standard for Buildings Except Low-Rise Residential Buildings.

1.3 SHOP DRAWINGS

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

.2 Indicate: equipment, including connections, fittings, control assemblies and ancillaries, identifying factory and field assembled.

.3 Provide for the following:

.1 Domestic hot water heater.

.2 Controls.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance and engineering data for incorporation into manual specified in Section 01 78 10 - Closeout Submittals .

Part 2 Product

2.1 ELECTRIC DHWH

.1 General: Light duty commercial electric, glass-lined storage tank with immersion type heating elements.

.2 Approvals: .ASME, NSF and UL approved. To CAN/CSA C22.2 No.110, CAN/CSA-C191 and CAN/CSA-C309.

.3 Tank: steel, glass lined with alkaline borosilicate fused to steel by firing at a

temperature of 871degC.

.4 Rated pressure: 1034kPa.

.5 Cathodic protection: extruded magnesium anode

.6 Jacket: steel, backed enamel finish.

.7 Insulation: foam insulation to exceed requirements of latest edition of ASHRAE 90.1.

.8 Elements: heat duty medium watt density, incoloy sheathing and pre wired leads.

.9 Thermostat: immersion type, close differential with control range 35degC to 82degC.

.10 Control circuit: 120v, fused transformer.

.11 Contactors: heat duty UL rated, 100 000 cycle rated.

.12 Control cabinet: hinged, house 120v control circuit transformer, transformer fusing, magnetic contactor(s), thermostats, high limit thermostats, element fusing to NEC and elements with pre wired terminal leads.

.13 Capacity: See Schedule.

2.2 TRIM AND INSTRUMENTATION

.1 Drain valve: 19dia as per Section 22 05 23 - Valves for Plumbing Piping.

.2 Thermowell filled with conductive paste for control valve temperature sensor.

.3 ASME rated temperature and pressure relief valve sized for full capacity of heater, having discharge terminating over floor drain and visible to operators.

.4 Magnesium anodes adequate for 5 years of operation and located for easy replacement.

2.3 ANCHOR BOLTS AND TEMPLATES

.1 Supply for use as required by 3.1.3 - Seismic securement.

Part 3 Execution

3.1 INSTALLATION

.1 Install in level and secure in accordance with manufacturer's recommendations and the authority having jurisdiction.

.2 Install drip pan below DHWH per NPCC latest edition. Pipe to floor drain

.3 Seismically secure DHWH to the requirements of Section 23 05 49 Seismic Restraint Systems (srs) - Type P2 Buildings

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures..

.2 Section 01 78 10 - Close Out Submittals.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.2 American Water Works Association (AWWA)

.3 Canadian Standards Association (CSA)

.4 Plumbing and Drainage Institute (PDI)

Part 2 Product

2.1 FLOOR DRAINS

.1 Floor Drains and Trench Drains: to CSA B79.

.2 General duty: cast iron body round,, adjustable head, sediment basket nickel bronze strainer, integral seepage pan suitable for installation in concrete floor, trap primer connection, and clamping collar.

2.2 TRAP SEAL PRIMERS

.1 Brass, with integral vacuum breaker, NPS 1/2 solder ends, NPS 1/2 drip line connection.

2.3 CLEANOUTS

.1 Cleanout Plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.

.2 Access Covers:

.1 Access Covers: face of wall type, round frame with secured cover, chrome plated bronze, vandal proof screws, beveled edge frame complete with anchoring lugs

.3 Floor Access Cleanouts-heavy traffic areas: heavy duty duct coated cast iron, removable positive gasket seal closure plug, 150mm round adjustable scoriated cast iron cover, CO cast in cover, adjustable collar, flashing clamp.

.4 Floor Access Cleanouts-Carpet and Linoleum floor finishes: heavy cast iron epoxy

coated, MJ, brass screws, round cover, adjustable collar, tile recess cover for inlay of finished flooring, nickel bronze finish, bronze plug with gasket seal.

.5 Floor Access Cleanouts-Ceramic Tile floor finishes: heavy cast iron epoxy coated, MJ, brass screws, square nickel bronze top, adjustable collar, nickel bronze finish, bronze plug with gasket seal.

2.4 NON-FREEZE WALL HYDRANTS (NFHB)

.1 NFHB: Non freeze, 1/4 turn non-drip, ceramic cartridge, 19mm non-freeze wall type with bronze face and stainless steel with full 180 deg. cover opening box, adjustable wall-flange operating key and self-draining integral vacuum breaker. Length to suit wall thickness

2.5 BACK FLOW PREVENTERS (GENERAL DUTY)

.1 Bronze body and covers, reduced pressure principal, dual mechanical stainless steel spring loaded poppet check valves, hydraulically dependent differential pressure relief valve, cast brass body, four test costs, dual full port ball shutoff valves.

.2 Approvals: CSA B64.4

.3 Max working pressure: 1205kPa.

.4 Temperature range: 1degC to 82degC.

.5 Size: Line size.

.6 Application: general backflow prevention.

2.6 STRAINERS

.1 1035 kPa, Y type with 20 mesh, stainless steel removable screen, bronze body screwed cap, threaded ends.

2.7 VENT FLASHINGS

.1 CSA approved stainless steel flashing sleeve with integral deck flange, premoulded urethane insulation liner, EPDM Triple Pressure Grommet Seal and EPDM Base Seal.

2.8 THERMOSTATIC MIXING VALVE

.1 Fixture thermostatic mixing valve, liquid filled thermal motor with piston driven positive shut off of hot supply if cold water supply lost to prevent scalding, valve to allow cold flow in event of loss or interruption of the hot water supply or thermostat failure, preset to 49degC, rough brass, key operated checkstops, liquid filled bi-metallic thermometer, FPT connections, built in cold water bypass, suitable for face/ eyewash application.

.2 Approvals: CSA B125/ASSE 1070.

.3 Mounting: Varies.

.4 Piping: prepiped w/ inlet and outlet shutoff. Compliance: ANSI Z358.1-1998.

.5 Capacity:

.1 To match supply line size.

.2 Flow rate based on supply temperature to fixture. DHW temp = 49 deg C, DCWS temp = 5 deg C, DHWS = 60 deg C

2.9 OIL INTERCEPTOR

.1 Steel construction, acid resistant coating interior and exterior, rated for 0.94L/s flow rate, bronze cleanout plug and visible double wall trap seal, removable combination pressure equalizing/flow diffusing baffle and sediment bucket, horizontal baffle, adjustable oil draw-off and vent connections on either side, secured gasketed non-skid cover, complete with flow control fitting. Oil float sensor, sensor box and remote display box.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with Canadian Plumbing Code, and as noted on drawings.

.2 Install in accordance with manufacturer's instructions and as specified.

3.2 CLEANOUTS

.1 In addition to those required by code, and as indicated, install at base of soil and waste stacks, and rainwater leaders..

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Line size to maximum 100 mm dia.

3.3 NON-FREEZE WALL HYDRANTS (NFHB)

.1 Install 600 mm above finished grade unless otherwise indicated.

3.4 BACK FLOW PREVENTERS

.1 Install in accordance with CSA-B64 Series as required by code.

.2 Pipe discharge to terminate over nearest drain or service sink c/w indirect connection using air gap drain.

.3 Provide adequate space all around valves to enable annual testing and service.

.4 Test to requirements of CSA B64-Series-01.

.1 All tests to be witnessed by Authority having jurisdiction and the Departmental Representative.

.2 Provide copies of all test certificates in O&M Manuals

3.5 TRAP SEAL PRIMERS (UP TO FOUR DRAINS)

.1 Install on cold water piping as indicated in concealed space with ball isolation valve..

.2 Distribution tubing from TSP to floor drain: minimum 13mm dia flexible copper tubing.

.3 Provide in line trap seal primer for all FD-1, not required for FD-2.

3.6 STRAINERS

.1 Install with sufficient room to remove basket.

3.7 PLUMBING VENT

.1 Coordinate with roof flashings and install as per manufacturers recommendations.

3.8 FLOOR DRAINS

.1 Install with flange countersunk in floor 1 mm below floor level.

.2 Coordinate membrane installation as required.

.3 Finished flooring to cover flange and butt up to strainer.

.4 Ensure strainers are completely covered and protected during concrete floor installation. Remove any debris and ensure drain clear.

.5 Connect to trap seal primer as specified.

3.9 START-UP

.1 Test, adjust and prove operation as indicated, to suit site conditions:

.1 Clean out strainers periodically until clear.

.2 Clean out and prime all floor drain traps using trap seal primers or other means acceptable to the National Plumbing Code.

.3 Test freedom of movement of cleanouts.

.4 Reduced pressure backflow preventors: test to requirements of CSA B64-Series-01

3.10 THERMOSTATIC MIXING VALVE

.1 Install mixing valve under counter below fixture.

.2 Adjust mixing valve to provide supply temperature to 45C.

.3 Provide all architectural modifications and repairs and replace/provide access hatch to valve as required for clean & complete mixing valve installation.

3.11 OIL INTERCEPTOR

.1 Coordinate conduit installation for remote oil float sensor display panel prior to pouring of slab.

.2 Provide sample point immediately downstream of oil interceptor.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 10 - Close Out Submittals.

1.2 REFERENCES

.1 CSA-B45 Series-99 Series-88, CSA Standards on Plumbing Fixtures.

.2 CSA-B125-01, Plumbing Fittings.

1.3 FIXTURES AND TRIM

.1 Manufacture plumbing fixtures in accordance with CSA B45 Series-02 (R2013).

.2 Manufacture plumbing fittings in accordance with CSA B125-12.

.3 Architectural drawings to govern in determination of number and location of fixtures.

.4 Fixtures of same service to be product of one manufacturer and of same type.

.5 Trim of same service to be product of one manufacturer and of same type.

.6 Exposed plumbing brass to be chrome plated.

Part 2 Product

2.1 BARRIER FREE WATER CLOSET

.1 WC-1:

.1 ADA barrier free compliant, floor mounted, vitreous china, low consumption 4.8L/flush, fully glazed 54mm internal trapway. Provide floor flange, flange bolts and gasket. Elongated bowl and seat.

.2 Standard of Acceptance: Kohler K-3609.

2.2 LAVATORIES

.1 LV-1: ADA Barrier free, countertop, vitreous china, self-draining deck, contoured back and side shields, 100mm centers, complete with carrier. Trim: lever handle faucet, 100mm centers.

.2 Standard of Acceptance: American Standard Cadet 9494.

2.3 MOP SINK MS-1

.1 Bowl: 600mm x 600mm x 250mm deep moulded stone, floor mounted sink with 25mm wide shoulders and stainless steel strainer.

.2 Trim: Exposed wall type supply with cross handles, spout wall brace, vacuum breaker, hose end spout, aerator, pail hook, eccentric adjustable inlets, integral screw driver stops with covering caps and adjustable threaded wall flanges, 1500mm of 15mm plain end reinforced rubber hose, hose clamp, mop hanger. Trim to be mounted 900mm above finished floor.

.3 Standard of Acceptance: Fiat 2424.

Part 3 Execution

3.1 INSTALLATION

.1 Connect fixtures complete with supplies and drains, trapped, supported level and square Hot water faucets shall be on left. Fixtures on outside walls to have supplies from floor; other fixtures to be served from wall. Wall hung fixtures to be securely and firmly mounted.

.2 Mounting heights for wall hung fixtures measured from finished floor:

.1 Standard: to comply with manufacturers roughing-in details unless otherwise indicated or specified.

.2 Accessible: to comply with NBC.

.3 Fixtures shall be serviced as follows:

Fixture	Waste (mm)	Vent (mm)	CW (mm)	HW (mm)
Lavatory	38	38	13	13
Water Closet	75	38	13	-

3.2 START-UP

.1 Flush valves: adjust settings to suit site conditions

.2 Aerator screens and strainers: clean out.

.3 Tempered water supply thermostatic mixing valves: adjust to maximum 32degC.

.4 DHW temperature stops: adjust to max DHW temp 40°C when faucet is running.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 50 00 - Temporary Facilities and Controls.

1.2 EXISTING PRODUCTS

.1 Use of new permanent heating systems for supplying temporary heat is permitted only under the following conditions:

.1 Use of new HW boilers and hydronic heating system is permitted on approval of the Departmental Representative and on completion of the following:

.1 Installation and testing of HW appliances, pumps, piping and incidentals to facilitate an operational system.

.2 Flushing and cleaning of all HW and permanent natural gas, propane gas or fuel oil piping. Use of temporary piping systems is not acceptable.

.3 Permanent installation of all HW appliance breeching, chimneys and sealed or side wall venting systems.

.4 Permanent installation of all terminal heating units. Use of temporary heating units is not acceptable.

.5 A temporary filtration system for all appliance burners to a minimum MERV 7 as defined by ASHRAE 52.2-1999.

.6 Clean all chimneys and breeching where directed by Departmental Representative.

.7 Replace oil burner nozzles where applicable.

.2 Submit for approval a detailed temporary heating plan outlining the proposed measures, remedial work and operating duration for use of permanent systems for supplying temporary .

.3 Obtain written approval from the Departmental Representative prior to implementing plan.

.4 Monitor and record continuously, all maintenance carried out and performance.

.5 Refurbish to as-new condition before final inspection and acceptance

.2 Construction use of air systems, air handling units, heat recovery ventilators, fans or any associated equipment and systems for ventilation, heating, de-humidification, humidification, dust control or any other use is strictly prohibited during the course of construction.

Part 2 NOT USED

2.1 NOT USED

.1 NOT USED

Part 3 NOT USED

3.1 NOT USED

.1 NOT USED

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 10 - Closeout Submittals.

.3 Section 23 05 93 - Testing, Adjusting and balancing for HVAC.

1.2 INTENT

.1 Provide a complete, fully tested and operational mechanical system to meet requirements specified herein and in accordance with local codes and ordinances. Include all costs to obtain all permits and pay for all fees and charges including inspection charges by authorities that issue the permits. Coordinate all related inspections, fee and permits including:

.1 Plumbing

.2 Fuel Oil

.3 Ventilation

.4 Boilers

.5 Building HVAC

.6 Dry chemical fire extinguishers

.2 Contract documents of Divisions 21, 22, 23 and 25 and the mechanical drawings are diagrammatic and approximately to scale unless detailed otherwise. They establish scope, material and installation quality and are not detailed installation instructions.

.3 Follow manufacturers detailed installation instructions, details and procedures for equipment, supplemented by the requirements of these documents.

.4 Install equipment and systems generally in locations and routes shown with minimum interference with other services or free space. Remove and replace improperly installed equipment to satisfaction of the Departmental Representative at no extra cost.

1.3 EQUIPMENT LIST

.1 Complete list of equipment and materials to be used on this project and forming part of tender documents by adding manufacturer's name, model number and details of materials, and submit for approval.

.2 Submit for approval within 14 days after award of contract

1.4 TRIAL USAGE

.1 Departmental Representative may use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Trial usage to apply to following equipment and systems: AHU, Heat Pump, Boilers, Building Controls, Plumbing Fixtures,

1.5 ANCHOR BOLTS & TEMPLATES

.1 Supply anchor bolts and templates for installation by other divisions where required.

1.6 PROTECTION OF OPENINGS

.1 General requirements: protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system.

1.7 PAINTING

.1 Prime and touch up marred finished paintwork to match original.

.2 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.

1.8 MOTORS

.1 Provide motors to CSA Standards for mechanical equipment as specified.

.2 If delivery of specified motor will delay delivery or installation of any equipment, install motor approved by Departmental Representative for temporary use. Final acceptance of equipment will not occur until specified motor is installed.

.3 Motor phase, cycle and voltage are specified within this Division. Coordinate with Division 16 regarding specified or substitute motors. Refer discrepancies to Departmental Representative for review.

.4 Types:

.1 Constant speed: open drip proof, TEFC, as specified in specific technical sections or as indicated.

.2 Variable frequency/speed: TEFC, NEMA MG1-2014 Part 31 suitable for use with VFD.

.3 All motors to be high power factor for 0.75kW and larger.

.4 All motors to be TEFC for 0.37kW and larger.

.5 Efficiency:

.1 Motors 1.2kW or less: minimum efficiency 85%

.2 Motors >1.2kW and up to 1.5kW: minimum efficiency 87%.

.3 Motors >1.5kW and up to 3.7kW: minimum efficiency 89%.

.4 Motors >3.7kW and up to 7.5kW: minimum efficiency 91%

.5 Motors >7.5kW and up to 18.7kW: minimum efficiency 92%.

.6 Motors greater than 18.7kW: minimum efficiency 94%

.6 Shaft grounding:

.1 Provide shaft grounding assembly for all motors 0.75kW and larger controlled by Variable Frequency Drive. Shaft grounding device to be in the form of brush that resides on the motor shaft. Brush assembly shall be capable of tolerating misalignment and maintaining rotating contact throughout the motor's life and as follows:

.1 Material: Material used in the grounding assembly shall be stable material commonly used within industry that is not believed to constitute a hazardous material under Occupational Safety and Health regulations.

.2 Brushes: Specifically developed carbon compounds of sustained performance with wear life expectancy of 3 years minimum.

.3 Seals: In wet or severe environment applications, brush contact area shall be of sealed type to keep contaminants from entering the shaft grounding system.

.4 Shaft grounding assembly installation shall not affect the motor manufacturer warranty. Where the severe environment conditions require application of the shaft grounding types that are screwed into the motor shaft, the installation of the shaft grounding system shall be performed either by the motor manufacturer or by the motor manufacturer authorized facility.

.5 Manufacturer: Shaft grounding Inc. or approved.

.2 Bond the brush to the closest ground point using code sized green insulated stranded copper conductor per manufacturer instructions.

.3 Test and verify the performance of the assembly to ensure that under no conditions the shaft voltage exceeds 3 volts.

1.9 O&M MANUALS

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 10 - Closeout Submittals. Include all operations, maintenance, performance, equipment and record drawing data described below.

.2 Operation and maintenance manual to be approved by, and final copies deposited with the Departmental Representative.

.3 Operation data to include:

.1 Control schematics for each system including environmental controls.

.2 Description of each system and its controls.

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

.4 Operation instruction for each system and each component.

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

.6 Valves schedule.

.7 Colour coding chart.

.4 Maintenance data shall include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

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

.5 Performance data to include:

.1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.

.2 Equipment performance test results.

.3 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.6 Equipment data to include:

.1 Complete reviewed shop drawings of all mechanical equipment including details of suppliers.

.7 Record Drawings:

.1 Provide reduced photocopy of mechanical as built drawings. Drawings to be reduced to approx 279mmx432mm and to be reduced scale. Blueline copies are not acceptable.

.8 Provide FOUR copies of O&M manuals per Section 01 78 00.

1.10 CLEANING

.1 Cleaning activities are specified in Section 01 74 00 - Cleaning, however, provide special emphasis on HVAC equipment and duct systems to remove contaminants from the systems prior to operation of any permanent ventilation equipment.

1.11 RECORD DRAWINGS

.1 Site records as per Section 01 78 10 - Closeout Submittals and as follows:

.1 Departmental Representative will provide 1 set of reproducible mechanical

drawings. Provide sets of white prints as required for each phase of the work. Mark thereon all changes as work progresses and as changes occur. This shall include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Use different colour waterproof ink for each service.

.3 Make available for reference purposes and inspection at all times.

.4 Transfer valve schedule number to site records identifying all tagged valves on drawings.

.5 Transfer total corrected HW media volume to site records.

.2 Record drawings as per 01 78 10 - Closeout Submittals and as follows:

.1 Prior to start of Testing, Adjusting and Balancing (TAB), finalize production of Record drawings.

.2 Record information to be transferred to final record files and hard copy utilizing AutoCAD. Drawing standards to be as per current standards utilized for completion of original drawings.

.3 Provide full size drawings for review by Departmental Representative. Provide final copies including all necessary changes.

.4 Transfer valve schedule number and copy of valve schedule identifying all tagged valves on drawings.

1.12 WASTE MANAGEMENT AND DISPOSAL

.1 Do not dispose of unused paint material into sewer system, into streams, lakes, onto ground or in other locations where it will pose health or environmental hazard.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Dispose of corrugated cardboard packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.13 FIRESTOPPING

.1 Sleeves as specified Section 23 05 01 - Installation of Pipework.

.2 Firestopping to the requirements of Section 07 84 00 - Fire stopping, supplemented as specified herein.

.3 Firestopping and smoke seal systems are based on the Hilti intumescent sealant system when installed in accordance with ULC certification and the manufacturers instructions.

.4 Provide the following fire stopping systems for pipework:

.1 Metallic uninsulated unheated pipes not subject to movement(FO):

.1 Sleeves not required.

.2 Fire stop piping with listed intumescent sealant to manufactured listings.

.2 Metallic insulated pipes not subject to movement (DCW & Water Service):

.1 Sleeve penetration and secure to wall. Pipe insulation to be continuous thru sleeve.

.2 Pack void with approved fire stop insulation or backing to ULC listing of sealant. Fire seal sleeve to wall with listed intumescent sealant to manufactured listings. Fire seal insulation to sleeve with minimum thickness listed intumescent sealant as per ULC listing of sealant.

.3 Metallic insulated pipes subject to movement (HW / DHW / DHWR):

.1 Sleeve penetration and secure to wall.

.2 Pipe insulation to be continuous thru sleeve Pack void with approved fire stop insulation or backing to ULC listing of sealant. Fire seal sleeve to wall with listed intumescent sealant to manufactured listings. Fire seal insulation to sleeve with minimum thickness listed intumescent sealant as per ULC listing of sealant.

.4 Plastic uninsulated pipes 50dia or less:

.1 Sleeves not required.

.2 Fire and smoke seal piping in place with listed intumescent sealant to manufactured and ULC listings.

.5 Plastic uninsulated pipes 63dia or larger:

.1 Sleeves not required.

.2 Provide listed fire stop collar smoke sealed in place with listed intumescent sealant to manufactured and ULC listings.

.5 All piping/duct penetrations thru 45min rated assemblies without separations to be cold smoke sealed/fire sealed with listed intumescent sealant or approved cold smoke sealed at fire penetrations to sealant ULC listing.

.6 Intumescent sealant:

.1 ULC/FM listed intumescent sealant, water based, containing no halogen, solvents or asbestos, suitable as fire and smoke sealant.

.2 Testing: to ULC S-115.

.3 Density: 1.5g/cm3.

.4 Working time: approx 20-30min.

.5 Curing time: approx 14-21 days.

.6 Intumescent activation: approx 121 degC.

.7 Temperature resistance: -40degC to 100degC.

.8 Application temperature: 2degC to 38degC.

.9 Flame spread: 0 to ASTM E84-96.

.10 Smoke developed: 5 to ASTM E84-96

.7 Intumescent Fire Stop Collars

.1 ULC/FM listed with galvanized metal collar, intumescent fire sealant for use with PVC and ABS sched 40 drainage piping.

.2 Testing: to ULC S-115 at 50 Pa pressure differential.

.3 Density: 1.5g/cm3.

.4 Intumescent activation: approx 121 degC.

.5 Flame spread: 0 to ASTM E84-96.

.6 Smoke developed: 5 to ASTM E84-96

1.14 SPARE PARTS

.1 Furnish spare parts in accordance with Section 01 78 10 - Closeout Submittals and as a minimum as follows:

.1 One casing joint gasket for each size pump.

.2 One set of belts for each piece of machinery.

.3 One filter cartridge or set of filter media for each filter or filter bank in addition to final operating set.

.4 20L pail of corrosion inhibitors.

.5 20L sealed drum of specified premixed heating water and heat pump water media (in addition to media required for filling and testing the systems).

.6 Additional spare parts as amended in any of sections of 22 & 23.

1.15 SPECIAL TOOLS

.1 Provide one set of special tools required to service equipment as recommended by manufacturers and as indicated in equipment specifications and in accordance with Section 01 78 10 - Close Out Submittals.

1.16 CONTRACT PRICE BREAKDOWN

.1 Provide detailed breakdown of Mechanical Sub-Contractor's work prior to first progress draw. Breakdown as follows.

Mechanical Contract Breakdown

		Cost
1.	Plumbing Material	$
2.	Plumbing Labour	$
3.	Heating Material	$
4.	Heating Labour	$
5.	Ventilation and Cooling Material	$
6.	Ventilation and Cooling Labour	$
7.	Controls Material	$
8.	Controls Labour	$
	Total	$

1.17 TRAINING

.1 These requirements supplment and do not supercede the requirements of Section 01 91 41 Commissioning: Training.

.2 Provide two days of project-specific training within one week, 3-hour sessions per day, to the Owner's O& M personnel

.3 Provide instruction to designated personnel in adjustment, operation, maintenance, pertinent safety requirements, of equipment and EMCS installed.

.4 Train O& M personnel in functional operations and procedures to be employed for system operation, include overview of system architecture, communications, operation of computer and peripherals, report generation; detailed training on operator interface functions for control of mechanical systems, CDL's for each system, and elementary preventive maintenance.

.5 At least 10 days prior to anticipated date of commencement of training, provide complete hour-by-hour schedule complete with brief overview of content of each segment to the Departmental Representative and Owner.

.6 Trainers to be competent, thoroughly familiar with all equipment and aspects of EMCS installed in the facility.

Part 2 NOT USED

2.1 NOT USED

.1 NOT USED

Part 3 NOT USED

3.1 NOT USED

.1 NOT USED

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 23 25 00 - HVAC Water Treatment Systems.

.2 Section 01 74 00 - Cleaning.

.3 Section 07 84 00 - Fire Stopping.

.4 Section 23 05 03 - Mechanical Start-up.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

Part 2 NOT USED

2.1 NOT USED

.1 NOT USED

Part 3 Execution

3.1 CONNECTIONS TO EQUIPMENT

.1 In accordance with manufacturer's instructions unless otherwise indicated.

.2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

.3 Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.2 CLEARANCES

.1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

.2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

3.3 DRAINS

.1 Install piping with grade in direction of flow except as indicated.

.2 Install drain valve at low points in piping systems, at equipment and at section

isolating valves.

.3 Pipe each drain valve discharge separately to above floor drain where indicated. Discharge to be visible

3.4 AIR VENTS

.1 Install manual air vents at high points in piping systems except provide automatic air vents in mechanical room or where indicated.

.2 Install isolating valve at each automatic air valve.

3.5 DIELECTRIC COUPLINGS

.1 General:

.1 To be compatible with and to suit pressure rating of piping system.

.2 Where pipes of dissimilar metals are joined.

.2 Pipes NPS 2 and under: isolating unions, flanges or cast brass adapters.

.3 Pipes NPS 2 1/2. and over: isolating flanges.

3.6 PIPEWORK INSTALLATION

.1 Screwed fittings jointed with Teflon tape unless otherwise noted.

.2 Protect openings against entry of foreign material.

.3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

.4 Assemble piping using fittings manufactured to ANSI standards.

.5 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main.

.6 Install exposed piping, equipment, rectangular clean outs and similar items parallel or perpendicular to building lines.

.7 Install concealed pipework to minimize furring space, maximize headroom, conserve space. Run exposed piping parallel to walls.

.8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.9 Install, except where indicated, to permit separate thermal insulation of each pipe.

.10 Group piping wherever possible and as indicated.

.11 Ream pipes, remove scale and other foreign material before assembly

.12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.13 Provide for thermal expansion as required and where indicated.

3.7 SLEEVES

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

.2 Material: min 16ga formed steel or galvanized sched 10 pipe.

.3 Construction: provide sleeves with annular fin continuously welded at midpoint or offset.

.1 Where sleeve extends above finished floor. Secure fin in floor.

.2 Where sleeve set in wall. Sleeve offset to one side of wall or adjust annular fin to center sleeve thru wall. Secure fin to wall.

.4 Sizes: 6 mm minimum, 13mm maximum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

.5 Coat exposed exterior surfaces of ferrous sleeves with heavy application of zinc rich paint to CAN/CGSB-1.181-99.

3.8 ESCUTCHEONS

.1 On pipes passing through walls, partitions, floors and ceilings in finished areas.

.2 Simulated chrome finish plastic one piece or split type without set screws.

.3 Outside diameter to cover opening or sleeve.

.4 Inside diameter to fit around finished pipe.

3.9 PREPARATION FOR FIRESTOPPING

.1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation to Section 07 84 00 - Fire Stopping.

.2 Uninsulated unheated pipes not subject to movement: No special preparation.

.3 Uninsulated heated pipes subject to movement: Wrap with non-combustible smooth material to permit pipe movement without damaging firestopping material or installation.

.4 Insulated pipes and ducts: Ensure integrity of insulation and vapour barriers.

3.10 FLUSHING OUT OF HVAC PIPING SYSTEMS

.1 In accordance with Section 23 25 00 - HVAC Water Treatment Systems.

.2 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 74 00 - Cleaning.

.2 Section 07 84 00 - Fire stopping.

.3 Section 23 25 00 - HVAC Water Treatment Systems.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB).

.2 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA).

.3 CAN/CSA-B139, Installation Code for Oil Burning Equipment.

1.3 GENERAL

.1 This section covers testing of piping systems and duct systems and startup of systems common to all sections of Division 23.

1.4 DEFINITIONS

.1 Initial Tests:

.1 Tests performed prior to final tests to verify general systems integrity. Tests are performed by the Contractor at their discretion.

.2 Final Tests:

.1 Mandatory tests performed to confirm system integrity. Final tests to be witnessed by Departmental Representative and Authority having jurisdiction except where specifically noted.

Part 2 NOT USED

2.1 NOT USED

.1 NOT USED

Part 3 Execution

3.1 NOTIFICATION

.1 Give 7 days written notice of date and test type for Final Tests.

.2 Provide written notice as per the requirements of Section 01 33 00-Submittal Procedures.

.3 Written notice to include request for confirmation of witnessing of Final Tests by Departmental Representative and Authority having jurisdiction.

3.2 COSTS

.1 Bear all costs for testing, making good and retesting.

.2 Final Tests are not complete until accepted by Departmental Representative and Authority having jurisdiction. No additional payment shall be made for retesting to meet requirement of these parties for acceptance of tests.

3.3 WITNESSES

.1 Witnessing of tests by the Departmental Representative and Authority having jurisdiction may be provided by designated Alternates at the discretion of the Departmental Representative or Authority having jurisdiction.

3.4 TESTING (GENERAL)

.1 Insulate or conceal work only after testing and approval by Departmental Representative.

.2 Conduct tests from commencement to finish in presence of Departmental Representative and Authority having jurisdiction or designated Alternate witnesses except where Acceptance of test is waived as per Part 3.3.

.3 Bear costs including retesting and making good.

.4 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures or test medium.

.5 Check systems during application of test presssure including visual check of leakage of water test medium, soap test for air or nitrogen test medium and halide torch for refrigerant medium.

.6 When using water as test medium for system not using water or steam, evacuate and dehydrate piping and certify that lines are dry. Use agency specializing in this work.

3.5 PIPEWORK TESTS

.1 General:

.1 Provide the following tests for complete assembled systems.

.2 Section systems as necessary for all initial tests and test complete system for final tests.

.3 Check systems during application of test pressure including visual check for leakage of water test medium, soap bubble test for air.

.4 During heating and cooling piping system tests, check linear expansion at elbows, U bends, expansion joints and offsets for proper clearance.

.5 When using water as test medium for system not using water, evacuate and dehydrate the piping and certify the lines are dry. Use agency specializing in this type of work.

.6 Check systems during application of test pressure including visual check for leakage of water test medium, soap bubbler test for air or nitrogen test medium and halide torch for refrigerant medium.

.7 Should tests indicate defective work or variance with specified requirements, make changes immediately to correct the defects. Correct leaks by re-making joints in screwed fittings, cutting out and re-welding welded joints, re-making joints in copper lines. Do not caulk.

.2 HW Piping:

.1 Initial test: Pneumatic. Acceptable for boarding where heating not available. Test pressure 413kPa. Minimum 30 minutes.

.2 Final test: Hydraulic. Minimum 860kPa. Minimum 24hrs.

.3 DWV Piping:

.1 Initial test: Provide for sectional ball tests to NPC where directed by Departmental Representative or Authorities having jurisdiction.

.2 Final tests: Hydraulic test for all drainage piping with minimum 1.5 m of hydrostatic head for 15 minutes.

.4 Domestic water(Rigid Piping):

.1 Initial test: Pneumatic. Acceptable for boarding where heating not available. Test pressure not less than 413kPa. Minimum 30 minutes.

.2 Final test: Hydraulic. Minimum 860kPa. Minimum 12hrs.

.5 Fuel Oil:

.1 Test system in accordance with CAN/CSA-B139 and CAN/CSA-B139 and authorities having jurisdiction.

.2 Test all suction and supply piping under 15in Hg vacuum and maintain vacuum for minimum 5min without loss of vacuum with no additional vacuum applied during test period.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 22 30 05 - Domestic Water Heaters.

.2 Section 23 05 93 - Testing, Adjusting and Balancing.

.3 Section 23 52 00 - Heating Boilers.

.4 Section 23 72 00 - Air To Air Energy Recovery Equipment

1.2 GENERAL

.1 This section covers testing of piping systems and duct systems and startup of systems common to all sections of Divisions 22, 23 and 25.

1.3 START-UP OF MECHANICAL SYSTEMS (GENERAL)

.1 Conduct operating startup to confirm that equipment and systems meet specified requirements after mechanical installations are completed and pressure tested and all systems operational. Conduct startup as soon as conditions permit. Make changes, repairs, adjustments and replacements required as tests may indicate prior to final operating tests.

.2 Startup only after completion of all pressure testing and substantially complete installation of systems.

.3 During start up advise Departmental Representative in writing of any system deficiencies that are evident and request direction.

.4 Make start up for a minimum of seven days under maximum available operating load conditions.

.5 Where seasonal lockout of equipment is specified override seasonal lockout and operate equipment for full seven days of startup. Where seasonal conditions do not allow for this, provide for deferred 7-day startup of affected system.

.6 Where lead/lag or main/standby staging specified override normal staging to change lead equipment on 24 hour rotation for full seven days of startup.

.7 Start up to occur in conjunction with EMCS Contractor and manufacturer startup and testing.

.8 During startup provide the following operations and maintenance procedures:

.1 Lubricate bearings, adjust and/or replace and set direct and V belt drives for proper alignment and tension.

.2 Calibrate and adjust thermostats, thermometers, gauges, linkage and dampers. Control valves shall operate freely.

.3 Operate and test motors and speed switches for correct wiring and sequences. Check overload heaters in motor starters.

.4 Air systems:

.1 Startup fans, coil circulators, exhaust air systems and interlocked cooling systems.

.2 Verify operation of mixing sections, blenders, filters.

.3 Balance systems in conformance with Section 23 05 93 - Testing, Adjusting and Balancing.

.4 Complete all fire dampers tests in conformance with Section 23 05 93 - Testing, Adjusting and Balancing.

.5 Complete acoustic testing in conformance with Section 23 05 93 - Testing, Adjusting and Balancing.

.6 Operate all air systems at normal operating set points at 100% for building flush out for one week. The one week operation can occur during the one week startup. See Section 23 72 00 - Air to Air Recovery Equipment and Section 23 05 93 - Testing, Adjusting and Balancing for additional requirements.

.7 Replace and clean filters. Clean fan wheels and coils.

.5 Hydronic systems:

.1 Startup pumps, boilers and all ancillary equipment.

.2 Verify operation of all equipment.

.3 Balance systems in conformance with Section 23 05 93 - Testing, Adjusting and Balancing.

.4 Complete all water treatment in conformance with 23 25 00 - HVAC Water Treatment Systems.

.5 Complete manufacturer startup of boilers where specified.

.6 Check system and correct for fluid noise in distribution and pump noise including noise evident of cavitation or pump coupling misalignment.

.7 Provided that the flow rate exceeds that specified at maximum pump speed, on direction by Departmental Representative, shave impeller on pumps larger than 1.5kW where current draw exceeds motor full load amps.

.6 Domestic water systems:

.1 Provide startup of DW systems and equipment specified in Division 22.

.2 Startup all pumps, hot water heaters, and ancillary equipment.

.3 Balance systems in conformance with Section 23 05 95 - Testing, Adjusting and Balancing.

.4 Complete all flushing and cleaning and disinfection as specified.

.5 Ensure all water hammer arrestors are installed and functioning. For each fixture or branch system let one outlet run for 10 seconds then shut water off quickly. If hammer occurs, replace arrestor.

.6 Aerator screens and strainers: clean out.

.7 Drainage systems:

.1 Provide startup of DW systems and equipment specified in Division 22.

.2 Ensure all traps primed.

.3 Flush each valve, operate each faucet to ensure drainage and trap anti-siphoning venting is effective.

.4 Open each cleaout cover and reseal. Ensure all CO are fully accessible.

1.4 SYSTEM TESTS

.1 Conduct specified system tests in presence of Departmental Representative to confirm that equipment and systems meet specified requirements. Conduct system tests during inspection and only after system startup completed.

.2 Where directed by the Departmental Representative make changes, repairs, adjustments and replacements within the scope of these documents as required to allow completion of the system tests.

.3 Provide all tools and equipment necessary to complete specified tests. Patch and make good any damage created during tests at no additional cost.

.4 Provide tradespersons knowledgeable in operation of all systems to be tested and demonstrated as required to complete specified tests for the duration of the one day testing period.

.5 Provide the following tests to be witnessed by the Departmental Representative:

.1 Prove random access to cleanouts at the direction of the Departmental Representative.

.2 Prove random access through access doors at the direction of the Departmental Representative.

.3 Prove random operation of plumbing fixtures including maximum DHW temperature at high limit protected plumbing fixtures and run time on all spring or metered fixtures.

.4 Demonstrate operation of all air and water systems & controls

.6 Prove operation of all safety systems for the following systems or provide test data from Authority having jurisdiction proving successful completion of tests:

.1 All HW Boilers.

.2 All DWH heaters.

.3 All fuel systems.

Part 2 NOT USED

2.1 NOT USED

.1 NOT USED

Part 3 NOT USED

3.1 NOT USED

.1 NOT USED

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Sections 01 33 00 - Submittal Procedures.

.2 Section 01 78 10 - Closeout Submittals.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).

1.3 SUBMITTALS

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

.2 Submit product data and indicate for items as applicable:

.1 Data to include:

.1 Manufacturer, model number, line contents, pressure and temperature rating.

.2 Movement handled; axial, lateral, angular and the amounts of each.

.3 Nominal size and dimensions including details of construction and assembly.

Part 2 Products

2.1 ANCHORS AND GUIDES

.1 Anchors: as indicated.

.2 Alignment guides:

.1 Carbon steel, galvanized finish, piping guide.

2.2 EXPANSION JOINTS

.1 Piped expansion joints. Dimensions as indicated on drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Install pipe anchors, expansion offsets and joints and guides as indicated and as required to control expansion and contraction of piping.

.2 Anchors to withstand 150 % of axial thrust.

.3 Provide guides at 4dia and 14dia up and downstream of expansion joints and offsets.

.4 Install expansion joints and offsets with cold setting. Do not compress or expand connectors during installation.

.5 Provide structural work as required to allow installation of pipe anchors and guides.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 23 05 54 - Mechanical Identification.

.3 Section 01 78 10 - Closeout Submittals.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME).

.2 Canadian General Standards Board (CGSB).

Part 2 Products

2.1 GENERAL

.1 Design point to be at mid point of scale or range.

2.2 DIRECT READING THERMOMETERS

.1 Bi-metal dial type direct reading.

.2 Accuracy: +/-1% of dial span throughout entire range to CAN/CGSB-14.4-M88.

.3 Case: hermetically sealed, 304 stainless steel socket with slip ring. .

.4 Helix: silicone dampening of bimetallic element.

.5 Socket and Stem: 304 stainless steel.

.6 Stem length: 100mm-150mm as required for insulation.

.7 Dial: white coated aluminum with black lettering.

.8 Lens: flat glass

.9 Size: 50mm

.10 Ranges:

.1 HW & DW: 0 to 120degC

.2 Boiler & DHWH Vent: 0 to 550degC.

.3 Duct: -70 to 70degC.

2.3 THERMOMETER WELLS

.1 Copper pipe: copper or bronze..

.2 Steel pipe: brass or stainless steel.

2.4 PRESSURE GAUGES

.1 Dial type to ASME B40.1-2013, self indicating, 2% accuracy and plain case with twist locking ring and recalibration adjustment.

.2 Bourdon tube: copper alloy tube, tip and socket.

.3 Dial: Steel, white enamel background, black printed labels.

.4 Lens: flat glass.

.5 Movement: brass, bronze bushings, stainless steel pinion and arbor.

.6 Size: 50mm.

.7 Snubbers: brass body, as required.

.8 Ranges:

.1 HW:0-413kPa

.2 DW:0-1100kPa

2.5 GAUGE VALVES

.1 Class 600, regular port, threaded, bronze body, plated brass ball, brass gland and PTFE Teflon seat, wing handle, screwed.

Part 3 Execution

3.1 GENERAL

.1 Install so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading units on approval of Departmental Representative.

.2 Install between equipment and first fitting or valve.

3.2 THERMOMETERS

.1 Install in wells on piping. Provide heat conductive material inside well.

.2 Install in locations as indicated and as follows:

.1 HW/DW: as indicated on drawings.

.3 Use extensions where thermometers are installed through insulation.

3.3 PRESSURE GAUGES

.1 Install as indicated.

.2 Install snubbers where required to provide stable indication of system pressure.

.3 Provide specified ball isolation valves.

.4 Use extensions where pressure gauges are installed through insulation.

3.4 NAMEPLATES

.1 Install engraved lamicoid nameplates as specified in Section 23 05 54 - Mechanical Identification, identifying medium.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures

.2 Section 01 78 10 - Closeout Submittals

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME).

.2 American Society for Testing and Materials International, (ASTM).

.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).

Part 2 Products

2.1 BALL VALVES

.1 Provide for all heating isolation valves 50 dia. and smaller.

.2 Class 600, bronze body, full bore, forged brass ball, brass gland and PTFE Teflon seat, steel lever handle, screwed.

.3 Class 600, bronze body, forged brass ball, brass gland and PTFE Teflon seat, steel lever handle, with soldered joint end.

2.2 CHECK VALVES

.1 To MSS SP-80-2013, Class 125, 860 kPa, bronze body, bronze swing disc, Y-pattern, screw in cap, regrindable seat, soldered.

.2 To MSS SP-80-2013, Class 125, 860 kPa, bronze body, bronze swing disc, Y-pattern, screw in cap, regrindable seat, screwed.

.3 Class 125, 860 kPa, bronze body, bronze disc, lift type, vertical way, screwed ends.

2.3 DRAIN VALVES

.1 Minimum 13dia, class 600, bronze body, full bore, forged brass ball, brass gland and PTFE Teflon seat, steel lever handle, screwed, male hose end c/w cap and chain.

2.4 RADIATOR GLOBE VALVES

.1 Class 100, bronze body, globe radiator valve c/w piggy back drain valve.

2.5 GLOBE VALVES

.1 Bronze body to MSS SP-80-2013, Class 125, 860 kPa, screwed bonnet, renewable Teflon disc, swivel type disc holder, screwed or soldered.

.1 Lock shield handles as indicated.

2.6 STRAINERS

.1 50dia and smaller: Class 150, 1033 kPa, Y-pattern, screwed cap, stainless steel screen, bronze body, screwed.

.2 Strainers to be line size.

2.7 FLOW BALANCING VALVE & MEASURING STATION

.1 Hydronic circuit balancing valve c/w pressure differential read-out ports.

.2 Shut off: positive drip proof.

.3 Metering ports: 6mm dia NPT brass, nordel check valves and gasketted caps.

.4 Drain ports: additional 6mm NPT connections with brass plugs.

.5 Valve body: Y pattern, equal percentage globe style.

.6 Construction: Y pattern, bronze body, high strength engineered resin plug with precision contoured channels for uniform flow distribution, bronze stem, high strength resin hand wheel and sleeve, minimum 4-360 turns from full open to full closed, hidden memory feature.

.7 Connections: sweat or threaded.

.8 Size: as indicated on drawings..

Part 3 Execution

3.1 INSTALLATION

.1 Install using stem valves in upright position with stem above horizontal unless otherwise approved by Departmental Representative.

.2 Remove internal parts before soldering.

.3 Install valves with unions or flanges as indicated at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

.4 Install to manufacturer's recommendations.

.5 Maintain proper clearance to permit service and maintenance.

.6 Should deviations beyond allowable clearances arise, request and follow Engineer's

directive.

.7 Install specified valves at all branch take-offs and as indicated.

.8 Install flow measuring stations and flow balancing valves at locations as indicated. Provide required straight pipe to manufacturers recommendations .

.9 Provide silent check valves in vertical pipes with downward flow and as indicated.

.10 Provide swing check valves on discharge of pumps as indicated.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 10 - Closeout Submittals.

.3 Refer to Structural Plans.

1.2 REFERENCES

.1 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)

.2 American Society for Testing and Materials (ASTM)

.3 Factory Mutual (FM)

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.5 Underwriter's Laboratories of Canada (ULC)

1.3 DESIGN REQUIREMENTS

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by ASME B31.1 or MSS SP58

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP58.

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.

.3 Support from structural members. Where structural bearing does not exist, provide supplementary structural members.

2.2 UPPER ATTACHMENTS

.1 Steel joist:

.1 Cold piping 50 dia. and under: galvanized steel washer plate with double locking nuts.

.2 Steel channel, joist or angle (bottom):

.1 Malleable iron C clamp to MSS SP-58-2009, type 23, galvanized. ULC listed.

.3 Steel channel, joist or angle (top):

.1 Malleable iron top of beam C clamp to MSS SP-58-2009, type 19, galvanized. ULC listed.

.4 Concrete:

.1 Insert type expanding anchor with 10dia internal threaded rod connection, galvanized steel, CSTB approved. ULC listed.

.5 Wood Joist/Beams or Wood Deck:

.1 All piping 50 dia & under and all plastic DWV piping: black malleable iron, galvanized, ceiling flange, rod or pipe threaded.

.6 Wall Hangers:

.1 Carbon steel, plain, medium duty suitable for loads to 675kg, suitable for loading from top or bottom, width as required. Complying with MSS-SP-69 (Type 32).

.2 Bottom loads: provide carbon steel washer plate, size to suit rod size.

2.3 MIDDLE ATTACHMENT

.1 Electro-galvanized carbon steel threaded rod material to MSS SP58.

2.4 PIPE ATTACHMENT

.1 Cold steel, cast iron and PVC/ABS piping, all hot steel piping less than 75dia and all copper piping where insulation shields and inserts provided: plain steel, adjustable clevis to MSS-SP-69 (Type 1), ULC listed, rated to 343degC, extended vertical risers as required for insulation.

.2 Hot steel piping 100dia and larger: cast iron roll, carbon steel yoke, roll rod and hex nuts, complying to MSS-SP-69(Type 43).

.3 All cold and hot copper piping where insulation shields and inserts not provided:

adjustable clevis to MSS SP 58-2009, type 1, Copper plated.

.4 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563 where indicated.

.5 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69 where indicated.

.6 Trapeze hangers: continuous slot formed hot dipped or electro-galvanized channel, 12Ga minimum with proprietary mounted fasteners and electro galvanized pipe clamps.

2.5 RISER CLAMPS

.1 Steel or cast iron pipe: galvanized carbon steel to MSS SP58, type 42, UL listed.

.2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

2.6 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

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

2.7 WALL CLAMPS

.1 Continuous slot formed hot dipped galvanized channel, 12-14Ga with proprietary mounted fasteners and standard pipe clamps.

2.8 HOUSE-KEEPING PADS

.1 For base-mounted equipment: Concrete, at least 100 mm high, 150 mm larger all around than equipment unless otherwise required to meet Seismic Restraint Requirements as specified in Section 23 05 49, and with chamfered edges.

.2 Concrete: as per Structural Plans.

Part 3 Execution

3.1 INSTALLATION

.1 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

3.2 HANGER SPACING

.1 Spacing and middle attachment (rod) diameter as specified in paragraphs below or as in table below, whichever is more stringent.

.1 Plumbing piping: most stringent requirements of Canadian Plumbing Code.

.2 Fire protection: to applicable ANSI/NFPA requirements.

.3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.

.4 Copper piping: up to NPS 1/2: every 1.5 m.

.5 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at each joint joint or to the manufacturers recommendations which ever is more stringent.

.6 Within 300 mm of each elbow unless piping otherwise suitably supported to approval of Departmental Representative.

.7 Pipework greater than NPS 12: to MSS SP69.

.2 Hanger Schedule:

Pipe Size	Rod Diameter	Maximum Spacing Steel	Maximum Spacing Copper
(up to) 32 dia	10mm	2.1m	1.8m
38 dia	10mm	2.7m	2.4m
50 dia	10mm	3.0m	2.7m
63 dia	10mm	3.6m	3.0m
75 dia	10mm	3.6m	3.0m
100 dia	16mm	4.2m	3.6m
150 dia	22mm	5.1m	

3.3 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions..

