

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 30 00 – Administrative Requirements.
- .2 Section 03 11 19 – Insulating Concrete Forming.
- .3 Section 03 20 00 – Concrete Reinforcing.
- .4 Section 03 30 00 – Cast-In-Place Concrete.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-O86S1-05, Supplement No. 1 to CAN/CSA-O86-01, Engineering Design in Wood.
 - .3 CSA S269.1-1975(R2003), Falsework for Construction Purposes.
 - .4 CAN/CSA-S269.3-M92(R2003), Concrete Formwork, National Standard of Canada
- .2 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 30 00 – Administrative Requirements.
- .2 Submit shop drawings for formwork and falsework.
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of new Brunswick, Canada, in accordance with the New Brunswick Occupational Health and Safety Act.
- .3 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 30 00 – Administrative Requirements.
- .4 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.
- .5 Indicate sequence of erection and removal of formwork/falsework.

Part 2 **Products**

2.1 **MATERIALS**

- .1 Formwork materials:
 - .1 For concrete without special architectural features, use wood and wood product formwork materials to CAN/CSA-O86 and CSA-A23.1/A23.2.
 - .2 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.
 - .3 For Service and Park Center Building foundation walls, use insulating concrete forming.
- .2 Form ties:
 - .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.
 - .2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.
- .3 Form release agent: non-toxic, biodegradable, chemically active release agent containing compounds that react with free lime in concrete resulting in water insoluble soaps.
- .4 Falsework materials: to CSA-S269.1.
- .5 Sealant: to Section 07 92 00 - Joint Sealants.

Part 3 **Execution**

3.1 **FABRICATION AND ERECTION**

- .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- .2 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .3 Fabricate and erect falsework in accordance with CSA S269.1.
- .4 Refer to architectural drawings for concrete members requiring architectural exposed finishes.
- .5 Do not place shores and mud sills on frozen ground.
- .6 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .7 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
- .8 Align form joints and make watertight.

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- .1 Keep form joints to minimum.
 - .9 Use 25 mm chamfer strips on external corners where indicated on drawings.
 - .10 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
 - .11 Construct forms for architectural concrete, and place ties and/or as directed.
 - .1 Joint pattern not necessarily based on using standard size panels or maximum permissible spacing of ties.
 - .12 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.
 - .1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
 - .13 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

- .1 Leave formwork in place for following minimum periods of time after placing concrete.
 - .1 1 day for footings.
 - .2 2 days for walls and piers.
 - .3 Under no circumstances will removal of formwork be accepted until criteria at item 2 is satisfied.
- .2 Remove formwork when concrete has reached 70% of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.
- .3 Provide necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.
- .4 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

END OF SECTION

Part 1 General

1.1. SUMMARY

- .1 Section Includes:
 - .1 Comply with the requirements for Division 1.
 - .2 Furnish all labor, materials, tools and equipment to perform the complete erection/ installation of the Insulating Concrete Form System (ICF), installation of reinforcing steel, placement of concrete within formwork, and final cleanup.
 - .3 Adequate bracing and false work shall be provided by the Installing Contractor to comply with all applicable Codes.

- .2 Products Supplied But Not Installed Under This Section:
 - 1. EPS compatible parge coat.

- .3 Products Installed But Not Supplied Under This Section:
 - 1. Sleeves
 - 2. Inserts
 - 3. Anchors
 - 4. Bolts
 - 5. Reinforcing Steel
 - 6. Concrete

- .4 Related Requirements:
 - 1. Section 03 20 00- Concrete Reinforcing
 - 2. Section 03 30 00- Cast-In-Place Concrete

1.2. PRICE AND PAYMENT PROCEDURES

- 1. Alternates:
 - .1 Materials shall be only as specified in Paragraphs 2.02 & 2.03 as per Manufacturer specified in Paragraph 2.01. No alternate materials shall be accepted for this Section.

1.3. REFERENCES

- .1 Abbreviations and Acronyms:
 - .1 EPS- Acronym for “Expanded Polystyrene” when referencing the insulating foam component of the Insulating Concrete Form System.
 - .2 ICF- Acronym for “Insulating (or Insulated) Concrete Form”

.2 Definitions:

- .1 Form Alignment System- a form alignment & scaffold system designed exclusively for use with Insulating Concrete Forms.
- .2 Trained Installer- An installation contractor, who has received instructional training in the installation of the specified Insulating Concrete Form System and is capable of providing written verification of his designation as such by the specified manufacturer of the system being installed.
- .3 Technical Associate- A technical representative, usually a staff member of a Distribution Firm, who has received instructional training in the installation of Insulating Concrete Form system and is in the capacity of supervising an installation crew on site.
- .4 Window or Door Opening Buck- a pre-manufactured or site constructed frame assembly consisting of wood or plastic material (or combination thereof) used to frame a rough opening within the forming system that will retain concrete around the opening. The frame can also provide for subsequent anchorage of doors and windows within the wall assembly.

.3 Reference Standards:

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C165: Standard Test Method for Measuring Compressive Properties of Thermal Insulations
 - .2 ASTM C177: Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
 - .3 ASTM C203: Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation
 - .4 ASTM C272: Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
 - .5 ASTM C303: Standard Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation
 - .6 ASTM C518: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
 - .7 ASTM D1621: Standard Test Method for Compressive Properties Of Rigid Cellular Plastics
 - .8 ASTM D2126: Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
 - .9 ASTM D2863: Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
 - .10 ASTM E90: Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
 - .11 ASTM E96: Standard Test Methods for Water Vapor Transmission of Materials
 - .12 ASTM E336: Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings.