.2 Adjust hangers to equalize load..

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

.4 Use of trapeze hangers is acceptable for parallel piping runs.

3.4 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.5 RISER CLAMPS

.1 Provide riser clamps at all floor penetrations and the base of all piping risers. Exception branch HW & DW piping 25 dia. or smaller.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports: to equalize load and maintain required grade.

3.7 HOUSEKEEPING PAD

.1 Provide specified housekeeping pads for all base mounted equipment unless otherwise indicated on drawings or on approval of Departmental Representative.

.2 Housekeeping pads are not required for any exterior base mounted equipment unless indicated on plans.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.3 Refer to Structural Plans.

1.2 REFERENCES

.1 National Fire Protection Association (NFPA)

.2 National Building Code of Canada (NBC)

1.3 SHOP DRAWINGS

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

.2 Provide separate shop drawings for each isolated system complete with performance and product data.

Part 2 Products

2.1 GENERAL

.1 Size and shape of bases type and performance of vibration isolation to be as indicated.

2.2 ELASTOMERIC MOUNTS

.1 Type M1 - colour coded; neoprene in shear; maximum durometer of 60; threaded insert and two bolt-down holes; ribbed top and bottom surfaces.

2.3 ACOUSTIC BARRIERS FOR ANCHORS AND GUIDES

.1 Acoustic barriers: between pipe and support, consisting of 25 mm minimum thick heavy duty duck and neoprene isolation material.

2.4 HORIZONTAL THRUST RESTRAINT

.1 Spring and elastomeric element housed in box frame; assembly complete with rods and angle brackets for equipment and ductwork attachment; provision for adjustment to limit maximum start and stop movement to 9 mm.

.2 Arrange restraints symmetrically on either side of unit and attach at centerline of thrust.

2.5 FLEXIBLE CONNECTION

.1 Approvals:

.1 FO Service: CSA/UL listed for fuel oil service.

.2 HPW and HW: CSA approved for pressure and temperature.

.2 Inner hose: Type 321 stainless steel.

.3 Jacket :braided wire mesh Type 301 stainless steel outer jacket.

.4 Diameter and type of end connection: as indicated.

.5 Operating conditions:

.1 Working pressure: 1034 kPa.

.2 Working temperature: 93°C.

.3 To match system requirements

.6 Minimum lengths:

.1 Other: 300 mm.

Part 3 Execution

3.1 INSTALLATION

.1 Install vibration isolation equipment in accordance with manufacturers instructions and adjust mountings to level equipment.

.2 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.

.3 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:

.4 Where isolation is bolted to floor use vibration isolation rubber washers.

.5 Block and shim level bases so that ductwork and piping connections can be made to a rigid system at the operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

.6 Provide for manufacturer sizing of scheduled vibration isolation measures based on final approved post contract award equipment list.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Seismic restraint systems for statically supported and vibration isolated equipment and systems; including heating and ventiation equipment, fire protection equipment and systems, both vibration isolated and statically supported.

.2 Related Sections:

.1 Sections 01 33 00 - Submittal Procedures.

.2 Sections 01 78 00 - Closeout Submittals.

1.2 REFERENCES

.1 Canadian Standards Association (CSA)

.2 SMACNA Seismic Restraint Manual-Guidelines for Mechanical Systems, 2008.

.3 ASHRAE RP-812 Guide to Seismic Restraint, 1999.

.4 IMC-2000 International Mechanical Code.

.5 NBCC-2015 National Building Code of Canada.

.6 ANSI/NFPA 13-2016, Installation of Sprinkler Systems.

1.3 DEFINITIONS

.1 Priority Two (P2) Buildings: buildings in which life safety is of paramount concern. It is not necessary that P2 buildings remain operative during or after earthquake activity. This building is NOT a post disaster building.

.2 SRS: acronym for Seismic Restraint System.

1.4 SYSTEM DESCRIPTION

.1 This section covers provision of SRS for all mechanical distribution systems and equipment including but not necessarily limited to the following:

.1 HW, DW, and fuel oil piping.

.2 All ventilation ducts.

.3 All vibration isolated Exhaust Fans and HRV.

.4 Fuel Oil Tank.

.5 Unit Heaters.

.6 All vibration isolated pumps.

.7 All DHWH.

.8 HW Expansion and Fill tanks.

.9 HW Boilers.

.10 Diffusers.

.2 Installation of SRS to be fully compatible with and to not affect performance of:

.1 Noise and vibration controls specified elsewhere in this project specification.

.2 Structural, mechanical, and electrical design of project.

.3 The intent of the SRS systems is both life safety and building operation. It is the intent of the systems to maintain all equipment in operational state after a significant seismic event. During a seismic event, the SRS is to prevent systems and equipment from causing personal injury and from moving from normal position. SRS fully integrated into, and compatible with:

.1 Noise and vibration controls specified elsewhere.

.2 Structural, mechanical, electrical design of project

.4 Designed by Professional Engineer specializing in design of SRS and registered in Yukon Territory.

1.5 SUBMITTALS

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

.2 Shop drawings: submit drawings stamped and signed by professional engineer registered or licensed in Yukon.

.3 Submit design data including:

.1 Full details of design criteria.

.2 Working drawings (prepared to same standard of quality and size as documents forming these tender documents), materials lists, schematics, full specifications for components of each SRS to be provided.

.3 Design calculations (including restraint loads resulting from seismic forces in accordance with National Building Code, detailed work sheets, tables).

.4 Separate shop drawings for each SRS and devices for each system, equipment.

.5 Identification of location of devices.

.6 Schedules of types of SRS equipment and devices.

.7 Details of fasteners and attachments to structure, anchorage loadings,

attachment methods.

.8 Installation procedures and instructions.

.9 Design calculations including restraint loads to NBC and Supplement.

.10 Detailed work sheets, tables Simplified, Detailed work sheets, tables. Simplified, conservative assumptions may be acceptable.

.11 Detailed design of SRS including complete working drawings prepared to same standard of quality and size as Contract Documents, materials lists, design calculations, schematics, specifications.

.4 Submit additional copy of shop drawings and product data to Structural Engineer for review of connection points to building structure.

.5 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

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

.6 Closeout Submittals:

.1 Provide maintenance data including monitoring requirements for incorporation into manuals specified in Section 01 78 00 - Closeout Submittals.

1.6 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling.

Part 2 Products

2.1 SRS MANUFACTURER

.1 SRS from one manufacturer regularly engaged in SRS production.

2.2 GENERAL

.1 SRS to provide gentle and steady cushioning action and avoid high impact loads.

.2 SRS to restrain seismic forces in every direction.

.3 Fasteners and attachment points to resist same load as seismic restraints.

.4 SRS of Piping systems compatible with:

.1 Expansion, anchoring and guiding requirements.

.2 Equipment vibration isolation and equipment SRS.

.5 SRS utilizing cast iron, threaded pipe, other brittle materials not permitted.

.6 Attachments to RC structure:

.1 Use high strength mechanical expansion anchors.

.2 Drilled or power driven anchors not permitted.

.7 Seismic control measures not to interfere with integrity of firestopping.

2.3 SRS FOR STATIC EQUIPMENT, SYSTEMS

.1 Floor-mounted equipment, systems:

.1 Anchor equipment to equipment supports.

.2 Anchor equipment supports to structure.

.3 Use size of bolts scheduled in approved shop drawings.

.2 Suspended equipment, systems

.1 Use one or combination of following methods:

.1 Install tight to structure.

.2 Cross-brace in every direction.

.3 Brace back to structure.

.4 Slack cable restraint system.

.2 SCS to prevent sway in horizontal plane, "rocking" in vertical plane, sliding and buckling in axial direction.

.3 Hanger rods to withstand compressive loading and buckling.

2.4 SRS FOR VIBRATION ISOLATED EQUIPMENT

.1 Floor mounted equipment, systems:

.1 Use one or combination of following methods:

.1 Vibration isolators with built-in snubbers.

.2 Vibration isolators and separate snubbers.

.3 Built-up snubber system approved by SRS designer, consisting of structural elements and elastomeric layer.

.2 SRS to resist complete isolator unloading.

.3 SRS not to jeopardize noise and vibration isolation systems. Provide 4-8 mm clearance between seismic restraint snubbers and equipment during normal operation of equipment and systems.

.4 Cushioning action: gentle and steady by utilizing elastomeric material or other means in order to avoid high impact loads.

.2 Suspended equipment, systems:

.1 Use one or combination of following methods:

.1 Slack cable restraint system.

.2 Brace back to structure via vibration isolators and snubbers.

2.5 SLACK CABLE RESTRAINT SYSTEM (SCS)

.1 Use elastomer materials or similar to avoid high impact loads and provide gentle and steady cushioning action.

.2 SCS to prevent sway in horizontal plane, "rocking" in vertical plane, sliding and buckling in axial direction.

.3 Hanger rods to withstand compressive loading and buckling.

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 Attachment points and fasteners:.

.1 To withstand same maximum load that seismic restraint is to resist and in every direction.

.2 Slack Cable Systems (SCS):

.1 Connect to suspended equipment so that axial projection of wire passes through centre of gravity of equipment.

.2 Use appropriate grommets, shackles, other hardware to ensure alignment of restraints and to avoid bending of cables at connection points..

.3 Piping systems: provide transverse SCS at 10 m spacing maximum, longitudinal SCS at 20 m maximum or as limited by anchor/slack cable performance.

.4 Small pipes may be rigidly secured to larger pipes for restraint purposes, but not reverse..

.5 Orient restraint wires on ceiling hung equipment at approximately 90 degrees to each other (in plan), tie back to structure at maximum of 45 degrees to structure.

.6 Adjust restraint cables so that they are not visibly slack but permit vibration isolation system to function normally.

.7 Tighten cable to reduce slack to 40 mm under thumb pressure. Cable not to support weight during normal operation.

.3 Install SRS at least 25 mm from equipment, systems, services..

.4 Miscellaneous equipment not vibration-isolated:

.1 Bolt through house-keeping pad to structure.

.5 Co-ordinate connections with other disciplines.

.6 Vertical tanks:.

.1 Anchor through house-keeping pad to structure.

.2 Provide steel bands above centre of gravity.

.7 Horizontal tanks:

.1 Provide at least two straps with anchor bolts fastened to structure.

3.3 FIELD QUALITY CONTROL

.1 Inspection and Certification:.

.1 SRS: inspected and certified by Seismic Engineer upon completion of installation.

.2 Provide written report to Departmental Representative with certificate of compliance.

.2 Commissioning Documentation:

.1 Upon completion and acceptance of certification, hand over to Departmental Representative complete set of construction documents, revised to show "as-

built" conditions.

3.4 CLEANING

.1 Proceed in accordance with Section 01 74 00 - Cleaning.

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 09 91 23 - Interior Painting.

1.2 REFERENCES

.1 Canadian Gas Association (CGA)

.2 Canadian General Standards Board (CGSB)

.3 National Fire Protection Association (NFPA)

.4 Alberta Public Works, Supply and Services Color Coding Requirements for Mechanical and Electrical Systems-June 1987.

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers to be raised or recessed.

.3 Information to include, as appropriate: size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motors.

2.2 SYSTEM & EQUIPMENT NAMEPLATES

.1 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background

.2 Construction:

.1 3 mm thick, laminated plastic or white anodized aluminum, matte finish, square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

Size #	Dimensions (mm)	Max No. of Lines	Letter Height (mm)

1	10x50	2	3
2	13x75	1	5
3	13x75	2	3
4	20x100	2	8
5	20x200	2	8
6	20x100	2	5
7	25x125	1	12
8	25x125	2	8

.2 Use average of 40 letters/numbers (maximum) per nameplate.

.3 Minimum sizes as follows:

.1 Equipment in mechanical rooms/crawlspaces/hidden spaces: Sizes 7.

.2 Equipment in finished architectural spaces: Sizes 1 and 3.

.3 Access doors: Sizes 1 and 3.

.4 Equipment names to to conform to PWGSC PMSS .

.5 Building Access Doors:

.1 Indicate the following information:

.1 Service: (i.e. AS-1B E/A.....)

.2 Type: (i.e. Fire Damper/Control Damper...)

.3 Size: as indicated..

.6 Duct Access Doors:

.1 Indicate the following information;

.1 Service: (i.e. AS-1B E/A.....)

.2 Type: (i.e. Fire Damper/Control Damper...)

.3 Normal Position (i.e. NO....)

.4 Location (i.e. Area5130-Wing A-Rm001)

2.3 IDENTIFICATION OF PIPING SYSTEMS

.1 To APWSS Colour Coding Requirements, CAN/CGSB 24.3 Identification of Piping Systems and requirements of ANSI/NFPA 13 except where specified otherwise.

.2 Identify medium by background colour marking, pictogram (as necessary), lettered legend; direction of flow by arrows. .

.3 Sizes:

.1 Legend: block capitals to following table:

Outside Dia. of Pipe or Insulation (mm)	Size of Letters (mm)
19 or less	8
25 to 65	19
75 to 130	50
Over 150	90

.2 Colour bands:

.1 At valves and fittings: 500 mm long.

.2 Elsewhere: 1000 mm long.

.3 Arrows:

.1 Outside diameter of pipe/insulation 75 mm and greater: 150 mm long x 50 mm high.

.2 Outside diameter of pipe/insulation less than 75 mm: 100 mm long x 50 mm high.

.3 Use double headed arrows where flow is reversible.

.4 Material:

.1 Paint: Section 09 91 23 - Interior Painting.

.2 Legend markers, arrow colour bands: plastic coated cloth material with protective overcoating and waterproof contact adhesive undercoating, suitable for 100% RH and continuous operating temperature of 150 deg.C and intermittent temperature of 200 deg.C. Apply to prepared surfaces. Wrap tape around pipe or pipe covering with ends overlapping one (1) pipe diameter.

.3 Waterproof and heat resistant plastic marker tags: for pipes and tubing 20 mm nominal and smaller.

.4 Banding: adhesive backed plastic tape, integrally coloured.

.5 Colours:

.1 To APWSS Colour Coding Requirements or CAN/CGSB 24.3 Identification of Piping Systems submit legend and classification colours to Departmental Representative for approval.

.6 Legend:

.1 Pipe and valve identification.

Description	Legend	Background Colour

Domestic Cold water	DCW	Green
Dom. hot water	DHW	Yellow
Dom. hot water recirc	DHWR	Yellow
Heating glycol supply	GWS	Yellow
Heating glycol return	GWR	Yellow
Heating water supply	HWS	Yellow
Heating water return	HWR	Yellow
Fuel Oil Supply	FOS	Brown
Fuel Oil Return	FOR	Brown
Sanitary sewer	SAN	Green
Vent Plumbing	VP	Green

.2 Legend and arrows:

.1 Black or white to contrast with primary colour.

.2 Fire protection: white on red background (by sprinkler contractor).

2.4 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high stenciled letters and directional arrows 150 mm long x 50 mm high..

.2 Colours: Black, or co-ordinated with base colour to ensure strong contrast.

.3 Paint: Section 09 91 23 - Interior Painting.

2.5 VALVES, CONTROLLERS

.1 Plastic laminated cards attached by brass jack chain or nylon cable tie clip.

.2 Sizes: 0.75mm thicknessx50mmx75mm minimum.

.3 Lettering: minimum 5mm high produced from laser printer in black.

.4 Consecutively number valves in systems and provide the following information on valve tag:

.1 Service (i.e. HWS/DCW...)

.2 Normal Position (i.e. NC/NO)

.3 Control (i.e. ISOLATION/CONTROL/BALANCE..)

.4 Location (i.e. Boiler Rm 001)

2.6 CONCEALED EQUIPMENT

.1 Provide adhesive discs or location tacks for the following mechanical equipment concealed above suspended t-bar ceilings.

.2 Schedule:

.1 HVAC Equipment: Yellow

.2 Fire and smoke dampers: Red

.3 Plumbing valves: Green

.4 Heating and cooling valves: Blue

Part 3 Execution

3.1 TIMING

.1 Provide identification only after all painting specified Section 09 91 23 - Interior Painting has been completed.

3.2 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3, ANSI/NFPA 13 and CSA B139 except as specified otherwise.

.2 Provide ULC or CSA registration plates as required by respective agency.

.3 Piping identification:

.1 Secure piping labels and flow arrows using waterproof contact adhesive undercoating, suitable for 100% RH and continuous operating temperature of 150 deg.C and intermittent temperature of 200 deg.C. Apply to prepared surfaces only. Overlap banding tape minimum 13mm on both ends of label to secure in place.

.2 Wrap color coded banding tape around pipe or pipe covering with ends overlapping one (1) pipe diameter.

3.3 NAMEPLATES

.1 Equipment: provide nameplates for all mechanical equipment. Identify to PWGSC PMMS and include:

.1 Equipment description.

.2 Equipment Tag.

.2 Duct Access Doors: provide nameplates at all duct access doors except where indicated:

.1 Nameplates not required at terminal reheat coil access doors.

.2 Nameplates not required on exposed duct access doors.

.3 Building Access Doors: provide nameplates at all mechanical equipment building access doors.

.4 Secure nameplates using adhesive backing of lamacoid and minimum two mechanical fasteners of either metal screws or pop rivets.

.5 EMCS Lamacoids: provide as specified in Division 25. Lamacoids to be provided in same format as equipment nameplates for finished architectural spaces.

3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: At not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification to be easily and accurately readable from usual operating areas and from access points.

.10 Plane of legend to be approximately at right angles to most convenient line of sight with consideration of operating positions, lighting conditions, reduced visibility of colour or legends caused by dust and dirt and risk of physical damage.

.11 Piping Identification Schedule

.1 Apply colour banding and identification to all exposed and concealed piping except exposed piping in finished architectural spaces.

.12 Duct Identification Schedule

.1 Provide identification for all exposed ducts in Mechanical and Electrical spaces.

3.5 VALVES, CONTROLLERS

.1 Provide for all valves and operating controllers except at the following locations:

.1 Chrome plated plumbing fixture stops.

.2 Heating terminal unit radiator and isolation valves.

.3 All drain valves.

.2 Secure tags with non-ferrous chains or plastic tie clips.

.3 Install one valve schedule mounted in frame behind non-glare glass where directed by Departmental Representative and in addition provide one softcopy in Microsoft Word 2000 format and one copy (reduced in size if required) in each operating and maintenance manual.

.4 Number valves in each system consecutively.

.5 Transfer tag schedule numbering to Record drawings specified in Section 23 05 00 - Common Work Results - Mechanical.

3.6 CONCEALED EQUIPMENT

.1 Locate tags or discs in corner of T-bar panel or access door closest to equipment.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 78 10 - Closeout Submittals.

1.2 GENERAL

.1 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.

.2 Do all testing over entire operating range in accordance with most stringent conditions of this specification and standards of the following organizations:

.1 AABC Associated Air Balance Council.

.2 ASHRAE.

.3 All TAB to be provided to the requirements of this specification.

1.3 QUALIFICATIONS OF TAB AGENCY & PERSONNEL

.1 General:

.1 All work described in this section to be performed by a qualified TAB Agency.

.2 Certification:

.1 Submit to Departmental Representative TAB agency and personnel for approval within 90 days after award of Contract.

.2 Certification documentation to confirm qualifications, experience of TAB Agency personnel.

.3 Prequalified firms:

.1 See Section 23 05 00 - Common Work Results - Mechanical.

1.4 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

.3 Co-ordinate all work specified in this Section.

.4 Provide all facilities required by TAB Agency in order to carry out work of this Section.

1.5 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere.

1.6 OPERATION OF SYSTEMS DURING TAB

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

1.7 START OF TAB

.1 Notify Departmental Representative 7 days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.1 Installation of ceilings, doors, windows, other construction affecting TAB.

.2 Application of weatherstripping, sealing, caulking.

.3 All pressure, leakage, other tests specified elsewhere.

.4 All provisions for TAB installed and operational.

.3 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air Systems:

.1 Filters in place and in clean condition.

.2 Duct systems clean of debris.

.3 Air shafts, ceiling plenums are airtight to within specified tolerances.

.4 All duct cleaning is completed and accepted by the Departmental Representative.

.5 Correct fan rotation.

.6 Fire and volume dampers in place and open.

.7 Coil fins cleaned and combed.

.8 Access doors closed and duct end caps in place.

.9 All outlets installed and connected.

.3 Liquid Systems:

.1 Flushed, filled and vented.

.2 Correct pump rotation.

.3 Strainer baskets in place and in clean condition.

.4 Service and balance valves open.

.5 Liquid treatment system operable.

1.8 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 HVAC systems: Plus or minus 10%.

.2 Hydronic systems: Plus or minus 10%.

1.9 ACCURACY TOLERANCES

.1 Measured values to be accurate to within plus or minus 5 % of actual values.

1.10 INSTRUMENTS

.1 Prior to TAB, submit to Departmental Representative list of instruments to be used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative.

1.11 TAB REPORT

.1 Format to be in accordance with referenced standard and standards of preliminary draft report.

.2 Provide any changes identified in the review of the draft report and any subsequent updates identified on site during the certification and site review process.

.3 Submit 1 digital TAB Report to Departmental Representative for approval.

1.12 SETTINGS

.1 After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

1.13 COMPLETION OF TAB

.1 TAB to be considered complete when final TAB Report received and approved by Departmental Representative

1.14 AIR SYSTEMS

.1 General: measurements as required by referenced organization standards, including, but not limited to, following:

.1 Air velocity.

.2 Static pressure.

.3 Velocity pressure.

.4 Temperature:

.1 Dry bulb.

.2 Wet bulb.

.5 Cross sectional area.

.6 RPM.

.7 Electrical Power:

.1 Voltage.

.2 Current draw.

.3 Size.

.8 Noise

.9 Vibration.

.10 Pressure.

.2 Location of equipment measurements:

.1 Inlet and outlet of each:

.1 Fan

.1 AHU SF and EF

.2 All EF, transfer air and cooling fans: design flow

.3 HRVs: measurements at design load.

.2 Coil

.3 Filter

.4 Main branch damper and control damper

.3 Location of system measurements at:

.1 Main ducts, main branches and sub-branches.

.2 Supply outlets.

.3 Exhaust inlets.

.4 Ducted return inlets.

1.15 HYDRONIC SYSTEMS

.1 Definitions: for purposes of this section, to include low pressure hot water heating, condensate & glycol systems.

.2 General: measurements as required by referenced standards, including, but not limited to, following:

.1 Flow

.2 Pressure

.3 Temperature

.4 Specific gravity

.5 RPM

.6 Electrical Power

.1 Voltage

.2 Current draw

.3 Motor

.3 Location of equipment measurements:

.1 Inlet and outlet of each:

.1 HPW and HW Pumps

.1 Equipment measurement not required for all Loadmatch zone control pumps.

.2 DW Pumps.

.4 Location of system measurements

.1 HW flow balancing stations with the following exceptions.

.1 HW Terminal units

.2 Duct mounted reheat coil flow balancing stations

.5 Flow Measurement Methodology:

.1 Measure flow using flow valve manufacturer approved test instrumentation

or approved alternate.

1.16 FIRE DAMPER TESTS

.1 Provide for drop test of fire dampers by removal of fusible link.

.2 Damper to drop and seal cleanly. Where damper fails test advise Departmental Representative.

.3 Affix seal indicating test completion, date and testing personnel to access door of FD. Where more than one access door provided affix seal to each access door.

.4 Provide written verification of successful completion of all fire damper drop tests and submit in TAB report.

1.17 BUILDING FLUSH OUT

.1 Advise Departmental Representative in writing when TAB completed and when the ventilation systems in the view of the TAB agent are suitable for building ventilation flush out as specified in Section 23 05 03 Mechanical Startup.

Part 2 NOT USED

2.1 NOT USED

.1 NOT USED

Part 3 NOT USED

3.1 NOT USED

.1 NOT USED

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittals Procedures.

.2 Section 01 78 10 - Closeout Submittals.

.3 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.2 American Society for Testing and Materials International, (ASTM)

.3 Canadian General Standards Board (CGSB)

.4 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).

.5 Underwriters Laboratories of Canada (ULC)

.6 Model National Energy Code for Buildings, MNECB.

.7 ASHRAE 90.1-2013, Energy Standard for Buildings Except Low-Rise Residential Buildings.

1.3 DEFINITIONS

.1 For purposes of this section:

.1 CONCEALED" - insulated mechanical services and equipment in hung ceilings non-accessible chases, furred spaces and crawlspaces.

.2 EXPOSED" - will mean "not concealed" as defined herein.

1.4 SHOP DRAWINGS

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

.2 Submit for approval manufacturer's catalog literature related to installation, fabrication for duct jointing recommendations.

.3 Provide shop drawings as follows:

.1 Type C1 Insulation.

.2 Type C2 Insulation.

.3 Adhesives.

.4 Provide product data or other documentation for adhesives and sealants used in that clearly shows VOC content (in g/L).

1.5 MANUFACTURER'S INSTRUCTIONS

.1 Submit manufacturer's installation instructions in accordance with Section 01 33 00 - Submittal Procedures..

.2 Installation instructions to include procedures used, and installation standards achieved.

1.6 QUALIFICATIONS

.1 Installer: specialist in performing work of this section, and have relevant experience in this size and type of project, qualified to standards of TIAC.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.

.2 Protect from weather and construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions recommended by manufacturer.

1.8 MAINTENANCE DATA

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

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:

.2 All components of insulation system to have maximum flame spread rating of 25 and maximum smoke developed rating of 50 in accordance with CAN/ULC-S102.

2.2 TYPE C-1 INSULATION

.1 TIAC Code C-1: formaldehyde free, rigid mineral fibre board to ASTM C612 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24degC mean temperature when tested in accordance with ASTM C335.

.3 Material: resilient inorganic glass fibers bonded by thermosetting resin mineral fibre blanket w vapor foil-scrim-kraft(FSK) facing material and vinyl vapor retarder.

.4 Density: 72 kg/m3 minimum.

.5 Thermal conductivity "k" shall not exceed 0.024 W/m deg.C at 24 deg.C mean temperature an a density of 72kg/m3 when tested to ASTM C 177-85(1993).

.6 Operating temperature: to 121degC

.7 Vapour permanence: maximum 0.02perms to ASTM E 96-00e1, Procedure A.

.8 Vapor absorption: less than 5% by weight to ASTM C 1104/C 1104M-00. .

.9 Mold Growth: no growth to ASTM C 1338-00.

.10 Puncture resistance: 25 beach units to TAPPI test T803.

.11 Listing: ULC and NFPA 90a flame spread and smoke developed 25.

2.3 TYPE C-2 INSULATION

.1 TIAC Code C-2: formaldehyde free, mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).

.2 Thermal conductivity ("k" factor) not to exceed specified values at 24oC mean temperature when tested in accordance with ASTM C335.

.3 Material: resilient inorganic glass fibers bonded by thermosetting resin mineral fibre blanket w vapor foil-scrim-kraft(FSK) facing material and vinyl vapor retarder.

.4 Density: 24 kg/m3 minimum.

.5 Thermal conductivity "k" shall not exceed 0.024 W/m deg.C at 24 deg.C mean temperature an a density of 24kg/m3 when tested to ASTM C 177-85(1993).

.6 Operating temperature: to 121degC.

.7 Vapour permanence: maximum 0.02perms to ASTM E 96-00e1, Procedure A.

.8 Vapor absorption: less than 5% by weight to ASTM C 1104/C 1104M-00.

.9 Mold Growth: no growth to ASTM C 1338-00.

.10 Puncture resistance: 25 beach units to TAPPI test T803.

.11 Listing: ULC and NFPA 90a, Can4-S102 flame spread 25 and smoke developed 40.

2.4 INSULATION SECUREMENTS

.1 Tape: ULC listed, self-adhesive, aluminum, plain, 50 mm wide minimum.

.2 Contact adhesive: Quick setting, asbestos free, low VOC to the current content limits of SCAQMD Rule #1168.

.3 Weld pins 4.0 mm diameter, 35mm diameter head, length to suit thickness of insulation. Nylon retaining clips, 32 mm square.

.4 Tie wire: 1.5 mm diameter stainless steel.

.5 Bands: Aluminum, 19 mm wide, 0.5 mm thick.

2.5 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation low VOC to the current content limits of SCAQMD Rule #1168.

2.6 SELF ADHERING WEATHER PROOFING MEMBRANE

.1 Weather barrier membrane (Self-Adhering): SBS modified bitumen, self-adhering sheet membrane complete with a reflective foil surface, and having the following physical properties:

.1 Thickness: 1.5 mm (60 mils).

.2 Vapour permeance: 2.8 ng/Pa.m².s (0.05 perms) to ASTM E96;

.3 Low temperature flexibility: -30°C to CGSB 37-GP-56M;

.4 Elongation: 40% to ASTM D412-modifed.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENTS

.1 Pressure testing of ductwork systems where specified complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Install in accordance with TIAC National Standards and in accordance with ANSI/ NFPA 90A-2015, ANSI/NFPA 90B-2015 and ANSI/NFPA 96-2014.

.2 Install all insulation systems including minimum insulation thicknesses to the most stringent requirements of ASHRAE 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings and the Canadian National Energy Code for Buildings unless otherwise noted in the insulation schedule.

.3 Apply materials in accordance with manufacturers instructions and as indicated.

.4 Use two layers with staggered joints when required nominal thickness exceeds

75mm.

.5 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes. Butt insulation and seal joints with lap seal adhesive; cover joint with approved FSK tape

.6 Supports, Hangers in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.7 Insulation at bolts, studs, nuts, instrumentation: bevel to permit removal without damage to insulation or finish.

.8 Application:

.1 Type C1:

.1 exterior rectangular ducts and interior rectangular ducts greater than 400mm largest duct dimension.

.2 Type C2:

.1 round, oval ducts and interior rectangular ducts 400mm or less largest duct dimension.

.9 Fastenings:

.1 Type C1:

.1 Interior and less than 32mm thickness: 150mm bands of contact adhesive on 400mm centres and insulation secured with stainless steel wire/aluminum bands or approved equal at 400mm on centre.

.2 All exterior and greater than 38mm thickness: 150mm bands of contact adhesive on 400mm centres, pins at minimum one per 0.18m2, cover retaining clip with approved FSK tape.

.2 Type C2:

.1 Interior and less than 32mm thickness insulation and 400mm maximum duct dimension: 50% minimum coverage of contact adhesive and insulation secured with aluminum bands or approved equal.

.2 All exterior and greater than 38mm thickness insulation and greater than 400mm duct dimension : 50% coverage contact adhesive, pins at minimum one per 0.18m2, cover retaining clip with approved FSK tape.

3.3 PROTECTION OF INSULATION DURING CONSTRUCTION

.1 Insulation is to be protected from moisture damage during all stages of construction.

.2 Where insulation is damaged due to moisture damage either prior to installation, during or subsequent to installation up to and including final inspection replace

damaged insulation to the satisfaction of the Departmental Representative.

3.4 SELF ADHERING WEATHER PROOFING MEMBRANE - INSTALLATION

.1 Verify that surfaces and conditions are ready to accept the work. Notify Departmental Representative in writing of any discrepancies. Commencement of the work or any parts thereof shall mean acceptance of the prepared substrate.

.2 Preparation

.1 All surfaces must be sound, dry, clean and free of oil, grease, dirt, or other contaminants.

.2 Seal all joints in ductwork to prevent air leakage.

.3 Install FSK or foil faced insulation over ducts and mechanically fasten using weld pins and washers or cup head pins welded to ductwork as specified.

.4 Cover washer or cup head pin with a 100mm (4") strip of membrane.

.5 Ensure positive slope to prevent the occurrence of ponding water.

.3 Weather Barrier Membrane

.1 Position membrane for alignment, and begin application of membrane on bottom of insulated plenum or duct returning up sides a minimum of 100mm.

.2 Install sections of membrane on sides of plenum and return on to the top a minimum of 100mm.

.3 Install top section, lapping down the sides 100mm.

.4 Membrane applied to the underside of the substrate wider than 600mm (2') requires mechanical fastening. Fasten immediately after installation of membrane and seal with a 100x100 mm patch of membrane.

.5 When membrane is entirely in place, roll membrane including seams with a counter top roller or apply pressure using a plastic tape applicator to ensure full contact.

3.5 DUCT INSULATION SCHEDULE

.1 Schedule:

.1 O/A Systems: provide 50mm insulation for full length of outdoor air ducts from air handling unit/fans/hrv to hood/louvre or roof penetration for all air systems.

.2 E/A Systems: provide 50mm insulation for full length of exhaust air ducts from air handling unit/fans/hrv to hood/louvre for all air systems.

.3 C/A (Combustion air) Systems: provide insulation for full length of ducts

inside the building

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 - Closeout Submittals.

.3 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.2 American Society for Testing and Materials (ASTM International)

.3 Canadian General Standards Board (CGSB)

.4 Thermal Insulation Association of Canada (TIAC)

.5 Underwriters Laboratories of Canada (ULC)

1.3 PRODUCT DATA

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

.2 Submit for approval manufacturer's catalog literature related to installation, fabrication and jointing recommendations.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to site in original factory packaging, labeled with manufacturer's name, address.

.2 Protect from weather and construction traffic.

.3 Protect against damage from any source.

.4 Store at temperatures and conditions recommended by manufacturer.

1.5 MAINTENANCE DATA

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

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:

.2 All components of insulation system to have maximum flame spread rating of 25 and maximum smoke developed rating of 50 in accordance with ASTM E 84-01, Test Method for Surface Burning Characteristics of Building Materials and CAN/ULC-S102.

2.2 CEMENT

.1 Thermal insulating and finish to CAN/CGSB-51.12-95, service temperature to 450 deg.C low VOC to the current content limits of SCAQMD Rule #1168.

2.3 INSULATION SECUREMENTS

.1 Contact adhesive: Quick setting, asbestos free, low VOC to the current content limits of SCAQMD Rule #1168.

.2 Tie wire: 1.5 mm diameter stainless steel.

.3 Bands: Aluminum, 19 mm wide, 0.5 mm thick.

2.4 REMOVABLE PREFABRICATED INSULATED ENCLOSURES

.1 Design: to permit periodic removal and replacement without damage to adjacent insulation, to enclose entire equipment body with minimum 50mm overlap at mating flanges or overlaps.

.2 Insulation:

.1 Hot systems: BGF needled E Glass Mat, binder free. Minimum thickness or U value as indicated. Thermal Conductivity "k" shall not exceed 0.031 W/m. deg.C at 24 deg.C mean temperature when tested in accordance with ASTM C 335-95.

.2 Cold systems: flexible unicellular, preformed tubular elastomer to CAN/CGSB-51.40-95, thermal conductivity "k" shall not exceed 0.04 W/m. deg.C at 24 deg.C mean temperature when tested in accordance with ASTM C 335-95, service temperature: -4degC to 100degC.

.3 Insulation thickness: to match piping system.

.3 Jacket & lining: ULC listed fiberglass cloth with Teflon coating.

.1 Liner not required for cold systems.

.4 Fasteners: Velcro type flap along parting edges. Cinch belts and D-rings as required.

.5 Quilts: 300SS quilting pins with SS washers.

.6 ID Tag: printed tags encased in plastic holder.

.7 Construction: jacket sewn with inside seams formed to fit insulation, insulation secured with quilting pins to jacket.

.8 Operating range: 0degC to 262degC.

2.5 JACKETS

.1 Aluminum:

.1 Apply in accordance with CSA HA Series M1980.

.2 Crimped or embossed jacketing 0.6 mm thick with longitudinal slip joints and 50 mm end laps, 0.4mm die shaped fitting covers, factory attached protective liner on interior surface. Aluminum alloy straps with mechanical fasteners.

Part 3 Execution

3.1 PRE-INSTALLATION REQUIREMENTS

.1 Pressure testing of equipment and adjacent piping systems complete, witnessed and certified.

.2 Surfaces clean, dry, free from foreign material.

3.2 INSTALLATION

.1 Apply materials in accordance with insulation and equipment manufacturer's instructions and this specification.

.2 Install in accordance with TIAC National Standards and the requirements of ANSI/NFPA 90A-2015 and ANSI/NFPA 90B-2015.

.3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm secured with wire or bands at 400 mm on centre intervals.

.4 Install 25 mm thick aluminum foil-back fibrous glass or mineral fibre insulation onto the back of all radiant panels, with foil backing face up.

3.3 REMOVABLE, PRE-FABRICATED INSULATED ENCLOSURES

.1 Design: to permit periodic removal and replacement without damage to adjacent insulation.

.2 Provide removable pre-fabricated insulated enclosures for equipment as specified.

3.4 EQUIPMENT INSULATION SCHEDULES

.1 Schedule:

APPLICATION	INSULATION TYPE	THICKNESS (MM)	JACKET
Air Separator	Insulated Enclosure	25	Foil, Face-Up

Heat Exchangers	Insulated Enclosure	25	Foil, Face-Up

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 10 - Closeout Submittals.

.3 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.2 REFERENCES

.1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)

.2 American Society for Testing and Materials (ASTM International)

.3 Canadian General Standards Board (CGSB)

.4 Thermal Insulation Association of Canada (TIAC)

.5 Underwriters Laboratories of Canada (ULC)

.6 National Energy Code for Buildings, NECB.

1.3 DEFINITIONS

.1 For purposes of this section:

.1 CONCEALED" - insulated mechanical services and equipment in hung ceilings non-accessible chases, furred spaces and crawlspaces.

.2 EXPOSED" - will mean "not concealed" as defined herein.

.3 Runouts" - refers to piping to individual terminal units or fixtures not exceeding 3.6m in length.

.4 HW" - refers to hydronic systems including heating water (HW), glycol systems (GL) and heat pump water/glycol (HPW).

Part 2 Products

2.1 FIRE AND SMOKE RATING

.1 In accordance with CAN/ULC-S102:

.2 All components of insulation system to have maximum flame spread rating of 25 and maximum smoke developed rating of 50 in accordance with ASTM E 84-01, Test Method for Surface Burning Characteristics of Building Materials and CAN/ULC-S102.

2.2 TYPE A-3 INSULATION

.1 TIAC Code A-3: Rigid molded formaldehyde free mineral fibre piping insulation with factory applied vapour retarder jacket to CAN/CGSB-51.9 and CGSB SI-GP-52M.

.2 Materials:

.1 Insulation: molded, heavy density one piece, inorganic glass fiber bonded with thermosetting resin.

.2 Jacket: white kraft paper bonded to aluminum foil and reinforced with glass fibers. 3. Lap seal: self adhesive.

.3 Temperature range: -29degC to 537degC

.3 Thermal Conductivity "k" shall not exceed 0.031 W/m. deg.C at 24 deg.C mean temperature when tested in accordance with ASTM C 335-95.

.4 Surface Burning Characteristics:

.1 To STM E84-98e, Test Method for Surface Burning Characteristics of Building Materials and ANSI/NFPA 255-2000, Burning Characteristics of Building Materials and CAN/ULC-S102-M88.

.2 UL Classified.

.3 Flame spread=25 as plain insulation or composite basis.

.4 Smoke developed=50 as plain insulation or composite basis.

.5 Vapour Transmission:

.1 To ASTM E 96-00e1, Standard Test Methods for Water Vapor Transmission of Materials.

.2 Maximum: 0.02 perms.

.6 Resistance to Fungi and Bacteria:

.1 ASTM listed to not promote growth of fungi or bacteria.

2.3 TYPE A-6 INSULATION

.1 TIAC Code A-6: flexible unicellular, preformed tubular elastomer to CAN/CGSB-51.40-95.

.2 Thermal Conductivity "k" shall not exceed 0.04 W/m. deg.C at 24 deg.C mean temperature when tested in accordance with ASTM C 335-95.

.3 Service temperature: -4degC to 100degC.

.4 Maximum thickness: 25mm.

2.4 CEMENT

.1 Thermal insulating and finish to CAN/CGSB-51.12-95 low VOC to the current content limits of SCAQMD Rule #1168.

2.5 INSULATION SECUREMENTS

.1 Tape: ULC listed, self-adhesive, aluminum, plain, 50 mm wide minimum.

.2 Contact adhesive: Quick setting, asbestos free, low VOC to the current content limits of SCAQMD Rule #1168.

.3 Tie wire: 1.5 mm diameter stainless steel.

.4 Bands: Aluminum, 19 mm wide, 0.5 mm thick.

2.6 INDOOR VAPOUR RETARDER FINISH

.1 Vinyl emulsion type acrylic, compatible with insulation low VOC to the current content limits of SCAQMD Rule #1168.

2.7 JACKETS

.1 Polyvinyl Chloride (PVC):

.1 One piece premoulded PVC jacketing to AC774.1K82 with 25 flame and 50 smoke rating to ASTM E 84-01.

.2 Gloss finish, UV resistant, premoulded for fitting applications, jacket for straight pipe runs.

.3 Temperature rating: max insulation surface temperature 60degC.

.4 Secure with PVC tape with manufactured supplied rivets. Tape only is not acceptable.

.2 Aluminum:

.1 Apply in accordance with CSA HA Series M1980.

.2 Crimped or embossed jacketing 0.6 mm thick with longitudinal slip joints and 50 mm end laps, 0.4mm die shaped fitting covers, factory attached protective liner on interior surface. Aluminum alloy straps with mechanical fasteners.

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 to be clean, dry, free from foreign material.

3.2 INSTALLATION (GENERAL)

.1 Install in accordance with TIAC National Standards and the requirements of ANSI/ NFPA 90A-1999 and ANSI/NFPA 90B-1999.

.2 Apply materials in accordance with manufacturers instructions and this specification.

.3 Seal and finish exposed ends as follows:

.1 Unfinished insulation: tape.

.2 Where insulation not provided at valves, fitting and trim delete insulation and finish away from studs and nuts to permit use of tools without damage to insulation.

.4 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.

.5 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.

.6 Ensure insulation is continuous through inside walls. Pack around pipes with fire proof self-supporting insulation material, properly sealed.

.7 Hot systems:

.1 Insulate pipe, fittings, valves, HEX, air separators, and equipment. Do not insulate pumps, unions, flanges (except on flanged valves), grooved mechanical couplings, strainers, flexible connectors, and expansion joints. Terminate insulation neatly with plastic material trowelled on a bevel.

.2 Flare out staples may be used to secure jacket laps on hot systems. Staples are to be applied on 100 mm centres.

.3 For fittings and valves, apply hydraulic insulating cement; or apply factory fabricated insulation half shells, seal all laps and joints.

.8 Finish insulation neatly at hangers, supports and other protrusions.

.9 Locate insulation or cover seams in least visible locations. Locate seams on piping in ceiling spaces on the underside of the pipe.

.10 Provide recovering jackets on exposed insulation throughout, including equipment rooms. Insulation located in pipe shafts and suspended ceiling spaces is not considered exposed. Make smooth uneven insulated surfaces before recovering.

.11 Cover insulation exposed to outdoors with aluminum jacket secured with aluminum bands on 200 mm centres. Lap circumferential joints 75 mm minimum and seal with compatible waterproof lap cement. Lock form longitudinal joints and seal.

3.3 REMOVABLE, PRE-FABRICATED INSULATED ENCLOSURES

.1 Design: to permit periodic removal and replacement without damage to adjacent insulation.

.2 Provide removable pre fabricated insulated enclosures for HW valves and trim as follows:

.1 Provide for the following valves and strainer types:

.1 All gate valves

.2 All globe valves

.3 All strainers

.4 All exposed ball valves

.5 All air separators

.2 Provide in the following locations:

.1 For exposed HW valves in all Mechanical and Electrical Spaces

.3 Do not provide valve jackets for the following valves:

.1 All drain valves.

.2 Chrome plated piping, valves and fittings.

.3 Terminal heating unit isolation, globe and flow balancing valves.

.4 Ball isolation valves on flexible piping systems at distribution headers.

3.4 CONCEALED BALL VALVES

.1 Concealed ball valves: insulate all concealed ball valves using specified pipe insulation continuous over valve. Core out insulation as required to suit valve body dimensions or provide one size larger pipe insulation.

3.5 PIPING

.1 Insulate piping for full length as per insulation schedule except as noted.

.2 Insulation is not required for the following:

.1 Flexible (hePEX and PEX-AL) HW tubing on concealed runouts up to a maximum length of 1.2m.

.3 Where insulation not provided at valves, fitting and trim delete insulation and finish away from studs and nuts to permit use of tools without damage to insulation.

.4 Fastenings-Type A3: secure insulation by tape at each end and centre of each section, but not greater than 900 mm on centres.

.5 Elastomeric Insulation: to remain dry, overlap to manufacturer's instructions. Joints

tight and sealed properly.

3.6 PROTECTION OF INSULATION DURING CONSTRUCTION

.1 Insulation is to be protected from moisture damage during all stages of construction.

.2 Where insulation is damaged due to moisture damage either prior to installation, during or subsequent to installation up to and including final inspection replace damaged insulation to the satisfaction of the Departmental Representative.

3.7 PIPING INSULATION SCHEDULES

.1 Schedule: *NOTE: See definition of HW

APPLICATION	INSULATION TYPE	THICKNESS (mm)	JACKET
Interior Rigid HW* Piping (Exposed)			
Runouts 50dia and less	A3	25	PVC
Pipe 50dia and less	A3	38	PVC
65dia and greater	A3	50	PVC
Interior Rigid HW* Piping (Concealed)			
Runouts 50dia and less	A3	25	N/A
19dia and greater	A3	38	N/A
Exterior Rigid HW* Piping			
Runouts 50 and less	A6	25	Aluminium
19dia and greater	A6	38	Aluminium
Flexible HW Tubing: Not required for in slab and runouts up to a maximum of 1.2m, otherwise as per rigid piping			
Ball valves (Exposed)	A3	Pipe thk	N/A
Ball valves (Concelaed)	A3	Pipe thk	N/A
HW valves (Exposed)	INSULATED ENCLOSURE		
Refrigerant Piping	A6	25	None

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 RELATED SECTIONS

.1 Section 01 91 13 - General Commissioning

.2 Section 01 91 31 - Commissioning Plan

.3 Section 01 91 33 - Commissioning Forms

.4 Section 01 91 41 - Commissioning Training

.5 Section 01 98 00 - Commissioning of Architectural Systems

.6 Section 26 08 00 - Commissioning of Electrical Systems

1.3 QUALITY ASSURANCE

.1 The commissioning shall be executed in accordance with the intent of Section 01 91 13 General Commissioning and referenced sections.

1.4 GENERAL

.1 Be responsible for the performance and commissioning of all equipment supplied under the Sections of Divisions 21, 22, 23, 25. 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 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.

.3 Fully cooperate with the Commissioning Authority.

.4 Refer to related sections for additional requirements.

1.5 COMMISSIONING AND DEMONSTRATION

.1 Provide the services of an approved independent specialist firm to coordinate the commissioning process specified under this division and those items of other Divisions which interact with work of this Division as outlined herein, including the complete life safety system.

.2 The cooperation of all trades is essential for an efficient and planned process. A team comprising the following is recommended:

.1 Commissioning Authority

.2 General Contractor

.3 Mechanical Contractor's Supervisor

.4 Mechanical Consultant

.5 Building Owner's Representative

.6 Mechanical Trades: especially Controls Contractor & TAB Agency.

.7 Electrical Trades

.3 Prepare a commissioning statement for each of the four [4] phases that the process is perceived to be worked through. In sequence, the phases are expected to be:

.1 PHASE 1 - System readiness.

.2 PHASE 2 - System start-up, testing, balancing etc..

.3 PHASE 3 - Verification of system performance.

.4 PHASE 4 - Demonstration & instruction.

.4 Each phase is applicable to each major and/or separate system making up the work in Divisions 21, 22, 23, 25 plus Divisions 26, 27, 28 interfaces as applicable.

.5 Regular meetings shall be held during the commissioning process. Minutes of the meetings shall be issued to all contractors involved, the Consultant and the Owners representative.

.6 Plan the work to be specific in respect of personnel, schedule, review and laboratory tests.

.1 Personnel: Assign direct overall charge of commissioning to a person (the commissioning coordinator) fully qualified through practical experience and a comprehensive knowledge of the interactive nature of building systems and their controls to understand the complete system and be available to carry the project through to total completion. This person shall be responsible for: Commissioning, Demonstration to the Consultant and Owner and Certifications of Substantial and Total Performance.

.2 Schedule: Submit a schedule, as part of the construction schedules, 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 performance.

.3 Timing of the various phases of the commissioning, testing, balancing and demonstration process.

.3 Review: Within three [3] months of commencing with the project work, the

person having direct overall charge of commissioning shall review design intent and intended commissioning procedures with the Consultant. Six [6] months prior to the date of scheduled substantial performance, submit a detailed plan that addresses the entire approach to the commissioning process. The plan should be prepared specifically for the project at hand. The plan should include the following components:

.1 Name and qualifications of the commissioning coordinator.

.2 Itemized check lists for the readiness, start-up and operational verification of all equipment and systems.

.3 Outline of proposed method of notification and correction of interim operational deficiencies.

.4 Outline of proposed demonstration and operator training program.

.4 Troubleshooting: Where problems become apparent during the commissioning process, work at the identification and resolution of these problems. The basic functions in trouble shooting are:

.1 What - Identification and definition of the problem.

.2 Why - Determination and evaluation of the causes.

.3 When - Determine the time available to resolve the problem.

.4 Involve the Departmental Representative in the review of the problem and proposed resolution.

.5 Co-ordinate remedial action with the appropriate parties.

.6 Evaluate the effectiveness of the remedial action.

.5 Laboratory Tests: If the field tests indicate that equipment supplied to the project does not meet specifications, laboratory certification of the potentially deficient equipment may be requested by the Commissioning Authority. In the event that equipment does not meet specifications, be responsible for the costs of:

.1 The above laboratory tests, and

.2 All subsequent testing and correction required.

.6 The work included in each of the four phases shall be generally as follows:

.1 PHASE 1 System readiness

.1 Before starting any of the separate systems, provide a certificate stating that the specific system is ready for start-up and the following conditions have been met.

.1 All safety controls installed and fully operational (dry run test).

.2 Qualified personnel available to operate the plant.

.3 Permanent electrical connections made to all equipment.

.2 System readiness shall include, but not necessarily be limited to the following:

.1 Checking system physical completion, including all instrumentation.

.2 Flushing, chemical cleaning (as required), charging, fluid treating (as required).

.3 Equipment lubrication and prestart checks.

.4 Rotational checks.

.5 Air system cleaning complete.

.6 Filter systems installed and sealed in place.

.7 Adjusting vibration isolation and seismic restraints.

.8 Alignment of drives (direct and belt).

.9 Control function checks, including all alarms.

.10 Self diagnostic packaged control items checked.

.11 All deficiencies to be recorded, reviewed by the commissioning team and, subsequently, corrected before proceeding to PHASE 2.

.2 PHASE 2 System startup, testing, balancing

.1 System commissioning shall include, but not necessarily be limited to:

.1 Activation of all equipment and systems.

.2 Testing and adjustment of all equipment and systems.

.3 All deficiencies are to be recorded, reviewed by the commissioning team and, subsequently, corrected. The process at the point of the deficiency, shall be repeated before proceeding to PHASE 3.

.2 Phase 2 is concluded when 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 Balancing of the liquid systems as specified in this section.

.3 Set up air diffusers, registers and grilles for optimum distribution/

comfort.

.4 Set up all automatic control valves/dampers and automatic temperature control devices.

.5 Set up constant volume and variable volume fans.

.6 Plug all air pressure and flow measuring holes.

.7 Adjust vibration isolators and earthquake restraints as necessary.

.8 Verification and certification of the sealing of all HVAC penetrations through fire separations (rated & non-rated) and sound separations.

.9 Verification of water tightness of all roof and exterior wall penetrations.

.10 Verification that all coil drain pans operate.

.11 Testing and debugging of EMCS.

.12 Set up and test all alarm protective devices.

.13 Power failure test with emergency generator start-up.

.14 Setting up automatic controls for accurate response and precise sequencing.

.15 Correction of problems revealed by Balance Agency and change of fan speed and pitch as necessary.

.1 Testing

.16 A detailed check by a person having direct overall charge of commissioning. This check to include all items and functions to be later demonstrated to the Commissioning Authority, Consultant and Owner's representatives.

.3 PHASE 3 Verification of System Performance

.1 Verification of system performance by the Consultant will not commence until PHASE 2 has been totally completed. Submit test procedure completion test certificates at the time of requesting the commencement of the verification procedure. The verification process will include the demonstration of the following:

.2 The ease of access that has been provided throughout for servicing coils, motors, drives, fusible fire damper links, control and smoke dampers and damper operators.

.3 Location of and opening and closing of all access panels.

.4 Operation of all automatic control dampers and automatic temperature control devices.

.5 Proper response of all mixing boxes and variable volume air valves to thermostats and volume adjustment controls.

.6 Operation of all smoke dampers and all smoke pressurization and removal provisions.

.7 Operability of randomly selected fire dampers.

.8 Noise level from typical mixing boxes and variable volume air valves under extreme operating conditions.

.1 Operation of all equipment and systems, under each mode of operation including:

.2 EMCS Control features.

.3 Heat exchangers/immersion heaters.

.4 Pumps.

.5 Cabinet unit heaters.

.6 Unit heaters.

.7 Fans.

.8 Coils.

.9 Humidifiers

.10 Boilers and associated gas/oil fuel systems.

.11 All heat recovery systems.

.12 Tanks - domestic hot water, condensate and expansion.

.13 Deaerator

.14 Condensate return units.

.9 At the completion of Phase 3, the Contractor shall submit the following to the Consultant:

.10 A letter certifying that all work specified under this contract is complete, clean and operational in accordance with the specification and drawings.

.11 A commissioning report which should include completed copies of all Phase 2 documentation outlined in the commissioning plan plus copies of start-up reports from specialty contractors and vendors and any other relevant information for inclusion in the operating & maintenance

manuals.

.12 Yukon Boiler Inspection Dept. approval of boiler, pressure vessels and pressure piping installations.

.13 Fire Commissioner's approval of oil fuel installations.

.14 Record drawings as specified, update to include changes resulting from commissioning.

.15 A statement confirming completion of B.M.S. acceptance test.

.4 PHASE 4 Demonstration and Acceptance

.1 Demonstration and acceptance shall not commence until the commissioning process PHASE 3 has been successfully completed.

.2 The Demonstration process is a planned process requiring a preplan approval before commencement and a signed statement of satisfaction from the Owner upon completion.

.3 For Demonstration and instruction to Operating staff requirements, refer to this section of the specification and also to Division 25 (Integrated Automation).

.4 Systems operation in the fire mode (pressurization and smoke removal) shall be demonstrated to the Authorities having jurisdiction. Obtain a written statement/certificate of approval.

.5 Post Substantial Performance Visits

.1 Provide follow-up visits to the site at one month and six month after substantial performance for a minimum period of two days, to ensure that the systems are operating correctly and that they are being operated and maintained properly.

.2 Submit a report to the Commissioning Authority, Consultant and Owner which documents any problems that have arisen and correction action required.

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 IEEE C57.13 , Requirements for Instrument Transformers.

.2 National Electrical Manufacturer's Association (NEMA)

.1 NEMA1

.2 NEMA12

.3 American Society of Heating, refrigeration and Airconditioning Engineers (ASHRAE)

.1 ASHRAE 135.1

.4 CAN/CSA

.1 CAN/CSA-C22.1 - Canadian Electrical Code

1.2 INSTALLATION INSTRUCTIONS

.1 Provide manufacturer's installation instructions with shop drawings and product data.

1.3 SUBMITTALS

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

.2 Product Data:Submit manufacturer's instructions, printed product literature and data sheets for electric and electronic control system for HVAC and include product characteristics, performance criteria, physical size, finish and limitations.

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

Part 2 Products

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant. Internal parts to be assembled in a watertight, shockproof, vibration-proof assembly.

.3 Operating conditions: 0-50C with 10-90% RH (non-condensing) unless otherwise specified.

.4 Terminations: use standard conduit box with slot screwdriver compression connector

block unless otherwise specified.

.5 Transmitters to be unaffected by external transmitters (eg. walkie talkies).

.6 Account for hysteresis, relaxation time, maximum and minimum limits in all applications of sensors and controls.

.7 Outdoor installations: use weatherproof construction in EEMAC 12 enclosures.

2.2 FLOW SWITCH

.1 Vane type suitable for low flow applications, SPDT, snap acting, line voltage water flow switch, CSA approved (Provide with current sensors).

.2 Paddle size and length to be as per manufacturer's recommendations for the pipe size and flow.

.3 Flow switch to be adjustable to the required flow.

.4 Weted parts to be brass.

.5 Flow switches to be installed on top of horizontal pipe with minimum five pipe diameters - both sides.

.6 Acceptable material: ITT McDonnel Miller FS4-3

2.3 CURRENT SENSORS

.1 Analog current sensor, loop powered, fully isolated ISA type 2, Class U with a 4 to 20 ma or 2 to 10 volt DC output, sensor through-hole to accommodate up to #2/0 THHN insulated wire suitable for sensing up to 200 amperes, and provided with over-range protection

.2 Current sensor to be sized to suit equipment load.

.3 Accuracy: plus or minus 0.5 percent of full scale

.4 Linearity and repeatability: plus or minus 0.1 percent of full scale

.5 Response time: of no less than 300 milliseconds to 99 percent of full scale.

2.4 ELECTRONIC CONTROL DAMPER OPERATORS

.1 Requirements:

.1 Rotating direct drive proportional type.

.2 Spring return for "fail-safe" in Normally Open or Normally Closed position as indicated.

.3 Operator: size so as to control dampers against maximum pressure or dynamic closing pressure (whichever is greater).

.4 Parallel mounting as integral unit is acceptable.

.5 Power requirements: 25 VA maximum at 24 V AC.

.6 Operating range: 0 - 20 V DC.

.7 Acceptable Material: Belimo

2.5 ELECTRONIC/ELECTRIC VALVE ACTUATORS

.1 Requirements:

.1 Construction: steel, cast iron, aluminum.

.2 Control voltage: 0-20V DC or 24V AC.

.3 Positioning time: to suit application. 90 sec maximum.

.4 Spring return to normal position as indicated.

.5 Direct drive.

2.6 CONTROL VALVES

.1 Requirements:

.1 NPS2 and under: bronze with screwed ends.

.2 NPS21/2 and over: cast iron with flanged ends.

.3 Trim: type 316 stainless steel.

.4 Leakage: 0.5% of rated flow maximum.

.5 Two or three port as indicated. Normally Open or Normally Closed, as indicated.

.6 Flow characteristics: linear.

.7 Rangeability: 50:1 minimum.

.8 Performance: refer to I/O Summaries.

.9 Minimum shut-off pressure: 220kPa.

2.7 TRANSFORMER

.1 Provide CSA approved transformers for each digital controller. Common servicing from transformers is not acceptable.

2.8 LOW VOLTAGE THERMOSTATIC CONTROLLER

.1 CSA approved, low voltage, 7 day progammable heat/cool thermostat with day/night time setback, backlite display, 1 heat, 1 cool, auto changeover.

2.9 LOW BUILDING TEMPERATURE ALARM

.1 Line voltage heavy duty heating thermostat

.2 Acceptable material: Honeywell Farmstat T631 series

.3 Location: Mechanical Room

2.10 BOILER CONTROLLER

.1 Microprocessor PID controller, CSA approved and meeting ICES & FCC regulations for EMI/RFI.

.2 Enclosure: blue modified PVC.

.3 Power: 115Vac, 600Hz, 600VA.

.4 Relay capacity: 230Vac, 5 Amp, 0.25kW pilot duty at 240VA.

.5 Modulating outputs: 0-20mA / 4-20mA (up to 1000ohm load).

.6 Demands: 20 to 260 Vac, 2VA.

.7 Sensors: NTC thermistor, 10kOhm @ 25degC, Outdoor sensor: 070, Universal sensor: 071, 4x 500Ohm resistors.

.8 Functions:

.1 Outdoor air reset.

.2 Sequential for up to three boilers.

.3 First On/Last Off or First On/First Off boiler rotation.

.4 Installer and advanced access levels.

.5 Boiler pump control output.

.6 Pump purge run timer.

.7 Test sequence.

.8 Pump exercise.

.9 Boiler temperature alarm.

.10 Soft stop.

.11 Warm weather shutdown.

.9 Acceptable material: Tekmar Boiler Control.

2.11 PUMP CONTROLLER

.1 CSA listed packaged pump sequencer capable of enable/disable of pump on demand from boiler controller.

.2 Main/Standby selection based on run time.

.3 Power supply: 120/1/60

.4 Acceptable material: Tekmar 132.

2.12 STAND ALONE TEMPERATURE CONTROLLERS

.1 Power: 24V or 120V.

.2 Sensed temperature:

.1 Outdoor air temperature.

.2 Duct temperature.

.3 Time clock.

.4 Standard of acceptance: Honeywell T775.

2.13 WIRING, CONDUIT, TERMINATIONS, BOXES

.1 To requirements of Division 26.

2.14 CARBON MONOXIDE DETECTOR

.1 Certification: CSA-C22.2.

.2 Packaged carbon monoxide detector and analog transmitter.

.3 4-20mA linear output signal.

.4 Temperature compensation.

.5 Visual LED for power and fault conditions.

.6 Water/dust tight enclosure with hinged door. - Intended for use in indirect water spray.

.7 Automated calibration procedure.

2.15 NOx DETECTOR

.1 Certification: CSA-C22.2.

.2 Packaged nitrogen dixoide detector and analog transmitter.

.3 4-20mA linear output signal.

.4 Temperature compensation.

.5 Visual LED for power & fault conditions.

.6 Water/dust tight enclosure with hinged door. - Intended for use in indirect water spray.

.7 Automated calibration procedure.

2.16 GAS DETECTION ALARM CONTROLLER

.1 Multi-channel gas detection system controller for monitoring CO, NOx.

.2 Water/dust tight enclosure with hinged door. - Intended for use in indirect water spray.

.3 May have integral sensors or remote. Provide sufficient inputs for specified sensors.

.4 Provide output signal to open motorized damper and start EF-1.

2.17 TANK LEVEL GAUGING

.1 Level gauging to meet ULC/FM requirements for hazardous liquids.

.2 Pneumatic, hand pump operated, accuracy 2%.

.3 Calibration and Units: Litres. Gauge to match tank capacity.

.4 Tubing: 4.7mm copper tubing with 50mmØ NPT bushing and end bell.

.5 Range: 0 to maximum tank capacity.

.6 Acceptable Material: Ktech Midget Model 277.

.7 Installation: Comply with manufacturer's written recommendations or specifications, including product technical bulletins, storage, and installation instructions, and datasheets.

Part 3 Execution

3.1 INSTALLATION

.1 Install all field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.2 Temperature transmitters, humidity transmitters, current-to-pneumatic transducers, solenoid air valves, controllers, relays: install in NEMAI enclosure or as required for specific applications. Provide for electrolytic isolation in all cases when dissimilar metals make contact.

.3 Support field-mounted transmitters, sensors on pipe stands or channel brackets.

.4 Install all wall mounted devices on fire resistant plywood panel properly attached to wall.

3.2 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for electric and electronic control systems installation in accordance with manufacturer's written instructions.

.2 Visually inspect substrate in presence of Departmental Representative.

.3 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.4 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative .

3.3 FIELD MOUNTED TRANSMITTERS AND SENSORS

.1 Support properly on pipe stands or channel brackets.

.2 Install wall mounted devices on backing plate or junction box attached properly to wall.

.3 Mounting height as per Architectural or where not indicated at 1250mm AFF.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2-94. 0-M91, Canadian Electrical Code, Part II, General Requirements.

.2 CAN/CSA-Z234.1-89, Canadian Metric Practice Guide.

.2 American National Standards Institute (ANSI)

.1 ANSI/ISAS5.5-1985, Graphic Symbols for Process Displays.

.2 ANSI/IEEE260-1978, Letter Symbols for SI and Certain Other Units of Measurements.

1.2 DESIGN DOCUMENTATION

.1 Design documentation for each system to include, as a minimum:

.1 Narrative type of Sequence of Operation.

.2 Control Description Logic (CDL).

.3 Schematics.

Part 2 Products

2.1 GENERAL

.1 Provide all wiring, conduit, relays, starters, electronics, etc., not indicated or specified but required for a complete and functional automatic control system.

.2 All scales to be in SI units.

.3 Operating range to suit application range.

Part 3 Execution

3.1 GENERAL

.1 Provide all wiring, conduit, relays, starters, electronics, etc., not indicated or specified but required for a complete and functional automatic control system.

.2 Location of controllers and panels not indicated or not as per drawing locations to be approved by Departmental Representative prior to installation.

3.2 INSTALLATION

.1 Install all systems and hardware in accordance with the requirements of this specification, good controls practice and the requirements of Division 26.

.2 Install all equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.3 Follow building lines.

.4 Run all systems exposed and do not pass thru or touch un-heated ducts or enclosures.

.5 Locate thermostat sensors 1500 mm above floor as indicated. When conflict occurs follow Departmental Representative's instructions.

.6 All wiring to be in conduit. Wiring, conduit connections, and fittings to be as per the requirements of Division 26.

3.3 ELECTRICAL GENERAL

.1 Complete installation in accordance with requirements of:

.1 Division 26, this specification.

.2 Electrical safety Code of Province/Territory having jurisdiction.

.3 ANSI/NFPA 70-1996SB.

.4 ANSI C2-1997.

.2 Fully enclose or properly guard electrical wiring, terminal blocks, all high voltage above 70 V contacts and mark to prevent accidental injury.

.3 Conform to all manufacturer's recommendations for storage, handling and installation.

.4 Check all factory connections and joints. Tighten where necessary to ensure continuity.

.5 Install electrical equipment between 1000 and 2000 mm above finished floor wherever possible and adjacent to related equipment.

.6 Shield and mark all live parts "LIVE 120 VOLTS" or other appropriate voltage.

.7 Holes through exterior wall and roofs: flash and make weatherproof.

.8 All digital controllers to be connected to dedicated surge and transient protected power supply.

3.4 CONTROL LOGIC - VENTILATION

.1 General description:

.1 Ventilation for the KNP Trades Building is provided by HRV-1. EF-2

provides ventilation to the Vehicle Storage Bays (Room 108 and 109).

.2 HRV-1 Sequence

.1 Time Schedule: HRV-1 operates based on a 365 day time based schedule. Initial time-based setpoint (confirm with Owner):

.1 HRV-1 ON: Mon-Fri @ 600hrs, Sat-Sun @ 0900hrs

.2 HRV-1 OFF: Mon-Fri @ 2000hrs, Sat-Sun @ 1600hrs

.2 Timeclock to be located in Room 106 at entry door (exact location to be approved by Departmental Representative).

.3 Unoccupied: Manual timeclock override off to de-energize HRV-1.

.4 Occupied: Manual timeclock override on to energize HRV-1

.5 Timeclock to clearly indicate which position is AUTO, Override ON and Override OFF.

.6 Exhaust only defrost by manufacturer supplied defrost cycles.

.7 Alarms: HRV-1 alarm light to illuminate on mechanical alarm panel at entrance to boiler room.

.8 HRV-1 Coils:

.1 PHC SAT controller to modulate three-way PHC mixing valve to maintain PHC SAT = -10 degC.

.2 RHC SAT controller to modulate three-way RHC mixing valve to maintain RHC SAT.

.3 RHC SAT controller to reset RHC SAT (to be adjustable at controller) based on outdoor air temperature as follows:

.1 If OAT<+10C: RHC SAT setpoint = 16C.

.2 If OAT>=+10C: RHC SAT setpoint = 14C.

3.5 CONTROL LOGIC - HEATING PLANT

.1 Boilers and primary recirculation pumps:

.1 Boilers operate using packaged boiler operating controls. Controls cycle burner to satisfy setpoint.

.2 Tekmar model 268 multi stage boiler controller to cycle lead boiler based on runtime and to provide outdoor reset HWS temperature reset schedule.

.3 HWS reset schedule initial setpoints:
At OAT = -40 deg C, HWS = 82 deg.C
At OAT = +15 deg C, HWS = 60 deg.C

.4 Tekmar controller to cycle lead boiler based on runtime. Lead boiler switches after 168 hrs run time. Sequence as follows: B-1= lead, B-2=lag. After 168hr runtime on lead boiler, change lead boiler to next in line, e.g. B-2 = lead, B-1 = lag.

.5 When lead boiler energized, associated boiler circulation pump energized (B-1/P-3.1, B-2/P-3.2). Current sensor to prove boiler recirc pump operation. In event of no HW flow, disable boiler, alarm boiler failure (energize auto-dialer and mechanical alarm panel BOILER ALARM indicator light) and energize next boiler.

.6 Low water cutoff (LWCO) to disable boiler in event of low heating water level.

.7 High limit controller with manual reset to disable boiler in event of high heating water temperature. Setpoint = 93 deg C.

.2 Secondary Pumps

.1 Secondary HW recirc pumps P3.3/P3.4 and P3.5/P3.6 operate as lead/ standby.

.2 Pump sequencers alternate lead pump every 168 hours of operation.

.3 In event of lead pump failure as sensed by current sensor, alarm lead pump failure at pump sequencer (energize auto-dialer and mechanical alarm panel BOILER ALARM indicator light) and energize lag pump.

.4 Pumps run continuous until outdoor air temperature greater than 16 deg C for 2 hours. Minimum deadband = 3 deg C.

3.6 CONTROL LOGIC - TERMINAL HEAT

.1 Radiation (panels and perimeter baseboards):

.1 Low Voltage thermostat cycles normally open two position zone valve to satisfy setpoint.

.2 Initial setpoint = 22 deg C.

.2 Unit Heaters:

.1 Line voltage thermostat cycles blower to satisfy setpoint.

.2 Where equipped with a 2-way control valve, relay thermostat signal to open/ close control valve on call for heat.

.3 Initial setpoint = 20 deg C.

.3 Cabinet Unit Heater:

.1 Integral thermostat cycles blower to satisfy setpoint.

.2 Initial setpoint = 22 deg C.

3.7 DCW RECIRCULATION PUMP

.1 P-1 to operate continuously.

.2 Provide hand switch and lamacoid reading "water supply freeze protection, do not turn off".

.3 Provide current switch and relay to mechanical alarm panel at entrance to boiler room. If pump fails, illuminate alarm panel DCW RECIRCULATION indicator light, and energize auto-dialer.

3.8 DOMESTIC HOT WATER HEATER

.1 Domestic hot water heater temperature controller to cycle electric heating elements to satisfy setpoint. Initial setpoint = 60 deg C.

3.9 HRV CONDENSATE PUMP P-2

.1 P-2 to cycle on integral level controls to discharge condensate to floor drain as required.

3.10 CONTROL LOGIC - FANS

.1 EF-1 Vehicle Storage Exhaust Fan

.1 General: EF-1 provides evacuation of Rooms 108 and 109 in the event of a Carbon Monoxide or Nitrogen Dioxide alarm event.

.2 Carbon monoxide detector setpoint: 100ppm.

.3 NOx detector setpoint: 1.5 ppm.

.4 Upon signal from CO/NO2 detector, open MD-1 and MD-2 and start EF-1.

.5 Run EF-1 until the CO/NO2 alarm signal is cleared.

.6 Once alarm signal is cleared, close MD-1 and MD-2.

.2 EF-2 Vehicle Storage Ventilation

.1 Interlock EF-2 with lighting circuits in room 108 and 109.

.2 Provide a delay timer.

.3 MD-3 opens and fan runs when light is switched on. Remain running 10 minutes after lights have been switched off.

.3 EF-3, EF-4 Janitorial & Washroom Exhaust

.1 Interlock EF-3 with lightswitch in Room 103.

.2 Interlock EF-4 with lightswitch in Room 102.

.3 Provide a delay timer.

.4 Fan runs when light is switched on. Remain running 10 minutes after lights have been switched off.

.4 CF-1, CF-2, CF-3 Ceiling Destratification Fans

.1 Provide control switch adjacent to lighting circuit at entry door.

3.11 LOW BUILDING TEMPERATURE ALARM

.1 In event of low building temperature as sensed by temperature sensor and 15 minute time delay, energize autodialer.

.2 Initial setpoint = 10 deg C

.3 Low temperature sensor located in Mechanical Room.

3.12 FUEL OIL LOW LEVEL ALARM

.1 In event of Fuel Oil low level float switch engangmenet, energize autodialer and illuminate mechanical alarm panel FUEL OIL LOW LEVEL indicator light.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 - Closeout Submittals

.3 Section 23 05 01 - Installation of Pipework

.4 Section 23 05 02 - Pipework

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.1 ASME-B16.3, Malleable-Iron Threaded Fittings: Classes 150 and 300.

.2 ASME-B16.9, Factory-Made Wrought Steel Buttwelding Fittings.

.2 ASTM International

.1 ASTM A47/A47M, Standard Specification for Ferritic Malleable Iron Castings.

.2 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.

.3 ASTM B61, Standard Specification for Steam or Valve Bronze Castings.

.4 ASTM B75M, Standard Specification for Seamless Copper Tube Metric.

.3 CSA International

.1 CSA-B139 (2015), Installation Code for Oil Burning Equipment.

.2 CSA-B140.0, Oil Burning Equipment: General Requirements.

.3 CSA-C282, Emergency Electrical Power Supply for Buildings.

.4 Manufacturers Standardization Society of the Valve and Fitting Industry (MSS)

.1 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.

.5 Underwriter's Laboratories of Canada (ULC)

.1 CAN/ULC S603.1, External Corrosion Protection Systems for Steel Underground Tanks for Flammable and Combustible Liquids.

.2 ULC ORD-C107.12, Line Leak Detection Devices for Flammable Liquid Piping.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Provide manufacturer's printed product literature, specifications and datasheets for piping, fittings and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

.1 Indicate on manufacturer's catalogue literature the following: valves.

.3 Indicate VOC's for adhesive and solvents during application and curing.

.4 Test Reports:

.1 Submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.5 Certificates:

.1 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Manufacturers' Instructions: provide manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

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

1.5 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging.

Part 2 Product

2.1 FILL VENT AND CARRIER PIPE

.1 Materials as per CSA-B139, CEPA SOR/2008-197, NFCC.

.2 Steel: to ASTM A53/A53M, Schedule 40, continuous weld or electric resistance welded, screwed.

.3 Copper: type L, soft copper tubing, to ASTM B75M, in long lengths.

2.2 STEEL PIPE COATING

.1 Bituminous paint: in accordance with manufacturer's recommendations.

.2 Paints: in accordance with manufacturer's recommendations for surface conditions.

.1 Primer: maximum VOC limit to Standard GS-11.

.2 Paints: maximum VOC limit to Standard GS-11.

2.3 JOINTING MATERIAL

.1 Screwed fittings: red paste jointing compound.

2.4 FITTINGS

.1 Steel:

.1 Malleable iron: screwed, banded, Class 150 to ASME-B16.3.

.2 Welding: butt-welding to ASME-B16.9.

.3 Unions: malleable iron, brass to iron, ground seat, screwed, to ASTM A47/A47M.

.4 Nipples: Schedule 40, to ASTM A53/A53M.

.2 Copper:

.1 Piping: brazed type.

.2 Flared Fittings

.3 Connections to equipment: compression.

2.5 VENT CAPS

.1 Aluminum body and cap, slip on with brass set screw, 40-mesh brass screen.

.2 Compliance: NFPA 30.

2.6 FUSIBLE LINK VALVE

.1 Brass body, ULC listed.

2.7 DRIP TRAY

.1 Welded steel, min: 12ga, liquid tight with minimum 25mm high sides.

.2 Min dimensions: 300x300mm, or as required to contain 10x the volume of the oil filter.

2.8 FUEL OIL DE-AERATOR

.1 Approved fuel oil de-aerator, ULC listed, max operating temp 40°C, max flow 72 L/

hr connections, 6Ø threaded, 3 pipe system.

2.9 BALL VALVES

.1 Interior: class 600 WOG, bronze body, full bore, forged brass ball, brass gland and PTFE Teflon seat, steel lever handle, screwed.

.2 Exterior: low temperature suitable for operating temperature to -40°, Class 600 WOG, bronze body, full bore forged brass ball, brass gland and PTFE Teflon seat, steel lever handle, screwed.

2.10 DRAIN VALVES

.1 Minimum 13Ø, class 600 bronze body, full bore, forged brass ball, brass gland and PTFE Teflon seat, steel lever handle, screwed, male hose end c/w cap and chain.

2.11 STRAINERS

.1 1035 kPa, Y type with 20 mesh stanless steel removable screen bronze body screwed cap, threaded ends.

2.12 BALL VALVES

.1 NPS 2 and under: bronze body, screwed ends, TFE seal, hard chrome ball, 4 MPa, WOG as specified under Section 23 05 23.01 - Valves - Bronze.

2.13 ANTI-SYPHON VALVE:

.1 Compatible with suction of pressurized systems, integral thermal expansion relief, ductile iron body, stainless steel cap and sprin

.2 Anti-Syphon to be achieved through use of a fuel oil solenoid valve. See 2.14.

2.14 FUEL OIL SOLENOID VALVE:

.1 CSA listed

.2 Intended for use with No. 2 Fuel Oil

.3 Two position, normally closed, fail closed

.4 On/off solenoid actuating valve

.5 Brass body

.6 No manual override

.7 24V DC

.8 Controls Execution:

.1 Control wiring to be teck cable, sleeve in EMT conduit acceptable within

mechanical room.

.2 Provide fuel anti-syphon solenoid control panel;

.1 Provide status indicator light which illuminates when solenoid is open;

.2 Provide push button override at panel with 1 hour override operation;

.3 Provide labeling:

.1 "FUEL OIL ANTI-SYPHON SOLENOID PANEL"

.2 "STATUS"

.3 "OVERRIDE OPEN (1HR)"

.3 Interlock with boiler burner operation:

.1 Solenoid to open when either boiler burner is called to run.

2.15 LEVEL GAUGING

.1 Level gauging to meet ULC/FM requirements for hazardous liquids.

.2 Pneumatic, hand pump operated, accuracy 2%.

.3 Calibration and Units: Litres and Imp Gallons. Gauge to match tank capacity.

.4 Tubing: 4.7mm copper tubing with 50mmØ NPT bushing and end bell.

.5 Range: 0 to maximum tank capacity.

.6 Installation: Comply with manufacturer's written recommendations or specifications, including product technical bulletins, storage, and installation instructions, and datasheets.

2.16 LEVEL SWITCH

.1 Brass column mounted, magnetic reed switche(s), buna-N float(s) enclosing magnet (s), 50dia NPT bushing for tank connection. Reed switche(s) to be SPDT to operate on rise or drop as required, low voltage, 20va.

.1 Day tank levels: four magnetic actuated reed switches, Hi Level Alarm & lock-out (HLA), Hi Level Cutoff (pump off, HLC), Low Liquid Level (pump on, HLL), low level alarm (HLA).

.2 Critical day tank level (CDT): one magnetic reed switch

.2 Listing: CSA/ULc listed for service.

Part 3 Execution

3.1 APPLICATION

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

3.2 PIPING

.1 Install piping in accordance with Section 23 05 05 - Installation of Pipework, supplemented as specified.

.2 Install oil piping system in accordance with NFCC.

.3 Slope piping down in direction of storage tank unless otherwise indicated.

.4 Underground piping to be protected in conformance with CAN/ULC-S603.1.

.5 Above ground piping to be protected from physical impact due to impact.

.6 Piping inside building:

.1 Ensure piping in solid flooring is installed to CSA-B139.

.2 Use flare joint to CSA-B139 for brass piping.

.3 Install filter, gate valve, and fire valve at burners.

.7 Fill, vent, suction and return piping outside building:

.1 Steel piping welded throughout except at tanks where electrically isolating fittings are used.

.2 Grading: slope piping at 1% minimum back to tanks.

.8 Piping at tanks:

.1 Suction: terminate 150 mm from bottom of tank with foot valve and strainer.

.2 Comply with authority having jurisdiction for piping for venting at tanks venting alarm.

.3 Fill pipes: install to comply with CSA-B139.

.1 Include vapour tight tamperproof cover.

.2 Equip fill pipes on tanks with capacity greater than 5000 L with liquid and vapour tight connections.

.4 Dipstick: extend tube to within 150 mm from bottom of tank. Terminate at grade with lockable cap and chain, and watertight cover.

.9 Clearly label piping runs in legible form indicating;

.1 Piping product content.

.2 Direction of flow.

.3 Identify transfer points in piping systems to CPPI Colour-Symbol System to Mark Equipment and Vehicles for Product Identification

3.3 VALVES

.1 Install valves with stems upright or horizontal unless approved otherwise by Consultant.

.2 Install gate valves at branch take-offs, to isolate pieces of equipment and as indicated.

.3 Install globe valves for balancing and in by-pass around control valves.

.4 Install swing check valves on discharge of pumps and as indicated.

.5 Install plug cocks as indicated.

.6 Install Anti-Syphon valves as detailed and to manufacturers recommendations.

3.4 OIL FILTERS

.1 Install ULC approved in supply line to.

.2 At time of acceptance, replace filter cartridge with new.

3.5 OVERFILL AND SPILL PROTECTION

.1 To CSA-B139.

3.6 LEAK DETECTION

.1 Install line leak detector to ULC ORD C107.12.

.2 Install secondary containment systems that will allow leaks to accumulate in containment sump available for visual inspection.

3.7 FIELD QUALITY CONTROL

.1 Site Tests/Inspection:

.1 Test system to CSA-B139 and CSA-B140.0 and authorities having jurisdiction.

.2 Isolate tanks from piping pressure tests.

.3 Maintain test pressure during backfilling.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Related Requirements

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 61 00 - Common Product Requirements.

.3 Section 01 78 00 - Closeout Submittals.

.4 Section 23 05 49 - SeismicRestraint Systems (srs) - Type P2 Buildings.

1.2 REFERENCES

.1 CAN/CSA-B139-2015, Installation Code for Oil Burning Equipment.

.2 CGSB 1-GP-140M, Primer, Red Lead, Iron Oxide, Oil Alkyd Type.

.3 ULC-S601, Steel, Aboveground Horizontal Tanks for Flammable and Combustible Liquids.

.4 ULC-S602, ABOVEGROUND STEEL TANKS FOR FUEL OIL AND LUBRICATING OIL

.5 ANSI/API 650, Welded Steel Tanks for Oil Storage.

.6 ULC/ORD-C142.3, Storage Vaults.

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

1.3 PRODUCT DATA

.1 Product Data:

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

.2 Indicate on manufacturer's catalogue literature the following:

.1 Capacity.

.2 Warranties.

.3 Approvals.

.4 Details of construction.

.5 Appurtenances.

.6 Installation instructions.

.7 Physical dimensions.

1.4 CLOSEOUT SUBMITTALS

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

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

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

Part 2 Product

2.1 EXTERIOR MAIN FUEL OIL STORAGE TANK (TK-1.1)

.1 Capacity: 2270 L.

.2 Fabrication: Double-walled steel to ASTM A 569A or equivalent, cylindrical design, heavy gauge tank shell and die formed ends, welded to CSA W59.

.3 Containment: 110%

.4 Entire assembly including tank to be ULC listed and constructed to ULC-S601-07 and ULC-S602.

.5 Tank shall be vented to atmosphere and be equipped with emergency venting.

.6 Factory applied paint shall be one coat red oxide primer applied to CGSB-1-GP-140M. Two final coats of polyurethane protective coating. Colour to be white.

.7 Sheet steel to ASTM A 635/A 635M-02 or equivalent.

.8 Accesories: locking vent caps, spill box, tank gauges, vent whistle.

.9 Minimum Connections:

.1 Vent: 50Ø

.2 Fill: 50Ø

.3 Level Gauging: 50Ø

.4 Level Indicator: 50Ø

.5 Levelometer: 50Ø

.6 Drain: 25Ø

.7 FOS: 50Ø

.8 Spare: 50Ø

.9 Emergency Vent: 100Ø

.10 Secondary Inspection: 50Ø

.11 Secondary Emergency Vent: 100Ø

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 tanks in accordance with CAN/CSA-B139 and manufacturers directions.

.2 Position exterior tanks using lifting lugs and hooks, and where necessary use spreader bars. Do not use chains in contact with tank walls.

.3 Exterior tanks to be installed secured to structural foundation with approved anchors and secured to seismic restraint fuel oil tank support stand and concrete housekeeping pad, per the requirements of Section 23 05 49 - SeismicRestraint Systems (srs) - Type P2 Buildings. Support stand to be approved andstamped by Structural Engineer licensed to practice in the Yukon Territory. Tank supports and ladder access provided with tank. Coordinate with General Contractor.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 10 - Closeout Submittals.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME).

.2 American Society for Testing and Materials, (ASTM).

.3 Canadian Standards Association (CSA International).

Part 2 Products

2.1 DIAPHRAGM TYPE EXPANSION TANK

.1 Vertical steel pressurized diaphragm type expansion tank.

.2 Diaphragm: EPDM, renewable suitable for 115 degrees C operating temperature.

.3 Working pressure: 860 kPa with ASME stamp and certification.

.4 Air precharged to 84 kPa (initial fill pressure of system).

.5 Schedule: see drawing

2.2 AUTOMATIC AIR VENT

.1 Standard float vent: brass body and NPS 1/8 connection and rated at 310 kPa working pressure.

.2 Industrial float vent: cast iron body and NPS 1/2 connection and rated at 860 kPa working pressure where indicated.

.3 Float: solid material suitable for 115 degrees C working temperature.

.4 Vent isolation valve: Class 600, regular port, threaded, bronze body, plated brass ball, brass gland and PTFE Teflon seat, wing handle, screwed.

2.3 AIR -DIRT SEPARATOR

.1 Combination air-dirt separator, steel, tested and stamped in accordance with ANSI/ ASME BPVC with galvanized steel integral strainer with 5 mm perforations, tangential inlet and outlet connections, and internal stainless steel air collector tube.

.2 Ratings: minimum 1100kPa at 177degC.

.3 Flow rate shall conform to the design flow rate of the system.

.4 Connections: NPT independent vent and blow down, flanged inlet and discharge.

2.4 PIPE LINE STRAINER

.1 Bronze body(50dia and smaller) :

.1 Class 150, 1033 kPa, Y-pattern, screwed cap, stainless steel screen, bronze body, screwed.

.2 Iron body (63dia and larger):

.1 Class 125, 860 kPa, Y-pattern, bolted cover, stainless steel screen, flanged ends.

.3 Blowdown connections: NPS 3/4.

.4 Screens: stainless steel with 1.19 mm perforations

.5 Size:line size.

2.5 MANUAL AIR VENT

.1 Brass body, 3 dia connection, screwdriver operated, 860kPa working pressure.

2.6 BRAZED PLATE HEAT EXCHANGERS

.1 General : Copper brazed plate heat exchanger, full flow with safety chambers to protect against pressure fluctuations and thermal shock.

.2 Plates: AISI 316 stainless steel.

.3 Brazing material: copper, 99.9% pure.

.4 Operating temperature: to 195degC.

.5 Operating pressure: to 3100 kPa .

.6 Approvals: Designed, constructed and tested in accordance with ANSI/ASME Boiler and Pressure Vessel Code, Section VIII, CSA B51 and ISO 9001.

.7 Fluids:

.1 Hot side: treated water.

.2 Cold side: 50% by solution propylene glycol.

.8 Capacity: See drawing schedule

Part 3 Execution

3.1 GENERAL

.1 Install as indicated and to manufacturer's recommendations.

.2 Run drain lines and terminate above nearest drain.

.3 Maintain proper clearance to permit service and maintenance.

.4 Should deviations beyond allowable clearances arise, request and follow Engineer's directive.

.5 Check shop drawings for conformance of all trappings for ancillaries and for equipment operating weights.

3.2 STRAINERS

.1 Install in horizontal or down flow lines.

.2 Ensure clearance for removal of basket.

.3 Install ahead of each pump.

.4 Install in other locations as indicated.

3.3 AIR VENTS

.1 Install at high points of systems.

.2 Install ball isolation valve on automatic air vent inlet.

.3 Install automatic air vents in mechanical room only.

3.4 EXPANSION TANKS

.1 Install level and secure.

.2 For base mounted tanks install on housekeeping pad specified in Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.3 Adjust expansion tank pressure to suit design criteria.

3.5 BRAZED PLATE HEAT EXCHANGER

.1 General:

.1 Install level and firmly anchored to supports.

.2 Install in accordance with manufacturer's recommendations.

.2 Appurtenances:

.1 Install with safety relief valve piped to drain.

.2 Install Pressure/temperature tappings on inlet and outlet of primary and

secondary side.

.3 Install pressure gauges as indicated.

.3 Start-up

.1 Check for cleanliness on primary and secondary sides.

.2 Check water treatment system is complete, operational and correct treatment is being applied.

.3 Check installation, settings, operation of relief valves and safety valves.

.4 Check installation, location, settings and operation of operating, limit and safety controls.

.5 Check supports, seismic restraint systems.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 10 - Closeout Submittals.

.3 Section 23 05 01 - Installation of Pipework.

.4 Section 23 05 02 - Pipework Testing.

.5 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

.6 Section 23 25 00 - HVAC Water Treatment Systems.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/American Welding Society (AWS)

.2 American Society of Mechanical Engineers (ASME)

.3 American Society for Testing and Materials (ASTM)

.4 Manufacturers Standardization Society (MSS)

1.3 DEFINITIONS

.1 For purposes of this section:

.2 "CONCEALED" - insulated mechanical services and equipment in hung ceilings non-accessible chases, furred spaces and crawlspaces.

.3 "EXPOSED" - will mean "not concealed" as defined herein.

.4 "RUNOUTS" - refers to piping to individual terminal units or fixtures not exceeding 3.6m in length.

Part 2 Products

2.1 PIPE

.1 Steel pipe: to ASTM A53/A53M, Grade B.

2.2 PIPE JOINTS

.1 NPS2 and under: screwed fittings with PTFE tape or lead free jointing compound..

.2 NPS2-1/2 and over::

.1 Welding fittings and flanges to CAN/CSA W48. and CSA W47.11. flanges:

plain, slip-on or weld neck.

.2 Roll grooved:

.1 Rigid coupling to ASME B31.1, angle bolt pattern.

.2 Flexible coupling to ASME B31.1 only where indicated or approved by Departmental Representative.

.3 Gaskets:

.1 Flange gaskets: EPDM to ANSI B16.21 or ANSI B16.20.

.2 Roll grooved coupling gaskets: EPDM rated to 121degC operating temperature, Grade EHP, red colour stripe, conforming to ASTM D-2000 designation, ULC classified to ANSI/NSF 61.

.4 Pipe thread: taper.

.5 Bolts and nuts: to ASME B18.2.1.

2.3 FITTINGS

.1 Screwed fittings: malleable iron, to ASME B16.3, Class 150.

.2 Pipe flanges and flanged fittings:

.1 Cast iron, Class 150: to ANSI B16.1.

.2 Steel: to ANSI B16.5.

.3 Welded: butt-welding fittings: steel, to ASME B16.9 and ASTM A 234/A 234M-02 .

.4 Unions: malleable iron, to ASTM A47/A47M..

.5 Fittings for roll grooved piping: malleable iron to ASTM A47/A47M.

Part 3 Execution

3.1 PIPING INSTALLATION

.1 Install pipework in accordance with Section 23 05 01 - Installation of Pipework.

3.2 CLEANING, FLUSHING AND START-UP

.1 In accordance with Section 23 25 00 - HVAC Water Treatment Systems.

3.3 TESTING

.1 Test system in accordance with Section 23 05 02 - Pipework Testing supplemented as specified herein.

.2 For glycol systems, retest with ethylene glycol to ASTM E202, inhibited, for use in building system after cleaning. Repair leaking joints, fittings or valves.

3.4 GLYCOL CHARGING

.1 Provide mixing tank and pump for glycol charging.

.2 Retest for concentration to ASTM E202 after cleaning.

3.5 GROOVED PIPEWORK INSTALLATION

.1 In accordance with Section 23 05 01 - Installation of PipeWork.

.2 Use of special lubricants to protect the gasket for chemical and temperature service are not acceptable.

.3 During installation lubricate gasket lips and exteior with thin coat of manufacturer approved lubricant to ease installation and reduce gasket pinching.

.4 Use roll grooving systems and tools in accordance with manufacturers specifications. Use roll tools to suit piping type.

.5 Provide rigid couplings except where otherwise indicated

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 10 - Closeout Submittals.

1.2 REFERENCES

.1 American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE).

.2 Electrical Equipment Manufacturers Advisory Council (EEMAC).

.3 Canadian Standards Association (CSA International).

.4 National Electrical Manufacturers Association (NEMA).

Part 2 Products

2.1 IN-LINE CIRCULATORS

.1 Volute: Cast iron radially split flanged design suction and discharge connections.

.2 Impeller: Cast bronze.

.3 Shaft: Alloy steel with bronze sleeve bearing, integral thrust collar.

.4 Seal assembly: mechanical carbon brass trim with ceramic seat for service to 135 degrees C.

.5 Coupling: Flexible self-aligning.

.6 Bearings: oil lubricated

.7 Motor: to NEMA MG 1.

.8 Design pressure: 1207 kPa minimum.

.9 Motors: Speed: 1800rpm preferred. Max 3200rpm.

.10 Capacities: See drawing schedule.

Part 3 Execution

3.1 INSTALLATION

.1 Do Work in accordance with CAN/CSA-B214.

.2 In line circulators: install as indicated by flow arrows. Support at inlet and outlet flanges or unions. Install with bearing lubrication points accessible.

.3 Base mounted type:

.1 Install on housekeeping pad specified in Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

.2 For end suction provide inertia base as specified in Section 23 05 48 - Vibration Controls for HVAC Piping and Equipment.

.3 Supply templates for anchor bolt placement. Furnish anchor bolts with sleeves. Place level, shim unit and grout.

.4 Align couplings in accordance with manufacturer's recommended tolerance. Check oil level and lubricate. After run-in, tighten glands.

.5 Pipe drain tapping to floor drain for all hydronic systems unless otherwise approved by Departmental Representative. Do not provide drain tapping for glycol systems.

.4 Ensure that pump body does not support piping or equipment. Provide stanchions or hangers for this purpose. Refer to manufacturer's installation instructions for details.

.5 Install volute venting pet cock in accessible location.

.6 Install pressure gauge isolation ball valves and pressure gauges.

3.2 START-UP

.1 Pre-startup:

.1 Drain casing and bleed all air from volute and ensure pump full primed.

.2 Verify pump is level.

.3 Check nameplate is readily visible.

.2 Startup:

.1 Startup as recommended by manufacturer.

.2 Check rotation.

.3 Run in pump for minimum 12hrs continuous operation.

.4 Ensure flow through parallel pumps is equally balanced.

.5 Verify seal performance.

.6 Clean strainers.

.7 Replace shaft seals if pump has been used to degrease system.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCES

.1 American Society of Mechanical Engineers (ASME)

.2 ASTM D1121-93 Standard Test Method for Reserve Alkalinity of Engine Coolants and Anti-rusts

.3 ASTM D2688-94 Corrosivity of Water in the Absence of Heat Transfer (Weight Loss Methods)

1.3 SHOP DRAWINGS

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

.2 Provide for the following:

.1 Glycol HW Media and Inhibitors.

.2 Glycol Fill Tanks.

.3 Side Arm Filters.

.4 Sight glass.

.5 Pot feeder.

.6 Degreasant.

.7 Treatment chemicals and inhibitors.

1.4 CLOSEOUT SUBMITTALS

.1 Submit operation and maintenance data for incorporation into manual specified in Section 01 78 10 - Closeout Submittals.

.2 Include following;

.1 Log sheets as recommended by the Water Treatment Specialist.

.3 In addition to submittal requirements, submit a written report of actual cleaning activities for each hydronic and glycol closed system:

.1 System status

.2 Times

.3 Type of glycol or manufacturer's brand name of glycol added to system.

.4 Inspection results

.5 Final glycol concentration or concentration of corrosion inhibitor in the system.

.6 Final pH level

.7 Final reserve alkalinity based on 100% glycol.

.8 Final suspended solids concentration

.9 Final conductivity.

.10 Final Iron and Copper concentration

.4 Document water analyses results, quantities, dates chemicals added and make-up water used on chemical treatment report form.

Part 2 Products

2.1 MANUFACTURER

.1 Equipment, chemicals, service by one supplier.

2.2 HW GLYCOL

.1 Factory premixed with distilled water. Inhibited high temperature low toxicity propylene glycol with advanced inhibitor package suitable for film temperatures to 190 degC.

.2 Glycol mixture shall be 50/50 for this project.

2.3 SIGHT GLASS

.1 Bronze body, 6.5mm thick glass, rated operating pressure to 860 kPa.

2.4 PRESSURE RELIEF VALVE

.1 ASME rated,Section VIII, DIV 1.

.2 Bronze construction.

.3 Relief Pressure: as indicated.

2.5 PRESSURE REDUCING VALVE

.1 Bronze body, low pressure reducing valve, adjusting set screw, built in check valve and strainer, removable seats, diaphragm operated.

2.6 BOILER AND HYDRONIC PIPING DEGREASANT & DETERGENT

.1 Neutral cleaner, compatible with all metals, non hazardous to zero COSHH rated, suitable for cleaning in accordance with BS7593:2006. Neutral pH cleaning solution which is capable of removing oil, grease, and rust from metal surfaces of system and passivating cleaned metal surfaces of system. Cleaning solution shall include:

.1 Low foaming non-ionic surfactant for penetrating oily and greasy deposit surfaces.

.2 Solvent for dissolving oil and grease

.3 Dispersant for dissolving rust.

.4 Reducing agent for corrosion control.