- .2 Canada Construction Materials Centre (CCMC)
 - .1 Technical Guide for the Evaluation of Modular Expanded-Polystyrene Concrete Forms.
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA A23.3 Design of Concrete Structures
- .4 Underwriters Laboratories of Canada Inc. (ULC)
 - .1 CAN/ULC S101: Standard Methods of Fire Endurance Tests of Building Construction and Materials
 - .2 CAN/ULC S102: Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
 - .3 CAN4-S124-M: Test for the Evaluation of Protective Coverings for Foam Plastic
 - .4 CAN/ULC S-134: Fire Testing of Exterior Wall Assemblies
 - .5 CAN/ULC S701: Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering
 - .6 CAN/ULC S717.1: Standard for Flat Wall Insulating Concrete Form (ICF) Systems

1.4. ADMINISTRATIVE REQUIREMENTS

- .1 Pre-installation Meetings:
 - .1 Ensure those materials listed under Sub-Sections 2.01 through 2.03 are provided to Trained Installer prior to commencement of work under this Section.
 - .2 Trained Installer for this section shall provide list of known special requirements for interface of materials provided in this section as such may pertain to co-ordination with mechanical, electrical, plumbing, interior and exterior finish sub trades prior to commencement of work.

1.5. SUBMITTALS

- .1 Bid Submission Documents:
 - .1 Contractor shall submit with bid proposal for this section written confirmation of:
 - .1 Name of ICF Product forming the basis for the material cost of the bid.
 - .2 Name of ICF Product forming the basis for the labor cost of the bid.
If two different ICF products are involved in above, contractor shall specify BOTH material AND Labor bids associated with each material.
 - .2 Contractor shall submit with bid proposal for this section, written verification of credentials of the subcontractor responsible for the form system installation (*trained installer*) designated to be installing the ICF product as follows:
 - .1 That the installing contractor is either:
 - 1) An experienced ICF Contractor (*trained installer*) with minimum 3 years experience in commercial ICF construction or;

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- 2) A qualified masonry or traditional concrete forming contractor with minimum 5 years experience in commercial construction applications.
- .2 Test and Evaluation Reports:
 - .1 *Technical Associate* for form system shall submit on request, relevant laboratory tests or data that validate product compliance with performance criteria specified prior to commencement of work under this Section (See Section 2.03 B Regulatory Requirements).
 - .2 Submit copy of valid product evaluation report demonstrating compliance with this specification and applicable codes for site condition. (See Section 2.03 B Regulatory Requirements).
 - .3 Manufacturers' Instructions:
 - .1 Submit copy of manufacturer's product installation manual
 - .4 Form Alignment System Engineering:
 - .1 For wall heights above 3.6 meters (12 ft) of unsupported wall height, the contractor shall provide scaffold engineering for support of the *Form Alignment System* or shall ensure this engineering is included by the engineer of record for support of the form system and the *Form Alignment System* assemblies during construction.

1.6. CLOSEOUT SUBMITTALS

- .1 Warranty Documentation:
 - .1 Product warranty documentation specified under Section 1.11 shall be supplied to contractor (for subsequent provision to building owner) upon completion of building construction.

1.7. MAINTENANCE MATERIAL SUBMITTALS

- .1 Maintenance:
 - .1 *Trained Installer* shall supply to contractor (for subsequent provision to building owner) copy of pertinent documentation as relates to instruction on post repair, renovation, modification or service work with respect to the form system once occupancy commences.

1.8. QUALITY ASSURANCE

- .1 Qualification- Installers / Applicators / Erectors:
 - .1 Contractor shall engage the services of a *Trained Installer* or *Technical Associate* for the duration of the work under this Section who has been trained in procedures pertaining to the correct installation of the specified form system (*Trained installer* may already be the designated ICF Installing Contractor if providing credentials as such).

.2 *Trained Installer/Technical Associate* shall furnish proof of training documentation to Contractor prior to commencement of work under this Section.

.2 Mock-ups:

.1 If required, construct sample wall mock-up panel to include full wall system and details, located where directed by Consultant. Panel may form part of finished work if approved by Consultant.

1.9. DELIVERY, STORAGE, AND HANDLING

.1 Delivery and Acceptance Requirements:

.1 *Trained Installer/Technical Associate* to meet with Contractor prior to material delivery on site to co-ordinate provision of access, storage area, and protection of insulating concrete form product and spatial requirements for *Form Alignment System* placement steel storage & forming.

.2 Deliver products in original factory packaging, bearing identification of product, manufacturer and batch/lot number.

.3 *Trained Installer* shall furnish product packaging labels to contractor as required to maintain traceability of product for duration of contract.

.4 Bulk of form shipment shall be delivered as pre-assembled units and folded flat to maximize shipping space. Only form panels and insert webs as may be required for floor interfaces or specialized construction on site are to be shipped unassembled but in labeled packages for traceability

.2 Storage and Handling Requirements:

.1 Handle and store products in location to prevent damaging and soiling.

.2 Maintain form materials and accessories in original packaging (or provide similar protection to unpackaged form materials -should on-site storage prior to installation extend beyond 3 months).

.3 Form units and related form installation materials and equipment to be stored flat until time of use.

1.10. SITE CONDITIONS

.1 Ambient Conditions:

.1 Use appropriate measures for protection and supplementary heating when required to ensure proper curing conditions in accordance with manufacturer's recommendations if installation is carried out during periods of weather where temperatures are below minimum specified by governing Building Code for concrete and masonry.

1.11. WARRANTY

.1 Manufacturer Warranty:

.1 *Technical Associate* shall supply of written copy of specific warranties of the product.

Part 2 Materials

2.1 MANUFACTURERS

- .1 Manufacturer List:
 - .1 Provide insulating concrete form system materials from one of the following Manufacturers assuring that system selected complies in all respects with performance requirements of Section 2.03.
 - .1 Nudura Corporation (www. Nudura.com);
 - .2 Logix ICF;
 - .3 or approved equal.
 - .2 Substitution Limitations:
 - .1 Forming System shall carry an active listing/classification for fire resistance rating of the completed wall assembly as endorsed by Underwriters Laboratories® of Canada Inc. (ULC) per testing to the ANSI/UL-263 Standard.
 - .2 Form System supplied shall provide full height webs fastening strips in contact throughout height of the wall assembly at 203 mm (8”) o/c placement within system to assure minimum settlement during concrete placement and maximum sleeve insertion diameter possible between webs.
 - .3 Form system shall provide dovetail flutes to both sides of its interior cavity to enable structural bonding of concrete to foam once concrete is cured.