.5 Ferrous and non-ferrous metal corrosion inhibitors.

.2 pH (conc): 7.0 - 7.5

.3 pH (1% soln): 7.5 - 7.8

.4 SG: 1.20 @ 20°C.

2.7 HW CHEMICAL TREATMENT

.1 Corrosion inhibitor including:

.1 Molybdate based for corrosion protection of ferrous material in system.

.2 Corrosion inhibitor for non ferrous material.

.3 Buffer for pH level control

2.8 FLUSH & CLEANING WATER

.1 All water for system flush and clean to be softened local water. Adjust water to ensure pH to neutral.

2.9 GLYCOL FILL SYSTEM

.1 General : feeder compatible with glycol solutions of up to 50% concentration, unit to be completely assembled.

.2 Tank: Per schedule. Fill/access opening and cover.

.3 Accessories: pump suction hose with inlet strainer and check valve; low fluid level pump cut-out float switch; manual diverter valve for purging air and agitating contents of storage tank; pressure switch with snubber and two sets of SPST contacts, each individually adjustable from 55 kPa to 125 kPa cut-out pressure; and liquid filled pressure gauge.

.4 Pump: diaphragm pressure pump with internal protection, of running dry without damage.

.5 Power: power supply adapter, 115/60/1 to 24 VDC 50 watts AC, supplied loose for

field installation.

.6 Alarms: second set of contacts in the pressure switch to be wired for use as low pressure alarm contacts for remote alarm circuit.

.7 Capacity: See Schedule.

Part 3 Execution

3.1 INSTALLATION

.1 Install HVAC water treatment systems in accordance with ASME Boiler Code Section VII, and requirements and standards of authorities having jurisdiction, except where specified otherwise.

.2 Ensure adequate clearances to permit performance of servicing and maintenance of equipment.

3.2 CLEANING OF MECHANICAL PIPING SYSTEMS

.1 Provide copy of recommended cleaning procedures and chemicals from Water Treatment Specialist for approval by Departmental Representative.

.2 Thoroughly flush mechanical systems and equipment after pressure tests for a minimum of 4 hours with local pre-softened water..

.3 Fill with solution of pre-softened water and no-foaming, phosphate-free detergent minimum 3% solution by weight or as per manufactured directions. Heat to minimum 82degC. Circulate for minimum of 48 hours to remove deposition from construction such as pipe dope, oils, loose mill scale and other extraneous materials.

.4 During all flush and clean procedures periodically remove strainer screen/basket and side arm filters and clean.

.5 During flush and clean ensure all valves to terminal units and coils left full open. Remove steam traps from systems.

.6 Drain system periodically from all drain locations and low points until complete cleaning water and detergent replaced with complete fresh softened water.

.7 Continue to circulate clean softened water for minimum 24hrs. Drain and flush with softened water for a minimum 2 hours.

.8 Final flush and clean water PH and TDS to be as per clean softened water. Repeat all steps as necessary until pH and TDS levels meet.

.9 Provide two 1 litre samples of clear water drained from each system. Confirm site test levels with test in laboratory and provide test results to Departmental Representative for review prior to filling of system with final heating media.

.10 Disposal of cleaning solutions to be approved by authority having jurisdiction.

Where no limits have been established stay within limits specified in "Alberta Infrastructure and Transportation Water Treatment Program Manual, Section 1 - Environmental Guidelines".

3.3 FILLING OF HYDRONIC SYSTEMS

.1 Upon receipt of approval of flushing water test results, fill complete system with clean and treated water.

.2 Provide preliminary adjustment of inhibitor levels using site tests.

.3 Provide one sample of adjusted treated heat transfer fluid. Test in laboratory and provide test results.

.4 Modify inhibitor levels or water pH as directed by water treatment analysis to meet specified treatment control limits.

.5 Provide two final samples. Test one in laboratory and provide test results. Turn over second sample to Departmental Representative.

3.4 FILLING OF GLYCOL SYSTEMS

.1 Upon receipt of approval of flushing water test results, fill complete system with clean heat transfer fluid.

.2 Heat transfer fluid to be factory premixed with required quality approved water prior to shipping. Mixture ratio to be as follows: 53% Re-formulated Dow frost HD combined with 47% distilled water.

.3 Provide preliminary adjustment of glycol and inhibitor levels using site tests.

.4 Provide one sample of adjusted treated heat transfer fluid. Test in laboratory and provide test results.

.5 Modify glycol and inhibitor levels as directed by water treatment analysis to meet specified chemical treatment control limits.

.6 Provide two final samples. Test one in laboratory and provide test results. Turn over second sample to Departmental Representative.

.7 Final heating fluid ratio: 50% glycol/50%water by volume.

3.5 SIDE STREAM FILTERS

.1 Install as per manufactured directions with isolation ball valve, radiator globe valve and sight glass.

.2 Provide filter wrench as required for filter change out

3.6 GLYCOL FILL STREAM

.1 Install to manufacturers recommendations.

.2 Install on wall stand fabricated of 32mmx32mmx3mm angle and minimum 14Ga steel plate. Finish stand with primer and black paint finish. Provide suitable backing for wall anchors.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 61 00 - Common Product Requirements.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM):

.1 ASTM A 480/A 480M-94b, Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A 525M-91b, Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process. (Metric).

.3 ASTM A 621/A 621M-92, Specification for Steel Sheet and Strip, Carbon, Hot-Rolled, Drawing Quality.

.2 National Fire Protection Agency (NFPA)

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.1 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

.4 ASHRAE Handbook, Fundamental, and Systems Volumes.

1.3 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

1.4 DEFINITIONS

.1 For purposes of this section:

.1 "CONCEALED" - insulated duct work in hung ceilings non-accessible chases, furred spaces and crawlspaces.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

Part 2 Products

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

MAX PRESSURE (Pa)	SMACNA SEAL CLASS
500	B

.2 Seal classification:

.1 Class B: longitudinal seams, transverse joints and connections made airtight with sealant.

2.2 SEALANT

.1 Concealed: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 30 deg.C to plus 93 deg.C.

.2 Exposed: latex duco sealant. Temperature range of minus 30degC to plus 93degC.

.3 All sealants to be low VOC to the current content limits of SCAQMD Rule #1168.

2.3 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

2.4 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Duct Leakage Test Manual.

2.5 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows: short radius.

.3 Square elbows: to 400 mm with single thickness vanes.

.4 Square elbows: over 400 mm with double thickness vanes.

.5 Main supply duct branches with balancing damper. Provide branch dampers as noted.

.6 Sub branch duct with 45 deg. entry and balancing damper on branch unless otherwise noted.

.7 Transitions unless otherwise noted:

.1 Diverging: 20 deg. maximum included angle.

.2 Converging: 30 deg. maximum included angle.

.8 Offsets: to SMACMA unless otherwise noted.

.9 Obstruction deflectors: maintain full cross- sectional area. Maximum included angles as for transitions unless otherwise noted.

.10 Exposed spiral duct joints: Butt joint as per details to satisfaction of Departmental Representative.

2.6 FIRESTOPPING

.1 Retaining angles around duct, on both sides of fire separation.

.2 Firestopping material and installation must not distort duct.

2.7 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653, Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to SMACNA.

.3 Joints: to SMACNA.

.4 Round:

.1 Exposed and concealed 250dia and larger: single spiral wound.

.2 Concealed less than 250dia: snap lock acceptable alternate.

.3 All exposed: double spiral wound.

2.8 HANGERS AND SUPPORTS

.1 Hidden ducts:

.1 Round to 500dia and rectangular to 300x200 strap hangers of same material as duct but next sheet metal thickness heavier.

.2 Rectangular ducts larger than 300 x 200 galvanized steel angle with galvanized steel rods to ASHRAE and SMACNA except where SRS required provide angle hangers to SMACNA.

.3 For round ducts 700dia and larger double hanger hanger with formed 6mm thk steel saddle.

.2 Exposed ducts: angle hangers for rectangular,

.1 Rectangular: angle hangers

.2 Round ducts 400 dia and smaller see details.

.3 Round ducts greater than 400dia double hanger with formed 6mm thk steel saddle. Where SRS required for ducts over 700dia provide angle hangers.

.3 Angle hangers to meet the requirements of the following table:

DUCT SIZE (mm)	ANGLE SIZE (mm)	ROD SIZE (mm)
up to 750	25x25x3	6
751 to 1050	40x40x3	6
1051 to 1500	40x40x3	10
1501 to 2100	50x50x3	10

2101 to 2400	50x50x5	10
2401 and over	50x50x6	10

.4 General hanger installation: to SMACNA unless otherwise noted.

2.9 UPPER ATTACHMENTS

.1 Steel channel, joist or angle (bottom):

.1 Malleable iron C clamp to ANSI/MSS SP-58-1983, type 23. ULC listed.

.2 Quick clip malleable steel with threaded rod insert.

.2 Steel channel, joist or angle (top):

.1 Malleable iron top of beam C clamp to ANSI/MSS SP-58-1983, type 19. ULC listed.

.2 Quick clip malleable steel with threaded rod insert.

.3 Concrete:

.1 Insert type expanding anchor with 10dia internal threaded rod connection, galvanized steel, CSTB approved. ULC listed.

2.10 MIDDLE ATTACHMENT (ROD)

.1 Electro-galvanized carbon steel threaded rod material to MSS SP58.

2.11 FLEXIBLE DUCTS

.1 Factory fabricated spiral wound flexible aluminum with flame spread rating not exceeding 25 and smoke rating not exceeding 50.

.2 Maximum length: 900mm

2.12 JOINT BEAUTY RINGS

.1 Beauty rings to be 22 ga x 75 mm width with flanged and bolted tightening tab.

Part 3 Execution

3.1 GENERAL

.1 Do work in accordance with SMACNA and as indicated.

.2 Do not break continuity of insulation vapour barrier with hangers or rods. Insulate strap hangers 100 mm beyond insulated duct.

.3 Support risers in accordance with ASHRAE and as indicated

.4 Install breakaway joints in ductwork on sides of fire separation.

.5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

3.2 DUCTWORK ROUTING & SITE REVIEW

.1 Duct work routing as shown on drawings is schematic. Provide all necessary ductwork offsets and fitting in order to route ductwork as indicated within the mechanical drawings.

.2 Verify ductwork routing by review of mechanical and structural steel/architectural drawings prior to ordering and shipping major ductwork elements.

.3 Where a minor conflict between ductwork and other mechanical or electrical services occurs the conflict is to be resolved by rerouting the service that requires the lesser amount of work at no additional cost to the Departmental Representative.

.4 Where a conflict between ductwork and the building structural elements occurs that could have been identified prior to ordering and shipping the duct work elements provide the required remedial work at no additional cost to the Departmental Representative.

3.3 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with ASHRAE SMACNA.as follows:

DUCT SIZE (mm)	SPACING (Maximum) (mm)
To 1500	3000
1501 and over	2500

.4 Support flexible ducts on 1200 mm centres.

3.4 WATERTIGHT DUCT

.1 Provide watertight duct for:

.1 outdoor air intake ducts from hood/louvre to air system (AHU, HRV, CF).

.2 exhaust air ducts from hood/louvre to air system (AHU, HRV, EF).

.2 Form bottom of horizontal duct without longitudinal seams. Solder joints of bottom and side sheets. Seal other joints with duct sealer.

.3 Fit base of riser with 150 mm deep drain sump and 32 mm drain connected, with deep seal trap and valve and discharging as indicated.

3.5 SEALING

.1 Concealed ducts: Apply sealant to outside of duct joint to manufacturer's recommendations.

.2 Exposed ducts: Apply silicone sealant to satisfaction of Departmental Representative. Sealant to be suitable for painting. See Arch. In lieu provide standard duct sealant and beauty rings.

3.6 TAPING

.1 Acceptable at connection between flexible ducts and rigid. Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations.

3.7 SERVICE ACCESS DOORS

.1 Provide duct service access doors as follows:

.1 To ensure that any section of duct is not more than 15m from the service access.

.2 At the base of all main risers.

.3 Upstream and downstream of the following:

.1 Turning vanes.

.2 At all fire/smoke and motorized dampers.

3.8 JOINT BEAUTY RINGS

.1 Provide beauty rings on all exposed duct joints as per sub 3.5 when standard duct sealant used. Beauty rings to be 22 ga x 75 mm width with flanged and bolted tightening tab. Install tab to be hidden from occupied space.

3.9 DUCT PROTECTION DURING CONSTRUCTION

.1 Store all sheet metal prior to installation to protect them from moisture or dust damage as specified in Section 01 61 00 - Common Product Requirements.

.2 Where terminal units have been contaminated by moisture or dust damage clean to the satisfaction of the Departmental Representative.

.3 Seal off all supply, return and exhaust air system openings to prevent the accumulation of dust and debris in the systems at all times unless work is being completed on the immediate area of the system using plastic seals to the approval of the Departmental Representative. This is to include overnight and longer work stoppages. Seal all until ventilation system openings until testing, adjusting and balancing commences.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.2 REFERENCES

.1 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

.2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

1.3 PRODUCT DATA

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

.2 Indicate the following:

.1 Flexible connections.

.2 Duct access doors.

.3 Turning vanes.

1.4 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 GENERAL

.1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

2.2 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.

.2 Material:

.1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 deg.C to plus 90 deg.C, density of 1.3 kg/sq.m.

2.3 ACCESS DOORS IN DUCTS

.1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal

thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.3 Gaskets: Neoprene.

.4 Hardware:

.1 Up to 300 x 300 mm: 2 sash locks complete with safety chain.

.2 301 to 450 mm: 4 sash locks complete with safety chain.

.3 451 to 1000 mm: piano hinge and minimum 2 sash locks.

.4 Doors over 1000 mm: piano hinge and 2 handles operable from both sides.

2.4 TURNING VANES

.1 Factory or shop fabricated single thickness and double thickness with trailing edge, to recommendations of SMACNA and as indicated.

2.5 INSTRUMENT TEST

.1 1.6 mm thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

Part 3 Execution

3.1 INSTALLATION

.1 Flexible connections:

.1 Install in following locations:

.1 Inlets and outlets of all indoor HRV.

.2 Inlets and outlets of in-line EF.

.3 Elsewhere as indicated.

.2 Length of connection: 100 mm.

.3 Minimum distance between metal parts when system in operation: 25 mm.

.4 Install in accordance with recommendations of SMACNA.

.5 When fan is running:

.1 Ducting on each side of flexible connection to be in alignment.

.2 Ensure slack material in flexible connection.

.2 Access doors:

.1 Size:

.1 630 x 350 mm for person size entry.

.2 530 x 530 mm for servicing entry.

.3 300 x 150 mm for viewing.

.4 As indicated.

.2 Location:

.1 Upstream and downstream at fire and smoke dampers.

.2 Upstream and downstream at control dampers.

.3 Upstream and downstream at turning vanes.

.4 At devices requiring maintenance.

.5 At locations required by code.

.6 At reheat coils, upstream and downstream of coil.

.7 Elsewhere as indicated.

.3 Turning vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated.

.4 Instrument test ports:

.1 Install in accordance with SMACNA and as per manufacture instructions.

.2 Locations: At inlet and outlet HRV, main and sub main ducts.

END OF SECTION

Part 1 General

1.1 RELATED SECTION

.1 Section 13 33 00 - Submittal Procedures.

1.2 REFERENCES

.1 Sheet Metal and Air Conditioning National Association (SMACNA)

.2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

1.3 PRODUCT DATA

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

.2 Indicate the following:

.1 Single blade dampers.

.2 Multiple blade dampers.

Part 2 Products

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 BALANCING DAMPERS (DUCTS LESS THAN 275mm DEPTH)

.1 Single blade, butterfly type.

.2 Metal thickness and construction to SMACNA.

.3 10dia threaded rod, with washer and locking nut, 22mmODx14mmIDx required length PVC sleeve for insulated ducts.

.4 Continuous MIG welded 10dia angle rod handle continuous for full length.

.5 Handle to extend minimum 50mm from duct wall/insulation for uninsulated and insulated ducts to 25mm thickness and 25mm from insulation for 50mm thickness insulation.

2.3 BALANCING DAMPERS (DUCTS 240mm OR GREATER IN DEPTH)

.1 Factory manufactured of material compatible with duct.

.1 Opposed blade configuration, metal thickness and construction to recommendations of SMACNA.

.2 Maximum blade height: 100 mm.

.3 Bearings: self-lubricating nylon.

.4 Linkage: shaft extension with locking quadrant.

.5 Channel frame of same material as adjacent duct, complete with angle stop.

2.4 BACK DRAFT DAMPERS

.1 Automatic gravity operated, multi leaf, aluminum construction with nylon bearings, centre pivoted, locate as indicated.

Part 3 Execution

3.1 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 For supply, return and exhaust systems, locate balancing dampers in each branch duct.

.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.

.5 All dampers to be vibration free.

.6 Ensure damper operators are observable and accessible.

.7 Install where indicated.

.8 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.9 For supply, return and exhaust systems, balancing dampers are to be located in each branch duct.

.10 Each grille, register and diffuser connection to have balancing damper located as close as possible to main ducts.

.11 Provide BDD for all EF & utility fans not provided with control dampers unless otherwise noted or where not allowed by code.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 23 33 00 - Air Duct Accessories.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.2 SMACNA HVAC Duct Construction Standards, Metal and Flexible.

1.3 PRODUCT DATA

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

.2 Indicate the following:

.1 Service

.2 Size

.3 Air flow

.4 Construction

.5 Connection

1.4 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency.

Part 2 Products

2.1 GENERAL

.1 Manufacture to SMACNA standards.

2.2 ALUMINUM INSULTED/THERMALLY BROKEN DAMPERS

.1 Frame: extruded 6063T5 aluminum, 2.03mm thick, 101.6mm deep, insulated with Styrofoam on three sides for duct mounting and four sides for flanged mounting.

.2 Blades: extruded 6063T5 aluminum, internally insulated with expanded polyurethane foam, thermally broken, minimum insulation value 0.4RSI.

.3 Blade and Frame Seals: extruded silicone secured in integral slot with aluminum

extrusions.

.4 Bearings: celcon inner bearing, 11mm aluminum hexagon blade pin, polycarbonate outer bearing.

.5 Linkage: frame side, aluminum and corrosion resistant zinc plated steel with slip proof cup-point trunion screws. Blade linkage hardware to be installed out of air-stream. .

.6 Jack shaft assemblies: to be provided for multiple damper installations.

.7 Operating temperature range: -40degC to 100degC.

.8 Leakage: 25L/s/m2 at 1kPa differential static pressure at -40degC.

.9 Pressure drop: full open 1200x1200 damper not to exceed .004kPa at 5.08m/s.

.10 Certification: AMCA 511.

.11 Application:

.1 OA intake (MD-1, MD-2, MD-3) opposed blade.

.12 Mounting:

.1 MD-1, MD-2, MD-3: Flanged to duct

Part 3 Execution

3.1 INSTALLATION

.1 Install where indicated.

.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.

.3 Seal multiple damper modules with silicon sealant.

.4 Install access door adjacent to each damper where specified. See Section 23 33 00 - Air Duct Accessories.

.5 Ensure dampers are observable and accessible.

.6 Permanently mark damper position on damper jack-shaft.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 10 - Closeout Submittals.

1.2 REFERENCES

.1 ANSI/NFPA 90A Installation of Air Conditioning and Ventilating Systems.

.2 CAN/ULC-S112-M90, Fire Test of Fire Damper Assemblies.

.3 ULC-S505, Fusible Links for Fire Protection Service.

1.3 PRODUCT DATA

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

.2 Indicate the following:

.1 Fire dampers.

.2 Fire damper mounting details.

1.4 CLOSEOUT SUBMITTALS

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

1.5 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 01 78 10 - Closeout Submittals.

.2 Provide following:

.1 6 fusible links of each type.

.2 Spare fusible links to facilitate fire damper drop tests as required.

1.6 CERTIFICATION OF RATINGS

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards.

Part 2 Products

2.1 FIRE DAMPERS

.1 Fire dampers: ULC listed and bear label of ULC meet requirements of territorial fire authority and ANSI/NFPA 90A-2015.

.2 Types:

.1 Type 1: curtain in air stream. Only on approval of Departmental Representative.

.2 Type 2: curtain out of air stream.

.3 Type 3: Horizontal spring.

.3 Fabrication:

.1 General: Mild steel factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.

.2 Stainless steel or chemical resistant PVC ducts: Stainless steel factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.

.4 Top hinged: round or square; multi-blade hinge or guillotine type; sized to maintain full duct cross section unless otherwise required due to clearances.

.5 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.

.6 40 x 40 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with ANSI/NFPA 90A and in accordance with conditions of ULC listing.

.2 Maintain integrity of fire separation.

.3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.4 Install access door adjacent to each damper. See Section 23 33 00 - Air Duct Accessories.

.5 Coordinate with installer of firestopping.

.6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.

.7 Install break-away joints of approved design on each side of fire separation.

.8 Type 2 FD to be provided except where alternate Type 1 approved by Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 10 - Closeout Submittals.

.3 Section 23 05 03 - Mechanical Start-Up.

.4 Section 23 33 00 - Air Duct Accessories.

1.2 REFERENCES

.1 AMCA 99, Standards Handbook.

.2 ANSI/AMCA 210, Laboratory Methods of Testing Fans for Rating.

.3 AMCA 300, Reverberant Room Method for Sound Testing of Fans.

.4 AMCA 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

.5 ANSI/ASHRAE 51, Laboratory Methods of Testing Fans for Rating.

.6 CGSB 1-GP-181M, Coating, Zinc Rich, Organic, Ready Mixed.

.7 CAN/CGSB-1.181, Coating, Zinc Rich, Organic, Ready Mixed.

.8 CSA C22.2. 113 Fans & Ventilators.

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product data to include fan curves and sound rating data, showing point of operation.

1.4 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 10 - Closeout Submittals.

Part 2 Products

2.1 FANS GENERAL

.1 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.

.2 Sound ratings: comply with AMCA 301, tested to AMCA 300. Units shall bear AMCA certified sound rating seal.

.3 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210, and ANSI/ASHRAE 51. Unit shall bear AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

.4 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards fan inlet safety screens and inlet dampers and vanes as indicated.

.5 Factory primed before assembly in colour standard to manufacturer.

2.2 WASHROOM EXHAUST FAN EF-3, 4

.1 Housing: corrosion resistant galvanized steel housing, four-point mounting capability.

.2 Blower assembly: removable, centrifugal-type blower wheel and a permanently lubricated motor designed for continuous operation and mounted with resilient anti-vibration mounts.

.3 Electronically Commutated Motor.

.4 Insulated housing.

.5 Dampers: non-metallic backdraft damper, balancing damper downstream

.6 Certification: air and sound ratings shall be certified by HVI, Energy Star® qualified.

.7 Listing: U.L. Listed for use over bathtubs and showers when connected to a GFCI protected branch circuit.

.8 Sound Power by Octave Band:

Sound Data	62.5	125	250	500	1000	2000	4000	8000	LwA
Inlet	61	65	62	51	49	49	41	35	57
Radiated	62	66	56	45	45	43	35	32	54

.9 Electrical: 120V/1ph/60Hz.

.10 Capacity: See schedule.

2.3 EXHAUST FANS EF-1, EF-2.

.1 Construction: acoustically insulated galvanized steel.

.2 Fan: Energy star rated, super quiet, in line.

.3 Electronically Commutated Motor.

.4 Insulated housing.

.5 Sound Power by Octave Band:

Sound Data	62.5	125	250	500	1000	2000	4000	8000	LwA

Inlet	82	87	80	85	74	68	68	66	83
Radiated	83	89	74	79	69	62	62	62	79

.6 Motor: built in thermal overload, 120v/1ph/60Hz.

.7 Capacity: see schedule

2.4 CELING DESTRATIFICATION FANS (CF-1, CF-2, CF-3)

.1 Blades:

.1 Flat, aerodynamically curved tip, aluminum, precision balanced.

.2 Construction: all metal, brushed steel finish, downrod.

.3 Motor: permanent sealed ball bearings, totally enclosed, heavy duty,impedance protected, 9.5mfd non plar encapsulated capacitor, highgrade silicone steel motor laminations.

.4 Finish: epoxy prime and finish coats.

.5 Mounting: J-hook, safety cable.

.6 Control: solid state, infinite speeds.

.7 Power: 120V/1ph/60Hz.

.8 Mounting Kit: Flat Ceiling.

Part 3 Execution

3.1 FAN INSTALLATION

.1 Install fans as indicated, complete with specified vibration isolation.

.2 Bearings and extension tubes to be easily accessible.

.3 Access doors and access panels to be easily accessible.

.4 Install fans with 100 mm flexible connection on inlet ductwork and on discharge ductwork. Ensure metal bands of connectors are parallel with minimum 25 mm flex between ductwork and fan during running.

.5 Install fan restraining snubbers as indicated.

.6 Flexible connections shall not be in tension when fan running.

.7 Install balancing dampers downstream of EF-3 and EF-4 to balance during simultaneous operation.

3.2 CONSTRUCTION USE OF HVAC FANS

.1 Construction use of HVAC Fans for ventilation, heating, de-humidification, humidification, dust control or any other use is strictly prohibited.

.2 Startup of the HVAC Fans can only occur after all ducts installed and cleaned and building and systems are completed to the pre-requisite requirements for commencing Testing Adjusting and Balancing as specified in Section 23 05 93.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 - Closeout Submittals.

1.2 PRODUCT DATA

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

.2 Indicate the following:

.1 Capacity

.2 Throw and terminal velocity

.3 Noise criteria

.4 Pressure drop

.5 Neck velocity

.6 Details of custom manufacturer

.7 Finish

1.3 MANUFACTURED ITEMS

.1 Grilles, registers and diffusers shall be product of one manufacturer for a specified service.

Part 2 Products

2.1 GENERAL

.1 Product to be by manufacturer/model indicated on schedule. No alternates accepted without prior approval by the Departmental Representative.

.2 Where duct cover required as noted on schedule, cover to be by same manufacturer as diffuser.

2.2 TYPE/SIZE

.1 Refer to Schedule.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturers instructions.

.2 Provide balancing damper on duct take-off to each diffuser at main branch take-off, even when volume dampers are specified as part of grille assembly.

.3 Sizes indicated are nominal. Provide correct standard product nearest to nominal to deliver the capacity listed without increasing noise levels or pressure drop.

.4 Confirm air outlet/inlet and louvre dimensions, mounting, finish and colours with ceilingand wall construction prior to submitting shop drawings.

.5 Provide smudge resistant frames on diffusers located on textured ceilings.

.6 Install with flat head screws in countersunk holes where fastenings are visible.

.7 Bolt grilles, registers and diffusers, in place and provide concealed safety chain on each grille, register and diffuser and elsewhere as indicated.

.8 All prime coated grilles and diffusers to be painted to match Architectural finishes.

.9 All grilles and diffusers to be all aluminum construction unless otherwise noted.

.10 Provide grille/diffuser mounted dampers where indicated on drawings. All dampers to be finished in colour determined by Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 23 05 00 - Common Work Results - Mechanical

.3 Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC

1.2 JOB CONDITIONS

.1 Review requirements of outlets as to size, finish, and type of mounting prior to submitting shop drawings and schedules of outlets.

.2 Positions indicated are approximate only. Confirm locations of outlets and make necessary adjustments in position to conform with Architectural and Structural features, mounting requirements, symmetry and lighting arrangement.

1.3 SUBMITTALS

.1 Submit shop drawings with complete catalogue information, materials of construction, dimensions and accessories.

.2 Submit colour selection charts of finishes for approval by Departmental Representative prior to fabrication.

1.4 REFERENCES

.1 American National Standards Institute (ANSI)/ National Fire Protection Association (NFPA)

.2 American Society for Testing and Materials (ASTM):

.1 ASTM E 90, Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):

.1 SMACNA HVAC Duct Construction Standards.

.4 Society of Automotive Engineers (SAE)

.5 AMCA-Air Movement and Control Association Inc.

Part 2 Products

2.1 BIRD SCREEN

.1 Screen: 19 mm mesh of 2 mm diam wire aluminum bird screen.

.2 Frame: formed U-frame of galvanized angle, minimum 18ga with intermediate supports, maximum unsupported dimensions 600mm.

.3 Fabrication: welded.

.4 Mounting: duct mounted angle frame on all sides except access to allow slide in/out removal of screen for maintenance purposes.

.5 Access door: full height duct access door sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation, neoprene gasket, sash locks and piano hinge.

2.2 OUTSIDE LOUVRES

.1 Louvers 150 mm deep with blades on 40° slope with double drainable blade and drainable heavy channel frame, birdscreen with 15 mm square mesh.

.2 Fabricated of 2.0 mm extruded aluminum blades and frame. Where openings exceed 1800 mm in height, jamb frames shall be 2.0 mm. Provide welded assembly

.3 Finish in factory baked enamel finish. Colour shall be selected by the Departmental Representative.

Part 3 Execution

3.1 INSTALLATION

.1 In accordance with manufacturers and SMACNA recommendations.

.2 Coordinate flashings and counter flashings with architectural.

.3 Anchor securely into opening. Seal with caulking around to ensure weather tightness.

.4 All curb mounted hoods to be provided with additional angle mounting. Provide min 32x32x3 additional angle screwed to hood and roof curb to secure hood.

3.2 BIRD SCREEN

.1 Provide duct mounted birdscreen for all E/A and O/A ducts where birdscreen or insect screen not supplied on hoods.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 10 - Closeout Submittals.

1.2 REFERENCES

.1 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)

.2 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE):

.1 ANSI/ASHRAE 52, "Method of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter".

.3 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-115.10-M90 Filters, Air, Disposable, for Removal of Particulate Matter from Ventilating Systems.

.2 CAN/CGSB-115.18-M85 Filter, Air Extended Area Panel Type, Medium Efficiency.

.4 Underwriters Laboratories of Canada:

.1 ULC-S111-M95, "Fire Tests for Air Filter Units".

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawing and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate the following:

.1 Filter media

.2 Filter racks and housings

Part 2 Products

2.1 GENERAL

.1 Media: suitable for air at 100% RH and air temperatures between minus 40 and 50 deg.C.

.2 Number of units, size and thickness of panels, overall dimensions of filter bank,

configuration and capacities: as indicated and as noted on drawings.

.3 Pressure drop when clean and dirty, sizes and thickness: as indicated on schedule in Section 23 73 11 - Air Handling Units - Packaged .

2.2 ACCESSORIES

.1 Holding frames: permanent "T" section construction of galvanized steel, 1.6 mm thick, except where specified otherwise.

.2 Seals: to ensure leak proof operation.

.3 Blank-off plates: as required, to fit all openings and of same material as holding frames.

.4 Access and servicing: through doors/panels on each side.

2.3 HRV FILTERS

.1 Media: disposable preformed fibrous glass or synthetic media cartridge.

.2 Media enclosing frame: galvanized steel with bracing.

.3 Media support: welded wire grid.

.4 Limit filter velocity based on face area to less than 2.1m/s.

.5 Efficiency: 35% to ANSI/ASHRAE 52 and to ASHRAE 52.2.

.1 Final Filter: MERV 8.

.6 Fire rated: to CAN4-S111.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install in accordance with manufacturer's recommendations and with adequate space for access, maintenance and replacement.

3.2 REPLACEMENT MEDIA

.1 Replace all media with new upon acceptance.

.2 Filter media to be new and clean at time of acceptance.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 10 - Closeout Submittals.

1.2 REFERENCES

.1 Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

.2 Underwriters' Laboratories of Canada (ULC)

1.3 PRODUCT DATA

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

.2 Clearly indicate following:

.1 Methods of expansion

.2 Details of thimbles

.3 Base and intermediate supports

.4 Guy details

.5 Exit cone

.6 Flange details

1.4 CLOSEOUT SUBMITTALS

.1 Submit operation and maintenance data for incorporation into manual specified in Section 01 78 10 - Closeout Submittals.

1.5 CERTIFICATIONS

.1 Cataloged or published ratings shall be those obtained from tests carried out by independent testing agency or manufacturer signifying adherence to codes and standards.

Part 2 Products

2.1 BREECHINGS

.1 Shop fabricated 3.5 mm thick and as per SMACNA HVAC Duct Construction Standards whichever is more stringent, mild steel, welded, with sweep bends from boiler outlet to chimney as indicated.

.2 Breeching Insulation: Semi-rigid mineral fibre insulation with glass mat, "K" value 0.035 W/m °C maximum at 24°C. Service temperature 65°C to 450°C. Aluminum jacket.

2.2 OIL FUEL CHIMNEY

.1 General: sectional, pre-fabricated, double wall insulated. ULC labeled, liquid/gas fuel rated to760 degrees C for all fuels.

.2 Seal: primary gas seal graphite gasket factor installed to inner liner.

.3 Insulation: 50mm thickness high temperature mineral wool insulation.

.4 Liner: type 304 stainless steel.

.5 Shell: type 304 stainless steel.

.6 Couplings: mated couplings with collar.

.7 Fittings for chimney:

.1 Base lateral tee with cap and drain.

.2 Rain Cap.

.3 Roof flashing, collar and roof brace.

.4 Radiation shields at roof penetration.

.5 Base and intermediate supports as required.

2.3 BREECHING CONNECTORS

.1 Flange connections at boiler discharge and chimney connections formed of mild steel of min gauge of breeching.

.2 Provide approved high temp. graphite gasket.

.3 All joints shall be butt seams continuously MIG. Welded. Lap type joints are not acceptable. All welded joints in exposed locations must be ground and polished.

2.4 ACCESSORIES

.1 Cleanouts: bolted, gasketted type, full size of chimney, as indicated.

.2 Hangers and supports: in accordance with recommendations of Sheet Metal and Air Conditioning Contractors National Association Inc. (SMACNA).

.3 Rain Cap.

.4 Radiation Shield.

2.5 FLUE BAROMETRIC DAMPERS

.1 ULC listed for service.

.2 Saddle mounting, dimension breeching diameter.

Part 3 Execution

3.1 INSTALLATION - GENERAL

.1 Follow manufacturer's and SMACNA installation recommendations for shop fabricated components.

.2 Suspend breeching at 1.5 m centres and at each joint.

.3 Insulate breeching throughout with 50mm insulation.

.4 Support chimneys at bottom, roof and intermediate levels as required.

.5 Install thimbles where penetrating roof, floor and ceiling. Pack annular space with heat resistant caulking..

.6 Install flashings on chimneys penetrating roofs, as indicated.

.7 Install rain caps and cleanouts on all chimneys.

.8 Install base cleanout mounted on lateral tee.

.9 Supports: to manufacturers recommendation and as per drawing details.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 10 - Closeout Submittals.

.3 Section 23 25 00 - HVAC Water Treatment Systems

1.2 REFERENCES

.1 American Boiler Manufacturer's Association (ABMA)

.2 American National Standards Institute (ANSI)

.3 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME):

.1 ANSI/ASME Boiler and Pressure Vessel Code, Section IV.

.4 Canadian Standards Association (CSA):

.1 CSA B51-03, Boiler, Pressure Vessel, and Pressure Piping Code.

.2 CSA B139, Installation Code for Oil-Burning Equipment.

.3 CSA B140, Oil-Burning Equipment: General Requirements.

.5 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

Part 2 Products

2.1 GENERAL

.1 Performance:

.1 Ratings: in accordance with Hydronics Institute (HYDI) and IBR.

.2 Certification

.1 Appliances shall be certified to the appropriate CSA B140 Series of standards.

.2 Electrical components: CSA approved.

.3 Mounting: as indicated.

.4 Temporary use by contractor:

.1 As specified in Section 23 03 01 - Use of Mechanical Systems During Construction.

2.2 CAST IRON HEATING WATER BOILERS

.1 General:

.1 Packaged boiler burner assembly requiring only field piping complete with burner and necessary accessories and controls.

.2 Performance: see schedule

.3 General: Sectional cast iron insulated steel jacket, natural daft firing.

.4 Water distribution: balanced water circulation and flue gas tervale, single supply and return headers.

.5 Provide supply and return headers, elbows to manufacturers recommendations and to suit installation.

.6 Thermal insulation: 50mm thick mineral fibre, top and all sides.

.7 CRN (Canadian Registration Number).

.2 Service: Treated water.

.3 Auxiliaries:

.1 Provide for each boiler and to meet ANSI/ASME requirements.

.2 Hot water boilers:

.1 ASME rated relief valves, set at 207 kPa, to release entire boiler capacity.

.2 Float type low water cut-off with manual test.

.3 One 1 set of cleaning tools.

.4 Adjustable immersion type, manual reset safety high limit.

.5 Flow switch to prove water flow.

.4 Capacity: See Schedule.

2.3 OIL BURNERS

.1 General:

.1 High efficiency flame retention oil burner

.2 UL/FM approved burner for two stage operation

.3 Type: pressure-mechanical atomizing.

.4 Ignition: direct spark by high voltage transformer.

.2 Electrical:

.1 Motor and Controls: 120V/1ph/60Hz.

.2 Approvals: CSA and ULC.

.3 Firing Rate: Per boiler manufacturer requirements.

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with ANSI/ASME Boiler and Pressure Vessels Code Section IV, regulations of Territory having jurisdiction, except where specified otherwise, and manufacturers recommendations.

.2 Make required piping connections to inlets and outlets recommended by boiler manufacturer.

.3 Maintain clearances as indicated or if not indicated, as recommended by manufacturer for operation, servicing and maintenance without disruption of operation of any other equipment/system.

.4 Mount unit level and secure to manufacturers recommendations on housekeeping pad specified in Section 23 05 29 Hangers and Supports for HVAC Piping and Equipment.

.5 Oil Fired installations - in accordance with CSA-B139.

3.2 MOUNTINGS AND ACCESSORIES

.1 Pipe hot water relief valves full size to nearest drain and to requirements of with ASME Boiler and Pressure Vessels Code Section IV .

3.3 CLEANING

.1 Degrease and flush boilers using ASME standard procedures and an approved degreasing compound prior to connection to heating system and as specified in Section 23 25 00 - HVAC Water Treatment Systems.

3.4 START UP

.1 Manufacturer to:

.1 Start up installation.

.2 Carry out on-site performance verification tests.

.3 Demonstrate operation and maintenance.

.2 Provide Departmental Representative at least 14 days notice prior to inspections, tests, and demonstrations. Submit written report of inspections and test results.

.3 Submit written report of inspections and test results.

.1 Report to include measurements of:

.1 % carbon dioxide,

.2 % oxygen,

.3 % excess air,

.4 flue gas temperature at outlet,

.5 ambient temperature,

.6 net stack temperature,

.7 % stack loss,

.8 % combustion efficiency,

.9 over fire draft,

.2 Test results to meet the recommended values as provided by the manufacturer and the requirements of CAN/CSA B139.-04, Installation code for oil-burning equipment.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute/Air-Conditioning and Refrigeration Institute (ANSI/ARI):

.1 ANSI/ARI 430-1999, Standard for Central Station Air Handling Units.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-99, Coating, Zinc-Rich, Organic Ready Mixed.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 10 - Closeout Submittals.

.3 Section 23 05 03 - Mechanical Start-Up

.4 Section 23 05 93 - Testing, Adjusting and Balancing for HVAC

.5 Section 23 05 49 - Seismic Restraint Systems (SRS) - Type P2 Buildings

Part 2 Products

2.1 SYSTEM DESCRIPTION

.1 Packaged heat recovery ventilator capable of transferring sensible energy as listed in the equipment schedule.

.2 Unit is designed to minimum OA as per ASHRAE 62.1.

2.2 QUALITY ASSURANCE

.1 Unit shall be constructed in accordance with CSA C22.2 and UL 1812 and shall carry the ETL label of approval.

.2 Insulation shall comply with NFPA 90A requirements for flame spread and smoke generation.

.3 Airflow data shall comply with AMCA 210 method of testing.

.4 All units shall be tested 100% prior to shipment.

2.3 WARRANTY

.1 Unit shall have 2 year warranty on all parts.

.2 Energy wheel and drive shall have a 5 year warranty. Manufacturers without a 5 year warranty shall provide a degradation report each year for 5 years and give a full report to the owner.

2.4 UNIT CABINET

.1 Unit base frame shall be constructed from a bolted, 10 gauge Galvanized steel 152mm high with internal structural cross members properly sized to allow for rigging and handling of the unit.

.2 Unit Cabinet to have dimensions of 1372 x 659 x 762 mm (Length x Width x Height.) Cabinet constructed of .050 pre-painted white aluminum with 25mm foil faced fiberglass insulation.

2.5 ACCESS

.1 Full size access doors to allow for periodic maintenance and inspections must be provided for all serviceable components. Doors shall be complete with heavy-duty hinges and compression type handles.

2.6 OPERATING CHARACTERISTICS

.1 Unit shall be capable of providing a constant volume of air at a specified external static pressure at all fan operating speeds.

2.7 BLOWERS

.1 Fan ratings are based on tests made in accordance with AMCA Standard 210.

.2 Fans and motors shall be mounted on an integral vibration isolator base with Rubber In Shear (R.I.S) vibration isolators 25mm deflection springs.

.3 Units shall be equipped with forward curved, DWDI supply and exhaust fans to provide scheduled airflows against static pressures indicated.

.4 Fan blades shall be statically and dynamically balanced and tested prior to shipment.

.5 Bearings shall be heavy duty, grease lubricated, self-aligning pillow block type.

.6 Fan discharge shall be as noted in the schedule.

2.8 ELECTRICAL REQUIREMENTS

.1 Unit shall have single point power connection only.

.2 All controls shall be factory mounted and wired, requiring only field installation of remote sensing devices and wiring to unit mounted terminal strips.

2.9 GENERAL - CONTROLS

.1 All electrical controls shall be ETL listed and the entire unit shall be factory wired in

accordance with the National Electrical Code standard.

.2 Unit shall be equipped with all necessary high voltage components as follows:

.1 Motor starters on all high voltage motors for constant speed applications.

.2 Thermal protection on all high voltage motors.

.3 Fuses and fuse holders.

.4 All necessary control transformers.

.3 Terminal board shall be provided for low voltage control wiring. Low voltage is 24V.

2.10 CAPACITIES

.1 See drawing schedule.

2.11 ACCESSORIES

.1 Dry contact to energize normal closed OA control damper

2.12 FILTERS

.1 The unit is to come complete with integral MERV-8 air filters. One on outdoor air and one on return air.

2.13 STANDARD OF ACCEPTANCE

.1 Standard of Acceptance: Nu-Air NU0912

Part 3 Execution

3.1 INSTALLATION

.1 Provide appropriate protection apparatus.

.2 Provide for installation, and warranty for all HRVs.

.3 Provide for sheaves as required for final air balancing.

.4 Ensure adequate clearance for servicing and maintenance.

.5 Unit shall be stored and handled per unit manufacturer's recommendations.

.6 Seismically restrain HRV per requirements of Section 23 05 49 - Seismic Restraint Systems (SRS) - Type P2 Buildings.

3.2 FANS

.1 Install flexible connections at fan inlet and fan outlets.

.2 Install vibration isolators.

.3 Install backdraft damper on EA duct and OA duct

.4 Install balancing dampers on all four HRV ducts (OA,SA,RA,EA)

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 10 - Closeout Submittals.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)

.2 Underwriters' Laboratories (UL) Inc.

1.3 PRODUCT DATA

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

.2 Equipment, capacity, piping, and connections.

.1 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes.

.3 Provide for all terminal units.

.4 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, cleaning procedures.

1.4 CLOSEOUT SUBMITTALS

.1 Submit operation and maintenance data for baseboard convectors in accordance with Section 01 78 10 - Closeout Submittals.

Part 2 Products

2.1 CAPACITY

.1 See Schedule. Based on 82 deg. entering water temperature, 11 deg. C temperature drop and 18 deg.C E.A.T.

2.2 FINNED TUBE PERIMETER RADIATION

.1 Heating elements: seamless copper tubing, diameter as noted, 1.2 mm minimum wall thickness, mechanically expanded into flanged collars of evenly spaced aluminum fins, 100 x 100 mm nominal, 180 fins per meter suitable for sweat fittings.

.2 Element hangers: ball bearing cradle type providing unrestricted longitudinal movement on enclosure brackets. Space brackets on 900 mm centres maximum.

.3 Finish: supply with factory applied baked primer coat suitable for site painting.

.4 Trim: provide end caps, inside and outside corners, end trim and center trim as necessary to form continuous enclosure wall to wall unless otherwise noted.

.5 Access: removable enclosure section, 900mm maximum length.

.6 Enclosures:

.1 See schedule.

Part 3 Execution

3.1 INSTALLATION

.1 Install baseboard convector heaters, blank sections and controls.

.2 When wireway is used, remove knock-outs and insert insulating bushing between units.

.3 Install in accordance with manufacturer's instructions.

.4 Install in accordance with piping layout and reviewed shop drawings.

.5 Provide for pipe movement during normal operation.

.6 Maintain sufficient clearance to permit performance of service maintenance.

.7 Check final location with Departmental Representative if different from that indicated prior to installation. Should deviations beyond allowable clearances arise, request and follow Engineer's directive.

.8 Valves:

.1 Install valves with stems upright or horizontal unless approved otherwise.

.2 Install isolating ball and zone control valves on inlet and globe radiator valve with piggy back drain valve on outlet of each zone.

.9 Venting:

.1 Install key operated air vent on high point of terminal unit.

3.2 WALL MOUNTED RADIATORS

.1 Clean finned tubes and comb straight.

.2 Install to allow access to control valves and trim

.3 Coordinate installation with architectural.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 10 - Closeout Submittals.

1.2 PRODUCT DATA

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

.2 Indicate:

.1 Equipment, capacity, piping, and connections.

.2 Dimensions, internal and external construction details, recommended method of installation with proposed support, sizes and location of mounting bolt holes.

.3 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence, cleaning procedures.

1.3 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for unit heaters for incorporation into manual specified in Section 01 78 10 - Closeout Submittals.

Part 2 Products

2.1 CABINET UNIT HEATERS

.1 Cabinet: 16 gauge steel, exposed corners rounded, rust proofed and prime coated, removable front panel, cabinet features as follows:

.1 Wall hung semi recessed inverted flow, stamped front bottom air outlet and stamped front top inlet, molded trim.

.2 Coils: hot water coil aluminum fins mechanically bonded to copper tubes. Hydrostatically test to 1 MPa.

.3 Fans: centrifugal forward curved double width wheels, statically and dynamically balanced, direct driven, sleeve bearings, resilient mounted.

.4 Motor: three speed, tap wound shaded pole built-in thermal overload protection and resilient rubber isolation mounting.

.5 Filters: removable 25 mm thick fibrous glass throwaway type.

.6 Control: integral thermostat - user adjustable.

.7 Schedule: see drawing schedule. EWT= 180F, LWT = 160F

2.2 UNIT HEATERS

.1 Casing: 18 gauge cold rolled steel, gloss enamel finish, with threaded connections for hangers rods.

.2 Coils: single aluminum fins mechanically bonded to tubing.

.3 Fan: direct drive propeller type, factory balanced, with anti-corrosive finish and fan guard, aluminum blades.

.4 Motor: speed as indicated totally enclosed shaded pole built-in overload protection, and resilient motor supports.

.5 Air outlet for horizontal type: two-way adjustable louvres, projection.

.6 Air outlet for vertical type: opening circular which encircles full depth of fan blade for protection against damage.

.7 Schedule: see drawing schedule. EWT= 180F, LWT = 160F

Part 3 Execution

3.1 INSTALLATION

.1 Install in accordance with manufacturer's instructions.

.2 Install in accordance with piping layout and reviewed shop drawings.

.3 Check final location with Departmental Representative if different from that indicated prior to installation. Should deviations beyond allowable clearances arise, request and follow Engineer's directive.

.4 Valves: for each unit, install ball valve and control valve on inlet and radiator valve on outlet of each unit. Install drain valve at low point. Install manual air vent at high point.

.5 Clean finned tubes and comb straight.

.6 Provide supplementary suspension steel as required.

.7 Before acceptance, set discharge patterns and fan speeds to suit requirements.

END OF SECTION

Part 1 General

1.1 GENERAL

.1 This Section covers items common to Sections of Divisions 26 and 28. This section supplements requirements of Division 1.

.2 For the proper execution of work, cooperate with other trades and contracts as needed.

.3 To avoid installation conflicts, thoroughly examine the complete set of contract documents. Resolve conflicts with Departmental Representative prior to installation.

.4 Prior to installation of feeders to equipment requiring electrical connections, examine the manufacturer's shop drawings, wiring diagrams, product data and installation instructions. Verify that the electrical characteristics detailed in the contract documents are consistent with the electrical characteristics of the actual equipment being installed. When inconsistencies occur request clarification from Departmental Representative.

.5 Examine the entire set of contract documents to avoid conflicts with other systems. Determine exact route and installation of electrical wiring and equipment with conditions of construction.

.6 Should the electrical documents indicate a condition conflicting with the governing codes or regulations, refrain from installing that portion of the work until clarified by Departmental Representative.

.7 Definitions:

.1 Provide - To furnish and install complete and ready for intended use.

.2 Furnish - Supply and deliver to project site, ready for unpacking, assembly and installation.

.3 Install - Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operation at the project site to complete items of work furnished.

.8 All correspondence and documents shall be submitted in English. Copies in other languages shall be provided where indicated.

.9 The entire bid package is considered related to all disciplines and shall be examined prior to bid and followed throughout construction and thereafter. Related sections listed hereinafter in this specification shall not be considered as relieving any Division from the above - indicated responsibility.

.10 Equivalent or equal products: Where either of these terms are used to reference acceptable material, proof of equality in the form of manufacturer representative's supplied itemized table or letter, to illustrate or certify that the product meets or exceeds each and every specification item is required for review prior to approval.

Manufacturer's raw catalog pages and the like are not acceptable substitute for the above-indicated table or letter and will be returned as insufficient for review.

.11 Sufficiency of drawings and specifications:

.1 Hold the Drawings and Specifications to determine the general character and general arrangement of the Work.

.2 Drawings and Specifications indicate the general scope of the Project in terms of the dimensions of the Work, the type of structural, mechanical, electrical utility systems and the architectural elements of construction. The Drawings and Specifications do not necessarily indicate or describe all Work required for the full performance and completion of the requirements of the Contract Documents. On the basis of the general scope indicated, stated, described or implied, furnish all items required for the proper execution and completion of the Work.

.3 The Contract Documents are issued to facilitate construction by expressing the design intent. The Drawings and Specifications do not necessarily contain all of the details required to construct the project, and contractor supplied detail in the form of detailed construction documents (referred to in the Contract Documents as the Contractors supplied shop drawings, submittals, and field coordination drawings) is required for construction of the Work; all of which set out the specific and final details required for placing and constructing the finished Work. By contrast, the Drawings and Specifications are provided to reflect the finished design of the Work. The Drawings and Specifications are not intended to be used as a set of detailed instructions on how to construct the Work. Construction means, methods, techniques, sequences, procedures, and site safety precautions are the responsibility of the Contractor.

.4 Shop Drawings, Product Data, Samples and similar submittals provided by the Contractor are not Contract Documents. The purpose of these submittals is to demonstrate the way by which the Contractor proposes to conform to the design intent expressed in the Contract Documents.

.5 Examine the Drawings and Specifications to satisfy yourself regarding the design intent and the extent of the proposed Work, and by personal examination of the site and surroundings make your own estimate of the facilities condition and difficulties attending the performance and completion of the Work.

.12 Make known in writing to the Departmental Representative ten (10) days prior to the tender closing date any materials specified or is required to complete the work, which are not currently available or will not be available for use as called for herein or on drawings. Failing to do so, it will be assumed that the most expensive compliant alternate has been included in the tender price.

.13 For the sake of clarity, electrical symbols are typically shown larger than they would be at the actual scale of the drawing. Therefore, do not scale electrical drawings. Where exact dimensions are required, refer to dimensioned architectural plans or

civil drawings. Failed to do so, bear all resulted costs and make good of the work.

.14 The general contractor who has contractual relationship with the Departmental Representative shall be responsible for providing complete and workable systems as outlined on drawings and in specifications. The Departmental Representative will not recognize any sub-contractor as such, but will consider all persons engaged on the work to be under the control of General Contractor. The Departmental Representative will not under any circumstances, enter into discussions concerning the responsibility of subtrades or the apportionment of work. No claim based on the division of work between specification sections or subtrades will be considered.

1.2 CODES AND STANDARDS

.1 Unless otherwise indicated, all references to standards and codes throughout this specification is to the latest applicable edition at the time of bid closing.

.2 Do complete installation in accordance with CSA C22.1, Canadian Electrical Code, Part 1. In case of a conflict between the code requirements and the contract documents, request clarification prior to proceeding with the work.

.3 Definitions:

.1 Abbreviations for electrical terms: to CSA Z85 - Abbreviations for Scientific and Engineering Terms.

.2 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122 - The Authoritative Dictionary of IEEE Standards Terms.

.4 Coordinate with other disciplines and provide plenum rated equipment and devices and plenum rated raceway, wiring and installation methods in all plenum spaces.

.5 Material and installations shall comply with the requirements of the following codes and standards, codes and standards mentioned in other sections of this specification, as well as other applicable codes and standards to the satisfaction of the Authorities Having Jurisdiction (AHJ):

.1 Canadian Electrical Code (CEC).

.2 National Building Code of Canada (NBCC).

.3 National Fire Code of Canada (NFCC).

.6 Provide the site office with a current copy of the following documents, codes and standards. These documents shall remain on site throughout the duration of construction for electricians and others reference and use. The maintenance of these codes on site may be checked at each site visit. Absence of one or more such documents will be indicated on the field review report as deficiency and non-compliance with contract requirements.

.1 Project's electrical specifications and drawings.

.2 Project's up to date electrical RFIs and responses, SIs and CCNs.

.3 Canadian Electrical Code (CEC).

.4 National Building Code of Canada (NBCC).

1.3 QUALITY ASSURANCE

.1 Conform to the requirements of CEC with amendments by local Authorities Having Jurisdiction (AHJ).

.2 Conform to the requirements of the NBC with amendments by local AHJ.

.3 Obtain and pay for the electrical permits, plan review and inspection from local AHJ.

.4 Conform to the requirements of the serving electric, telephone utilities.

1.4 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.

.4 Notify Departmental Representative of changes required by Electrical Inspection Department or Supply Authority prior to making such changes.

.5 Furnish Certificates of Acceptance from Authorities Having Jurisdiction on completion of work to Departmental Representative.

1.5 ALTERNATE PRODUCT APPROVAL

.1 Refer to Division 1 sections for more information.

.2 Electrical price shall be based on the equipment specified or alternate equipment that received prior approval from the Departmental Representative before tender closing.

.3 Requests for prior approval of alternates shall be received at the Departmental Representative's office a minimum of ten (10) business days prior to the closing date for issuing the last addendum or official response by Departmental Representative.

.4 Request for approval shall clearly indicate the specified product and the related specification section(s) as well as a comprehensive list identifying all areas where the submitted alternative does not comply with the specifications.

.5 Notwithstanding item 4, substitution requests shall be complete with proper support documents to clearly identify the equality of the specifications of the suggested product on an item by item basis compared to the specifications listed for the specified product. Requests not meeting this requirement, will be returned as insufficient information for review.

.6 No substitution of items specifically called for on the drawings, such as feeders, etc., with other products- even the ones listed in specifications, is allowed without timely and proper request and approval.

1.6 SHOP DRAWINGS AND PRODUCT DATA

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

1.7 CONTRACT BREAKDOWN

.1 Provide separate material and labour breakdown for the total electrical sub-contract as indicated below. This breakdown is to meet the satisfaction of the Departmental Representative and is to be submitted within 14 days of contract award.

.2 The breakdown will be used in computing of progress claims. Progress claims are to be itemized with separate labour and material listing against each item of the contract breakdown. Progress claims will not be reviewed if they are not presented as per the following breakdown:

.1 Mobilization.

.2 Service and Distribution.

.3 Lighting.

.4 Power Branch Circuitry.

.5 Emergency Lighting.

.6 Provisions for structured wiring (structured wiring by others).

.7 Other Speciality Items.

.8 Training, O&M Manuals, Reports and Records.

1.8 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Include in Operation and Maintenance Data:

.1 Component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.

.2 Wiring and schematic diagrams indicating all connections, terminals and wire numbers.

.3 Names and address of all suppliers for items must be included in the Maintenance Manuals.

.4 All manufacturer's operating and maintenance information prepared for any installed equipment.

.5 Reviewed shop drawings & product data of all installed equipment.

.6 Results of all tests performed.

.7 Spare parts list.

.8 All studies, test reports, testing certificates and Inspection Department acceptances.

.9 One set of full size prints of record drawings.

.10 One copy of all panel directories.

.3 Neatly type lists and notes. Use clear drawings diagrams or manufacturers' literature.

.4 Submit operation and maintenance manuals before or with request for final field review.

1.9 DELIVERY, STORAGE AND HANDLING

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

Part 2 Product

2.1 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification labels for control items in English.

2.2 MATERIALS AND EQUIPMENT

.1 Provide material in accordance with Section 01 61 00 - Common Product Requirements.

.2 Equipment and Material to be CSA certified. Where CSA certified are not available, obtain special approval from authority having jurisdiction before delivery to site and

submit such approval.

.3 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

2.4 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.5 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with labels as follows:

.1 Nameplates: plastic laminate mm melamine, black face, white core, lettering accurately aligned and engraved into core.

.2 Sizes as follows:

NAMEPLATE SIZES			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates to be approved by Departmental Representative prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per line.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. " as directed by Departmental Representative.

.7 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.8 Terminal cabinets and pull boxes: indicate system and voltage.

.9 Transformers: indicate capacity, primary and secondary voltages.

2.6 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

2.7 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

System	Prime Colour	Auxiliary Colour
Power 120/208	Grey	Purple
Structured Wiring	White	Blue
DC Emergency Lighting	Orange	
Lighting	Blue	
Security	White	Green

2.8 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish.

.2 Paint indoor switchgear and distribution enclosures light gray.

Part 3 Execution

3.1 EXAMINATION

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

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately

upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative .

3.2 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

.2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise.

3.3 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.4 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: ridgid galvanized steel conduit, sized for free passage of conduit, and protruding 150 mm. Notify the Departmental Representative if conduit sleeves will contain unbalanced phase conductors.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.5 LOCATION OF OUTLETS AND LIGHT SWITCHES

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets and light switches at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors.

.5 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.6 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment

unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: 1200 mm.

.2 Wall receptacles:

.1 General: 400 mm.

.2 Above top of continuous baseboard heater: 200 mm.

.3 Above top of counters or counter splash backs: 175 mm.

.4 In mechanical rooms: 450 mm.

.3 Panelboards: as required by Code or as indicated.

3.7 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.8 FIELD QUALITY CONTROL

.1 Load Balance:

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain balance of current between phases to within 15% of the average of the phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Provide upon completion of work, load balance report as directed in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS, phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct following tests in accordance with Section 01 45 00 - Quality Control.

.1 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Check resistance to ground before energizing.

.3 Carry out tests in presence of Departmental Representative where requested in these

documents.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.5 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.9 SYSTEM STARTUP

.1 Instruct operating personnel in operation, care and maintenance of systems, system equipment and components.

3.10 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for wire and box connectors.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International):

.1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes and Fittings.

.2 CAN/CSA-C22.2 No.65, Wire Connectors.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC):

.1 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

Part 2 Product

2.1 MATERIALS

.1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:

.1 Connector body and stud clamp for stranded or round solid copper conductors as required.

.2 Stud clamp bolts.

.3 Bolts for copper buss bar.

.4 Bolts for aluminum buss bar.

.5 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, as required to: CAN/CSA-C22.2 No.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 where aluminium is shown on drawings.

.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CAN/CSA-C22.2 No.65.

.3 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap every time the connection is removed and reinstalled.

.4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 CSA C22.2 No. 0.3, Test Methods for Electrical Wires and Cables.

1.2 PRODUCT DATA

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

Part 2 Product

2.1 BUILDING WIRES

.1 Conductors: Copper, stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90 XLPE

2.2 TECK 90 CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131..

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.3 Insulation: Cross-linked polyethylene type RW90 XLPE, 600V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking galvanized steel..

.6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.

.7 Fastenings:

.1 One hole malleable iron straps to secure surface cables 53 mm and smaller. Two hole steel straps for cables larger than 53 mm.

.2 Channel type supports for two or more cables at 1500 mm centers.

.3 Threaded rods: 6 mm diameter to support suspended channels.

.8 Connectors:

.1 Dry type approved for TECK cable in indoor type 1 environments.

.2 Wet type approved for TECK cable where installed outdoors, or where installed above cabinets in sprinklered areas.

2.3 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated. Minimum size to be #12 AWG.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from aluminum strip.

.4 Type: flame retardant jacket over thermoplastic armour and compliant to applicable Building Code classification for this project wet locations.

.5 Connectors: Standard 3/8" BX. Straight, 90, or duplex to suit application. Approved for AC cable. Provide plastic insulating bushing for all cable ends.

2.4 CONTROL CABLES

.1 Type PLTC: Multiconductor controls cable

.1 Conductors: PVC insulated, PVC jacketed, copper , unshielded pair, overall shield, minimum size to be #16 AWG.

.2 Insulation: 105 degrees C Flame retardant PVC

.3 Aluminium foil/polyester shield with tinned copper drain wire.

.4 Jacket to by UL listed, sunlight and moisture resistant, sequentially marked, nylon ripcord for jacket removal. FT-4 Flame spread minimum, FT-6 for return air plenums.

.5 Conductors are to be black/white number coded, rated for 300V at 105 degrees C.

Part 3 Execution

3.1 GENERAL CABLE INSTALLATION

.1 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).

.2 Cable Colour Coding: to Section 26 05 00 - Common Work Results for Electrical.

.3 Conductor length for parallel feeders to be identical.

.4 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.

.5 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.

.6 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.

.7 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.2 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Do not splice the wiring between three and four way switches inside the luminaire enclosures.

3.3 INSTALLATION OF TECK CABLE (0 -1000 V)

.1 Install cables.

.2 Install cable in trenches in accordance with Section 33 65 76.

.1 Terminate cables in accordance with Section 26 05 44 - Installation of Cables in Trenches and in Ducts.

3.4 INSTALLATION OF ARMOURED CABLES

.1 Armoured cables are only allowed for the purposes identified below:

.1 drops to light fixtures in suspended ceilings, maximum length of 1.5m;

.2 branch circuits installed in building framing for up to two circuits;

.3 applications specifically indicated elsewhere within the contract documents.

.2 Group cables wherever possible.

.3 Lay cable in cable troughs in accordance with Section 26 05 36.

.4 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0-1000V.

3.5 INSTALLATION OF CONTROL CABLES

.1 Install control cables concealed in wood frame walls. Maintain clearances and protection from mechanical damage as required by the Candian Electrical Code.

.2 Ground control cable shield.

.3 Use cable listed for wet locations in wet or damp areas.

.4 Install straps and box connectors to cables as required.

.5 Use armored control cable where exposed.

.6 All costs associated with the supply and installation of control wiring described in Divisions 23 and 25 are outside the scope of Division 26 except where specifically noted otherwise in these contract documents.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE 837, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.

.2 CSA International

.1 CSA Z32, Electrical Safety and Essential Electrical Systems in Health Care Facilities.

Part 2 Product

2.1 EQUIPMENT

.1 Provide new artificial grounding electrode system as indicated on drawings.

.2 Clamps for grounding of conductor: size as indicated to electrically conductive underground water pipe.

.3 Grounding conductors: bare stranded copper, soft annealed, size as indicated.

.4 Insulated grounding conductors: green, stranded copper type RW90-XLPE.

.5 Grounding connectors: Hydraulic compression tool applied connectors or exothermic welding process connector or listed powder-actuated mechanical type connectors.

.6 Pipe grounding clamp: Mechanical ground connector with cable parallel or perpendicular to pipe.

.7 Telecommunications Ground bus: 6 mm thick by 50 mm wide by 300 mm long copper ground bar complete with insulated supports, fastenings, connectors, etc.

.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.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Install equipment grounding conductor, code sized minimum unless noted otherwise on drawings, in all non-metallic and metallic raceway system.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Use bare copper conductor for underground and partially underground, and insulated copper conductor for above ground connections.

.5 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process, permanent mechanical connectors or irreversible wrought copper compression connectors to ANSI/IEEE 837.

.6 Use mechanical connectors for grounding connections to equipment provided with lugs.

.7 Soldered joints not permitted.

.8 Install bonding wire for flexible conduit, connected at one ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.9 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.10 Install separate ground conductor to outdoor lighting standards.

.11 Connect building structural steel and metal siding to ground by welding copper to steel.

.12 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.13 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

3.2 ELECTRODES

.1 Make ground connections to continuously conductive underground water pipe on street side of water meter.

.2 Install water meter shunt.

.3 Install plate electrodes and make grounding connections as indicated.

.4 Bond separate, multiple electrodes together.

.5 Use copper conductors for connections to electrodes; size as indicated on drawings.

.6 Make special provision for installing electrodes that will give acceptable resistance to ground value where rock or sand terrain prevails. Ground as indicated.

3.3 EQUIPMENT BONDING

.1 Install bonding connections to typical equipment included in, but not necessarily limited to following list:

.1 Service equipment;

.2 Frames of motors;

.3 Motor control centers;

.4 Starters;

.5 Control panels;

.6 Building steel work;

.7 Distribution panels;

.8 Outdoor lighting and parking receptacles;

.9 Motor shaft grounding devices where provided. See motor specifications in Division 25.

.10 Low voltage and telecommunications systems including but not limited to cabinets, racks, patch panels, electronics, device boxes, etc..

.2 Water service grounding: Bond metallic water service pipe to service ground bus using #6 AWG insulated ground conductor. Connect to the utility side of isolating fittings or meter. Jumper across the meter.

3.4 GROUNDING BUS

.1 Install copper grounding bus mounted on insulated supports on wall of electrical room and communication equipment room. Size as required for the service grounding.

.2 Ground items of electrical equipment in electrical room and IT equipment in communication equipment room to ground bus with individual stranded copper connections. Conductor size as indicated on drawings.

3.5 COMMUNICATION SYSTEMS

.1 Install grounding connections for telephone, sound, security systems, intercommunication systems as follows:

.1 Telephone service conduit: 1 #6 AWG RW90-XLPE at each end to main service ground connection point and grounding bus respectively.

.2 Structured wiring equipment: 1 #6 AWG RW90-XLPE to grounding bus for

each.

.3 Security systems, intercommunication systems as indicated.

3.6 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Perform tests before energizing electrical system.

.3 Disconnect ground fault indicator during tests.

.4 Obtain a copy of the latest service requirements from the utility company, perform tests listed therein as instructed, rectify issues and provide test reports.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 48 - Seismic Restraints for Electrical Systems.

Part 2 Product

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted and suspended.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to hollow masonry, tile and plaster surfaces with nylon shields or lead anchors.

.2 Secure equipment to poured concrete with expandable inserts or rated epoxy anchors.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.

.5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.6 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole malleable iron straps to secure surface conduits and cables 53 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 53 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.7 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.

.8 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.11 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.12 Do not use supports or equipment installed for other trades for conduit or cable support except where allowed by applicable codes, with permission of other trade and approval of Departmental Representative.

.13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

.14 Where screw fastenings are used on metal decking, screws are to be set in lower flutes only.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1.

Part 2 Product

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel single gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.

.3 102 mm square or octagonal outlet boxes for luminaire outlets.

.4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster walls.

.5 Sectional boxes are not allowed.

2.3 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 35mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.

.5 Vacuum clean interior of outlet boxes before installation of wiring devices.

.6 Identify systems for outlet boxes as required.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes and Fittings and Associated Hardware, A National Standard of Canada.

.2 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit, steel.

.3 CSA C22.2 No. 83, Electrical Metallic Tubing.

.4 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.

1.2 LOCATION OF CONDUIT

.1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only. Determine best routing for conduit on site, ensuring requirements of this specification are met.

Part 2 Product

2.1 CONDUITS

.1 Rigid galvanized steel threaded conduit.

.2 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.

.3 Rigid pvc conduit: to CSA C22.2 No. 211.2.

.4 Flexible steel conduit and liquid-tight flexible metal conduit.

.5 Conduit size to be a minimum of 21mm, regardless of device or system supplied.

2.2 CONDUIT FASTENINGS

.1 One hole malleable iron straps to secure surface conduits 53 mm and smaller.

.1 Two hole steel straps for conduits larger than 53 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1.5 m on centre.

.4 Threaded rods, 6 mm diameter, to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified. Coating: same as conduit.

.2 Ensure factory "ells" where 90 degrees bends for 27 mm and larger conduits.

.3 Set screw where allowed by code and watertight connectors and couplings elsewhere.

.4 Conduit Moisture Sealant: Sealant to be moisture barrier type, non-toxic, non-shrink, non-hardening, putty type hand applied material providing effective barrier under submerged conditions.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.

2.5 PULL STRING

.1 Minimum 6 mm stranded nylon (polypropylene) pull rope, tensile strength 5 kN.

2.6 THREAD LUBRICANT

.1 Use lubricant for use on all conduit threads.

Part 3 Execution

3.1 INSTALLATION

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.

.3 Use electrical metallic tubing (EMT) except in cast concrete and where subject to mechanical injury.

.4 Use rigid galvanized steel conduits for all exposed runs where subject to mechanical injury as defined by the Canadian Electrical Code and the local inspection authority.

.5 Use rigid PVC for conduit runs in concrete slabs and floors.

.6 Use rigid PVC conduit underground.

.7 Use flexible metal conduit for connection to motors and vibrating equipment in dry areas.

.8 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.9 Minimum conduit size for lighting and power circuits: 21 mm.

.10 Mechanically bend steel conduit over 21 mm diameter or as recommended by manufacturer, using approved conduit bending machine or hickey. Bend conduit cold:

.1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.11 Treat all male ends with thread lubricant prior to being made up.

.12 Install nylon pull string in empty conduits.

.13 Remove and replace blocked, crushed, deformed or otherwise injured or damaged conduit sections.

.1 Do not use liquids to clean out conduits.

.14 Where cables or conduits pass through floors and fire rated walls, pack space between wiring and sleeve full with fire rated caulking compound if approved, or other approved fire rated fire stop assembly suitable for the application and to the code requirements.

.15 Where cables or conduits pass through non-rated walls, pack space between wiring and sleeve full with caulking compound suitable for the application and paint to match the wall finish.

.16 Dry conduits out before installing wire.

.17 Provide plastic bushing at the end of raceway, per CEC rule 12-906, to protect conductors from abrasion where they issue from raceways. This applies to all raceway and all wiring regardless of voltage or application. EMT connector without insulated throat or bushing installed between the conduit and box meets the 12-906 requirement for conductors smaller than #8 AWG.

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended channels. Channels to have 25% spare capacity.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.3 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

.3 Do not install conduits in terrazzo or concrete toppings.

.4 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.5 Do not use supports or equipment installed for other trades for conduit or cable support.

3.4 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

.1 Provide 50 mm of sand over conduit below floor slab.

3.5 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

.3 Seal both ends of conduits with sealant to prevent ingress and transmission of foreign material and moisture.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association, (CSA International)

.2 Insulated Cable Engineers Association, Inc. (ICEA)

Part 2 Products

2.1 CABLE PROTECTION

.1 38 x 140 mm (thickness x width) planks pressure treated with clear, copper napthenate or 5% pentachlorophenol solution, water repellent preservative.

Part 3 Execution

3.1 DIRECT BURIAL OF CABLES

.1 Provide offsets for thermal action and minor earth movements. Offset cables 150 mm for each 60 m run, maintaining minimum cable separation and bending radius requirements.

.2 Make termination only as indicated leaving 0.6 m of surplus cable in each direction.

.3 Underground cable splices not acceptable.

.4 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.

.5 Cable separation: Maintain 1 m separation between primary power feeder cables and low tension systems in parallel and perpendicular crossings.

.6 Install continuous marker tape for each underground cable.

3.2 CABLE INSTALLATION IN DUCTS

.1 Clean and dry ducts prior to installing conductors.

.2 Install cables as indicated in ducts.

.3 Install multiple cables in duct simultaneously.

.4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.5 To facilitate matching of colour coded multi-conductor control cables reel off in

same direction during installation.

.6 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.7 After installation of cables, seal duct ends with duct sealing compound.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Perform test in accordance with manufacturer's instructions.

.6 Submit test results showing location at which each test was made, circuit tested and result of each test. Include a copy of test reports in the O&M manuals.

.7 Remove and replace entire length of cable if cable fails to meet any of test criteria.

.8 Photograph all installations prior to backfilling and include photos in the Operations and Maintenance manuals.

.9 Call for field review by prior to backfilling trenches. Provide at least 5 business days of notice in advance.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 Scope of the work under this section is to provide professional design and build seismic restaints accordingly for electrical systems as indicated hereinafter, as well as site certification of such work.

1.2 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

.1 Submit product data in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Provide shop and placement drawings for all electrical equipment and equipment assemblies including runs of conduit/cable racks showing the methods of attachment to the particular structure for each piece of equipment and assembly and provide anchorage/attachment details.

.3 Submit samples of materials required to complete the seismic restraint work for review if and when required.

1.3 DEFINITIONS

.1 SRS: Seismic Restraint System.

1.4 SYSTEMS

.1 This section applies to the following systems:

.1 Switchboards and transformers.

.2 Luminaires.

.3 Conduit, cable banks and boxes installed on T-bar ceiling.

1.5 DESIGN OF RESTRAINTS

.1 Detailed design of restraints is to be completed by a Professional Engineer specializing in design of SRS and who is registered to practice in the Yukon Territory.

1.6 SITE CERTIFICATION

.1 Site certification for systems described in article 1.4 is to be provided at no additional cost to the owner. Provide for site certification of installation by Professional Engineer specializing in design of SRS and who is registered to practice in the Yukon Territory. For measures of cost savings, the same seismic engineer that is used by the Division 23 contractor is to be shared with Division 26.

1.7 DESIGN AND INSTALLATION COORDINATION

.1 Coordinate the design and installation of the seismic restraints for the following with Departmental Representative:

.1 Luminaires installed in an all-around exposed fashion such as pendent mounted or the like, installed in public spaces, areas subject to general occupant view, and other areas to architect's discretion; and

.2 Other electrical equipment, devices and components installed in public spaces, areas subject to general occupant view, and other areas to Departmental Representative's discretion.

Part 2 Products

2.1 MATERIALS

.1 Where provided, SRS components are to be provided from one manufacturer regularly engaged in the production of SRS components.

.2 Security Bridles: Minimum #16 AWG stranded stainless steel aircraft cable.

.3 Mechanical Anchors: Approved SRS anchors, minimum 13mm dia.

.4 Threaded Anchors: Minimum Type ASTM A 325-00. Minimum 13mm diameter.

Part 3 Execution

3.1 INSTALLATION

.1 Provide seismic restraint and anchorage for all equipment and services as indicated.

.2 Free-standing equipment shall be fastened to the basic structure using anchorage/ attachments to overcome seismic overturning forces.

.3 Provide Seismic restraint for all cables and raceways exceeding 50 mm in any cross-sectional dimension and which are supported more than 300 mm vertically from the basic structure.

.4 Provide slack cable restraint systems as follows:

.1 Connect slack cable restraints to suspended equipment in such a way that the axial projection of the wires passes through the centre of gravity of the equipment.

.2 Orient restraint wires on suspended equipment at approximately 90 degrees to each other (in plan) and tie back to the structure at an angle not exceeding 45 degrees to the horizontal.

.3 Select each anchor in the structure for a load equal to twice the weight of the

equipment with the safety factor of 4.

.4 Install cables using appropriate grommets, shackles, thimbles, U-bolts and other hardware to ensure alignment of the restraints and to avoid bending the cables at connection points.

.5 Restraints shall be installed at least 50 mm clear of all other equipment and services.

.6 Adjust restraint cables such that they are not visibly slack, but such that the flexibility is approximately 35 mm under thumb pressure for a 1500 mm cable length (equivalent ratio for other cable lengths).

.5 Provide transverse and axial restraints within 4.0 m of a vertical bend.

.6 Trapeze hangers for cables and raceways shall be restrained utilizing minimum 10 mm diameter slack cable restraints, which shall be provided at maximum transverse spacing of 12.5 m and longitudinal restraints at 25 m maximum spacing, or as otherwise limited by anchor/slack cable performance. Adjacent spacing of restraints on a run shall vary by 10% to 30% to avoid coincident resonances.

.7 Transverse bracing for one raceway section may also act as longitudinal bracing for the raceway connected perpendicular to it, provided the bracing is installed within 610 mm of the elbow or junction box. Branch runs shall not be used to restrain main runs.

.8 All recessed lighting fixtures in mechanical grid ceilings (e.g. T-bar or suspended GWB) shall be restrained using at least 2 security bridles per fixture tied to the basic building structure. Attach security bridles at ends of each fixture using a further attachment to each corner of the fixture and in such a manner that the fixture cannot fall lower than 300 mm (12") beneath ceiling.

.9 Surface-mounted lighting fixtures mounted on mechanical grid ceilings shall be attached to the ceiling system with positive clamping devices that completely surround the supporting members.Security bridles shall be attached between the clamping devices and the adjacent ceiling hanger or to the structure above in the same manner as described for recessed fixture supports.

.10 Pendant-hung lighting fixtures supported from their outlet boxes shall be provided with a security bridle from the outlet box to an adjacent ceiling hanger or to the structure above in the same manner as described for recessed fixture supports.

.11 Electrical outlet boxes flush mounted in mechanical grid ceilings shall be anchored to the ceiling grid.

3.2 INSPECTION AND CERTIFICATION

.1 Do not cover any seismic restraint systems until reviewed by the SRS Engineer and the representative of the local authority having jurisdiction.

.2 Site certification shall be complete prior to request for substantial completion review. Provide a copy of the certificate attached to the request for substantial completion

review.

.3 Include a copy of site certification in O&M manuals.

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 RELATED SECTIONS

.1 Section 01 91 13 - General Commissioning

.2 Section 01 91 31 - Commissioning Plan

.3 Section 01 91 33 - Commissioning Forms

.4 Section 01 91 41 - Commissioning Training

.5 Section 01 98 00 - Commissioning of Architectural Systems

.6 Section 23 08 00 - Commissioning of Mechanical Systems

1.3 INTENT

.1 This Section specifies electrical requirements relating to the commissioning of components, equipment and systems specified within Division 26 and 28.

.2 Commissioning of electrical components and systems is of the utmost importance to ensure the successful operation of the building electrical systems. The systems will not be considered complete until all systems have been demonstrated to work precisely in accordance with the Contract requirements and a percentage witnessed by the Commissioning Authority.

.3 Responsibility for the satisfactory completion of the system and the subsequent demonstration of systems to the requirements of the commissioning rests with the Division 26 sub-contractor. The Division 26 sub-contractor is to provide and pay for any specialist supervision, inspection and testing as required to complete the work described with the exception of the other members of the Commissioning Team.

.4 The electrical contractor may engage a specialist commissioning agent to coordinate the commissioning process specified under this division and those items of other Divisions which interact with work of this Division as outlined herein, including the complete life safety system.

.5 Fully cooperate with the Commissioning Authority.

.6 Refer to related sections for additional requirements.

.7 The electrical Commissioning process consists of:

.1 Review by the electrical commissioning agent of all contractor submittals.

.2 Completion and acceptance of Pre-Functional Check sheets (PC) for the

specified Electrical Equipment. Submit to the Commissioning Authority for review and recommended acceptance.

.3 Completion and acceptance of Functional Performance Tests (FPT) for the specified building systems. FPT will be directed by the commissioning agent and witnessed by the Commissioning Authority. The FPT tests will be performed by the Division 26 sub-contractor.

.4 Review by the Commissioning Authority of all training procedures and operations and maintenance manuals.

.5 Completion of a 10 month warranty performance review by the Commissioning Authority.

.6 Completion of a Systems Manual by the Commissioning Agent and submitted to the Commissioning Authority for recommended acceptance.

.8 Except where otherwise specified, the Division 26 sub-contractor is to arrange and pay for the testing and related requirements specified in this and related Sections.

.9 If test results do not conform with applicable requirements, repair, replace or adjust or balance components and systems. Repeat testing as necessary until acceptable results are achieved.

.10 This Section is to be read in conjunction with related Sections which specify specific portions of electrical starting and testing work.

1.4 COMMISSIONING TEAM

.1 The cooperation of all trades is essential for an efficient and planned process. A team comprising the following is recommended:

.1 Commissioning Authority.

.2 General Contractor.

.3 Electrical Contractor's Supervisor.

.4 Electrical Consultant.

.5 Property Manager.

.6 Mechanical Trades: especially Controls Contractor and TAB Agency.

.7 Authorities having jurisdiction where applicable.

1.5 SITE REPORTING

.1 Site hard copies of all Commissioning forms will be provided and maintained by the commissioning agent for use by the commissioning team.

.2 The commissioning agent and the Division 26 sub-contractor will be responsible for recording all data gathered on site on the hard copy forms as specified.

1.6 FINAL REPORT

.1 The commissioning agent will be responsible for compiling the final report.

.2 The commissioning agent shall provide upon request within 14 days a completed single copy of any required test sheets, warranties, start up and systems commissioning sheets as requested by the commissioning authority for compiling within the final report.

.3 Copies of the final report will be provided to all Commissioning Team members.

1.7 PROCESS

.1 The commissioning process commenced during design and will proceed through construction and post construction to the following general process and schedule:

.1 Design: through design review and planning processes have been completed. These are detailed in the appended commissioning plan.

.2 Construction:

.1 Within 90 days of award of the contract a Commissioning kick-off teleconference meeting will be held.

.2 Submittal reviews will be completed by the commissioning agent to ensure conformance to the design criteria, and submitted to the Commissioning Authority.

.3 Throughout the course of construction the commissioning agents are to complete all specified contractor proving tests and submit the necessary documentation. The Commissioning Authority will witness this testing at their discretion.

.4 Throughout the course of construction the commissioning agents are to complete the Pre-Functional Checksheets for each specified system/ equipment for which they are responsible.

.5 A minimum 120 days prior to the start of the Functional Performance Tests a site testing schedule will be developed by the commissioning agent in cooperation with the Commissioning Authority. At this time copies of all Functional Performance Test Checksheets will be made available.

.6 During the last three months of the construction process there will be a monthly commissioning meeting to review the construction schedule and commissioning requirements.

.7 Within 30 days of the start of the startup, check-out and commissioning verification process a dedicated Test Planning and Scheduling meeting will be completed to coordinate the commissioning verification process.

.8 Upon completion of the construction the design Consultant will

identify that the building startup and checkout is completed and the systems are suitable for verification.

.3 Commissioning Verification

.1 Verification of testing required by the Division 26 documents by the Commissioning Authority.

.2 Sample review and acceptance by the Commissioning Authority of the Pre-Functional Check sheets (PC) for the specified Electrical Equipment completed by the commissioning agent.

.3 Completion and acceptance of all Functional Performance Tests (FPT) for the specified building systems. The FPT testing will be directed by the Commissioning Agent and witnessed by the Commissioning Authority. The FPT testing will be performed by the commissioning agent.

.4 Additional commissioning meetings as specified.

.4 Warranty: Commissioning activities for warranty period are detailed in the Commissioning Plan.

.2 Contractor's representatives to be present for all Commissioning of systems that falls within the scope of their work.

.3 Unless otherwise specified in writing by the Contractor all testing and related requirements specified herein will be performed prior to the issue of the Substantial Performance Certificate.

1.8 PRE-COMMISSIONING

.1 All startups, balancing and adjustment as specified in Divisions 01, 26, 27, and 28 are to be completed prior to commencement of the Functional Performance Tests (FPT).

1.9 COORDINATION

.1 It is the responsibility of the Division 26 commissioning agent to coordinate all sub-trades, manufacturers, suppliers and other specialists as required to ensure all phases of work shall be properly organized prior to commencement of each particular testing procedure. Establish all necessary manpower requirements.

.2 Where any components or systems require testing prior to starting, ensure that such work has been completed and approved prior to starting of these components and systems.

1.10 SEASONAL CONSTRAINTS

.1 Notwithstanding all-inclusive requirements specified in this Section an additional separate cycle of Commissioning may be necessitated at a later time for components

and systems whose full operation is dependent on seasonal conditions.

.2 The Division 26 commissioning agent responsibilities with respect to such Commissioning activities will be the same as all activities specified in this Section.

1.11 COMMISSIONING MEETINGS

.1 Provide the appropriate representation at the scheduled commissioning meetings as follows:

.1 Pre-commissioning kick-off meeting.

.2 FPT startup meeting.

.3 Commissioning wrap-up meeting.

.2 With the exception of the pre commissioning kick off meeting which will be by teleconference all other meetings will be held at the site offices of the General Contractor.

1.12 PRESIDING AUTHORITIES

.1 Procedures defined in this section may duplicate verification conducted by Authorities having jurisdiction. To facilitate expedient turnover of building, arrange for authorities to witness procedures in a manner that avoids unnecessary duplication of tests.

.2 Obtain certificates of approval, acceptance and comply with rules and regulation of Authorities having jurisdiction. Provide originals of all certificates to the Consultant, and include a copy in the O&M manuals.

1.13 CORRECTION OF DEFICIENCIES

.1 Correct all contract deficiencies found during Commissioning.

1.14 COMPLIANCE

.1 Failure to follow the specific instructions defined herein pertaining to correct starting procedures may result in re-evaluation of components by independent testing agency selected by the Commissioning Authority at the Contractor's expense. Should results reveal components have not been started in accordance with specified requirements, components may be rejected. If rejected, remove components from site and replace. Replacement components shall also be subject to full starting procedures, using same procedures specified on the originally installed components.

1.15 WITNESSING OF CONTRACTOR PROVING TESTS

.1 The Commissioning Authority may witness selected Contractor starting, testing, adjusting, balancing and cleaning procedures.

.2 Advise the Commissioning Authority in advance that starting, testing, adjusting,

balancing or cleaning processes are ready to commence. Consult with the Commissioning Authority to determine which procedures he may elect to witness. Provide advanced notice prior to commencement of each procedure or series of procedures to allow the Commissioning Authority to arrange for witnessing of tests as required.

.3 The commissioning agent to submit to the Commissioning Authority all testing, startup, adjusting, balancing and cleaning reports on successful review by the Consultant.

1.16 ADDITIONAL TESTING CONDUCTED BY COMMISSIONING AUTHORITY

.1 The Commissioning Authority may select and conduct at random: components, systems and/or integrated systems to be re-tested in addition to the specified tests.

.2 Testing of any component, system, or integrated system by the Commissioning Authority does not reduce the Division 26 commissioning agent's obligations for complete testing and start-up of systems as specified.

.3 The Division 26 commissioning agent will provide, without cost, support for these tests, including:

.1 Qualified personnel to operate the appropriate components, systems and/or integrated systems.

.2 Making all test equipment and instrumentation available to the Commissioning Authority.

.4 The Division 26 commissioning agent can choose to witness any testing conducted by the Commissioning Authority.

.5 Should any component or system fail under additional testing completed by Commissioning Authority the Division 26 commissioning agent will correct the deficiency and retest to the satisfaction of the Commissioning Authority at the Contractor's expense.

1.17 SPECIALIZED AGENCIES AND TESTING LABORATORIES

.1 All reports generated by special testing agencies or testing laboratories shall be submitted by the Division 26 Commissioning Agent to the Commissioning Authority.

.2 All agencies and testing laboratories shall be pre-approved by the Consultant with acceptable facilities and qualifications.

.3 Include a copy of all such reports in O&M manuals.

Part 2 Products

2.1 TESTING INSTRUMENTS

.1 Provide two-way radios, ladders, tools, instruments and other equipment as required to complete the program and as outlined in this specification.

.2 Provide all safety equipment required for personnel involved in the starting, testing, adjusting and balancing program.

.3 Use instruments supplied or calibrated by approved laboratory or manufacturer.Show the Commissioning Authority the current calibration certificate for each instrument to be used. Provide a copy of the calibration certificates with test reports.

Part 3 Execution

3.1 GENERAL

.1 All Division 26 commissioning agent startups, balancing and adjustment to be completed prior to commencement of Functional Performance Tests including the following:

.1 Megger testing of feeder cables;

.2 Soil resistance and ground impedance testing.

.3 Operational testing of all components in power distribution system;

.4 Operation of exterior lighting control system;

.5 Motor control operations, settings;

.6 Full operational testing of intrusion alarm system;

.7 Testing of emergency lighting (battery-type);

3.2 PRE-FUNCTIONAL CHECKLISTS (PC'S)

.1 Pre-Functional Checklists are the process to ensure the specified equipment is installed to the contract requirements. To complete this work a database of the checklists is completed by the Commissioning Agent. The Division 26 sub-contractor shall then complete the PC's during the course of construction. When commissioning commences the Commissioning Authority will verify the validity of selected sample PC's prior to commencing any performance tests. This process ensures that the equipment and systems are correctly installed prior to actually testing their operation.

.2 Specifically the PC process shall follow these steps:

.1 The Commissioning Agent will complete the PC forms using an approved data base and hard copies will be provided to the Division 26 sub-contractor at the commissioning kick-off meeting.

.2 Where the commissioning agent identifies missing PC's they are to advise the Commissioning Authority in writing. The Commissioning authority works with the commissioning agent to generate the missing verification forms

within 21 days.

.3 During the course of construction the Division 26 commissioning agent shall complete the Contractor portion of the PC forms, and submit to the commissioning authority.

.4 Minimum 14 days prior to commencing any performance tests the Division 26 commissioning agent shall submit the completed hard copies of the forms for review by the Commissioning Authority. The Commissioning Authority will advise the Division 26 commissioning agent of any missing information which the Division 26 commissioning agent shall rectify in a timely manner. It is recommended, however, that the Cx agent prepare the PC's during the course of construction and submit them as they are completed during site review meetings.

.5 Upon receipt and acceptance off all PC's and when the design Consultants advise that the buildings are ready for Commissioning the Commissioning Team under the direction of the Commissioning Authority shall verify all or a selected portion thereof for the completed PC's.

.6 Any deficiencies in the PC's shall be corrected in a timely manner by the Division 26 subcontractor.

3.3 FUNCTIONAL PERFORMANCE TESTS (FPT's)

.1 Functional performance tests (FPT's) are the process to ensure the systems operate to the contract requirements. To complete this work real time 100% point testing of all systems is completed by the Division 26 Cx agent under the direction and witness of the Commissioning Authority and/or team.

.2 Prior to the FPT's commencing all Division 26 sub-contractor's and manufacturers startup and proving tests specified elsewhere are to be completed and approved.

.3 Prior to the FPT's commencing all PC's are to be completed and approved.

.4 FPT's shall be first conducted by the Division 26 commissioning agent independent of the Commissioning Team and then re-conducted and witnessed by the Commissioning Authority and/or team based on the mutually agreed schedule developed by the Commissioning Agent as indicated elsewhere in the specifications.

.5 The FPT forms will be generated by the Commissioning Agent from an approved data base and provided to the Commissioning authority for review a minimum 30 days prior to commencing the functional performance testing.

.1 Where the Division 26 commissioning agent identifies missing FPT forms they are to advise the Commissioning Authority in writing. The Commissioning authority works with the commissioning agent to generate the missing FPT forms within 21 days.

3.4 BUILDING OPERATIONAL SEMINAR

.1 Subsequent to the substantial completion and as a component of the commissioning, the Commissioning Agent will provide a 4-hour seminar on the "Building Operation" to the operating and maintenance personnel describing the intended operation of the building electrical systems. Provide one senior tradesperson familiar with the complete building electrical systems to assist in this training session as specified in Section 26 05 00 - Common Work Results for Electrical. Notify the Commissioning Authority for their participation and to witness.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for standard and custom breaker type panelboards.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

1.3 SHOP DRAWINGS

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

.2 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

.3 Provide proof of compatible series rated combination groups for breakers and equipment, if used, with shop drawings.

1.4 PLANT ASSEMBLY

.1 Install circuit breakers in panelboards before shipment.

.2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

1.5 CLOSEOUT SUBMITTALS

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

.2 Include data for each panelboard.

.3 Include a copy of typewritten panel directories.

Part 2 Products

2.1 PANELBOARDS

.1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.

.2 250 V panelboards: bus and breakers rated for interrupting capacity as indicated on the drawings. 120/208 volt, 3 phase, 4 wire, solid neutral design with sequence style bussing and full size neutral of capacity indicated.

.3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.

.4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated on the panel schedules.

.5 Two keys for each panelboard and key panelboards alike.

.6 Copper bus with neutral of same ampere rating as mains.

.7 Suitable for bolt-on breakers.

.8 Trim with concealed front bolts and hinges.

.9 Trim and door finish: air dried grey enamel for indoors and baked grey enamel for outdoors.

.10 Provide fully rated circuit breakers throughout the system.

.11 Branch circuit panelboards and all breakers within are to be part of a series rated combination group, which is compatible with upstream breakers and service entrance board.

.12 Enclosure: Indoor type sprinkler proof.

2.2 BREAKERS

.1 Breakers: to Section 26 28 21 - Moulded Case Circuit Breakers.

.2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.

.3 Branch circuit breakers to be bolt-on type, fully rated for the available fault current at the panel. Series combination rated protection is not acceptable.

.4 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.5 Lock-on devices for 10% of 15 to 30 A breakers installed or as indicated. Turn over unused lock-on devices to Departmental Representative.

.6 Lock-on devices for door supervisory, exit light, fire alarm and emergency lighting circuits.

2.3 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Nameplate for each panelboard size 4 engraved as indicated.

.3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.

.4 Complete typewritten panel directory showing number and location of each circuit. Provide three (3) typrwritten directories, two of which in the plastic pouch attached to the inside of the panelboard door, and one in the O&M manuals.

Part 3 Execution

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.

.2 Install surface mounted panelboards on plywood backboards in accordance with Section 06 10 10 - Rough Carpentry. Where practical, group panelboards on common backboard.

.3 Mount panelboards to height specified in Section 26 05 00 - Common Work Results - Electrical or as indicated.

.4 Connect loads to circuits.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

.6 Mount panelboard vertically with odd numbered breaker on the left and even numbered breakers on the right.

.7 Wherever possible use pull boxes to collect home runs and larger conduits to complete the return to the branch circuits to avoid conduit congestion at the face of walls. Consider the CEC required derating factors and overcurrent protection when using collected homeruns.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 REFERENCES

.1 CSA International

.1 CSA C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CAN/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).

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

Part 2 Product

2.1 SWITCHES

.1 15 A, 120 V, single pole, double pole, three-way, four-way switches to: CSA C22.2 No.55.

.2 Manually-operated general purpose AC switches with following features:

.1 Terminal holes approved for No.10 AWG wire.

.2 Silver alloy contacts.

.3 Urea moulding for parts subject to carbon tracking.

.4 Suitable for side wiring.

.5 Toggle to be White.

.3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.

.4 Switches of one manufacturer throughout project.

.5 All switches to be commercial specification grade.

2.2 RECEPTACLES

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA C22.2 No.42 with following features:

.1 Reinforced thermoplastic base and deep nylon body.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Four side wiring screws.

.5 Triple wipe contacts and riveted grounding contacts.

.6 Finish: White.

.2 Duplex receptacles CSA type 5-20R, 125 V, 20 A, U ground, to: CSA-C22.2 No.42 with following features:

.1 Reinforced thermoplastic base and deep nylon body.

.2 Suitable for No. 10 AWG for back and side wiring.

.3 Break-off links for use as split receptacles.

.4 Four side wiring screws.

.5 Triple wipe contacts and riveted grounding contacts.

.6 Finish: White.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

.5 All receptacles to be Commercial specification grade.

.1 All receptacles to have permanently attached nametags on wall above receptacle identifying panel and circuit references.

.6 Surge protected receptacles: common and normal mode protection, 80 Joules/6500 Amps per mode, audio & visual status indicators, alarm silencing, 500 V maximum suppressed voltage (ANSI/UL 1449-1986 testing), quad outlet, blue finish.

.7 Weatherproof type receptacles will be provided for receptacles located on the building exterior and where otherwise shown on the drawings.

.1 Provide cast, while-in-use type covers. Plastic covers are not acceptable.

2.3 SPECIAL WIRING DEVICES

.1 Switches with Pilot Lights:

.1 Pilot lights as indicated, with neon type 0.04 W, 125 V lamp and red plastic jewel flush type.

.2 Lighted Toggle Switch: toggle action type with ivory nylon handle, one way or three way as indicated, light on with load off, rated 15 amp, 120 volt, 1/2 HP.

.2 Emergency Stop Push Buttons: Red mushroom head, 30 mm diameter, 1 NO and 1 NC sets of contacts, rated for 120 V, push off, pull/twist release, suitable for mounting in standard outlet box. Include jumbo, yellow legend plate reading "PUSH TO STOP" and "TWIST OR PULL TO RELEASE".

.3 Fan speed controllers: 12 Amp minimum, dial control with selectable reverse capability. RFI filter, suitable for linear speed control of shaded pole or permanent split capacitor motors. Compatible with ceiling fans supplied by other divisions. Stainless steel cover plate to match device.

.4 Special purpose receptacles: Refer to drawings for NEMA Standard Device Configuration.

2.4 OCCUPANCY SENSORS

.1 Switch type Occupancy Sensors: Wall-mounted, intelligent, combined passive infrared and acoustic detection. To include adaptive, adjustable time delay of 0.5-30 minutes, 180 degree field of view, suitable for 1400 VA at 347 or 120 VAC to match the circuit voltage, fluorescent load and programmable ON/OFF pushbutton with manual "ON" override.