2.2 INSULATING CONCRETE FORMING SYSTEM (ICF)

- .1 Where project scope permits, form units shall be supplied through an authorized distributor of the Manufacturer listed for the bid. The distributor shall be capable of providing product on site within 24 hours notice.
- .2 The Manufacturer’s authorized distributor shall have available local to the region, technical sales staff that can be contacted or even contracted (under separate contract) as may be required to provide timely on site problem resolution as installation or product supply issues may arise.
- .3 Where local distribution cannot service the requirements of the contract scope and product is to be supplied directly by the manufacturer, the manufacturer shall provide on-site technical assistance as specified under Clause 4 of this section.
- .4 Where product is supplied direct, technical assistance supplied by the manufacturer shall include the provision of a technical consultant direct from or contracted by the manufacturer for first week of contract that form product is to be erected on the site to coordinate form system installation, crew organization and set-up. During installation, (as agreed to with terms of contractor), the manufacturer’s technical consultant shall provide periodic site visits

(as may required under separate contract) at key stages of form installation, to assure continued product installation quality.

2.3 DESCRIPTION

.1 General:

- .1 Insulating concrete form system shall consist of two (2) flame resistant panels of expanded polystyrene (*EPS*) connected by either high-density polypropylene hinged pin foldable webs or EPS embedded polystyrene fastening strips interconnected with slide in format - high density polypropylene web connectors. EPS foam panels shall feature continuous vertical dove tail grooves on interior panel surfaces to provide integral surface bonding to concrete core once filled and concrete is cured. Dove tail grooves shall also facilitate structural linkage with end cap forms placed into the form cavity where required as part of the overall architectural design layout.
- .2 All web fastening strips to run full height of form and be fitted top and bottom with reversible fitting, "triple-tooth" interlocking mechanisms to enable positive vertical interlocking of forms with each other. Wall system webs to provide minimum 38 mm (1 ½") wide fastening strips at 203 mm (8") on center approx 15.9 mm (5/8") below insulation face to facilitate finish fastening of both interior and exterior finishes.
- .3 Insulating concrete form system shall be capable of forming ALL of following concrete core thicknesses: 102, 152, 203, 254 or 305 mm (4, 6, 8, 10 or 12-inches) wall sections (as required for various locations throughout project scope with standard form line-up) (See form dimensions summary Attachments Table A at end of Section.
- .4 Insulating concrete form system shall provide a minimum insulation panel thickness of 66.7 mm (2 5/8") throughout ALL forms and panels forming the form system product inventory (with exception of variance required for brick ledge and tapered top forms).
- .5 All form units of wall forming system shall be capable of being shipped to site in folded condition to minimize shipping cost and site storage space requirement and be capable of being deployed to installation ready condition by simply unfolding the unit in a single pull motion or pull motion combined with insertion of a single web (at corner condition).
- .6 Standards, corner forms and stand alone panels of form system shall provide fully reversible interlocks along top and bottom edges to assure minimum product waste on site. EPS foam panels shall be molded with 25 mm (1") wide by 12.7 mm (½") high/deep alternating male/female reversible projection/socket interlocks positioned in pairs along both top and bottom edges of all panels.
- .7 Wall system shall be capable of providing horizontal and vertical lock positioning of steel within form cavity to conform to all reinforcing requirements of CAN/CSA A23.3.

.2 Regulatory Requirements:

- .1 Form system manufacturer shall provide on request, written documentation verifying active compliance to the Canadian Construction Materials Centre's "Technical Guide for the Evaluation of Modular Expanded-Polystyrene Concrete Forms", with valid listing in the report verifying qualification of form system for use

in Types I through V construction as qualified under the governing Building Code for this project and additional compliances as outlined in Section 2.03.1.2.3 (below).

- .2 Documentation as provided per Section 2.03.1.2.1 shall verify that form system has been assessed and confirmed in conformance with:
 - .1 Form system structural, and general performance assessment of properties of EPS foam and polypropylene materials assessment in accordance with the following standards:
 - .1 CAN/ULC S701: Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering (Which Includes Results for);
 - .1 ASTM C165: Standard Test Method for Measuring Compressive Properties of Thermal Insulation
 - .2 ASTM C177: Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
 - .3 ASTM C203: Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation
 - .4 ASTM C272: Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
 - .5 ASTM C303: Standard Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation
 - .6 ASTM C518: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
 - .7 ASTM D1621: Standard Test Method for Compressive Properties Of Rigid Cellular Plastics
 - .8 ASTM D2126: Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
 - .9 ASTM D2863: Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
 - .10 ASTM E96: Standard Test Methods for Water Vapor Transmission of Materials
 - .3 As required by Architect- additional documentation to be supplied by manufacturer on request to include (dependent upon construction classification) one, part, or all of the following tests or documentation;
 - .1 Finish attachment testing in accordance with:
 - .1 ASTM D1761: Standard Test Methods for Mechanical Fasteners in Wood (Modified for Polypropylene Web assessment) (Need to do something here but could not understand the note)
 - .2 Surface Burning, Flash Ignition and Self Ignition Temperature Characteristics assessment of both plastic web and EPS form materials in accordance with:
 - .1 ASTM D635: Standard Test Method for Rate of Burning and/or Extent and of Burning of Plastics in a Horizontal Position

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- .2 CAN/ULC S102: Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
 - .3 ASTM D1929: Standard Test Method for Determining Ignition Temperature of Plastics