.1 Finish: To be White.

2.5 PARKING RECEPTACLE

.1 Outdoor rated, dual-circuit 125 VAC, 15 A time and temperature controlled receptacle suitable for use as a split parking receptacle for two stalls.

.2 Load limit: 1800 W.

.3 Initial power delay after connecting block heater: 2 h.

.4 Programmable maximum load limitation.

.5 Green and red indicating LED lights for each stall indicating a live outlet, a functioning block heater, open circuit in the block heater, circuit overload or short circuit.

.6 Cast aluminum, weatherproof box.

.7 Programmable profile, preprogrammed as follows:

.1 Temperature above -5ºC: 0% of time ON.

.2 Vary duty cycle infinitely from -5ºC to 100% ON at -25ºC.

2.6 COVER PLATES

.1 Cover plates for wiring devices to: CSA C22.2 No.42.1.

.2 Cover plates from the wiring device manufacturer throughout project.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Stainless steel, vertically brushed, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

.5 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

.6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.

.7 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.

.8 Weatherproof while-in-use covers: NEMA 3R when closed over energized plug. Vertical mount for duplex receptacle. Provide continuous use cover with cover capable of closing over energized cord plug with bottom aperture for cord exit. To be Die cast aluminum cover with closed cell neoprene foam gasket.

2.7 SOURCE QUALITY CONTROL

.1 Cover plates from one manufacturer throughout project.

Part 3 Execution

3.1 INSTALLATION

.1 All wiring devices to be fed from "pigtail" splices. Feed through splices utilizing the devices as a splicing terminal is not acceptable.

.2 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 Mount toggle switches at height in accordance with Section 26 05 00 -

Common Work Results for Electrical .

.3 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height specified in Section 26 05 00 - Common Work Results - Electrical or as indicated..

.3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.4 Mount receptacles with u-ground on the bottom of the receptacle.

.5 Install GFI type receptacles as indicated.

.6 Identification: Each receptacle shall have the circuit number and the supplying panelboard permanently identified at the outlet. This identification shall be visible when receptacle cover plate is in place, shall be in a position where it is not likely to be painted over, and if the only identification, should not be on the coverplate itself.

.4 Cover plates:

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

.5 Install occupancy sensor switches as recommended by manufacturer. Refer to article 2.4 for detailed requirements. Adjust, program, test and verify the operation of the sensors.

.6 Calibrate, adjust and aim occupancy and sensors for optimum coverage at the presence of the building maintainer.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Equipment and installation for ground fault circuit interrupters (GFCI).

1.2 REFERENCES

.1 CSA International

.1 CAN/CSA C22.2 No.144, Ground Fault Circuit Interrupters.

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA PG 2.2, Application Guide for Ground Fault Protection Devices for Equipment.

1.3 SUBMITTALS

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

.2 Submit product data and shop drawings.

.3 Submit test report for field testing of ground fault equipment to Departmental Representative and a certificate that system as installed meets criteria specified herein.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Product

2.1 MATERIALS

.1 Equipment and components for ground fault circuit interrupters (GFCI): to CAN/CSA C22.2 No.144.

.2 Components comprising ground fault protective system to be of same manufacturer.

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.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Demonstrate simulated ground fault tests.

END OF SECTION

Part 1 General

1.1 PRODUCT DATA

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

.2 Provide proof of compatible series rated combination groups for breakers and equipment, if used, with shop drawings.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.

.2 Common-trip breakers: with single handle for multi-pole applications.

.3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.4 Circuit breakers with interchangeable trips as indicated.

.5 Circuit breakers to have minimum of 10,000 A symmetrical rms interrupting capacity rating.

.6 Provide fully rated circuit breakers throughout the system.

2.2 THERMAL MAGNETIC BREAKERS [DESIGN A]

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

.2 Provide ground fault protection where shown on drawings.

.1 GFCI protection will be from the feeder breaker, and not at the point of use for exterior receptacles. Refer to specification "26 28 20 - Ground Fault Circuit Interrupters - Class 'A'", Part 2.2.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 American National Standards Institute (ANSI)

.1 ANSI C78.377, Electric Lamps – Specifications for the Chromaticity of Solid State Lighting (SSL) Products.

.2 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

.1 ANSI/IEEE C62.41, Surge Voltages in Low-Voltage AC Power Circuits.

.3 ASTM International Inc.

.1 ASTM F1137-88, Specification for Phosphate/Oil and Phosphate/Organic Corrosion Protective Coatings for Fasteners.

.4 Illuminating Engineering Society of North America (IESNA)

.1 IESNA LM-79, Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products.

.2 IESNA LM-80, Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules

.3 IESNA TM-21, Projecting Long Term Lumen Maintenance of LED Light Sources.

.5 Canadian Standards Association (CSA International)

.6 ICES-005-07, Radio Frequency Lighting Devices.

.7 Underwriters' Laboratories of Canada (ULC)

1.2 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for approval by Departmental Representative.

.3 Product data to include: total input watts, candlepower summary, candela distribution zonal lumen summary, luminaire efficiency, CIE (International Commission on Illumination) type, coefficient of utilization, lamp type, and lumen rating in accordance with IESNA testing procedures.

1.3 DELIVERY, STORAGE AND HANDLING

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

Part 2 Product

2.1 LED LIGHTING FIXTURES

.1 LED Light Sources and Luminaires to: ANSI/ANSLG C78.377, IESNA LM-79, IESNA LM-80, IESNA TM-21 and UL 8750.

.2 Luminaire Efficiency. Allow for thermal and optical losses. Efficiency to be determined on a "delivered lumens per watt" basis for comparison of each luminaire using input drive current. Minimum initial delivered lumens per watt required to be verified with independent testing lab certification and in no case to be less than 70 lumens per Watt.

.3 Depreciation:

.1 As a miniumum, average delivered lumens over 50,000 hours of operation to be a minimum of 95% of initial delivered lumens.

.2 Life-span rating shall be based on L70 in units of hours as defined by IESNA standard LM-80.

.4 Warranty: Manufacturer's warranty of a minimum of 5 years on LED's and drivers.

.5 Manufacturer: Must have verifiable history of having been in the business of manufacturing LED light fixtures for a minimum of 7 years.

.6 LED Drivers:

.1 Electronic.

.2 Input voltage tolerance of rated voltage +/- 10%.

.3 Power factor >90% at full load.

.4 THD <10%.

.5 Load regulation: +/- 1% from no load to full load.

.6 Exterior fixtures to be rated for -40 through +40 degrees Celsius ambient temperature.

.7 Integral overheating protection.

.8 Integral overload protection.

2.2 LUMINAIRES

.1 Provide luminaires according to schedule on drawings.

2.3 FINISHES

.1 As specified in the luminaire schedule on the drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Locate and install luminaires as indicated.

.2 Check the ceiling types by refering to architectural drawings prior to ordering material. Inform Departmental Representative of any descripancies between the electrical drawings and ceiling types immediately and request clarification. Provide all necessary accessories for mounting the specified luminaires on the ceiling type in each space.

3.2 WIRING

.1 Connect luminaires to lighting circuits:

.1 Armoured cable (BX) may be used for drops to luminaires in accessible ceiling space.

.2 Provide extra length of armoured cable securely coiled in accessible ceiling space to allow relocation of the luminaire within a 2m radius at no extra cost.

.3 Install flexible or rigid conduit for luminaires as indicated.

3.3 LUMINAIRE SUPPORTS

.1 For suspended ceiling installations support luminaires independently of ceiling.

.2 Provide safety chain or cable, in addition to standard mounting method, for all luminaires mounted higher than 4 m above the finished floor in shops, warehouses, gymnasiums, arenas, etc.

3.4 LUMINAIRE ALIGNMENT

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

.3 Focus and adjust all adjustable luminaires, at presence of Departmental Representative, at such time of day or night as required.

.4 Clean paint splatters, dirt, dust, fingerprints and debris from luminaires.

.5 Where finish of luminaire has been damaged, touch up finish per manufacturer instructions.

3.5 CLEANING

.1 Clean in accordance with Section 01 74 00 - Cleaning.

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for emergency lighting systems.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Data to indicate system components, mounting method, source of power and special attachments as well as battery charge and discharge voltage/time characteristics.

.3 Submit operation and maintenance data in accordance with Section 01 33 00 - Submittal Procedures.

Part 2 Products

2.1 EQUIPMENT

.1 Emergency lighting equipment: to CSA C22.2 No.141.

.2 Supply voltage: 120 V AC, 60 Hz.

.3 Output voltage: 24 V DC.

.4 Operating time: 30 minutes, and to produce not less than 91% of nominal DC system voltage with AC supply 'off'.

.5 Battery: sealed, long life 10 year maintenance free life expectancy.

.6 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected with regulated output of plus or minus 0.01V for plus or minus 10% input variations.

.7 Solid state transfer circuit.

.8 4 circuit fuse distribution box

.9 Automatic self-diagnostic circuitry.

.10 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.11 Signal lights: solid state, for 'AC Power ON' and 'High Charge'.

.12 Lamp heads: integral on unit, 345 degrees horizontal and 180 degrees vertical

adjustment. Lamp type: MR16, 4W LED.

.13 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Removable or hinged front panel for easy access to batteries.

.14 Finish: White.

.15 Auxiliary equipment:

.1 Voltmeter.

.2 Test switch.

.3 AC input and DC output inside cabinet.

.4 Brownout protector.

.5 Low voltage disconnect.

.16 Battery Charger:

.1 Automatically maintain battery in fully charged state while main power available. Maintain DC float voltage within plus or minus 1% of setting, no load to full load, during main voltage variations of plus 10% to minus 10% and frequency variations of plus or minus 5%.

.2 Equalize charging rate such that after battery has provided full power output for specified duration, charger returns battery to 95% of fully charged state in 12 h.

.3 Automatic cycle test providing 12 discharges per year.

.17 LED indicators:

.1 Amber LED: unit ready and trouble free and Audible Alarms (flashing); charging mode failure (on); master card failure (off).

.2 Green LED Test in progress: delay TDR; equalize mode.

.3 Red LED: battery low.

.4 Audible alarm: Any failure shall be followed by a pulsating audible alarm on for 3 seconds every two and one half minutes (2 1/2) until the failure is repaired.

.18 Remote Heads: surface mount vandal resistant weatherproof Lexan, fully adjustable, c/w MR16, LED 4W 24 V, glare free, and minimum 800 lumen output lamps.

.19 2-hr rated units to have integral TVSS protection on supply side.

2.2 WIRING OF REMOTE HEADS

.1 Concealed NMD Wiring, minimum #10 AWG, or EMT conduit.

.2 Remote heads to be double, MR16, LED 4W, 24Volt. Weatherproof heads where

installed outside.

.3 Conductors: in accordance with Section 26 05 21 - Wires and Cables 0-1000 V, sized to be #10 AWG minimum.

Part 3 Execution

3.1 INSTALLATION

.1 Identify conductors for polarity and voltage.

.2 Install with conductors sized to maintain current flow with maximum 3% voltage drop.

.3 Install central and remote heads per CEC rule 46-304 and as indicated on drawings and make all required connections to heads.

.4 Direct light heads to suit site condition and check operation.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Include: Performance test for 0.5 hours.

.3 Include a copy of the test report in the O&M manuals.

.4 Units will be tested during the substantial completion field review by the Departmental Representative. Schedule the work at the outset of the construction so that work schedules are properly coordinated to guarantee this. Coordinate with other subtrades involved to ensure attendance at the time of tests.

.5 Pretest the units prior to request for substantial completion field review and troubleshoot all deficiencies. Submit a copy of successful pretesting along with the request for substantial completion review. Coordinate with other subtrades involved to ensure their components and systems are installed, tested and ready for pretesting at the time of the pretests.

.6 Arrange for facility's maintainer to be present during all tests.

END OF SECTION

Part 1 General

1.1 SCOPE

.1 Provision of spare parts, devices and components as indicated herein.

Part 2 Products

2.1 LIGHTING

.1 Luminaires:

.1 Furnish three (3) spare Type 01 luminaires.

.2 Furnish three (3) spare Type 03 luminaires.

.3 Furnish one (1) spare luminaire each for Types 02, 04 and 05.

2.2 MOTOR STARTERS

.1 Three (3) spare fuses of each type and size used.

.2 One (1) set of each type of adjustable thermal overload device.

.3 One (1) spare coil of each starter size.

.4 Two (2) spare control transformers.

.5 One spare time delay device of each type used.

2.3 OTHER SPARE PARTS

.1 Provide additional spare parts recommended by the manufacturer for systems other than listed herein before.

.2 Provide spare parts as indicated in other sections of this specifications.

Part 3 Execution

3.1 VERIFICATION

.1 Assemble all listed parts at one location at the time of interim inspection for verification by Departmental Representative and building maintainer.

.2 Prepare typewritten list of all spare parts provided and present at time of inspection for witnessing and signature by building maintainer. Include one copy of signed list in each copy of O & M manuals.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Control panel.

.2 Detection Accessories.

.3 Communications.

.4 Environmental monitoring.

1.2 REGULATORY REQUIREMENTS

.1 All equipment to be listed by an Accredited Certification Body of the Standards Council of Canada for its intended purpose.

1.3 REFERENCE DOCUMENTS

.1 Electronic Industries Association (EIA)

1.4 DEFINITIONS

.1 PIR: Passive Infrared Detectors.

1.5 TRAINING

.1 Conduct training program for designated building personnel to allow system users to understandand exercise the following:

.1 Alarm arming and dis-arming.

.2 Alarm programming and control.

.3 Other aspects important for the maintaining and full operation of the intrusion alarmsystem.

.2 Training program to be of 2-hour duration. Training period schedule to be established by the Departmental Representative. Training period to take place at the time of substantial completion and prior to building occupancy, or as otherwise identified.

1.6 OPERATION

.1 When alarm system has been set, the activation of any monitoring device or switch on the system is to activate:

.1 remote signalling device;

.2 interior sounding device;

.3 exterior audio and/or visual device;

.2 System is to detect and report disconnection or tampering with any device, panel or keypad as a trouble condition.

.3 Arming/disarming to be accomplished via numeric keypad(s) and to allow building entry/exit by delaying alarm signal for specified amount of time. Entering of the correct numeric code to facilitate arming or disarming of system.

.4 Additional capability to allow arming/disarming by internal timeclock according to programmed schedule.

.5 Ability for partition-specific or global arming/disarming of system.

.6 Authority level (Master, Manager, or several other Operator levels). Each User Code (other than the installer code) shall be capable of being assigned the same or a different authority level for each partition that it will operate.

.7 Programming of the system to be accessible via the same electronic keypads as used for arming/disarming.

1.7 DESIGN PERFORMANCE REQUIREMENTS

.1 System to be designed as an extension of the existing intrusion alarm monitoring system in the existing park headquarters main building. Provide all components necessary to integrate all new devices with existing system.

.2 Alarm condition: Design system to provide maximum time for an alarm to be communicated of 60 seconds from alarm initiation to the time of activating any signalling or controls.

.3 Design system power supplies rated to provide cumulative load of all systems components plus safety factor of 50% or greater.

1.8 SUBMITTALS

.1 Product Data: Submit manufacturer's printed product literature, specifications and datasheet inaccordance with Section 01 33 00 - Submittal Procedures.

.2 Shop Drawings: Submit in accordance with Section 01 33 00 - Submittal Procedures.

.3 Indicate system components, size of components, location, full schematic of wiring system for building and operation details.

.4 Samples: Submit in accordance with Section 01 33 00 - Submittal Procedures.

.5 Quality Assurance Submittals: Submit the following in accordance with Section 01 33 00 - Submittal Procedures.

.6 Maintenance Data: Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.9 WARRANTY

.1 System Warranty: Minimum according to contract warranty requirements.

.2 Manufacturer's Warranty: Include written document from manufacturer executed by authorized company official in maintenance materials package.

1.10 ENCLOSURE

.1 Main panel enclosure to be EEMAC 1 and sprinkler proof as per CSA-C22.1, suitable for the location shown on drawings.

.2 The enclosure to facilitate ventilation and natural cooling necessary for the proper operation of the equipment enclosed therein.

1.11 SYSTEM DESCRIPTION

.1 The system to include the following features and capabilities:

.1 The complete combined system for park headquarters main & trades buildings is to be CSA or ULC listed for intrusion detection and alarm.

.2 Trades Building to be monitored as a separate partition from the main headquarters building.

.3 Support up to 32 device zones.

.4 Capable of supporting hardwired, addressable or wireless zone devices.

.5 Support up to 2 separate partitions.

.6 Supports up to 75 users.

.7 Capable of storing up to 512 events.

.8 Supervision of peripheral devices.

.9 Complete with 2 relay outputs.

.10 Supports long-range radio (LRR) communication.

.11 Provides scheduling capability to allow for automated operations.

1.12 SUBMITTALS

.1 Provide per section 26 05 00 - Common Work results for Electrical.

.2 Include:

.1 Manufacturer data sheets for all components and devices.

.2 Wiring and schematic connection diagrams.

.3 Battery calculation indicative of sufficient capacity to support the system for the duration as specified in this section.

.4 Recommended raceway, and wiring type and method.

1.13 QUALITY ASSURANCE

.1 The system manufacturer shall be in the business of design and production of Intrusion Alarm andAccess Control Systems and components for more than 10 years and shall be certified as being compliant with ISO9001.

.2 Provide statement of compliance for the above-indicated requirements with the shop drawings for review.

1.14 TRAINING

.1 Conduct training program for designated building operation personnel to allow system users to understandand exercise the following:

.1 Alarm arming and dis-arming.

.2 Alarm programming and control.

.3 Other aspects important to maintaining and fully operating the system.

.2 Training program to be of 3-hour duration. Training period schedule to be established by the Departmental Representative and is intended to take place near the time of achieving substantial performance of the contract.

Part 2 Products

2.1 MATERIALS

.1 Control Panel: Existing DSC MAXSYS 4020 located in main headquarters building lower floor LAN Room.

.2 Communications: Existing telephone line digital dialer.

.3 Accessories and incidentals necessary for a complete operational system as intended.

2.2 PASSIVE INFRARED DETECTORS

.1 Space type detector with long range pattern and spare lens to field convert to broad pattern. Interface type: hardwired.

.2 Curtain type detectors to be provided where indicated on drawings. Interface type: hardwired.

.3 Dual element, low noise sensor, transient-protection, high immunity to white light and radio frequencies, temperature-compensated, LED on light, vertical adjustment, tamper switch.

.4 Linear-type (long-range, broad-range and curtain detectors) to be suitable for wall or ceiling mounting.

.5 360-degree type to be suitable for ceiling mounting and to have hemispherical view.

2.3 DOOR POSITION SWITCHES

.1 Long range, magnetic-type door position switches with ability to function across gap between magnet and switch of 25mm.

.2 Switch sensor and magnet to be recess flush mounted in door and door frame.

.3 Hardwired type of switch supplied by same manufacturer as other system components and designed for compatibility with system provided.

.4 Wet location rated for wet and damp locations where shown on the drawings.

2.4 POWER SUPPLY

.1 Take power from independent 120 volt 15 amp circuit. Circuit disconnect device to be accessible only to authorized personnel.

.2 Rectifier: Approved for purpose and be part of control panel or a separate unit to automatically maintain standby battery bank fully charged under normal conditions and sized to recharge standby batteries in twelve (12) hours maximum, following emergency operation. Rectifier to operate system when batteries are disconnected.

.3 Standby Battery Bank: The battery bank to be kept "floating" across the line. Gel type batteries of sufficient capacity to operate system under supervisory load conditions without recharging for 24 consecutive hours.

2.5 NUMERIC KEYPAD

.1 To be primary means to arming and disarming system by entering a numeric code, and for programming system.

.2 To have 32-character, LCD or LED alpha-numeric display that identifies system status, trouble conditions, event history.

.3 Keys with etched identifiers.

.4 Four programmable function keys.

.5 Suitable for mounting on standard back boxes.

.6 Provide wet location rated enclosure for keypads located in wet or damp locations as shown on the drawings.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install intrusion alarm system and components in accordance with CAN/ULC-S302.

.2 Supply print of building plans with all device locations and corresponding labels clearly indicated upon completion.

.3 Install panels, intrusion detection system and components in accordance with manufacturer's written installation instructions to locations, heights and surfaces shown on reviewed shop drawings.

.4 Install panels, intrusion detection system and components secure to walls, ceilings or other substrates.

.5 Install required boxes in inconspicuous accessible locations.

.6 All intrusion alarm wiring to be in conduit except for drops in suspended ceilings of length 2m or less. Conceal conduit and wiring.

.7 Passive infrared devices to be located at 300 mm below finished ceiling (except where otherwise indicated) with aiming such that the intended areas are completely monitored.

.8 Adjust sensitivity of devices as required to monitor assigned spaces.

.9 Provide passive infrared detector lenses as necessary to select long range or broad coverage patterns for appropriate space coverage.

.10 Where ceiling height exceeds 2700, located passive infrared devices at 2400 above finished floor.

.11 Keypad(s) to be mounted at 1200 mm above finished floor.

.12 Adjust sensitivity of all detection devices to suit installation conditions.

.13 Connect intrusion alarm system to all peripheral signal devices.

.14 Each initiating device is to have separate wiring home run back to control panel. Each device to be a separate zone with zones partitioned as indicated on the drawings.

.15 Provide all necessary backboxes, pullboxes, connectors, supports, conduit, cable, and wire required fo a complete and reliable system installation.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Representative Services:

.1 Certify the installation is complete and per manufacturer instructions.

.2 Certify the system is programmed per owner's requirements and all the codes and information have been communicated to the owner's representative(s).

.3 Provide training as indicated elsewhere in these specifications.

3.4 VERIFICATION

.1 Perform verification inspections and test in the presence of the Departmental Representative.

.2 Provide two-way radios for communication during verification testing.

.3 Visual verification: Objective is to assess quality of installation and assembly and overall appearance to ensure compliance with Contract Documents. Visual field review to include:

.1 Ensuring that all devices and equipment are located as required for intended function and according to the contract requirements;

.2 Verification of compliance to workmanship standards;

.3 All installations and devices are clean and in state of ready for operation.

.4 Operational verification: Purpose to ensure that devices and system performance meet or exceed described functional requirements including:

.1 Demonstrated testing of the control panel, keypads, all devices, wiring, communicators and remote signalling functions;

.2 Arming and disarming of system according to specified requirements.

3.5 CLEANING AND ADJUSTING

.1 Remove protective coverings from control panels, detection accessories and components.

.2 Adjust all components for correct function.

.3 Clean housings and system components, free from marks, packing tape, and finger prints, in accordance with manufacturer's written cleaning recommendations.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Contractor to review and follow the site specific Geotechnical Report (prepared by Tetra Tech EBA on December 5, 2014) included with these Contract Documents..

1.2 REFERENCES

.1 ASTM International

.1 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600kN-m/m³).

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 31 05 16 - Aggregate Materials. Replace defective or damanged materials with new.

Part 2 Product

2.1 MATERIALS

.1 Granular material (sub-base and base course) as per Section 31 05 16 - Aggregate Materials.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions:

.1 Examine and follow geotechnical report attached to these Contract Documents.

.2 Before commencing work establish locations of buried services on and adjacent to site.

.2 Evaluation and Assessment:

.1 Arrange with appropriate authority for relocation of buried services that interfere with execution of work. Pay costs of relocating services.

.2 Testing of materials and compaction of backfill and fill is the responsibility of the Contractor as per 3.4 below.

.3 Not later than 48 hours before backfilling or filling with approved material, provide Departmental Representative with compaction results carried out by appropriate testing agency.

.4 Before commencing work, conduct, with Departmental Representative, condition survey of existing structures, trees and plants, lawns, fencing, service poles, wires, rail tracks and paving, survey bench marks and monuments which may be affected by work.

3.2 PREPARATION

.1 Temporary Erosion and Sedimentation Control:

.1 Use temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff to adjacent properties and walkways, in accordance with sediment and erosion control drawings (locations of silt fence indicated on drawing C-102).

.2 Apply a mixture of water and calcium chloride to graded areas to control dust as required.

.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.

.2 Protection of in-place conditions:

.1 Protect excavations from freezing.

.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's approval.

.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 to remain undisturbed.

.3 Site preparation:

.1 Where marked, remove and dispose of curb appropriately.

.2 Scarify, grade and compact existing parking lot chip seal (BST) and leave as gravel surface to extents indicated on drawings.

.4 Removal:

.1 Remove abandoned buried services within 2 m of foundations. Cap cut-offs.

.2 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

.3 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

.4 Remove trees, stumps, logs, brush, shrubs, bushes, vines, undergrowth, rotten wood, dead plant material, exposed boulders and debris within areas designated on drawings.

.5 Remove stumps and tree roots below footings, slabs, and paving, and to 600 mm below finished grade elsewhere.

3.3 EXCAVATION

.1 Shore and brace excavations, protect slopes and banks and perform work in accordance with Territorial and Municipal regulations.

.2 Excavate as required for foundations and bearing surfaces.

.1 Do not disturb soil or rock below bearing surfaces. Notify Departmental Representative when excavations are complete.

.2 If bearings are unsatisfactory, additional excavation will be authorized in writing and paid for as additional work.

.3 Fill excavation taken below depths shown without Departmental Representative's written authorization with concrete of same strength as for footings.

.4 Proper precautions shall be taken during excavation so as not to expose unduly the permafrost surface. Prolonged exposure of frozen soil may result in excessive thawing and water accumulation in the excavation. Backfill operation must follow soon after the excavation is undertaken. Limit and minimize the extent of clearing to allow backfill operation to follow soon after, so as to ensure that a 150 mm minimum layer of backfill material is present at all times over excavated areas.

.3 Excavate for slabs and paving to subgrade levels.

.1 Remove topsoil, organic matter, debris and other loose and harmful matter encountered at subgrade level.

3.4 SITE QUALITY CONTROL

.1 Fill material and spaces to be filled to be inspected and approved by Departmental Representative.

.2 The Contractor is soley responsibile for all Quality Control and Quality Control Testing to ensure that the work is completed according to the Contract requirements.

Contractor is to retain an independent third party testing company for this purpose.

.3 Frequency of tests:

.1 Trench backfill: minimum of one compaction test per 50 metres of trench per 0.5 metres of backfill depth

.2 Base and Sub-base material: minimum of one compaction test per 500 square metres of fill area per lift of material

3.5 GRADING

.1 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.

.2 Place granular sub-base after subgrade is inspected and approved by Departmental Representative.

.1 If subgrade is soft and/or wet, or if unanticipated ground conditions are encountered, inform Departmental Representative and do not proceed to place fill until inspected and approved.

.3 Maintain finished sub-base until succeeding base course is constructed, or until sub-base is accepted by Departmental Representative.

.4 Placing:

.1 Ensure no frozen material is placed. Place material only on clean unfrozen surface, free from snow or ice.

.2 Place granular materials using methods which do not lead to segregation or degradation.

.3 Place backfill, sub-base and basecourse material in 200 mm lifts. Add water as required to achieve specified density.

.4 Shape each layer to smooth contour and compact to specified density before suceeding layer is placed.

.5 Remove and replace portion of layer in which material has become segregated during spreading.

.6 Construct to grade and elevation as indicated on drawings. Typically granular base course material is the final 200mm above sub-base, with sub-base material used to make up the remaining depth from sub-grade.

.5 Compaction: unless indicated otherwise compact each layer of material to following densities for material to ASTM D698:

.1 To underside of basecourses: 98% Standard Proctor Maximum Dry Density (SPMDD)

.2 Basecourses: 98% SPMDD

.3 Elsewhere: 95% SPMDD

.4 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.

.5 In areas not accessible to rolling equipment, compact to specified density withmechanical tampers approved by Departmental Representative.

.6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

.6 Against foundations (except as applicable to trenches and under slabs and paving): excavated material or imported material with no stones larger than 200 mm diameter within 600 mm of structures.

.7 Ensure a minimum of 1.7m of granular, non-frost susceptible material is present below all building perimeter concrete aprons and sidewalks. Sub-excavate and replace sub-grade as needed in order to achieve this.

.8 Grade to ensure that water will drain away from buildings, walls and paved areas, to catch basins and other disposal areas approved by Departmental Representative. Grade to be gradual between finished spot elevations as indicated.

3.6 TOLERANCES

.1 Finished sub-base and base surfaces to be within 50mm of established grade and elevation indicated but not uniformly high or low.

.2 All surfaces are to drain properly, with no sags, low area, or ponding.

3.7 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Dispose of cleared and grubbed material off site daily.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM D4791-10, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

.2 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

.3 ASTM D422-63(2007)e2, Standard Test Method for Particle-Size Analysis of Soils

.4 ASTM C117-04, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.

.5 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-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.2 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit test results and data sheets for aggregate materials and include sieve analysis (particle size distribution) for approval, for each proposed granular source.

1.3 DELIVERY, STORAGE AND HANDLING

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

.2 Transportation and Handling: handle and transport aggregates to avoid segregation, contamination and degradation.

.3 Storage: store washed materials or materials excavated from underwater 24 hours minimum to allow free water to drain and for materials to attain uniform water content.

Part 2 Product

2.1 MATERIALS

.1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, free from adherent coatings and injurious amounts of disintegrated pieces or other deleterious substances.

.2 Flat and elongated particles of coarse aggregate: to ASTM D4791.

.1 Greatest dimension to exceed 5 times least dimension.

.3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:

.1 Screenings produced in crushing of quarried rock, boulders, gravel or slag.

.2 Reclaimed asphalt pavement.

.3 Reclaimed concrete material.

.4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:

.1 Crushed rock.

.2 Gravel composed of naturally formed particles of stone.

.3 Light weight aggregate, including slag and expanded shale.

.4 Reclaimed asphalt pavement.

.5 Reclaimed concrete material.

.5 Granular sub-base material is to meet the following requirements (as per geotech report):

.1 Crushed, pit run or screened stone, gravel or sand

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.2.

.1 Table

Particle Size (mm)	% Passing (by weight)
80	100
25	55-100
12.5	42-84
5	26-65
1.25	11-47
0.315	3-30
0.080	0-8

.6 Produce granular basecourse to meet the following requirements (as per geotech report):

.1 20mm crushed stone or gravel

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.2.

.1 Table

Particle Size (mm)	% Passing (by weight)
-	-
20	100
12.5	64-100
5	36-72
1.25	12-42
0.315	4-22
0.080	3-6

.3 Crushed particles: at least 60% of particles by mass within each of the following sieve designation ranges to have at least 1 freshly fractured face: 25-12.5mm, 12.5-5mm.

.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 below when tested to ASTM C136. Sieve sizes to CAN/CGSB-8.2.

.2 Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve

.1 Table:

Sieve Size (mm)	% Passing (by weight)
2	100
0.1	45-100
0.02	10-80
0.005	0-45

2.2 SOURCE QUALITY CONTROL

.1 The Contractor is solely responsible for all Quality Control and Quality Control Testing to ensure that the work is completed according to the Contract requirements

and shall retain an independent, certified, third-party testing agency for these purposes.

.2 Inform Departmental Representative of proposed source of aggregates and provide sample test results 2 weeks minimum before placing material.

.3 If materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate alternative source.

.4 Advise Departmental Representative 2 weeks minimum in advance of proposed change of material source.

.5 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions are acceptable for topsoil / organic material stripping.

.1 Visually inspect substrate and provide photographs to Department Representative if required.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with topsoil / organic material stripping. only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative .

3.2 PREPARATION

.1 Topsoil / organic stripping:

.1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.

.2 Begin topsoil stripping of areas as directed by Departmental Representative after area has been cleared of brush 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.

.2 Aggregate source preparation:

.1 Prior to excavating materials for aggregate production, clear and grub area to be worked, and strip unsuitable surface materials. Dispose of cleared, grubbed and unsuitable materials as approved by authority having jurisdiction.

.2 Where clearing is required, leave screen of trees between cleared area and roadways as directed.

.3 Clear, grub and strip area ahead of quarrying or excavating operation sufficient to prevent contamination of aggregate by deleterious materials.

.4 When excavation is completed dress sides of excavation to nominal 1.5:1 slope, and provide drains or ditches as required to prevent surface standing water.

.5 Trim off and dress slopes of waste material piles and leave site in neat condition.

.6 Provide silt fence or other means to prevent contamination of existing watercourse or natural wetland features.

.3 Processing:

.1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.

.2 Blend aggregates, as required, including reclaimed materials that meet physical requirements of specification is permitted in order to satisfy gradation requirements for material and, percentage of crushed particles, or particle shapes specified.

.1 Use methods and equipment approved in writing by Departmental Representative.

.4 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate gradation.

.5 Where necessary, screen, crush, wash, classify and process aggregates with suitable equipment to meet requirements.

.1 Use only equipment approved in writing by Departmental Representative.

.6 Stockpiling:

.1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Departmental Representative. Do not stockpile on completed pavement surfaces.

.2 Stockpile aggregates in sufficient quantities to meet project schedules.

.3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.

.4 Except where stockpiled on acceptably stabilized areas, provide compacted

sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into Work.

.5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.

.6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Departmental Representative within 48 hours of rejection.

.7 Stockpile materials in uniform layers of thickness as follows:

.1 Maximum 1.5 m for coarse aggregate and base course materials.

.2 Maximum 1.5 m for fine aggregate and sub-base materials.

.3 Maximum 1.5 m for other materials.

.8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.

.9 Do not cone piles or spill material over edges of piles.

.10 Do not use conveying stackers.

.11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

.3 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.

.4 Leave any unused aggregates in neat compact stockpiles as directed by Departmental Representative.

.5 For temporary or permanent abandonment of aggregate source, restore source to condition meeting requirements of authority having jurisdiction.

.6 Restrict public access to temporary or permanently abandoned stockpiles by means acceptable to Departmental Representative.

END OF SECTION

Part 1 General

1.1 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.

1.2 STORAGE AND PROTECTION

.1 Prevent damage to existing items 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.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Felled timber may be made available for use by local staff as firewood.

Part 2 Product

2.1 Not Used

Part 3 Execution

3.1 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.

.4 Keep roads and walks free of dirt and debris.

3.2 APPLICATION

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

3.3 CLEARING

.1 Clearing includes felling, of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including rubbish occurring within cleared areas.

.2 Clear as directed by Departmental Representative, by cutting at height of not more than 300 mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 1000 mm above ground surface.

.3 cut down trees overhanging area cleared as directed by Consultant.

.4 Cut off unsound branches on trees designated to remain as directed by Consultant.

3.4 CLOSE CUT CLEARING

.1 Close cut clearing to ground level.

.2 Perform close cut clearing by hand so that existing muskeg is not damaged.

.3 Cut off branches overhanging area cleared as directed by Departmental Representative.

.4 Cut off unsound branches on trees designated to remain as directed by DCC Representative.

3.5 ISOLATED TREES

.1 Cut off isolated trees as indicated by Departmental Representative at height of not more than 300 mm above ground surface.

.2 Grub out isolated tree stumps.

.3 Prune individual trees as indicated.

.4 Trim trees designated to be left standing within cleared areas of dead branches 4 cm or more in diameter; and trim branches to heights as indicated.

.5 Cut limbs and branches to be trimmed close to bole of tree or main branches.

.6 Paint cuts more than 3 cm in diameter with approved tree wound paint.

3.6 GRUBBING

.1 Remove and dispose of roots larger than 7.5 cm in diameter, matted roots, and designated stumps from indicated grubbing areas.

.2 Grub out stumps and roots to not less than 200 mm below ground surface.

.3 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m^3.

.4 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.

3.7 REMOVAL AND DISPOSAL

.1 Remove cleared materials off site.

.2 Cut timber greater than 125 mm diameter to 800mm lengths and stockpile for future use. Stockpiled timber becomes property of Owner.

3.8 FINISHED SURFACE

.1 Leave ground surface in condition suitable for immediate grading operations to approval of Departmental Representative.

END OF SECTION

Part 1 General

1.1 MEASUREMENT PROCEDURES

.1 Excavation, trenching, backfilling and associated works shall be incidental to the Contract and will not be considered extra.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM D698-00ae1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ^{3}) (600 kN-m/m ^{3}).

.2 ASTM D1557-02e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ^{3}) (2,700 kN-m/m ^{3}).

1.3 DEFINITIONS

.1 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.

.2 Waste material: excavated material unsuitable for use in Work or surplus to requirements.

.3 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.

.4 Recycled fill material: material, considered inert, obtained from alternate sources and engineered to meet requirements of fill areas.

.5 Unsuitable materials: as defined in Section 31 05 16 - Aggregrate Materials.

.6 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 ACTION AND INFORMATIONAL 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 condition survey of existing conditions as described in EXISTING CONDITIONS article of this Section.

.2 Submit for review by Departmental Representative proposed heave prevention methods as described in PART 3 of this Section.

.3 Submit to Departmental Representative results report as described in PART 3 of this Section.

.3 Preconstruction Submittals:

.1 Submit construction equipment list for major equipment to be used in this section prior to start of Work.

.2 Submit records of underground utility locates, indicating: clearance record from utility authority.

.4 Samples:

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

1.5 QUALITY ASSURANCE/QUALITY CONTROL

.1 The Contractor is solely responsible for all Quality Control and Quality Control Testing to ensure that the work is completed according to the Contract requirements.

.2 Submit design and supporting data at least 2 weeks prior to beginning Work.

.1 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in Territory of Yukon, Canada.

.3 Engage services of qualified professional Engineer who is registered or licensed in Territory of Yukon, Canada in which Work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for Work.

.4 Do not use soil material until written report of soil test results are reviewed by Departmental Representative.

.5 Health and Safety Requirements:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Divert excess aggregate materials from landfill to local facility for reuse as directed by Departmental Representative.

1.7 EXISTING CONDITIONS

.1 Examine and follow geotechnical report attached to these Contract Documents .

.2 Buried services:

.1 Before commencing work establish location of buried services on and adjacent to site.

.2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.

.3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.

.4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.5 Prior to beginning excavation Work, notify applicable authorities having jurisdiction establish location and state of use of buried utilities and structures. authorities having jurisdiction to clearly mark such locations to prevent disturbance during Work.

.6 Confirm locations of buried utilities by careful soil hydrovac methods or test pit methods.

.7 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered appropriate.

.8 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before re-routing.

.9 Record location of maintained, re-routed and abandoned underground lines.

.10 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, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.

.2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair as directed by Departmental Representative

.3 Where required for excavation, cut roots or branches as directed by Departmental Representative .

Part 2 Product

2.1 MATERIALS

.1 Properties as required in Section 31 05 16 - Aggregate Materials.

.2 Type 3/recycled fill: selected material from excavation or other sources, approved by

Departmental Representative for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

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 to adjacent properties and walkways, according to sediment and erosion control drawings.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 SITE PREPARATION

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

.2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

3.3 PREPARATION/PROTECTION

.1 Protect existing features in accordance with Section 01 50 00 - Temporary Facilities and Controls and 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 approval.

.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.

3.4 STOCKPILING

.1 Stockpile fill materials in areas designated by Departmental Representative.

.1 Stockpile granular materials in manner to prevent segregation.

.2 Protect fill materials from contamination.

.3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

3.5 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

.1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 35 29.06 - Health and Safety Requirements Health and Safety Act for the Territory of Yukon .

.1 Where conditions are unstable, Contractor to verify and advise methods.

.2 Obtain permit from authority having jurisdiction for temporary diversion of water course.

.3 Construct temporary Works to depths, heights and locations as approved by Departmental Representative .

.4 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.

.5 When sheeting is required to remain in place, cut off tops at elevations as indicated.

.6 Upon completion of substructure construction:

.1 Remove cofferdams, shoring and bracing.

.2 Remove excess materials from site and restore watercourses as directed by Departmental Representative.

3.6 DEWATERING AND HEAVE PREVENTION

.1 Keep excavations free of water while Work is in progress.

.2 Provide for approval details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs if necessary.

.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 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.

3.7 EXCAVATION

.1 Excavate to lines, grades, elevations and dimensions as indicated.

.2 Excavation must not interfere with bearing capacity of adjacent foundations.

.3 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.

.4 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 and do not leave open more than 15 m at end of day's operation.

.5 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Departmental Representative.

.6 Restrict vehicle operations directly adjacent to open trenches.

.7 Dispose of surplus and unsuitable excavated material off site unless Departmental Representative approves an on-site disposal area.

.8 Do not obstruct flow of surface drainage or natural watercourses.

.9 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.10 Notify Departmental Representative when bottom of excavation is reached.

.11 Obtain Departmental Representative approval of completed excavation.

.12 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Departmental Representative.

.13 Correct unauthorized over-excavation as follows:

.1 Fill under foundation bearing surfaces, footings, and pipe bedding with 20mm crushed basecourse compacted to not less than 98% of corrected Standard Proctor Maximum Dry Density (SPMDD).

.2 Fill under other areas with sub-base fill (pit run gravel) compacted to not less than 95% SPMDD.

.14 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.

3.8 BEDDING AND SURROUND OF UNDERGROUND SERVICES

.1 Place and compact granular material for bedding and surround of underground services as specified in Section 33 07 16 - Factory Pre-insulated Piping and as shown on the project drawings. See Standard Trench Detail on Drawing C-501.

.2 Place bedding and surround material in unfrozen condition.

3.9 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.

.6 If buried utilities are backfilled prior to receiving written approval from Departmental Representative, Contractor is responsible for all costs relating to re-exposing buried utilities for inspection and approval, and re-backfilling.

.2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.3 Do not use backfill material which is frozen or contains ice, snow or debris.

.4 Place backfill material in uniform layers not exceeding 200 mm compacted thickness up to grades and elevations indicated. Compact each layer before placing succeeding layer.

.5 Compaction:

.1 98% SPMDD under roadways and parking lots

.2 95% SPMDD elsewhere

.6 Backfilling around installations:

.1 Place bedding and surround material as specified elsewhere.

.2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.

.3 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 0.50 m.

.4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:

.1 Permit concrete to cure for minimum 7 days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from Departmental Representative:

.2 If approved by Departmental Representative, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Departmental Representative.

.7 Place recycled fill in areas as indicated.

.8 Consolidate and level unshrinkable fill with internal vibrators.

3.10 RESTORATION

.1 Upon completion of Work, remove waste materials and debris, trim slopes, and correct defects as directed by Departmental Representative.

.2 Replace topsoil as directed by Departmental Representative .

.3 Reinstate lawns to elevation which existed before excavation.

.4 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.

.5 Clean and reinstate areas affected by Work as directed by Departmental Representative.

.6 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.

.7 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 01 33 00 - Submittal Procedures

1.2 REFERENCES

.1 ASTM International

.1 ASTM A53/A53M-10, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 A653/A653M-10, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-138.1-96, Fabric for Chain Link Fence.

.2 CAN/CGSB-138.3-96, Installation of Chain Link Fence.

.3 CAN/CGSB-138.4-96, Gates for Chain Link Fence.

.3 CSA International

.1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CAN/CSA-A3000-08, Cementitious Materials Compendium.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit product data and shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations.

.2 Store and protect fence and gate materials from damage.

.3 Replace defective or damaged materials with new.

Part 2 Product

2.1 MATERIALS

.1 Chain-link fence fabric: to CAN/CGSB-138.1.

.1 Type 1, ClassA, heavy style, Grade 1.

.2 Fence height: 1829mm (6')

.2 Posts, braces and rails: to CAN/CGSB-138.2, galvanized steel pipe.

.3 Bottom tension wire: to CAN/CGSB-138.2, single strand, galvanized steel wire.

.4 Tension bar: to ASTM A653/A653M, 5 x 20 mm minimum galvanized steel.

.5 Gates: to CAN/CGSB-138.4.

.6 Gate frames: to ASTM A53/A53M, galvanized steel pipe, standard weight 45 mm outside diameter pipe for outside frame, 35 mm outside diameter pipe for interior bracing.

.1 Fabricate gates as indicated with electrically welded joints, and hot-dip galvanized after welding.

.2 Fasten fence fabric to gate with twisted selvage at top.

.3 Furnish gates with galvanized malleable iron hinges, latch and latch catch with provision for padlock which can be attached and operated from either side of installed gate.

.4 Hardware extra heavy duty to permit 180 degree opening of gate.

.5 Gate to match height of fencing. Refer to drawings for width.

.7 Fittings and hardware: to CAN/CGSB-138.2, galvanized steel.

.1 Tension bar bands: 3 x 20 mm minimum galvanized steel or 5 x 20 mm minimum aluminum.

.2 Post caps to provide waterproof fit, to fasten securely over posts and to carry top rail.

.3 Turnbuckles to be drop forged.

.4 Gate Fork Latch: galvanized steel, for swing gates.

.8 Barbed wire: to CAN/CGSB-138.2, 2.5 mm diameter.

.9 Organic zinc rich coating: to CAN/CGSB-1.181.

.10 Concrete mixes and materials: in accordance with CSA A23.1.

.1 Nominal coarse aggregate size: 20-5.

.2 Compressive strength: 20 MPa minimum at 28 days.

.11 Padlocks and chain:

.1 Outdoor, heavy duty padlock c/w 38mm non-corrosive chain c/w flexible nylon cover, 1m long, for securing gates.

2.2 FINISHES

.1 Galvanizing:

.1 For chain link fabric: to CAN/CGSB-138.1 Grade 2.

.2 For pipe: 550 g/m²minimum to ASTM A90.

.3 For other fittings: to ASTM A123/A123M.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for fence and gate 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 ERECTION OF FENCE

.1 Erect fence along lines as indicated and to CAN/CGSB-138.3.-M80.

.2 Space straining posts at equal intervals not to exceed 80 m if distance between end or corner posts on straight continuous lengths of fence over reasonably smooth grade, is greater than 80 m.

.3 Install end posts at end of fence and at buildings.

.1 Install gate posts on both sides of gate openings.

.4 Install overhang tops and caps.

.5 Install top rail between posts and fasten securely to posts and secure waterproof caps and overhang tops.

.6 Ensure locking pins, locking nuts and gates have opposing hinge pins to increase

level of security and prevention of gate removal.

.7 Provide gate fork latch at each gate.

.8 Install bottom tension wire, stretch tightly and fasten securely to end, corner, gate and straining posts with turnbuckles and tension bar bands.

.9 Provide outdoor padlock (keyed) c/w protected chain at each gate.

3.3 INSTALLATION OF GATES

.1 Install gates in locations as indicated.

3.4 TOUCH UP

.1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas .

.1 Pre-treat damaged surfaces according to manufacturers' instructions for zinc-rich paint.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM C117-13, Standard Test Method for Materials Finer than 75-µm (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 C518-10, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

.4 ASTM D698-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3(600 kN-m/m^3))

.5 ASTM D1622-08, Standard Test Method for Apparent Density of Rigid Cellular Plastics.

.6 ASTM D2842- 12, Standard Test Method for Water Absorption of Rigid Cellular Plastics.

.7 ASTM D3574-11, Standard Method of Testing Flexible Cellular Materials - Slab, Bonded and Molded Urethane Foams.

.8 ASTM D6226-10, Standard Test Method for Open Cell Content of Rigid Cellular Plastics.

.2 American Water Works Association (AWWA)

.1 ASTM F714-13 , Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2-88, Sieves, Testing, Woven Wire, Metric.

.3 CSA B137 Series-13, Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).

1.2 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 factory pre-insulated piping systems for utility applications and include product characteristics, performance criteria, physical size, finish and limitations.

.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 for specified materials from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

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

1.3 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Operation and Maintenance Data: submit operation and maintenance data for pre-insulated piping systems for incorporation into manual.

.3 Record Drawings: submit data necessary to produce record drawings on project completion and following requirements:

.1 Give details of pipe material, location of fittings, maintenance and operating instructions.

1.4 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labeled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect pre-insulated piping system materials from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Product

2.1 CARRIER CORE PIPE

.1 Water service: per Section 33 11 16 - Site Water Utility Distribution Piping

.1 Factory-applied 50mm thick insulation and waterproof jacket

.2 Supplied in minimum 10m length. No joints are allowed in the 10m length.

.2 Sanitary service: per Section 33 31 13 - Public Sanitary Utility Sewerage Piping

.1 Factory-applied 50mm thick insulation and waterproof jacket

2.2 FACTORY APPLIED INSULATION

.1 Clean pipes of surface dust or dirt and treat to assure positive bond of foam to entire pipe surface.

.2 Material: rigid polyurethane foam factory applied.

.3 Insulation thickness: 50 mm.

.4 Density: to ASTM D1622, 0.032 to 0.048 gm/cm³.

.5 Closed cell content: to ASTM D6226, 90% minimum.

.6 Water absorption: to ASTM D2842, 4.0 gm/1000 cm³, maximum 4.25% by volume.

.7 Compressive strength: to ASTM D1621, up to 200 kPa.

.8 Thermal conductivity: to ASTM C518, 0.022 to 4 W/m. degrees C.

.9 Service temperature: minus 45 degrees C to plus 120 degrees C.

.10 Centering of pipe within insulation: no more than plus or minus 6 mm off centre.

.11 Protect insulation on both ends of pipe from moisture and sunlight by 3 mm thick continuous concentration of black asphalt mastic compound.

.12 Insulation must completely fill space between pipe and conduit.

2.3 OUTER JACKET FOR BURIED APPLICATIONS

.1 Material: factory applied high density polyethylene jacket, black in colour (UV inhibited).

.2 Density of HDPE jacket: to ASTM D1505, 0.940 gm/cm³ minimum.

.3 Sealant: synthetic polymers or modified rubber mastic.

.4 Jacket thickness: 1.14 mm minimum.

.5 Elongation: to ASTM D638, 400% maximum 6 month test.

.6 Service temperature: minus 45 degrees C to plus 120 degrees C maximum.

.7 Water vapour transmission rate: 3 gm/m²/24 hours average.

.8 Tensile strength: 25 kg/cm width minimum.

.9 Impact strength: to ASTM G14, 7.79 N/m at minus 40 degrees C minimum.

2.4 INSULATED PIPE JOINTS FOR BURIED APPLICATIONS

.1 Material: rigid polyurethane half shells with heat shrink sleeves and mastic sealant to provide moisture-proof seal.

.2 Pre-formed rigid polyurethane halves, as indicated, with properties as described in this Section.

.3 Heat shrink sleeves: adhesive coated cross linked polyethylene sleeve.

.4 Sleeves: to cover entire exposed joint length plus overlap of about 76 mm of pipe coating on either side.

.5 Waterproofing mastic sealant for coating exposed ends of insulation after field cutting or trimming has been carried out: as described in this Section.

2.5 INSULATION KITS FOR FITTINGS

.1 Material: rigid polyisocyanurate foam with fully bonded FRP glass reinforced polyester or polymer protective coating on exterior surfaces including ends.

.1 Supply kits complete with silicone caulking for seams, stainless steel attachment straps and clips, and heat shrink sleeves to seal between pipe and insulation cover.

.2 Rigid polyisocyanurate foam insulation.

.1 Density: to ASTM D1622, 0.03 gm/cm³ minimum.

.2 Compressive strength: to ASTM D1621, 137 kPa minimum.

.3 Closed cell content: 92% minimum.

.4 Water absorption: to ASTM D2842, 0.02 g/m².

.5 K Factor: to ASTM C518, 0.02 W/m. degrees C maximum.

.3 FRP coating.

.1 Glass reinforced polyester fully bonded to insulation.

.2 Laminating resin black in colour, UV inhibited.

.3 Thickness: 2.54 mm minimum.

.4 Exterior surface: resin-rich hot coat of 0.25 mm minimum thickness.

.4 Polymer coating: to ASTM D3574.

.1 Two component high density polyurethane coating, black in colour.

.2 Density: 1170 kg/m².

.3 Abrasion: durometer D scale: 60.

.4 Tensile strength: 11,000 kPa minimum.

.5 Tear strength: 26.5 N/mm minimum.

2.6 INSULATION FOAMED IN PLACE

.1 Material: two component polyurethane Class I foam, supplied in portable, disposable, pressurized container.

.2 Density: to ASTM D1622, 0.035 to 0.039 gm/cm³.

.3 Closed cell content: to ASTM D6226, 90% minimum.

.4 Thermal conductivity: to ASTM C518, 0.022 to 0.024 W/m. degrees C.

.5 Compressive strength: to ASTM D1621, 103 to 172 kPa at 10% defection minimum.

.6 Water absorption: to ASTM D2842, 4.25% maximum by volume.

2.7 INSULATION ACCESSORIES

.1 Heat shrink tape for sealing insulation half shells against moisture adaptable to flexible installations.

.1 Crosslinked polyolefin backing with a hot melt adhesive coating.

.2 Backing thickness: 0.35 mm minimum.

.3 Adhesive thickness: 0.51 mm.

.4 Service temperature: minus 18 to plus 20 degrees C maximum.

.5 Tensile strength: 16 N/mm.

.2 High density polyethylene tape for minor repair of the outer jacket or completion of straight insulation joints in field where irregular surfaces are not involved.

.1 Adhesive backed tape: heated to approximately 50 degrees C prior to installation.

.2 Backing thickness: 0.50 mm average.

.3 Adhesive thickness: 0.127 mm average.

.4 Service temperature: minus 34 to plus 82 degrees C.

.5 Tensile strength: 10 N/mm.

.6 Colour: black.

.3 Asphalt mastic vapour barrier coating to waterproof exterior surfaces of half shells or sprayed in place foam.

.1 Colour: black.

.2 Solids by volume: 62%.

.3 Coverage: 14 L at 9.0 m².

.4 Drying time to touch: 4 hours maximum.

.5 Drying time firm: 48 hours maximum.

.6 Service temperature: minus 29 to plus 93 degrees C.

.7 Application temperature: 4.4 degrees C minimum.

.8 Moisture permeability: 3.2 mm wet film at 37.3 degrees C.

.9 90% relative humidity: to ASTM E96, 02 perms.

.10 Shelf life: 12 months.

.4 Silicone caulking for joining faces of rigid urethane insulation.

.1 Colour: black.

.2 Specific gravity: 1.07.

.3 Tensile strength: 25 kg/cm².

.4 Tear strength: 8 kg/cm².

.5 Service temperature: 205 degrees C maximum.

2.8 WARNING TAPE

.1 Polyethylene tape: 150 mm wide by 0.15 mm thick as approved by Departmental Representative.

.2 Tape for water mains: blue in colour with factory applied markings at one metre intervals, i.e. "Caution Buried Water Line".

.3 Tape for sanitary sewers: green in colour with factory applied markings at one metre intervals, i.e. "Caution Buried Sewer Line".

2.9 PIPE BEDDING AND SURROUND MATERIALS

.1 As described in Section 31 23 33.01 - Excavating, Trenching and Backfilling and on the project drawings.

.2 Bedding and surround materials to meet Section 31 05 16 - Aggregate Materials

2.10 ESCUTCHEON PLATES

.1 Provide split hinge type metal plates for piping entering walls and floors in exposed spaces.

.2 Provide chromium-plated finish on copper alloy plates in finished spaces.

.3 Provide paint finish on metal plates in unfinished spaces.

2.11 PIPE SLEEVES

.1 Provide sleeves where piping passes entirely through walls and floors.

.2 Ensure sleeves are of sufficient length to pass through entire thickness of walls and floors.

.3 Provide 25 mm minimum clearance between exterior of piping or pipe insulation, and interior of sleeve or core-drilled hole.

.4 Firmly pack space with mineral wool insulation.

.5 Seal space at both ends of sleeve or core-drilled hole with plastic waterproof cement which will dry to firm but pliable mass, provide mechanically adjustable segmented elastomeric seal.

.6 In fire walls and fire floors, seal both ends of sleeves or core-drilled holes with UL listed fill, void, or cavity material.

.1 For sleeves in masonry and concrete walls and floors provide cast-iron sleeves.

.2 Provide core drilling of masonry and concrete in lieu of sleeves when cavities in core-drilled hole are grouted smooth.

.3 In other than masonry and concrete walls and floors provide sleeves made from 0.5 mm thick galvanized steel sheet.

2.12 BACKFILL MATERIALS

.1 As described in Section 31 23 33.01 - Excavating, Trenching and Backfilling and on the project drawings.

.2 Backfill trenches with approved native material/recycled fill, or sub-base material

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for pre-insulated piping systems 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 REPAIRING DAMAGED PRE-INSULATED PIPE

.1 Repair damage to outer jacket by applying heat shrink sleeve as reviewed by Departmental Representative or cover using heated PE UV resistant adhesive backed tape.

3.3 TRENCHING

.1 Do trenching work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Trench depth to provide cover over pipe as indicated.

.3 Trench alignment and depth require Departmental Representative's approval prior to placing bedding material or pipe.

3.4 GRANULAR BEDDING AND SURROUND

.1 Place bedding and surround material in unfrozen condition.

.2 Place materials in uniform layers not exceeding 150mm compacted thickness to depth as indicated.

.1 Compact each layer before placing succeeding layer.

.3 Shape bed true to grade to provide continuous uniform bearing surface for pipe exterior. Do not use blocks when bedding pipe.

.4 Shape transverse depressions in bedding as required to make joints.

.5 Compact each layer full width of bed to at least 98% SPMDD to ASTM D698.

.6 Fill authorized excavation or unauthorized over excavation below design elevation of bottom of specified bedding with compacted bedding material.

3.5 PIPE INSTALLATION

.1 On dry ground, assemble shipping lengths of pipe into suitable installation lengths

.2 Join pipes in accordance with manufacturer's recommendations.

.3 Recheck pipe joints assembled above ground after placing in trench to ensure no movement of joints has taken place.

.4 Complete installation of rigid polyurethane halves on joints after laying pipe in trench and after successful pressure testing of pipe.

.1 Trim half shells to required length with handsaw to provide tight-fit in insulation gap between ends of factory insulation.

.2 Do not allow seam to exceed 3 mm in width at joint.

.1 Match outer surface of shell with outer surface of installation on pipe within tolerance of plus or minus 6 mm.

.2 Shave off any sharp edge with rasp.

.3 Hold half shells in place with masking tape while installing heat shrink sleeve.

.5 Install heat shrink sleeves using large broad flame propane torch to produce 600 mm flame.

.1 Peel back release liner 12 cm from end, centre sleeve over joint and press firmly down.

.1 Wrap sleeve around pipe, removing release liner as it is wrapped.

.2 If corner on underlap is not precut, then cutoff about 25 mm from each corner.

.2 Before completing overlap wrapping, warm underlap area approximately 12 cm until adhesive starts to appear at edge.

.1 Smooth out wrinkles with gloved hand.

.3 Remove remaining release liner and complete wrapping.

.4 Remove release paper from closure seal, prewarm adhesive slightly, centre seal over overlap and press down until well bonded.

.1 Heat closure seal, and press down with gloved hand to remove bubbles and wrinkles.

.5 Shrink sleeve around joint with torch: start at centre of sleeve.

.1 Keep torch moving using broad circumferential strokes to avoid burning.

.2 Continue shrinking sleeve toward one end until about 50 mm is left.

.3 Then aim torch inward towards centre and shrink edges.

.4 Repeat this operation on other end of sleeve.

.5 Finish off by applying long horizontal strokes of torch all around sleeve.

.6 Pay special attention to sleeve overlap area, ensuring no void remains along underlap edge.

.1 Use roller, or gloved hand to firmly and thoroughly press down along underlap edge.

.2 Start in centre and work outwards.

.7 Joint and sleeve cool for at least 30 minutes before lowering pipe into trench.

.8 Lay pipes on prepared bed, true to line and grade as indicated.

.1 No deviations without written approval of Departmental

Representative.

.2 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.3 Take out and replace defective pipe.

.4 Correct pipe which is not in true alignment or grade, or pipe which shows undue settlement after installation.

.5 Change method or equipment for setting alignment or grade if requested by Departmental Representative.

.9 Do not lay pipe on frozen bedding.

.10 Do not let rocks or other foreign material, which might damage insulation jacket, fall on pipe.

.11 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.

.1 Install removable watertight bulkhead at open end of pipe to prevent entry of foreign materials.

3.6 INSULATION OF FITTINGS

.1 Cut pipes as required to accommodate fittings and fitting insulation kits without damaging pipe insulation or its jacket.

.1 Leave smooth end at right angles to pipe axis.

.2 Cracks larger than 6.4 mm to be filled with insulation foamed-in-place in following manner:

.1 Use strip of thin galvanized sheet metal wide enough to overlap both insulation kit and pipe by at least 8 cm and long enough to wrap around pipe leaving 2.5 cm opening on top.

.2 Hold metal in place with two tension metal or nylon straps, one at either end.

.3 Spray foam through opening on top into cavity.

.4 Spray until cavity is almost half-filled on both sides of pipe.

.1 Foam will rise to complete filling.

.5 Allow to cure for 10 to 15 min.

.6 Trim top and apply waterproofing sealant asphalt mastic, HDPE tape or heat shrink tape.

3.7 PIPE BACKFILLING

.1 Do backfilling work in accordance with Section 31 23 33.01 - Excavating Trenching

and Backfilling.

.2 Lay continuous runs of warning tape on top of surround material 300 mm directly above water and sewer mains.

.3 Surround and cover pipes between joints when pipe laying is complete and inspected by Departmental Representative.

.4 Protect pipe from freezing if temperatures lower than -5 degrees C.

.5 Surround and cover joints and fittings with surround material placed and compacted as specified when testing results are accepted by Departmental Representative.

.6 Place backfill material above pipe surround, in uniform layers not exceeding 200mm compacted thickness.

.7 Mechanically compact each layer to at least 98% SPMDD.

3.8 FIELD QUALITY CONTROL

.1 Site tests, and inspections:

.1 Test water service for leakage in accordance with Section 33 11 16 - Site Water Utility Distribution Piping

.2 Flush and disinfect water service in accordance with Section 33 11 16 - Site Water Utility Distribution Piping.

.3 Field test sanitary sewers for infiltration and exfiltration in accordance with Section 33 31 13 - Public Sanitary Utility Sewerage Piping.

.4 Protect piping from freezing if testing at temperatures lower than minus 5 degrees C.

3.9 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning. .1

Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 33 07 16 - Factory Pre-insulated Piping Systems.

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 ANSI/AWWA C901-08, PE Pressure Pipe and Tubing, 13 mm through 76 mm for Water Service

.2 ASTM International

.1 ASTM F714-10, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

.2 ASTM D2657-07, Standard Practice for Heat Fusion Joining

.3 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 for piping materials and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Pipe certification to be on pipe.

.3 Shop Drawings:

.1 Submit shop drawings of pipe, joints and fittings.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 Submit data to produce record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material.

.1 Include top of pipe, horizontal location of fittings and type, valves.

.3 Operation and Maintenance Data: submit operation and maintenance data for valves, valve boxes, valve chambers for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 10 Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect water distribution piping from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

1.6 SCHEDULING OF WORK

.1 Submit schedule of expected interruptions for approval and adhere to interruption schedule as approved by Departmental Representative.

.2 Notify Department Representative and building manager a minimum of 48 hours in advance of interruption in service. If the interruption will last longer than 1 hour, it must be coordinated with and approved by the Owner.

Part 2 Product

2.1 PIPE, JOINTS AND FITTINGS

.1 High Density Polyethylene (HDPE) pressure pipe:

.1 NPS 1/2 to NPS 6: to ASTM F714, type PE 3408 .

.2 To ASTM F714 and CSA B137.1

.3 Service pipe: SDR 9

.4 Polyethylene to polyethylene joints: to be thermal butt fusion joined, to ASTM D2657.

.5 Polyethylene fittings: to CAN/CSA-B137.1, for pipe sizes NPS 4 and less.

2.2 VALVES AND VALVE BOXES

.1 Valves to open clockwise.

2.3 SERVICE CONNECTIONS

.1 Main stop: Cambridge Brass, Mueller, or approved equal

.2 Service saddle: Robar 2706, stainless steel (or approved equal)

.3 Half shell insulation kit shall be provided.

.4 As water main material is unknown, DO NOT supply tapping saddle and associated equipment until pipe material has been confirmed and shop drawings have been approved. Confirmation of pipe material of main is responsibility of Contractor.

2.4 PIPE BEDDING AND SURROUND MATERIAL

.1 Granular material to Section 31 05 16 - Aggregate Materials

.2 Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks: to requirements on Structural drawings.

2.5 BACKFILL MATERIAL

.1 As indicated on project drawings.

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 in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative .

3.2 PREPARATION, TRENCHING, BEDDING, SURROUND

.1 As per Section 33 07 16 - Factory Pre-insulated Piping and Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.3 PIPE INSTALLATION

.1 Prepare building water service

.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 and join pipes as per manufacturer's recommendations

.1 Do not use blocks except as specified.

.3 Join pipes in accordance with ANSI/AWWA C602 manufacturer's recommendations.

.4 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.

.5 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.

.6 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.

.7 Do not exceed permissible deflection at joints 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, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.9 Position and join pipes with equipment and methods approved by Departmental Representative.

.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 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Departmental Representative.

.18 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.19 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.

.20 Do not lay pipe on frozen bedding.

.21 Do hydrostatic and leakage test and have results approved by Departmental Representative before surrounding and covering joints and fittings with granular material.

.22 Backfill remainder of trench.

3.4 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.

3.5 UNDERCROSSING

.1 Excavate working pit outside utility to be crossed.

.2 Excavate working pit to not less than 0.6 m below lowest invert of encasing pipe.

.3 Dewater excavation.

.4 Dewater area of undercrossing.

.5 Install heavy timber backstop.

.6 Place encasing pipe to exact line and grade indicated. Encasing pipe to cross under obstruction at an angle of 22.5 degrees.

.7 Ensure encasing pipe is not in tension.

.8 Joints for encasing pipe: mechanical type.

.9 Place concrete grout levelling pad in encasing pipe. Control level of grout during placing.

.10 Insert water main into encasing pipe, in end with largest open area, after placement

of levelling pad.

.11 Use approved blocking method to guide water main in true alignment.

.12 Clearance between blocks and encasing pipe: maximum 15 mm when water main is in position.

.13 Join water main one length at time outside encasing pipe. Pull water main into position.

.14 Couplings of water main shall not rest on levelling pad when water main is in position.

.15 Place concrete cradle around water main after it is positioned. Cradle to be minimum of 225 mm and maximum of 300 mm above levelling pad.

.16 Pressure grout remaining void.

3.6 SERVICE CONNECTIONS

.1 Construct service connections at right angles to water main unless otherwise directed. Locate curb stops 300 mm insideright-of-way.

.2 Use Robar 2706 bronze tapping saddle or approved equivalent.

.3 Tappings on PVC pipe to be either PVC valve tees or bronze type service clamps, strap type with "O" ring seal cemented in place.

.4 Tappings for PE pipe: PE tapping tees or multi-saddle tees.

.5 Employ only competent workmen equipped with suitable tools to carry out tapping of mains, cutting and flaring of pipes.

.6 Install single and multiple tap service connections on top half of main, between 45 degrees and 90 degrees measured from apex of pipe.

.7 Tap main at 2:00 o'clock or 10:00 o'clock position only; not closer to joint nor closer to adjacent service connections than recommended by manufacturer, or 1 m minimum, whichever is greater.

.8 Leave corporation stop valves fully open.

.9 Install rigid stainless steel liners in small diameter plastic pipes with compression fittings.

.10 Place temporary location marker at ends of plugged or capped unconnected water lines.

.1 Each marker to consist of 38 x 89 mm stake extending from pipe end at pipe level to 600 mm above grade.

.2 Paint exposed portion of stake red with designation "WATER SERVICE LINE" in black.

3.7 THRUST BLOCKS AND RESTRAINED JOINTS

.1 For thrust blocks: do concrete work in accordance with requirements on Structural drawings.

.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 24 hours after placing.

.5 For restrained joints: only use restrained joints approved by Departmental Representative.

3.8 HYDROSTATIC AND LEAKAGE TESTING

.1 Do tests in accordance with ANSI/AWWA C800.

.2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.

.3 Notify Departmental Representative at least 72 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 or 2 days if high early strength concrete is used.

.5 Test pipeline in sections not exceeding 200 m in length, unless otherwise authorized by Departmental Representative.

.6 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated.

.7 Leave hydrants, valves, joints and fittings exposed.

.8 When testing is done during freezing weather, protect hydrants, valves, joints and fittings from freezing.

.9 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.

.10 Open valves.

.11 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.

.12 Fill asbestos cement pipe and concrete pipe at least 24 hours before testing to allow

water absorption by pipe material.

.13 Thoroughly examine exposed parts and correct for leakage as necessary.

.14 Apply hydrostatic test pressure of 1034 kPa minimum based on elevation of lowest point in main and corrected to elevation of test gauge, for period of 1 hour.

.15 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.

.16 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.

.17 Repeat hydrostatic test until defects have been corrected.

.18 Apply leakage test pressure of 1034 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.

.19 Define leakage as amount of water supplied from water storage tank in order to maintain test pressure for 2 hours.

.20 Locate and repair defects if leakage is greater than amount specified.

.21 Repeat test until leakage is within specified allowance for full length of water main.

3.9 PIPE SURROUND

.1 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround and cover pipes as indicated.

.2 Hand place surround material in uniform layers not exceeding 200mm compacted thickness as indicated.

.1 Do not dump material within 1.0 m of pipe.

.3 Place layers uniformly and simultaneously on each side of pipe.

.4 Do not place material in frozen condition.

.5 Compact each layer from pipe invert to mid height of pipe to at least 98% SPMDD.

3.10 BACKFILL

.1 As described in Section 31 23 33.01 - Excavating, Trenching and Backfilling and on the project drawings.

.2 Place backfill material, above pipe surround, in uniform layers not exceeding 200mm compacted thickness up to grades as indicated.

.3 Do not place backfill in frozen condition.

3.11 FLUSHING

.1 Flushing and disinfecting operations: witnessed by Departmental Representative.

.1 Notify Departmental Representative at least 4 days in advance of proposed date when disinfecting operations will begin.

.2 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum 10 minutes, or until foreign materials have been removed and flushed water is clear.

.3 Flushing flows as follows:

.4 Provide connections and pumps for flushing as required.

.5 Open and close valves, hydrants and service connections to ensure thorough flushing.

.6 When flushing has been completed to Departmental Representative approval, introduce strong solution of chlorine as approved by Departmental Representative into water main and ensure that it is distributed throughout entire system.

.7 Disinfect water mains to the requirements of local authority.

.8 Rate of chlorine application to be proportional to rate of water entering pipe.

.9 Chlorine application to be close to point of filling water main and to occur at same time.

.10 Operate valves, hydrants and appurtenances while main contains chlorine solution.

.11 Flush line to remove chlorine solution after 24 hours.

.12 Measure chlorine residuals at extreme end of pipe-line being tested.

.13 Perform bacteriological tests on water main, after chlorine solution has been flushed out.

.1 Should contamination remain or recur during this period, repeat disinfecting procedure.

.2 Specialist contractor to submit certified copy of test results.

.14 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.

3.12 SURFACE RESTORATION

.1 After installing and backfilling over water mains, restore surface to original condition as directed by Departmental Representative.

3.13 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 33 07 16 - Factory Pre-insulated Piping.

1.2 REFERENCES

.1 ASTM International

.1 ASTM D698-07e1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft4-lbf/ft³ (600 kN-m/m³)).

.2 ASTM D3350-10, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

.3 ASTM F714-10, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

.2 CSA International

.1 CSA A257 Series-09, Standards for Concrete Pipe and Manhole Sections.

.2 CSA B137 Series-13, Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).

.3 CSA B1800-11, Thermoplastic Non-pressure Pipe Compendium.

.1 CSA B182.11-11, Standard Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 Scheduling:

.1 Submit schedule of expected interruptions for approval and adhere to approved schedule.

.2 Notify Departmental Representative and building manager a minimum of 48 hours in advance of any interruption in service. If the interruption will last longer than 1 hour, it must be coordinated with and approved by the Owner.

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 pipes, and backfill and include product characteristics, performance

criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Indicate on drawings proposed method for installing carrier pipe for undercrossings (if any).

.2 Submit shop drawings of pipe, joints and fittings.

.4 Certificates:

.1 Certification to be marked on pipe.

.1 Submit proof of operator certification to perform fusion/welding of HDPE pipe to manufacturer's requirements.

.5 Test and Evaluation Reports:

.1 Submit manufacturer's test data and certification 2 weeks minimum before beginning Work.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 10 Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labeled 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 Product

2.1 HDPE SEWER SERVICE PIPE

.1 To CSA B137.1

.1 See 33 07 16 for insulation requirements (minimum 50mm, factory-applied)

.2 All joints to be butt fusion welded or electrofusion (fully restrained).

.3 Minimum DR 21

.4 Nominal lengths: 12.2m

2.2 PIPE BEDDING AND SURROUND MATERIALS

.1 Granular material to Section 31 05 16 - Aggregate Materials and as shown on project drawings.

.2 Concrete mixes and materials for cradles, encasement, supports: to Section 03 30 00 - Cast-in-Place Concrete.

2.3 BACKFILL MATERIAL

.1 As indicated on project drawings.

.2 In accordance with Section 3.31 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 sewer pipe installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative .

3.2 PREPARATION

.1 Temporary Erosion and Sedimentation Control:

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff to adjacent properties and walkways, according to sediment and erosion control drawings.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

.2 Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of Departmental Representative.

.3 Clean and dry pipes and fittings before installation.

.4 Obtain Departmental Representative's approval of pipes and fittings prior to installation.

3.3 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.

.3 Trench alignment and depth require approval of Departmental Representative prior to placing bedding material and pipe.

3.4 CONCRETE BEDDING AND ENCASEMENT

.1 Do concrete Work in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.1 Place concrete to details as indicated.

.2 Position pipe on concrete blocks to facilitate placing of concrete.

.1 When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed.

.3 Do not backfill over concrete within 24 hours after placing.

3.5 GRANULAR BEDDING

.1 Place bedding in unfrozen condition.

.2 Place granular bedding materials in uniform layers not exceeding 200mm 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 pipe.

.4 Shape transverse depressions as required to suit joints.

.5 Compact each layer full width of bed to at least 98% SPMDD.

.6 Fill excavation below bottom of specified bedding adjacent to manholes or structures with compacted bedding material.

3.6 INSTALLATION

.1 Lay and join pipes to: CSA B182.11

.2 Lay and join pipes 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 invert smooth and free of

sags or high points.

.1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length. .

.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 pipe 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 Pipe joining: Follow manufacturer's instructions for electrofusion / butt fusion welding of HDPE pipe. Proof of operator certification to perform electrofusion / butt fusion welding to be provided to Departmental Representative for acceptance prior to start of pipe joining.

.1 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.2 Align pipes before joining.

.3 Maintain pipe joints free from mud, silt, gravel and foreign material.

.4 Complete each joint before laying next length of pipe.

.5 Minimize joint deflection after joint has been made to avoid joint damage.

.6 At rigid structures, install pipe joints not more than 1.2 m from side of structure.

.7 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

.10 When stoppage of Work occurs, block pipes as directed by Departmental Representative to prevent creep during down time.

.11 Plug lifting holes with pre-fabricated plugs approved by Departmental Representative, set in shrinkage compensating grout.

.12 Cut pipes as required for special inserts, fittings or closure pieces as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.13 Make watertight connections to manholes.

.1 Use shrinkage compensating grout when suitable gaskets are not available.

3.7 PIPE SURROUND

.1 Place surround material in unfrozen condition.

.2 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.

.3 Hand place surround material in uniform layers not exceeding 200mm compacted thickness as indicated.

.1 Do not dump material within 1.0 m of pipe.

.4 Place layers uniformly and simultaneously on each side of pipe.

.5 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

3.8 BACKFILL

.1 Place backfill material, above pipe surround, in uniform layers not exceeding 200mm compacted thickness up to grades as indicated.

.2 As described in Section 31 23 33.01 - Excavating, Trenching and Backfilling and on the project drawings.

.3 Do not place backfill in frozen condition.

3.9 SERVICE CONNECTION

.1 Install pipe to CSA B182.11 manufacturer's instructions and specifications.

.2 Service connections: break into existing manhole as indicated on drawings

.1 Provide flow-through in manhole base

3.10 FIELD TESTING

.1 Repair or replace pipe, pipe joint or bedding found defective.

.2 When directed by Departmental Representative, draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.

.3 Remove foreign material from sewers and related appurtenances by flushing with water.

.4 Perform infiltration and exfiltration testing as soon as practicable after jointing and bedding are complete, and service connections have been installed.

.5 Do exfiltration test to ASTM C828.

.6 Do exfiltration testing as specified herein and as directed by Departmental Representative.

.1 Perform tests in presence of Departmental Representative.

.2 Notify Departmental Representative 24 hours minimum in advance of proposed tests.

.7 Install watertight bulkheads in suitable manner to isolate test section from rest of pipeline.

.8 Exfiltration test:

.1 Fill test section with water to displace air in line. Maintain under nominal head for 24 hours to ensure absorption in pipe wall is complete before test measurements are begun.

.2 Immediately prior to test period add water to pipeline until there is head of 1 m over interior crown of pipe measured at highest point of test section or water in manhole is 1 m above static ground water level, whichever is greater.

.3 Duration of exfiltration test: 2 hours.

.4 Water loss at end of test period: not to exceed maximum allowable exfiltration over any section of pipe.

.9 Leakage: not to exceed following limits in litres per hour per 100m of sewer including service connections:

.1 Exfiltration, based on 600 mm head: 0.050 L/h

.10 Repair and retest sewer line as required, until test results are within limits specified.

.11 Repair visible leaks regardless of test results.

.12 Television and photographic inspections:

.1 Carry out inspection of installed sewers by video camera and provide a digital copy to Departmental Representative.

.2 Provide means of access to permit Departmental Representative to do additional inspections as required.

3.11 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 00 - Cleaning. .1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA).

1.2 SUBMITTALS

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

1.3 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Product

2.1 PVC DUCTS AND FITTINGS

.1 Rigid PVC duct: to CSA C22.2 No. 211.1, Type DB2/ES2, with fabricated fittings, for direct burial expanded flange ends, schedule 40, Trade size as indicated on drawings.

.1 Nominal length: 6 m plus or minus 12 mm.

.2 Rigid PVC couplings, reducers, bell and fittings, plugs, caps, adaptors, and supports as required tomake a complete installation.

.3 Rigid PVC split ducts.

.4 Rigid PVC bends, couplings, reducers, bell end fittings, plugs, caps, adaptors same product material as duct, to make a complete installation.

.5 Rigid galvanized steel or schedule 80 PVC 90° and 45° bends.

.6 Rigid PVC 5° angle couplings.

.7 Expansion joints every 100m and as required.

2.2 SOLVENT WELD COMPOUND

.1 Solvent cement for PVC duct joints.

2.3 CABLE PULLING EQUIPMENT

.1 6 mm stranded nylon pull rope tensile strength 5 kN. Leave pull ropes in ducts after cables havebeen installed.

2.4 MARKERS

.1 Concrete type cable markers: as indicated, with words: "Cable", "Joint" or "Conduit" impressed in top surface, with arrows to indicate change in direction of duct runs.

.2 Cedar post type markers: 89 x 89 mm square, 1.5 m long, pressure treated with clear or copper naphthenate or 5% pentachlorophenol solution, water repellent preservative, with nameplate fastened near post top, on side facing duct.

.1 Nameplate: aluminum anodized 89 x 125 mm, 1.5 mm thick mounted on cedar post with mylar label 0.125 mm thick with words "Cable" "Joint" or "Conduit" with arrows to indicate change in direction.

.3 Underground marker:

.1 Inert polyethylene plastic ribbon, 150 mm wide by 0.1 mm thick. Safety red for electricpower distribution. Safety alert orange for telephone, signal, data and cable TV. Imprintover entire length of ribbon in permanent black letters, the system description selectedfrom manufacturer standard legend, which most accurately describes the sub-gradesystem. To be Allen Systems, Panduit Corp., or approved equal.

2.5 CONDUIT SEALANT

.1 Sealant to be moisture barrier type, non-toxic, non-shrink, non-hardening, putty type hand appliedmaterial providing effective barrier under submerged conditions.

Part 3 Execution

3.1 INSTALLATION

.1 Install duct in accordance with manufacturer's instructions.

.2 Clean inside of ducts before laying.

.3 Place a minimum of 75 mm cover of sand or clean earth fill around the duct on the trench bottom.Lay duct on the smooth layer, so that contact is made for its entire length. Remove water fromtrench before the duct is installed.

.4 Install code sized pull boxes to limit the sum of bends in a run of duct to 360 degrees.

.5 Ensure full, even support every 1.5 m throughout duct length.

.6 Slope ducts with 1 to 400minimum slope.

.7 During construction, cap ends of ducts to prevent entrance of foreign materials.

.8 Pull through each duct steel mandrel not less than 300 mm long and of diameter 6 mm less thaninternal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreignmatter. Pull stiff bristle brush through each duct immediately before pulling-in cables.

.9 In each duct install pull rope continuous throughout each duct run with 3 m spare rope at each end.

.10 Install continuous marker tape 150 to 200 mm below finished grade, for each exterior duct.

.11 Install above-ground cable markers every 10-15 metres and where direction changes.

.12 Seal both ends of ducts with sealant to prevent ingress and transmission of foreign material and humidity.

.13 Where conduit crosses building expansion joints, install expansion fitting approved byauthority having jurisdiction.

END OF SECTION

APPENDIX A

TETRA TECH

TECHNICAL MEMO

ISSUED FOR USE

To:	Stéphane Clavel, Senior Project Manager	**Date:**	April 6, 2018
c:		**Memo No.:**	
From:	Taylor Pasloski, P.Eng	**File:**	704-ENG.WARC03394-01
Subject:	Revision of Geotechnical Report W14103509-01 Kluane Trades/Storage Building – Haines Junction, Yukon		

1.0 INTRODUCTION

On December 05, 2014 Tetra Tech Canada Inc. (Tetra Tech) issued report W14103509-01 to Stantec Architecture Ltd. (Stantec) with geotechnical recommendations for the construction of a Trades/Storage building in Haines Junction, Yukon. When the report was issued for use, seismic site classification recommendations were provided as per the National Building Code of Canada (NBCC) 2010, and the preferred foundation was a structural slab on grade with thickened spread and strip footings.

Since the report was issued, the preferred foundation changed to strip footings at various burial depths, and the seismic site classification needs to be revised to conform to the NBCC 2015 standards.

The approval for the scope of work outlined in proposal 704-ENG.WARC03375-01 dated March 8, 2018 was approved on March 19, 2018 by Government of Canada PO #700405983.

2.0 SEISMIC SITE CLASSIFICATION

The 2015 National Building Code requires that a site classification be established for all structures. Based on the soil conditions noted it is Tetra Tech's conclusion that the soils near the proposed building correspond to those described in Site Classification D, per Table 4.1.8.4.A, NBCC 2015.

3.0 LIMIT STATE BEARING RESISTANCE

The NBCC 2015 stipulates that foundation design must be carried out using Limit State Design (LSD) methods. Under LSD, a minimum of two loading cases must be considered by geotechnical and structural designers; the Ultimate Limit State (ULS) and the Serviceability Limit State (SLS). The ULS and SLS bearing resistances are calculated differently. The ULS resistance is the maximum pressure that can be applied to the soil without causing bearing failure. The SLS bearing pressure is the maximum allowable pressure required to limit the settlement to a tolerable amount. Both the ULS and SLS bearing resistances are highly dependent on soil properties and footing geometry, including the footing size, shape, and burial depth.

Resistance factors are applied to the calculated (un-factored) resistances to determine the maximum allowable factored design load. Geotechnical resistance factors for design of shallow foundations against vertical bearing failure (ULS), horizontal displacement (sliding under lateral loading), and overturning, per the NBCC 2015 are provided in Table 1.

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61 Wasson Place
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Table 1: Geotechnical Resistance Factors – Shallow Foundations

Item	Resistance Factor*
Vertical Bearing Resistance (ULS)	0.5
Sliding (ULS)	0.8
Overturning (ULS)	0.5

* From "User's Guide– NBCC, Structural Commentaries (Part 4 of Division B)"

The ULS and SLS bearing resistances shown are un-factored and must be multiplied by the appropriate resistance factor prior to use in any calculations.

The un-factored ULS and SLS bearing resistances for specific footing shapes and burial depths are summarized in the Tables 2 . Depths and bearing pressures were calculated in reference to Stantec's drawing S-501 Revision A dated February 23, 2018. All SLS values were determined using a tolerable settlement of 0.025 m.

Table 2: ULS and SLS bearing resistances – Spread Footing Detail 10

Footings	Width (m)[1]	L/B Ratio[2]	ULS (kPa)	SLS (kPa)
Perimeter Footing – Detail 1	0.6	N/A	1000	300
Strip Footing GL 3 – Detail 2	0.4	N/A	340	390
Strip Footing GL 2 – Detail 3	0.4	N/A	500	400
Perimeter Footing – Detail 4	0.6	N/A	650	280
Retaining Wall Footing – Detail 5	1.4	N/A	430	150
Perimeter Footing – Detail 9	0.6	N/A	700	250
Spread Footing – Detail 10	1.2	1	1300	400

Please note that all other recommendations in the previous report are still applicable.

4.0 CLOSURE

We trust this technical memo meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.

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Attachment: Tetra Tech's Limitations on the Use of this Document

LIMITATIONS ON USE OF THIS DOCUMENT

GEOTECHNICAL

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Both electronic file and/or hard copy versions of TETRA TECH's Instruments of Professional Service shall not, under any circumstances, be altered by any party except TETRA TECH. TETRA TECH's Instruments of Professional Service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Professional Document have been conducted in accordance with the Contract, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Professional Document. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Professional Document.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of TETRA TECH.

1.4 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by third parties other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this document, at or on the development proposed as of the date of the Professional Document requires a supplementary exploration, investigation, and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, TETRA TECH has not been retained to explore, address or consider and has not explored, addressed or considered any environmental or regulatory issues associated with development on the subject site.

1.8 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems, methods and standards employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. TETRA TECH does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

1.9 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

1.10 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historical environment. TETRA TECH does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional exploration and review may be necessary.

1.11 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

1.12 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

1.13 INFLUENCE OF CONSTRUCTION ACTIVITY

Construction activity can impact structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques, and construction sequence are known.

1.14 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, and the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

1.15 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued satisfactory performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

1.16 DESIGN PARAMETERS

Bearing capacities for Limit States or Allowable Stress Design, strength/stiffness properties and similar geotechnical design parameters quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition used in this report. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions considered in this report in fact exist at the site.

1.17 SAMPLES

TETRA TECH will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

1.18 APPLICABLE CODES, STANDARDS, GUIDELINES & BEST PRACTICE

This document has been prepared based on the applicable codes, standards, guidelines or best practice as identified in the report. Some mandated codes, standards and guidelines (such as ASTM, AASHTO Bridge Design/Construction Codes, Canadian Highway Bridge Design Code, National/Provincial Building Codes) are routinely updated and corrections made. TETRA TECH cannot predict nor be held liable for any such future changes, amendments, errors or omissions in these documents that may have a bearing on the assessment, design or analyses included in this report.

TETRA TECH EBA

December 5, 2014

ISSUED FOR USE
FILE: W14103509-01
Via Email: mike.frasher@stantec.com

Stantec Architecture Ltd.
202 – 107 Main Street
Whitehorse YT Y1A 2A7

Attention: Mike Frasher, Manager of Projects

Subject: Geotechnical Evaluation
New Trades/ Storage Building, Kluane National Park Headquarters
Haines Junction, Yukon

1.0 INTRODUCTION

Tetra Tech EBA Inc. (Tetra Tech EBA) was retained by Stantec Architecture Ltd. (Stantec) to complete a geotechnical drilling program and provide geotechnical recommendations for a proposed new trades/ storage building at the Kluane National Park Headquarters in Haines Junction, YT. Authorization to proceed was provided by Mr. Mike Frasher of Stantec by way of a signed subconsultant agreement, received by Tetra Tech EBA on October 21, 2014.

1.1 Project Background

We understand that Public Works and Government Services Canada (PWGSC) is contemplating construction of a new building to be located in the existing parking area at the site of the Kluane National Park (KNP) Headquarters. Based on a preliminary project description and sketches provided by Stantec, this building will be about 4,000 square feet in size and will include space for vehicle parking/ maintenance, equipment storage, and shop areas for KNP carpenters and trail crews. The remainder of the building will be occupied by a small office space and washroom, as well as a mechanical room for building services.

1.2 Project Location

The subject site is located at the KNP Headquarters in Haines Junction, YT. The project site can be found on NTS Mapsheet 115-A/ 13 at approximate UTM coordinates of 6,737,900 N and 362,855 E in Zone 8V.

2.0 GEOTECHNICAL DRILLING PROGRAM

Midnight Sun Drilling Inc. was retained by Tetra Tech EBA to complete a geotechnical drilling program at the site. Two boreholes (BH01 and BH02) were drilled within the footprint of the proposed building using solid stem augers. Both holes were advanced to a target depth of 5.8 m below ground surface.

Borehole locations were selected to avoid buried water and sewer lines that are present at the site, as shown on as-built drawings provided by PWGSC and Stantec. Borehole locations are shown on the attached site plan (Figure 1).

At each borehole location, a Dynamic Cone Penetration Test (DCPT) was completed prior to drilling. The DCPT involves advancing a steel cone tip into the ground using the drill's automatic drop hammer, while recording the number of hammer blows per 0.3 m of penetration. Because the DCPT tip is of similar size and shape to the Standard Penetration Test (SPT) split-spoon sampler, and because the DCPT is advanced using the same hammer as the SPT, DCPT blow counts are considered to be reasonably equivalent to the SPT N-value, which is commonly used as a measure of the in situ soil consistency.

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During drilling, the soil profile was logged in the field by an experienced geotechnical engineer, and representative disturbed samples were collected and returned to Tetra Tech EBA's Whitehorse laboratory for routine geotechnical index testing.

Upon completion of drilling, the boreholes were backfilled with drill cuttings and the paved surface of the parking area was repaired using cold mix asphalt.

3.0 SITE CONDITIONS

3.1 Soil Conditions

The soil profile at the site was relatively consistent between the two borehole locations, as shown on the borehole logs attached in Appendix B. Please note that the borehole logs contain detailed information that is specific to each borehole, and should be read in preference to the generalized descriptions provided below.

In general, the soil profile consists of above 0.5 m of sand and gravel fill capped with a bituminous surface treatment (BST), over stiff, till-like, well-graded sand and silt to about 4 m depth, over uniformly graded fine sand and silt. The sand and silt at depth is estimated to be dense to very dense based on the DCPT blow counts, however the relatively abrupt increase in the DCPT resistance observed at about 3 m suggests that the ground may be frozen below this depth; if this is the case then the in situ soil density cannot be reliably estimated based on the DCPT.

3.2 Groundwater Conditions

Groundwater was not encountered in either of the boreholes drilled at the site. Moisture content testing conducted on recovered samples indicates a natural water content of about 11% in the till-like soil and about 4% in the sand at depth.

For reference, based on Atterberg Limits plasticity testing, the moisture content of the till-like soil was shown to be below the plastic limit, reflecting relatively dry moisture conditions. The moisture content of about 4% measured in the fine sand and silt at depth represents similarly dry conditions.

3.3 Permafrost and Seasonal Frost Penetration

No ice-rich permafrost was encountered in either of the boreholes. However, as mentioned above, the abrupt increase in the DCPT driving resistance observed below about 3 m in the two boreholes suggests that the soil below this depth may be frozen. If so, this would be classified as Nbn-type permafrost (no visible ice, no excess moisture).

Based on average climate data and the soil profile at the site, the maximum seasonal frost depth can be assumed to be about 2.4 m below ground surface.

4.0 RECOMMENDATIONS

Based on the soil conditions encountered during the drilling program and discussion with Stantec, a structural slab-on-grade with thickened spread and strip footings is considered to be the preferred foundation system for the proposed new building. As such, geotechnical recommendations for the design and construction of a structural slab-on-grade foundation are provided in the following sections.

4.1 Site Preparation

Site preparation for construction of the new building foundations should be completed in accordance with the following recommendations:

- The existing paved surface and granular fill should be removed to expose the stiff, till-like sand and silt, or to the bottom of footing elevation plus as additional 0.2 m, whichever is greater. For most of the proposed building area, till-like soil should be encountered within about 0.5 m of the existing paved ground surface. It is likely that a somewhat greater depth of excavation will be required below the location of the existing treed island, in the approximate area of the northwest corner of the building;
- Prior to backfilling and/ or commencement of foundation construction, we recommend that the exposed subgrade be inspected by a qualified geotechnical engineer in order to confirm that suitable ground conditions have been encountered and to provide additional recommendations, if necessary;
- Further to the item above, if the subgrade is soft and/ or wet, or if unanticipated ground conditions are encountered, additional measures may be recommended including, but not necessarily be limited to, additional subexcavation or placement of geotextile filter fabric to cover the subgrade;
- If suitable, stiff, till-like soil is encountered within 0.2 m below the bottom of footing depth, the exposed subgrade should be covered with a minimum of 0.2 m of 20 mm, crushed basecourse (CBC) gravel, moisture conditioned and compacted to at least 98% Standard Proctor Maximum Dry Density (SPMDD). This will provide a smooth, level bearing surface on which to cast the concrete slab-on-grade foundation. The recommended gradation of 20 mm CBC is provided below on Table 1;
- If a final depth of excavation greater than 0.2 m below the bottom of footing elevation is required to expose stiff till, the additional subexcavation can be backfilled using 80 mm pit run gravel, moisture conditioned and compacted to at least 98% SPMDD, and then topped with 0.2 m of compacted CBC, as described in the item above. The recommended gradation of pit run gravel is provided below on Table 1;

Table 1: Recommended Gradation for Granular Fill Materials

Pit Run Gravel		20 mm Crushed Basecourse	
Particle Size (mm)	**% Passing (by weight)**	**Particle Size (mm)**	**% Passing (by weight)**
80	100	-	-
25	55 – 100	20	100
12.5	42 – 84	12.5	64 – 100
5.00	26 – 65	5.00	36 – 72
1.25	11 – 47	1.25	12 – 42
0.315	3 – 30	0.315	4 – 22
0.080	0 – 8	0.080	3 – 6

4.2 Foundation Design and Construction

4.2.1 Limit States Design

The 2010 edition of the National Building Code of Canada (NBCC 2010) stipulates that foundation design must be carried out using Limit State Design (LSD) methods. Under LSD, a minimum of two loading cases must be considered by geotechnical and structural designers; the Ultimate Limit State (ULS) and the Serviceability Limit State (SLS). The ULS and SLS bearing resistances are calculated differently. The ULS bearing resistance is the maximum pressure that can be applied to the soil without causing bearing failure. The SLS bearing pressure is the maximum allowable pressure required to limit settlement to a tolerable amount. Both the ULS and SLS bearing resistances are highly dependant on soil properties and footing geometry, including the footing size, shape and burial depth.

Additionally, under LSD, resistance factors are applied to the calculated (unfactored) resistances to determine the maximum allowable factored design load. Geotechnical resistance factors for design of shallow foundations against vertical bearing failure (ULS) and horizontal displacement (sliding under lateral loading) are provided below on Table 2, per Table 6.1 of the *Canadian Highway Bridge Design Code* (CAN/CSA-S6-06). Per CAN/CSA-S6-06, SLS resistances should consider unfactored loads and therefore, no resistance factor is required.

Table 2: Geotechnical Resistance Factors – Shallow Foundations

Item	Resistance Factor
Vertical Bearing Resistance (ULS)	0.5
Horizontal Resistance (Sliding)	0.8

4.2.2 Foundation Recommendations

As noted above, a structural slab-on-grade with thickened spread and strip footings is the recommended foundation type for the proposed building. As such, design and construction of the new building foundations should be undertaken in accordance with the following recommendations:

- Spread and strip footings refer to thickened areas within the structural slab-on-grade that are designed to provide the required bearing resistance under building loads. For the purposed of geotechnical design, Tetra Tech EBA has assumed a footing thickness of 0.2 m and a minimum depth of cover of 0.3 m from finished grade to the underside of footing;
- Unfactored bearing resistances are provided based on minimum footing dimensions of 0.4 m for strip footings and 1.0 m for spread (square) footings. If significantly different footing sizes are preferred for this project, or if higher bearing resistance is required to support the design building loads, Tetra Tech EBA should be notified to review and adjust the calculated bearing resistances, as necessary;
- Unfactored ULS bearing resistances of 390 and 260 kPa should be used for spread and strip footings, respectively;
- Unfactored SLS bearing resistances of 860 and 750 kPa should be used for spread and strip footings, respectively. SLS bearing resistances are calculated based on an allowable elastic settlement of 25 mm, which is generally sufficient to limit total and differential settlement to tolerable levels for typical building projects;

- Based on the relatively dry, heavily consolidated, till-like soil that was encountered during the drilling program, significant long term settlement is not anticipated under building loads, provided that site preparation is completed in accordance with the recommendations provided in Section 4.1;
- The concrete foundation should be cast onto a clean, compacted, granular bearing surface. It is important that no loose and/or disturbed material be allowed to remain on the bearing surface. As discussed above in Section 4.1, foundation bearing surfaces should consist of 20 mm CBC gravel, moisture conditioned and compacted to at least 98% SPMDD; and
- The working area should be protected from the inflow of surface water at all times. Concrete foundation elements should not be cast onto saturated or seasonally frozen soil.

4.2.3 Frost Protection

Frost heave is a common cause of damage to building foundations in cold climates and occurs when three conditions are satisfied; the ground temperature is below freezing, frost-susceptible soils are present, and the soil pore space is near 100% saturation. In this case, because generally dry conditions were encountered in the boreholes drilled at the site, only two of these three conditions are present and the risk of foundation damage due to frost heave is considered to be low, provided that the subgrade soils do not become saturated over the design life of the building.