 - .3 Verification of performance and compliance of finishes for provision thermal barrier protection to foam plastic.
 - .1 CAN4-S124-M: “Test for the Evaluation of Protective Coverings for Foam Plastic” proving that the finish material attains a minimum classification “B” as specified in this standard for...
 - .2 CAN/ULC S101: “Standard Methods of Fire Endurance Tests of Building Construction and Materials” with observation conducted by the testing authority specific to finish facing the immediate fire face of the test assembly proving compliance a classification “B” as described under CAN4-S124-M “Test for the Evaluation and Protective Coverings for Foam Plastic”

 - .4 Fire Resistance Rated Construction assessment in accordance with:
 - .1 CAN/ULC S101: Standard Methods of Fire Endurance Tests of Building Construction and Materials” (See also Sections 2.01 and 2.04.1. 4 through 9)

 - .5 Non-Combustible Construction assessment substantiating compliance with one of the following:
 - .1 Testing to verify stay-in-place burn duration of 15 minutes without perforation or failure or the exterior finish coating when tested in application over the specified form product in accordance with “CAN/ULC S101: Standard Methods of Fire Endurance Tests of Building Construction and Materials” or;
 - .2 Engineered listing as provided by a 3rd party Standard Council of Canada (SCC) accredited independent testing agency verifying a stay-in-place burn during of 15 minutes without perforation or failure of the exterior finish coating when applied over a sheet form plastic insulation that is of greater than or equivalent combustible content than the specified for product’s exterior foam surface when tested in compliance with “CAN/ULC S-134: Fire Testing of Exterior Wall Assemblies”.

 - .6 Additional Testing and engineering documentation to verify qualification of EPS foam panels as a Vapor Retarder in conjunction with testing to:
 - .1 ASTM E-96 Standard Test Methods for Water Vapor Transmission of Materials

 - .7 Testing and engineering documentation to verify qualification of fully assembled wall system as an air barrier element in accordance with:
 - .1 ASTM E1677 Standard Specification for an Air Retarder (AR) Material or System for Low-Rise Framed Building Walls

- .8 Testing and engineering documentation to verify qualification of the form system as meets the minimum STC performance requirements of 50 (and STC 55 for application around garbage chutes and elevators) in accordance with:
 - .1 ASTM E 90: Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements, or;
 - .2 ASTM E 336: Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings.

- .4 Sustainability Characteristics:
 - .1 When required by Architect/Engineer, *Technical Associate* for the form system shall provide, written documentation verifying product recycle content and manufacturing location compliances with respect to CaGBC/LEED® document submissions.

2.4 PERFORMANCE / DESIGN CRITERIA

- .1 Capacities:
 - .1 Selected system in conjunction with concrete and designated exterior and interior finishes shall provide minimum insulation level of R 23.59 (hr.ft².F/Btu) or (RSI 4.158 (m².K/W) -U Factor 0.2405 W/m².K) across full line of form unit cavity widths.
 - .2 EPS foam panels forming part of wall system shall provide maximum vapor permeation rate of 36 ng/Pa.s.m² (0.78 Perm-inch) based on 66.7 mm (2 5/8") singles thickness of foam on interior surface of concrete core.
 - .3 Finished wall assembly formed by system shall provide minimum sound transmission class (STC) sound attenuation performance as follows:
 - .1 100 mm (4") core form (if specified):
 - .1 STC 42 (when installed with 12.7 mm (1/2") gypsum board both sides)
(Not to be used for demising walls unless specified otherwise by architect)
 - .2 STC 52 (when installed as specified by manufacturer with additional hat channel and acoustic material with 15.9 mm (5/8") finish on one side (12.7 mm (1/2") gypsum board opp.).
 - .2 6-inch (152mm) core form
 - .1 STC 50 (with regular 12.7 mm (1/2")gypsum board both sides)
 - .4 Finished insulating concrete form wall assembly shall be capable of providing fire resistance ratings as listed in this section. Manufacturer of the specified wall assembly number (BXUVC.WO12) shall be actively listed and classified with Underwriters Laboratories of Canada Inc. Listings shall be verifiable under Certifications Directory of ULC at:

- .5 Fire resistance ratings shall be established by testing in full accordance with CAN/ULC S-101 when installed as per the listed classification (BXUVC.WO12)
 - .1 100 mm (4") core form - 2 hour fire resistance rating
 - .2 152 mm (6") core form and above - 4 hour fire resistance rating
- .6 Per BXUVC.WO12 Note 2- Wall reinforcement shall consist of minimum grade 400 metric bar (No. 4) 60 ksi yield strength installed at 400 mm (16") o/c vertically and 457mm (18") o/c horizontally.
- .7 Per BXUVC.WO12 Note 3- Concrete shall be minimum 20 MPa (2900psi) compressive strength at 28 days and shall be a minimum density of 2,323 kg/m³ +/- 80 kg/m³ (145 lbs +/- 5lbs /ft³) using regular siliceous concrete aggregate.
- .8 Per BXUVC.WO12 Note 4- Finished wall assembly shall provide above noted fire resistance ratings using unclassified or classified 12.7 mm (½") gypsum board finish (interior surface only for exterior walls and both sides for interior demising walls).
- .9 When reinforced per BXUVC.WO12 Note 2, 152 mm (6") load bearing wall must demonstrate being able to be loaded to a minimum axially applied load of 5,532 kg/m (40,000 lbs/lf) for full 4-hour burn duration under above test conditions.

2.5 MATERIALS

- .1 Insulating Concrete Forming:
 - .1 Provide Insulating Concrete Forming as listed in Appendix A as may be required for proper execution of the work.
- .2 Concrete:
 - .1 Concrete supplied under Section 03 30 00 shall be of strength as specified by the design engineer (measured at 28 days). Recommended maximum aggregate size to be 12.7mm (½") aggregate for 102mm & 152mm (4" & 6") cavity forms and, 19mm (¾") aggregate for 203mm (8") cavity forms and higher.
 - .2 Recommended concrete slump is 102mm to 152mm +/- 25mm (4" to 6" +/- 1") (subject to design revision to suit application).
 - .3 Where required by engineer of record, recommended slump specification shall be attained through addition of super plasticizer/mid-range water reducing agents to achieve design mix strength and concrete flow-ability.
- .3 Reinforcing Steel:
 - .1 Reinforcing steel shall be as specified in Section 03 10 00 and shall be supplied under that Section for placement by the Form System's *Trained Installer*.
- .4 Waterproofing:
 - .1 Where specified, waterproofing shall be self-adhesive modified bituminous sheet waterproofing membrane as supplied by concrete form system manufacturer specific to the form system specified under this section. Material to be supplied under this Section & installed as specified under Section 07 13 52 (Modified Bituminous Sheet Waterproofing).
 - .2 Waterproofing material shall be *EPS* foam compatible.
- .5 Parging:

- .1 Where called for on drawings, parging (acrylic stucco type) shall be as recommended and supplied by Concrete Form Manufacturer under this section and installed as specified under Section 09 24 00 (Portland Cement Plaster).
- .2 Alternate EIFS supplied and installed under Section 07 24 00 (Exterior Insulation and Finish System).

2.6 ACCESSORIES

- .1 *Form Alignment System*
 - .1 The *Trained Installer* shall furnish and utilize the Wall Access and *Form Alignment System* (as supplied by the Manufacturer or approved equivalent) to facilitate construction of the wall assembly, and to provide adjustment for ensuring plumbness and straightness of the wall system during construction, just prior to concrete placement and immediately after concrete placement while form system is still adjustable to final finished position.
 - .2 *Form Alignment System* shall be CSA Standards and OPS Specification compliant. *Technical Associate* shall supply engineering documentation pertaining to the “base” *Form Alignment System* components to verify compliance upon request.
 - .3 As specified under Section 1.05 Submittals, for wall heights above 3.6 m (12ft), the contractor shall provide scaffold engineering for *Form Alignment System* support or shall ensure this engineering is included by the engineer of record for support of the form system during construction.

Part 3 Execution

3.1. INSTALLERS

- .1 Installer List:
 - .1
- .2 Substitution Limitations:
 - .1 Per Section 1.05 Submittals – Bid Submittal requirements, the installing contractor for this section shall be:
 - .1 An experienced ICF Contractor (*trained installer*) with minimum 3 years experience in commercial ICF construction or;
 - .2 A qualified mason or traditional concrete forming contractor with minimum 5 years experience in commercial construction applications.
 - .3 A qualified master carpenter with minimum 5 years experience in commercial construction applications.

3.2. EXAMINATION

- .1 Verification of Conditions:

- .1 Inspect all areas included in Part 1 Section 1.01 Summary to establish extent of work and verify site access conditions.
- .2 Verify that site conditions are as set out in Part 1- Section 1.10 Site Conditions.
- .2 Evaluation and Assessment:
 - .1 Examine footings installed under Section 03 10 00 are within +/-6 mm (¼") of level and that steps footing increments are 457 mm (18") in height.
 - .2 Where partial or half course is intended for starting course elevation, ensure step footing increment is equal to cut form unit less 13 mm (½").
 - .3 When specified, ensure reinforcing steel dowels are in place at specified centers along footing lengths.
 - .4 Ensure reinforcement steel dowels have CSA Standard compliant protection installed until formwork is erected above dowel level.

3.3. PREPARATION

- .1 Surface Preparation:
 - .1 Clean all debris from top of footings prior to commencement of insulating concrete form system installation.
 - .2 Sequence installation of concrete formwork with related work specified in other sections to ensure that wall assemblies, including window and door accessories, trim, service penetrations, transition changes, and mechanical service are protected against damage from effects of weather, corrosion, and adjacent construction activity.

3.4. ERECTION / INSTALLATION / APPLICATION

- .1 Installation Procedures:
 - .1 Installation of forms to be in strict accordance with manufacturer's product installation manual as supplied in evidence to contractor under Part 1 Section 1.05 of this Section.
 - .2 The *trained installer* shall ensure all manufacturer's procedures for the following work are employed on site (as outlined in the manufacturer's product Installation manual) Additional to all required procedures being followed, the trained Installer shall specifically assure cross checks with respect to layout, leveling and vertical alignment are executed as noted below in each section:
 - .1 First Course Placement – perform cross checks for accuracy of plan layout to survey pins, marks or grid lines as set by the contractor.
 - .2 Horizontal Reinforcement Placement – assure reinforcement diameter, grade and positioning is accurate to engineering specifications on structural drawings and installed in correct axis of wall for each course placed.
 - .3 Successive Course Placement – assure system is accurately leveled subsequent to 2nd course placement.
 - .4 Door & Window Opening Construction – when specified, assure bucks have been prepared for anchorage with concrete and/or fitted with mesh attachments as may be required for subsequent exterior finishes such as acrylic stuccos or similar architectural coatings for non-combustible