However, because the till-like subgrade soils are potentially frost-susceptible and lie within the depth of seasonal frost penetration, the risk of building damage due to seasonal frost action can be minimized by installing foundation perimeter insulation, as shown schematically in Figure 2, attached.

4.3 Site Grading

The ground elevation at finished grade around the building perimeter should be at least 0.3 m above surrounding grade to maintain positive drainage away from the building foundations. Ponding and/or infiltration of water adjacent to the building should be prevented, as this could have detrimental effects on the performance of the building foundations. Runoff from the roof should be directed onto splash pads and away from the building. This is particularly important in the late fall, just prior to freeze-up.

4.4 Concrete

Tetra Tech EBA recommends that all concrete be designed, mixed, placed and tested in accordance with the most recent edition of the Canadian Standards Association (CSA) *Standard CAN/CSA-A23.1* and *A23.2.* According to these standards, concrete should be designed to at least satisfy the minimum durability requirements as defined by exposure class.

The exposure class of the concrete is dependent on the presence or lack of chlorines, sulphates, freezing and thawing conditions and soil saturation. Based on the aforementioned recommendations, the foundation system will have concrete exposed to cycles of freezing and thawing. In this case, the governing exposure class is “F-1”.

4.5 Pavement

For projects with paved parking lot(s), as well as concrete sidewalks and aprons, the main consideration is the frost heave potential of the near-surface soils. There is potential for this concern at the subject site. Tetra Tech EBA routinely recommends at least 1.7 m of granular, non-frost susceptible soils below all perimeter concrete sidewalks and parking lots. It is understood that this may be considered excessive for parking lots, but as a minimum it is recommended to reduce the risk of frost heave, that all frost-susceptible soils be removed from the

parking lot and exterior concrete covered areas and replaced with a minimum of 1.0 m of non-frost susceptible pit run gravel. This should be capped with a 150 mm thick traffic course of 20 mm crushed basecourse aggregate. As previously stated, all imported gravels utilized for parking area construction should conform to the gradation specifications presented in Table 1 and should be placed in lifts of 200 mm maximum thickness, moisture conditioned and compacted to at least 98% SPMDD. If the parking lots are to be paved the asphalt surface should be at least 50 mm thick and compacted to 98% of Marshall Density.

4.6 Seismic Site Classification

NBCC 2010 requires that a seismic site classification be established for proposed buildings. As such, we recommend that the site be considered as Site Class D, per Table 4.1.8.4A in NBCC 2010.

5.0 CONSTRUCTION TESTING AND MONITORING

All foundation design recommendations presented are site-specific and based on the assumption that an adequate level of construction monitoring during foundation excavation and installation will be provided, and that all construction will be carried out by a suitably qualified, experienced contractor. An adequate level of construction monitoring also ensures the recommendations based on geotechnical data obtained at borehole locations are applicable to the entire building site. Appropriate Quality Assurance and Quality Control (QA/QC) testing should be undertaken during construction to confirm that construction is completed in accordance with the recommendations provided in this report.

Furthermore, it is recommended that Tetra Tech EBA be given the opportunity to review the details of the final design related to the geotechnical aspects of the building foundation, prior to construction. Past experience has shown that this action may prevent inconsistencies, poor performance, and/ or increased costs that may lead to disputes.

6.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Stantec Architecture Ltd. and their agents. Tetra Tech EBA Inc. (Tetra Tech EBA) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Stantec Architecture Ltd., or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in the signed contract and to Tetra Tech EBA's General Conditions, which are provided in Appendix A of this report.

7.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech EBA Inc.

PROFESSIONAL
YUKON
ADAM W. WALLACE
TERRITORY
5 Dec 2014
ENGINEER

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/cr

Attachments: Figures (2)
Appendix A: Tetra Tech EBA's General Conditions – Geotechnical
Appendix B: Borehole Logs and Geotechnical Laboratory Testing Results

PERMIT TO PRACTICE
TETRA TECH EBA INC.
SIGNATURE
Date Dec 5/14
PERMIT NUMBER PP003
Association of Professional
Engineers of Yukon

FIGURES

LEGEND

- BOREHOLE LOCATION
- APPROXIMATE BUILDING FOOTPRINT

0 100 m

Scale: 1 : 1750 @ 11" x 17"

CLIENT

Stantec

TETRA TECH EBA

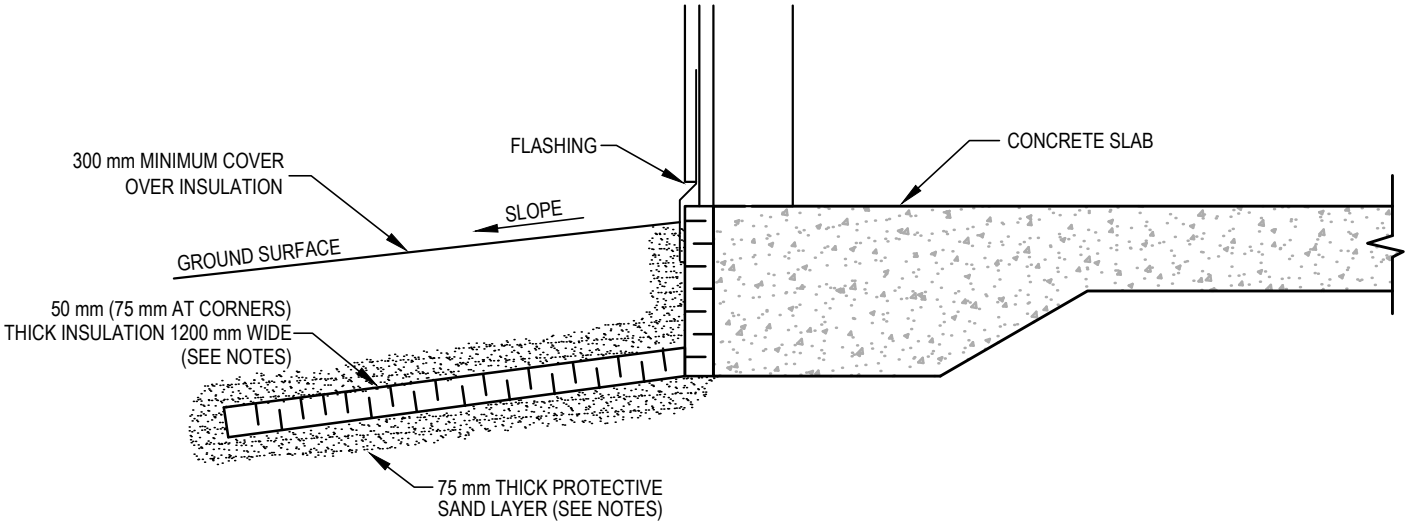
NEW TRADES / STORAGE BUILDING GEOTECHNICAL EVALUATION
KLUANE NATIONAL PARK HEADQUARTERS - HAINES JUNCTION, YT

SITE PLAN SHOWING BOREHOLE LOCATIONS

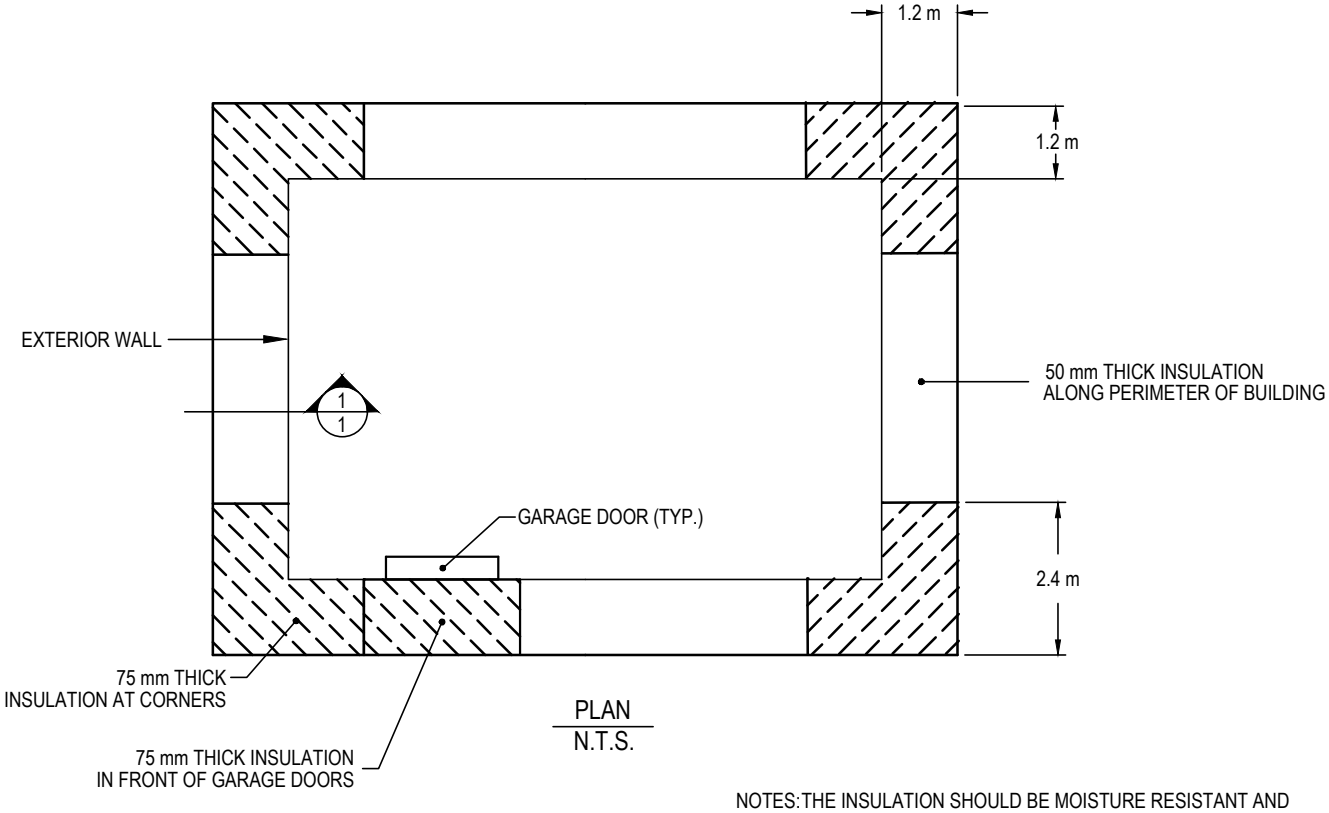
PROJECT NO.	DWN	CKD	REV
W14103509-01	CB	AW	0
OFFICE	DATE		
EBA-WHSE	December 4, 2014		

Figure 1

Q:\Whitehorse\Data\0201drawings\Haines Junction\W14103509-01 New Trades & Storage Building Geotechnical Evaluation\W14103509-01 Fig.1_R0.dwg [FIGURE 1] December 04, 2014 - 3:24:35 pm (BY: BUCHAN, CAMERON)



1/1 SECTION
STRUCTURAL SLAB-ON-GRADE
N.T.S.



PLAN
N.T.S.

NOTES: THE INSULATION SHOULD BE MOISTURE RESISTANT AND SUITABLE FOR BURIAL (i.e. DOW CHEMICAL HI OR SM SERIES STYROFOAM OR POLYURETHANE).

A MINIMUM BEDDING THICKNESS OF 75 mm OF FINE TO MEDIUM SAND SHOULD BE PLACED ABOVE AND BELOW THE INSULATION FOR PROTECTION.

CLIENT

Stantec

TETRA TECH EBA

NEW TRADES / STORAGE BUILDING GEOTECHNICAL EVALUATION
KLUANE NATIONAL PARK HEADQUARTERS - HAINES JUNCTION, YT

STRUCTURAL SLAB-ON-GRADE
PERIMETER INSULATION DETAILS

PROJECT NO.	DWN	CKD	REV
W14103509-01	CB	AW	0

OFFICE	DATE
EBA-WHSE	December 4, 2014

Figure 2

APPENDIX A

TETRA TECH EBA'S GENERAL CONDITIONS

GENERAL CONDITIONS

GEOTECHNICAL REPORT

This report incorporates and is subject to these “General Conditions”.

1.0 USE OF REPORT AND OWNERSHIP

This geotechnical report pertains to a specific site, a specific development and a specific scope of work. It is not applicable to any other sites nor should it be relied upon for types of development other than that to which it refers. Any variation from the site or development would necessitate a supplementary geotechnical assessment.

This report and the recommendations contained in it are intended for the sole use of Tetra Tech EBA’s Client. Tetra Tech EBA does not accept any responsibility for the accuracy of any of the data, the analyses or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than Tetra Tech EBA’s Client unless otherwise authorized in writing by Tetra Tech EBA. Any unauthorized use of the report is at the sole risk of the user.

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Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. Tetra Tech EBA does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

5.0 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

6.0 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. Tetra Tech EBA does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

7.0 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

8.0 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

9.0 INFLUENCE OF CONSTRUCTION ACTIVITY

There is a direct correlation between construction activity and structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known.

10.0 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

11.0 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

12.0 BEARING CAPACITY

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

13.0 SAMPLES

Tetra Tech EBA will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

14.0 INFORMATION PROVIDED TO TETRA TECH EBA BY OTHERS

During the performance of the work and the preparation of the report, Tetra Tech EBA may rely on information provided by persons other than the Client. While Tetra Tech EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, Tetra Tech EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

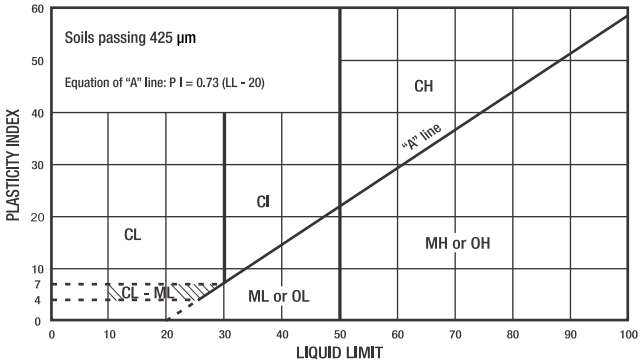
APPENDIX B

BOREHOLE LOGS AND GEOTECHNICAL LABORATORY RESULTS

MODIFIED UNIFIED SOIL CLASSIFICATION

MAJOR DIVISION			GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA		
COARSE-GRAINED SOILS More than 50% retained on 75 µm sieve*	GRAVELS 50% or more of coarse fraction retained on 4.75 mm sieve	CLEAN GRAVELS	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	Classification on basis of percentage of fines GW, GP, SW, SP GM, GC, SM, SC Borderline Classification requiring use of dual symbols	$C_U = D_{60} / D_{10}$ Greater than 4 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines		Not meeting both criteria for GW	
		GRAVELS WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits plot below "A" line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits plot above "A" line or plasticity index greater than 7	
	SANDS More than 50% of coarse fraction passes 4.75 mm sieve	CLEAN SANDS	SW	Well-graded sands and gravelly sands, little or no fines	Less than 5% Pass 75 µsieve More than 12% Pass 75 µsieve 5% to 12% Pass 75 µsieve	$C_U = D_{60}/D_{10}$ Greater than 6 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			SP	Poorly graded sands and gravelly sands, little or no fines		Not meeting both criteria for SW	
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures		Atterberg limits plot below "A" line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits plot above "A" line or plasticity index greater than 7	
FINE-GRAINED SOILS (by behavior) 50% or more passes 75 µm sieve*	SILTS	Liquid limit <50	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands of slight plasticity	For classification of fine-grained soils and fine fraction of coarse-grained soils.		
		Liquid limit >50	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts			
	CLAYS Above "A" line on plasticity chart negligible organic content	Liquid limit <30	CL	Inorganic clays of low plasticity, gravelly clays, sandy clays, silty clays, lean clays			
		Liquid limit 30-50	CI	Inorganic clays of medium plasticity, silty clays			
		Liquid limit >50	CH	Inorganic clays of high plasticity, fat clays			
	ORGANIC SILTS AND CLAYS	Liquid limit <50	OL	Organic silts and organic silty clays of low plasticity			
		Liquid limit >50	OH	Organic clays of medium to high plasticity			
HIGHLY ORGANIC SOILS			PT	Peat and other highly organic soils			

PLASTICITY CHART



*Based on the material passing the 75 mm sieve
Reference: ASTM Designation D2487, for identification procedure see D2488. USC as modified by PFRA

SOIL COMPONENTS

FRACTION	SIEVE SIZE		DEFINING RANGES OF PERCENTAGE BY MASS OF MINOR COMPONENTS	
	PASSING	RETAINED	PERCENTAGE	DESCRIPTOR
GRAVEL				
coarse	75 mm	19 mm	>35 %	"and"
fine	19 mm	4.75 mm	21 to 35 %	"y-adjective"
SAND				
coarse	4.75 mm	2.00 mm	10 to 20 %	"some"
medium	2.00 mm	425 µm		
fine	425 µm	75 µm	>0 to 10 %	"trace"
SILT (non plastic) or CLAY (plastic)	75 µm		as above but by behavior	

OVERSIZE MATERIAL

Rounded or subrounded	
COBBLES	75 mm to 300 mm
BOULDERS	> 300 mm
Not rounded	
ROCK FRAGMENTS	>75 mm
ROCKS	> 0.76 cubic metre in volume

Tt_Modified Unified Soil Classification.cdr

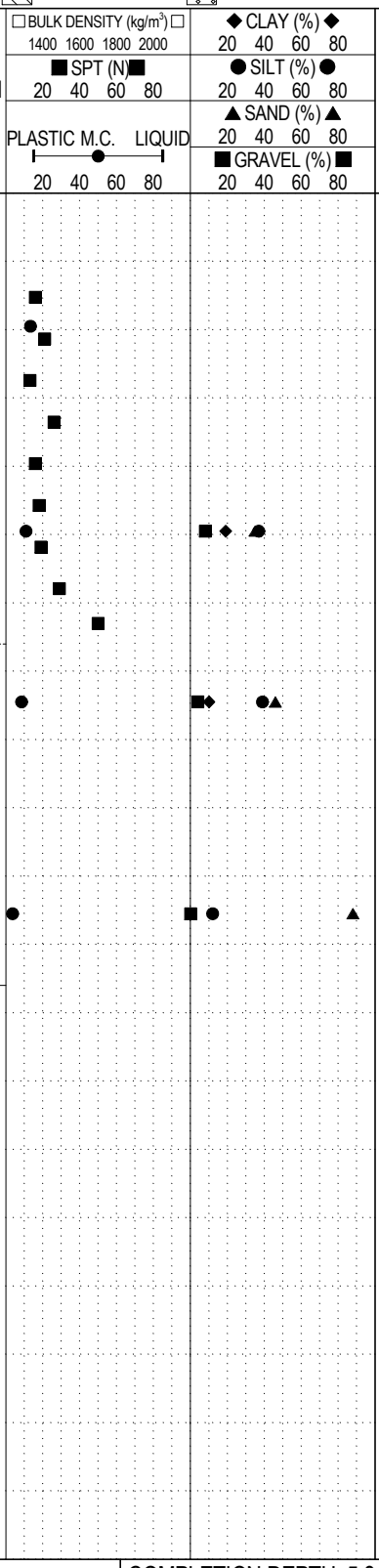
TETRA TECH

New Trades/Storage Building	CLIENT: Stantec Architecture Ltd.	PROJECT NO. - BOREHOLE NO.
Kluane National Park Headquarters	DRILL: Midnight Sun Drilling Inc. - MARL M4CT	W14103509 - BH01
Haines Junction, YT	METHOD: Solid Stem Augers/DCPT	

SAMPLE TYPE: DISTURBED, NO RECOVERY, SPT, A-CASING, SHELBY TUBE, CORE

BACKFILL TYPE: BENTONITE, PEA GRAVEL, SLOUGH, GROUT, DRILL CUTTINGS, SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	GROUND ICE DESCRIPTION AND COMMENTS
0	BST over SAND and GRAVEL (Fill) - trace of silt, gravel subround to subangular, to 50 mm diameter, well graded, brown, frozen.				Unfrozen
	SILT and SAND (Till-like) - some clay, trace to some gravel, gravel subangular, to 25 mm diameter, damp, stiff, brown-grey.			16	
1			SA01	21	
				13	
	- grey below 1.5 m			26	
2				16	
				18	
			SA02	19	
3				29	
				50/200mm	
					Possibly frozen (Nbn) below 3.3 m
	- SAND and SILT below 3.7 m		SA03		
4					
	SAND - some silt, fine, uniformly graded, damp, brown.				Nf
5			SA04		
6	END of BOREHOLE at 5.8 m (Target Depth).				
	Dynamic Cone Penetration Test (DCPT) conducted from 0.6 to 3.3 m.				
7					
8					
9					
10					



Depth (ft): 0, 5, 10, 15, 20, 25, 30, 33

TETRA TECH EBA

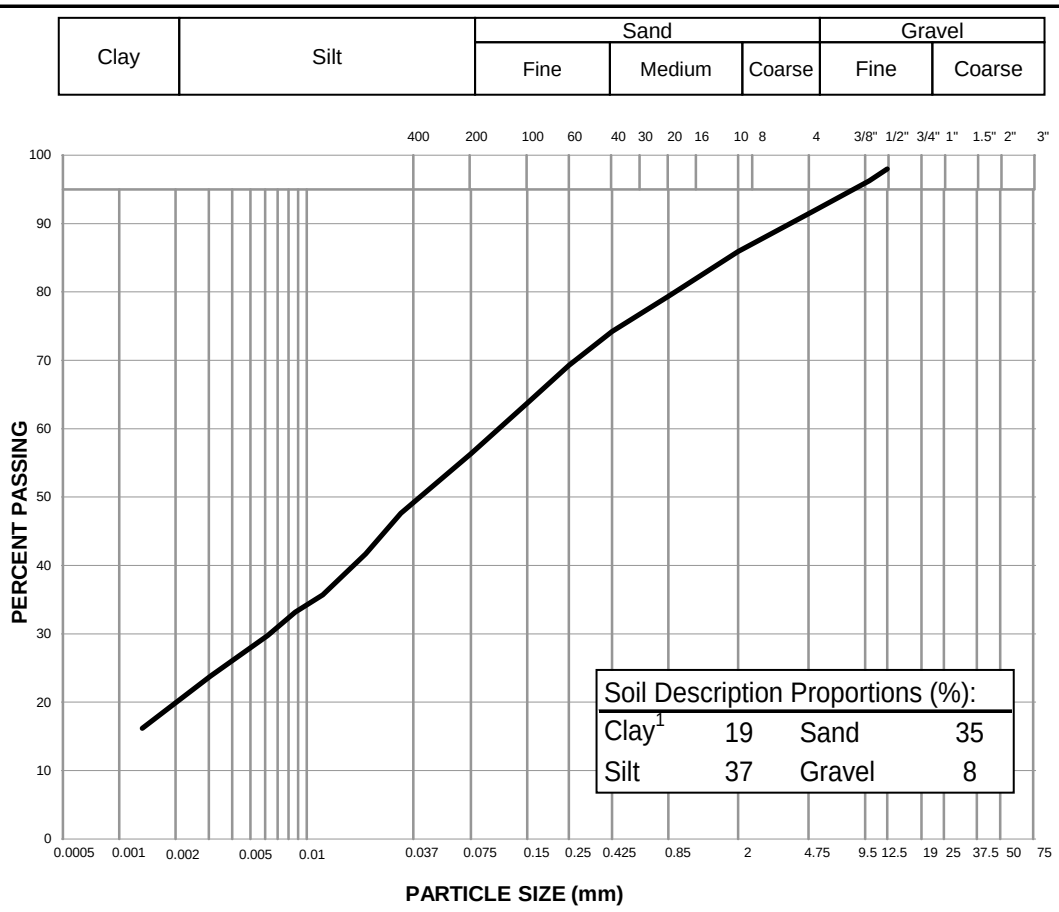
LOGGED BY: AWW	COMPLETION DEPTH: 5.8m
REVIEWED BY: JRT	COMPLETE: 11/4/2014
DRAWING NO: See Figure 1	Page 1 of 1

PARTICLE SIZE ANALYSIS REPORT

ASTM D422, C136 & C117

Project:	Trades/Storage Bldg. - Geotech Eval.	Sample No.:	SA02
Project No.:	W14103509-01	Material Type:	
Site:	Kluane Park HQ, Haines Junction, YT	Sample Loc.:	BH01
Client:	Stantec Architecture Ltd.	Sample Depth:	2.4 m
Client Rep.:	Mike Frasher	Sampling Method:	Grab
Date Tested:	November 20, 2014 By: AMT	Date sampled:	November 4, 2014
Soil Description[2]:	SILT and SAND - some clay	Sampled By:	AWW
	trace gravel	USC Classification:	CL Cu: #N/A
Moisture Content:	10.9%		Cc: #N/A

Particle Size (mm)	Percent Passing
75	
50	
38	
25	
19	
12.5	98
10	96
5	92
2	86
0.85	79
0.425	74
0.25	69
0.15	64
0.075	56.4
0.0317	47.6
0.0206	41.7
0.0122	35.7
0.0087	33.2
0.0062	29.8
0.0031	23.8
0.0013	16.2



Notes: [1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual

[2] The description is visually based & subject to EBA description protocols

Specification: _____

Remarks: _____

Reviewed By: _____ P.Eng.

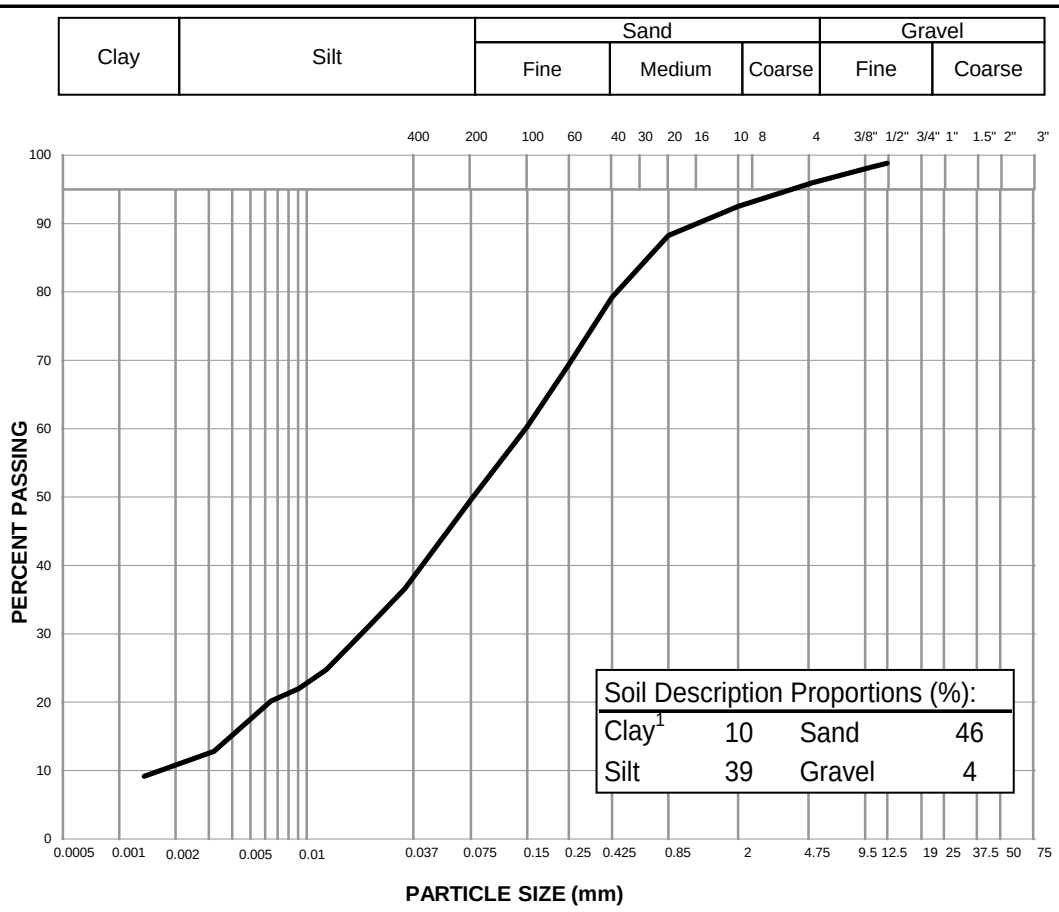
TETRA TECH

PARTICLE SIZE ANALYSIS REPORT

ASTM D422, C136 & C117

Project:	Trades/Storage Bldg. - Geotech Eval.	Sample No.:	SA03
Project No.:	W14103509-01	Material Type:	
Site:	Kluane Park HQ, Haines Junction, YT	Sample Loc.:	BH01
Client:	Stantec Architecture Ltd.	Sample Depth:	3.7 m
Client Rep.:	Mike Frasher	Sampling Method:	Grab
Date Tested:	November 20, 2014 By: AMT	Date sampled:	November 4, 2014
Soil Description[2]:	SAND and SILT - some clay, trace gravel	Sampled By:	AWW
		USC Classification:	ML Cu: 82.9
Moisture Content:	8.5%		Cc: 1.5

Particle Size (mm)	Percent Passing
75	
50	
38	
25	
19	
12.5	99
10	98
5	96
2	93
0.85	88
0.425	79
0.25	69
0.15	60
0.075	49.6
0.0334	36.6
0.0216	31.1
0.0127	24.7
0.0091	22.0
0.0064	20.2
0.0032	12.8
0.0014	9.2



Notes: [1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual

[2] The description is visually based & subject to EBA description protocols

Specification: _____

Remarks: _____

Reviewed By: _____ P.Eng.

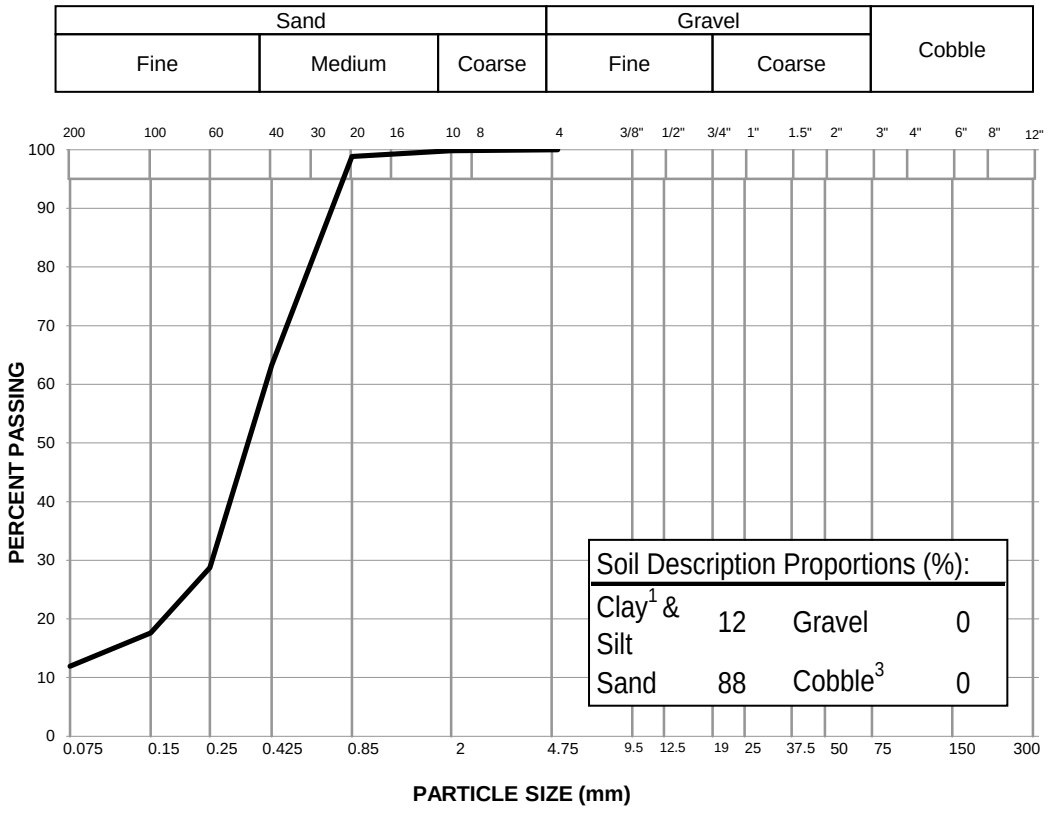
TETRA TECH

PARTICLE SIZE ANALYSIS REPORT

ASTM D422, C136 & C117

Project:	Trades/Storage Bldg. - Geotech Eval.	Sample No.:	SA04
Project No.:	W14103509-01	Material Type:	
Site:	Kluane Park HQ, Haines Junction, YT	Sample Loc.:	BH01
Client:	Stantec Architecture Ltd.	Sample Depth:	5.2 m
Client Rep.:	Mike Frasher	Sampling Method:	Grab
Date Tested:	November 28, 2014 By: AMT	Date sampled:	November 4, 2014
Soil Description[2]:	SAND - some silt	Sampled By:	AWW
		USC Classification:	SM Cu: #N/A
Moisture Content:	3.6%		Cc: #N/A

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	
38	
25	
19	
12.5	
10	
5	100
2	100
0.85	99
0.425	63
0.25	29
0.15	18
0.075	12.0



Notes: [1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual

[2] The description is visually based & subject to EBA description protocols

[3] If cobbles are present, sampling procedure may not meet ASTM C702 & D75

Specification: _____

Remarks: _____

Reviewed By: _____ P.Eng.

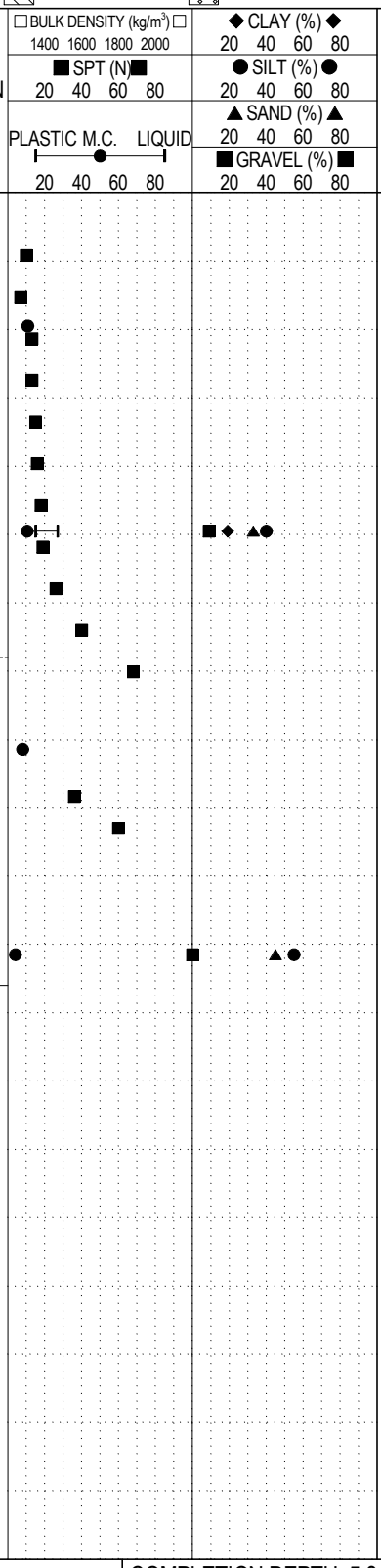
TETRA TECH

New Trades/Storage Building	CLIENT: Stantec Architecture Ltd.	PROJECT NO. - BOREHOLE NO.
Kluane National Park Headquarters	DRILL: Midnight Sun Drilling Inc. - MARL M4CT	W14103509 - BH02
Haines Junction, YT	METHOD: Solid Stem Augers/DCPT	

SAMPLE TYPE: DISTURBED, NO RECOVERY, SPT, A-CASING, SHELBY TUBE, CORE

BACKFILL TYPE: BENTONITE, PEA GRAVEL, SLOUGH, GROUT, DRILL CUTTINGS, SAND

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SPT (N)	GROUND ICE DESCRIPTION AND COMMENTS
0	BST over SAND and GRAVEL (Fill) - trace of silt, gravel subround, to 50 mm diameter, brown, frozen.				Unfrozen
	SILT (Till-like) - sandy, some clay, trace to some gravel, gravel subround to subangular, to 50 mm diameter, damp, stiff, grey.			10	
				7	
1			SA01	13	
				13	
				15	
2				16	
				18	
			SA02	19	
3				26	
				40	
				68	Possibly frozen (Nbn) below 3.7 m
4	SILT and SAND - fine, uniformly graded, occasional traces of fine gravel, subround, to 10 mm diameter, moist, brown, occasional zones of SAND with some silt.		SA03		Nf
				36	
				60/150mm	
5					
			SA04		
6	END of BOREHOLE at 5.8 m (Target Depth).				
	Dynamic Cone Penetration Test (DCPT) conducted from 0.3 to 3.7 m and from 4.3 to 4.7 m.				
7					
8					
9					
10					



Depth (ft): 0, 5, 10, 15, 20, 25, 30, 33

TETRA TECH EBA

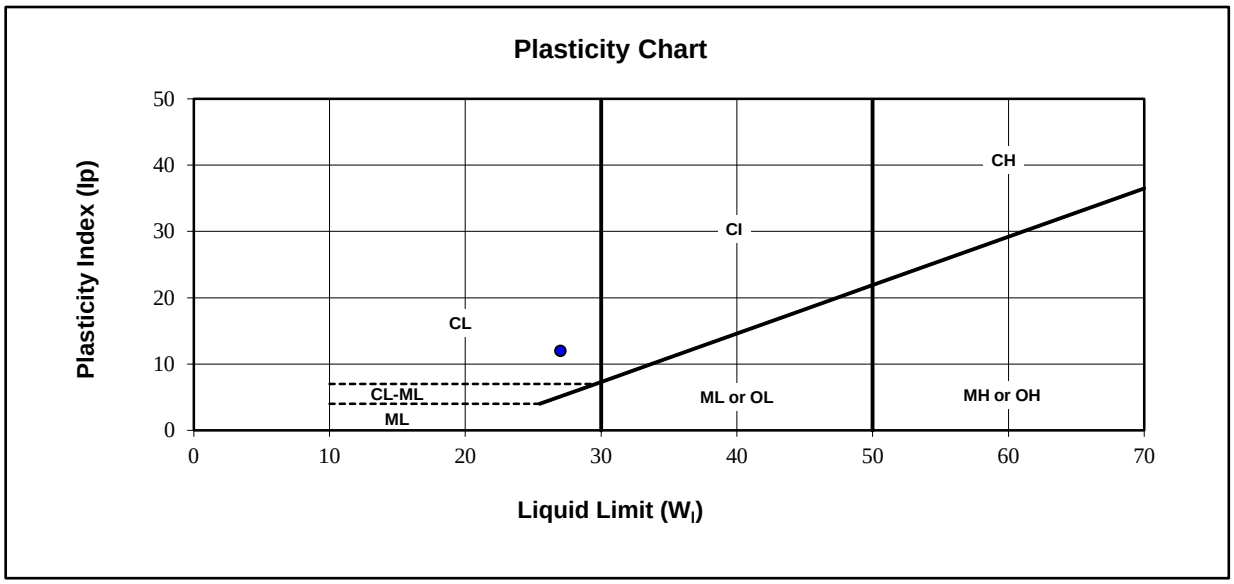
LOGGED BY: AWW	COMPLETION DEPTH: 5.8m
REVIEWED BY: JRT	COMPLETE: 11/4/2014
DRAWING NO: See Figure 1	Page 1 of 1

ATTERBERG LIMITS TEST REPORT

ASTM D4318

Project:	Trades/Storage Bldg. - Geotech Eval.	Sample Number:	SA02
	Kluane Park HQ - Haines Junction, YT	Borehole Number:	BH02
Project No:	W14103509-01	Depth:	2.4 m
Client:	Stantec Architecture Ltd.	Sampled By:	AWW Tested By: AMT
Attention:	Mike Frasher	Date Sampled:	November 4, 2014
Email:		Date Tested:	November 28, 2014

Sample Description: SILT - sandy, some clay, trace gravel



Liquid Limit (W_1) :	27	Natural Moisture (%)	10.5
Plastic Limit :	15	Soil Plasticity:	Low
Plasticity Index (Ip) :	**12**	Mod.USCS Symbol:	CL

Remarks:

Reviewed By: P.Eng.

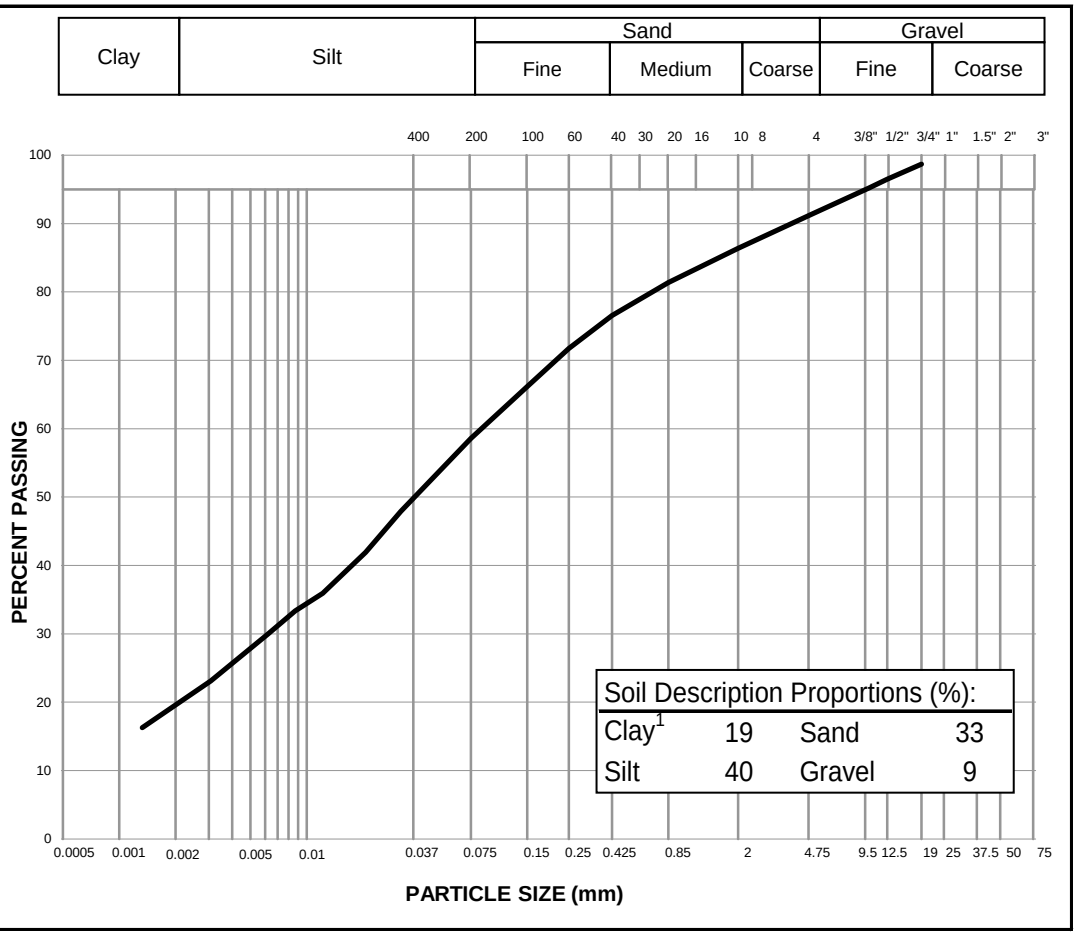
TETRA TECH

PARTICLE SIZE ANALYSIS REPORT

ASTM D422, C136 & C117

Project:	Trades/Storage Bldg. - Geotech Eval.	Sample No.:	SA02
Project No.:	W14103509-01	Material Type:	
Site:	Kluane Park HQ, Haines Junction, YT	Sample Loc.:	BH02
Client:	Stantec Architecture Ltd.	Sample Depth:	2.4 m
Client Rep.:	Mike Frasher	Sampling Method:	Grab
Date Tested:	November 20, 2014 By: AMT	Date sampled:	November 4, 2014
Soil Description[2]:	SILT - sandy, some clay, trace gravel	Sampled By:	AWW
		USC Classification:	CL Cu: #N/A
Moisture Content:	10.5%		Cc: #N/A

Particle Size (mm)	Percent Passing
75	
50	
38	
25	
19	99
12.5	96
10	95
5	91
2	86
0.85	81
0.425	77
0.25	72
0.15	66
0.075	58.6
0.0317	47.9
0.0206	41.9
0.0122	35.9
0.0087	33.4
0.0062	29.9
0.0031	23.1
0.0013	16.3



Notes: [1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual

[2] The description is visually based & subject to EBA description protocols

Specification: _____

Remarks: _____

Reviewed By: _____ P.Eng.

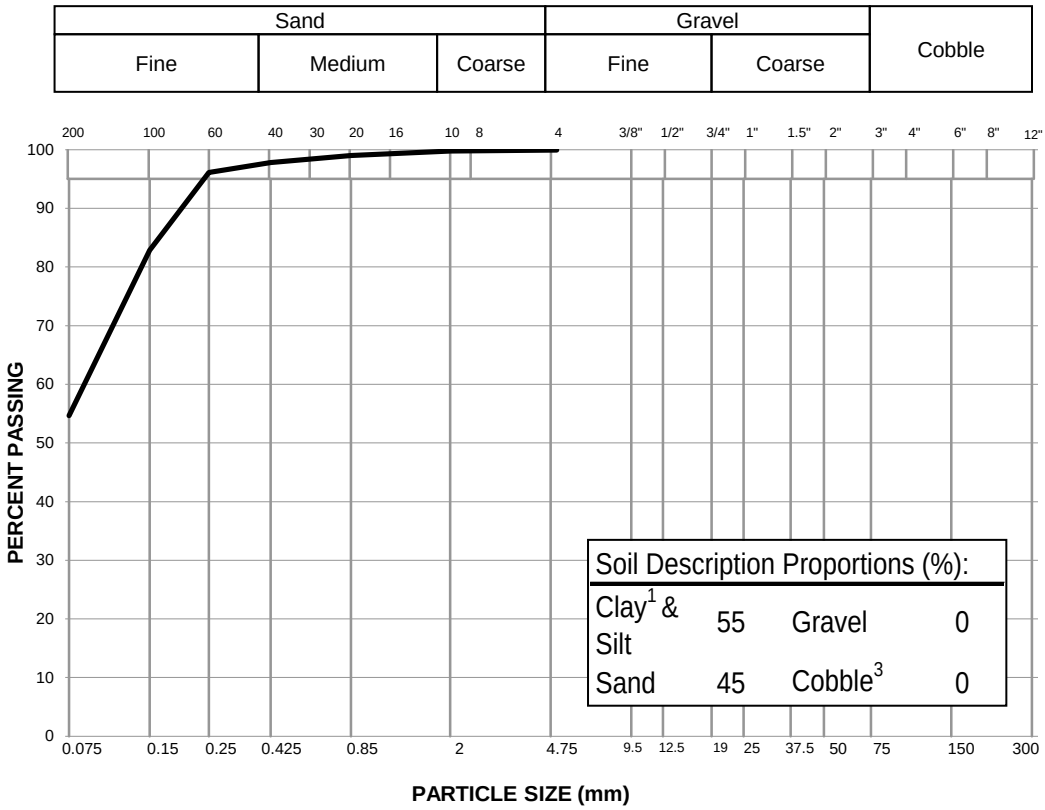
TETRA TECH

PARTICLE SIZE ANALYSIS REPORT

ASTM D422, C136 & C117

Project:	Trades/Storage Bldg. - Geotech Eval.	Sample No.:	SA04
Project No.:	W14103509-01	Material Type:	
Site:	Kluane Park HQ, Haines Junction, YT	Sample Loc.:	BH02
Client:	Stantec Architecture Ltd.	Sample Depth:	5.5 m
Client Rep.:	Mike Frasher	Sampling Method:	Grab
Date Tested:	November 28, 2014 By: AMT	Date sampled:	November 4, 2014
Soil Description[2]:	SILT and SAND	Sampled By:	AWW
		USC Classification:	ML Cu: #N/A
Moisture Content:	4.1%		Cc: #N/A

Particle Size (mm)	Percent Passing
300	
200	
150	
100	
75	
50	
38	
25	
19	
12.5	
10	
5	100
2	100
0.85	99
0.425	98
0.25	96
0.15	83
0.075	54.6



Notes: [1] The upper clay size of 2 um, per the Canadian Foundation Engineering Manual
[2] The description is visually based & subject to EBA description protocols
[3] If cobbles are present, sampling procedure may not meet ASTM C702 & D75

Specification: _____

Remarks: _____

Reviewed By: _____ P.Eng.

TETRA TECH