-
- construction. *Trained Installer* shall also assure all top, bottom and stirrup steel fittings are installed per engineering specifications.
- .5 *Form Alignment System* /Installation – assure *Form Alignment System* is regularly checked for crew safety, anchorage to form system as specified, vertical alignment checks at both pre-placement of concrete as well.
 - .6 Vertical Reinforcement Placement- assure reinforcement diameter, grade and positioning is accurate to engineering specifications on structural drawings and installed in correct axis of wall, prior to placement of concrete.
 - .7 Pre-Concrete Placement Inspection- trained installer shall assure string lines are place at top of all pours and wall system aligned for placement, cross check and assure that all required service penetration sleeves, embed plates, anchor bolts, fittings, beam pocket preparations, as specified on drawings are in place prior to commencement of concrete placement.
 - .8 Concrete Placement- trained installer shall assure concrete tickets retained for contractor records and that slump, strength and aggregate size are as specified per Section 2.04 of this Section. *Trained installer* to assure truck delivery timed for rate of placement and that placement does rate not exceed ACI recommended practices. *Trained installer* shall also assure that concrete during lift placement is mechanically and internally vibrated per ACI Standards to assure full monolithic concrete placement for all areas of formwork.
 - .9 *Form Alignment System* and Scaffold Access Assembly, adjustment & removal. *Trained installer* shall assure entire wall lengths aligned to vertical plumb by string line and screeded to horizontal level as required for finished wall height prior to concrete set. Subsequent to initial concrete cure, contractor shall assure that scaffold access and *Form Alignment System* remains in place until removal is directed accordingly by engineer of record for the project.
- .2 Interface with Other Work:
- .1 Service penetrations (electrical service conduits, water service pipes, air supply and exhaust ducts etc.) shall be installed at the required locations as indicated by the appropriate trade.
 - .2 Service penetrations exceeding 400 mm x 400 mm (16” x 16”) in area shall be reinforced per engineer specifications
 - .3 Prior to concrete placement, install service penetration sleeves (supplied by others) at designated locations to create voids for service placement at later date.
 - .4 Instructions for exterior finish application to be reviewed with each trade. Contractor shall contact *Trained Installer* for specific instructions where sub trade has insufficient information or specialty requirements not addressed in specification specific to ICF applications.

3.5. CLEANING

- .1 Waste Management

- .1 Clean up and properly dispose of all debris remaining on job site related to the installation of the insulated concrete forms.

3.6. PROTECTION

- .1 Assure final finishes are installed over form product or provide temporary coverage of installation to reduce EPS foam surface exposure to ultra violet light should final finish application be delayed longer than 18 months after form product installation.
- .2 Consult with exterior finish contractor concerning exposure to ultraviolet light to ensure proper finish to ICF walls.

ATTACHMENTS

(A) SUMMARY OF SPECIFIED FORM UNIT THICKNESSES AND DIMENSIONS

| Product | Feature | 4" (100mm) | | 6" (150mm) | | 8" (200mm) | | 10" (250mm) | | 12" (300mm) | |
|---------------------|------------------|------------|------|------------|------|------------|------|-------------|------|-------------|------|
| | | inches | mm | inches | mm | inches | mm | inches | mm | inches | mm |
| Standard Form Unit | Length | 96 | 2438 | 96 | 2438 | 96 | 2438 | 96 | 2438 | 96 | 2438 |
| | Width | 9 1/4 | 235 | 11 1/4 | 286 | 13 1/4 | 337 | 15 1/4 | 387 | 17 1/4 | 438 |
| | Height | 18 | 457 | 18 | 457 | 18 | 457 | 18 | 457 | 18 | 457 |
| | EPS Thickness | 2 5/8 | 67 | 2 5/8 | 67 | 2 5/8 | 67 | 2 5/8 | 67 | 2 5/8 | 67 |
| 90 Degree Form Unit | Length (a) (lng) | 31 5/8 | 803 | 31 5/8 | 803 | 33 5/8 | 854 | 35 5/8 | 905 | 37 5/8 | 956 |
| | Length (b) (sht) | 15 5/8 | 397 | 15 5/8 | 397 | 17 5/8 | 448 | 19 5/8 | 498 | 21 5/8 | 549 |
| | Width | 9 1/4 | 235 | 11 1/4 | 286 | 13 1/4 | 337 | 15 1/4 | 387 | 17 1/4 | 438 |
| | Height | 18 | 457 | 18 | 457 | 18 | 455 | 18 | 455 | 18 | 455 |
| 45 Degree Form Unit | Length (a) (lng) | 26 1/2 | 673 | 26 1/2 | 673 | 26 1/2 | 673 | 28 1/2 | 724 | 30 1/2 | 775 |
| | Length (b) (sht) | 10 1/2 | 267 | 10 1/2 | 267 | 10 1/2 | 267 | 12 1/2 | 318 | 14 1/2 | 368 |
| | Width | 9 1/4 | 235 | 11 1/4 | 286 | 13 1/4 | 337 | 15 1/4 | 387 | 17 1/4 | 438 |
| | Height | 18 | 457 | 18 | 457 | 18 | 457 | 18 | 457 | 18 | 457 |
| | Length | 48 | 1219 | 48 | 1219 | 48 | 1219 | 48 | 1219 | 48 | 1219 |

| | | | | | | | | | | | |
|--|------------------------|--------|------|--------|------|--------|------|--------|------|--------|------|
| One & Two Sided Tapered Top Form Units* | Width | 9 1/4 | 235 | 11 1/4 | 286 | 13 1/4 | 337 | 15 1/4 | 387 | 17 1/4 | 438 |
| | Height | 18 | 457 | 18 | 457 | 18 | 457 | 18 | 457 | 18 | 457 |
| | EPS Thickness | 2 5/8 | 67 | 2 5/8 | 67 | 2 5/8 | 67 | 2 5/8 | 67 | 2 5/8 | 67 |
| Molded Brick Ledge* | Length | 48 | 1219 | 48 | 1219 | 48 | 1219 | 48 | 1219 | 48 | 1219 |
| | Width | 9 1/4 | 235 | 11 1/4 | 286 | 13 1/4 | 337 | 15 1/4 | 387 | 17 1/4 | 438 |
| | Height | 18 | 457 | 18 | 457 | 18 | 457 | 18 | 457 | 18 | 457 |
| T-Form Units (main and T- wall core thickness matching) | Lg. T Mn. Lgth | 18 | 457 | 20 | 508 | 22 | 559 | 24 | 610 | 26 | 660 |
| | Sh. T Mn. Lgth | 50 | 1270 | 52 | 1321 | 54 | 1372 | 56 | 1422 | 58 | 1473 |
| | Height | 18 | 457 | 18 | 457 | 18 | 457 | 18 | 457 | 18 | 457 |
| | EPS Thickness | 2 5/8 | 67 | 2 5/8 | 67 | 2 5/8 | 67 | 2 5/8 | 67 | 2 5/8 | 67 |
| Molded Brick Ledge & Tapered Top Unit | Length | 48 | 1219 | 48 | 1219 | 48 | 1219 | 48 | 1219 | 48 | 1219 |
| | Width | 9 1/4 | 235 | 11 1/4 | 286 | 13 1/4 | 337 | 15 1/4 | 387 | 17 1/4 | 438 |
| | Height | 18 | 457 | 18 | 457 | 18 | 457 | 18 | 457 | 18 | 457 |
| Brick Ledge Extension | Length | 32 | 813 | 32 | 813 | 32 | 813 | 32 | 813 | 32 | 813 |
| | Width | 4 1/2 | 114 | 4 1/2 | 114 | 4 1/2 | 114 | 4 1/2 | 114 | 4 1/2 | 114 |
| | Height | 13 1/2 | 343 | 13 1/2 | 343 | 13 1/2 | 343 | 13 1/2 | 343 | 13 1/2 | 343 |
| End Cap | Width | 4 1/4 | 108 | 6 1/4 | 159 | 8 1/4 | 210 | 10 1/4 | 260 | 12 1/4 | 311 |
| | Height | 18 | 457 | 18 | 457 | 18 | 457 | 18 | 457 | 18 | 457 |
| | EPS Thickness | 2 5/8 | 67 | 2 5/8 | 67 | 2 5/8 | 67 | 2 5/8 | 67 | 2 5/8 | 67 |
| | Fast. Strip Op. | YES | |
| Height Adjuster | Length | 32 | 813 | 32 | 813 | 32 | 813 | 32 | 813 | 32 | 813 |
| | Height | 3 | 76 | 3 | 76 | 3 | 76 | 3 | 76 | 3 | 76 |
| | Fast. Strip Op. | YES | |

These form units sold in 2438 mm (96-inch) lengths in some regions of the USA

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 30 00 – Administrative Requirements.
- .2 Section 03 10 00 – Concrete Forming and Accessories.
- .3 Section 03 30 00 – Cast-In-Place Concrete.

1.2 REFERENCES

- .1 American Concrete Institute (ACI)
 - .1 SP-66-04, ACI Detailing Manual 2004.
 - .1 ACI 315-99, Details and Detailing of Concrete Reinforcement.
 - .2 ACI 315R-04, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.
 - .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A143/A143M-03, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
 - .2 ASTM A185/A185M-05a, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .3 ASTM A497/A497M-05a, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
 - .4 ASTM A775/A775M-04a, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
 - .3 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1-04/A23.2-04, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-A23.3-04, Design of Concrete Structures.
 - .3 CAN/CSA-G30.18-M92(R2002), Billet-Steel Bars for Concrete Reinforcement, A National Standard of Canada.
 - .4 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 30 00 – Administrative Requirements.
- .2 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and ACI 315.
- .3 Submit drawings, stamped and signed by professional engineer licensed in Province of New Brunswick, Canada.

- .4 Prepare reinforcement drawings in accordance with RSIC Manual of Standard Practice and ACI 315.
- .5 Submit shop drawings including placing of reinforcement and indicate:
 - .1 Bar bending details.
 - .2 Lists.
 - .3 Quantities of reinforcement.
 - .4 Sizes, spacings and locations of reinforcement with identifying code marks to permit correct placement without reference to structural drawings.
 - .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
- .6 Detail lap lengths and bar development lengths to CSA-A23.3, but not less than:
 - .1 400 mm for 10M.
 - .2 600 mm for 15M.
 - .3 700 mm for 20M.
 - .4 1100 mm for 25M.
- .7 Quality Assurance: as described in PART 2 – SOURCE QUALITY CONTROL.
 - .1 Upon request, submit in writing to Engineer proposed source of reinforcement material to be supplied.

Part 2 Products

2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by Engineer.
- .2 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.
- .3 Cold-drawn annealed steel wire ties: to ASTM A497/A497M.
- .4 Deformed steel wire for concrete reinforcement: to ASTM A497/A497M.
- .5 Welded steel wire fabric: to ASTM A185/A185M.
 - .1 Provide in flat sheets only.
- .6 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .7 Plain round bars (where applicable): to CSA-G40.20/G40.21-300W.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 ACI 315 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Obtain Engineer's approval for locations of reinforcement splices other than those shown on placing drawings.

-
- .3 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, inform Engineer of proposed source of material to be supplied.

Part 3 Execution

3.1 FIELD BENDING

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

3.2 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.
- .2 Use plain round bars as slip dowels in concrete.
 - .1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.
 - .2 When paint is dry, apply thick even film of mineral lubricating grease.
- .3 Prior to placing concrete, obtain Engineer's approval of reinforcing material and placement.
- .4 Ensure cover to reinforcement is maintained during concrete pour.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 30 00 – Administrative Requirements
- .2 Section 03 10 00 – Concrete Forming and Accessories.
- .3 Section 03 20 00 – Concrete Reinforcing.
- .4 Section 13 17 60 – Ice Rink Slab
- .5 Section 31 23 33.01 – Excavating, Trenching and Backfilling
- .6 Section 32 16 15 – Concrete Walks, Curbs and Gutters (where applicable)
- .7 Section 33 65 73 – Concrete Encased Duct Banks

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C260-01, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309-03, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C494/C494M-05, Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM D1751-04, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - .5 ASTM C1107-02, Standard Specification for Packaged Dry, Hydraulic-cement Grout (Non-Shrink).
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1/A23.2-2004, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A283-00(R2003), Qualification Code for Concrete Testing Laboratories.
 - .3 CAN/CSA-A3000-03, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001-03, Cementitious Materials for Use in Concrete.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 30 00 – Administrative Requirements.
- .2 Concrete pours: submit accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.

1.4 QUALITY ASSURANCE

- .1 Submit to Engineer prior to starting concrete work, valid and recognized certificate from plant delivering concrete.
 - .1 When plant does not hold valid certification, provide test data and certification by qualified independent inspection and testing laboratory that materials used in concrete mixture will meet specified requirements.
- .2 Prior to starting concrete work, submit proposed execution and quality control procedures for review by Engineer on following items:
 - .1 Curing.
 - .2 Finishes.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.
 - .1 Modifications to maximum time limit must be agreed to Engineer laboratory representative and concrete producer as described in CSA A23.1/A23.2.
 - .2 Deviations to be submitted for review by Engineer.
- .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.
- .3 Waste Management and Disposal:
 - .1 Divert unused concrete materials from landfill to local quarry and/or facility approved by Authority having jurisdiction.
 - .2 Provide an appropriate area on the job site where concrete trucks can be safely washed.
 - .3 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by the Authority having jurisdiction.
 - .4 Unused admixtures and additive materials must not be disposed of into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.
 - .5 Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal. Dispose of waste in accordance with applicable local, Provincial/Territorial and National regulations.

Part 2 Products

2.1 MATERIALS

- .1 Cement: to CAN/CSA-A3001.
- .2 Supplementary cementing materials: CAN/CSA-A3001.
- .3 Water: to CSA-A23.1.

- .4 Aggregates: to CAN/CSA-A23.1/A23.2. Coarse aggregates to be normal density.
- .5 Admixtures:
 - .1 Air entraining admixture: to ASTM C260.
 - .2 Chemical admixture: to ASTM C494 Engineer to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .6 Shrinkage compensating grout: premixed compound consisting of cement, based mineral aggregate, water reducing and plasticizing agents to CSA-A23.1/A23.2.
 - .1 Compressive strength: 50 MPa at 28 days.
- .7 Curing compound: to CSA-A23.1/A23.2 white and ASTM C309, Type 1-chlorinated rubber. Use curing compounds compatible with applied finish on concrete surfaces. Provide written declaration to Architect that compounds use are compatible.
- .8 Mechanical waterstops: ribbed extruded PVC of sizes indicated with pre-welded with legs not less than 300 mm.
- .9 Premoulded joint fillers:
 - .1 Bituminous impregnated fiber board: to ASTM D1751.
- .10 Void Form:
 - .1 SlabVoid® (4" Minimum Height for exterior application made of corrugated paper with moisture-resistant outer surface) by SureVoid Products or approved equal.
- .11 Thermal and Moisture Protection: to Division 7.

2.2 MIXES

- .1 Proportion normal density concrete in accordance with CAN/CSA-A23.1/A23.2, to give following properties:
 - .1 For all interior concrete slabs not exposed to freezing and thawing (suspended slabs and slabs on grade):
 - .1 Cement: Type GU - General Use Hydraulic Cement.
 - .2 Maximum water/cementing materials ratio: 0.55.
 - .3 20 mm nominal size coarse aggregate.
 - .4 Minimum compressive strength at 28 days: 25 MPa.
 - .5 Class of exposure: Normal.
 - .6 Chemical admixtures in accordance with ASTM C494.
 - .7 Slump at time and point of discharge 80 mm \pm 20 mm.
 - .2 For all interior concrete not exposed to freezing and thawing (interior footings and interior piers, excluding interior slabs) and for concrete to be used within ICF walls:
 - .1 Cement: Type GU - General Use Hydraulic Cement.
 - .2 Maximum water/cementing materials ratio: 0.55.

- .3 20 mm nominal size coarse aggregate (refer to section 03 11 19 for additional requirements for concrete to be used within ICF walls).
 - .4 Minimum compressive strength at 28 days: 32 MPa.
 - .5 Class of exposure: Normal.
 - .6 Chemical admixtures in accordance with ASTM C494.
 - .7 Slump at time and point of discharge 80 mm \pm 20 mm.
-
- .3 For all exterior concrete (exterior walls and exterior piers, excluding structural slabs at door entrances and exterior equipment pads):
 - .1 Cement: Type GU - General Use Hydraulic Cement.
 - .2 Maximum water/cementing materials ratio: 0.55.
 - .3 20 mm nominal size coarse aggregate.
 - .4 Minimum compressive strength at 28 days: 32 MPa.
 - .5 Class of exposure: F-2.
 - .6 Air content 4% to 7%
 - .7 Chemical admixtures in accordance with ASTM C494.
 - .8 Slump at time and point of discharge 80 mm \pm 20 mm.
 - .4 For all exterior structural concrete slabs at door entrances and exterior equipment pads exposed to freezing and thawing:
 - .1 Cement: Type GU - General Use Hydraulic Cement.
 - .2 Maximum water/cementing materials ratio: 0.40.
 - .3 20 mm nominal size coarse aggregate.
 - .4 Minimum compressive strength at 28 days: 35 MPa.
 - .5 Class of exposure: C-1.
 - .6 Air content 5% to 8%
 - .7 Chemical admixtures in accordance with ASTM C494.
 - .8 Slump at time and point of discharge 80 mm \pm 20 mm.
 - .5 For ice rink concrete slab, refer to Section 13 17 60 – Ice Rink Slab.
-
- .2 Do not change concrete mix without prior approval of Engineer. Should change in material source be proposed, new mix design to be approved by Engineer.

Part 3 Execution

3.1 PREPARATION

- .1 Obtain Engineer's approval before placing concrete.
 - .1 Provide 24 hour notice prior to placing of concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.

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- .3 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
 - .4 Pumping of concrete is permitted only after approval of equipment and mix by Engineer.
 - .5 Ensure reinforcement and inserts are not disturbed during concrete placement.
 - .6 Prior to placing of concrete obtain Engineer's approval of proposed method for protection of concrete during placing and curing in adverse weather.
 - .7 Protect previous Work from staining.
 - .8 Clean and remove stains prior to application for concrete finishes.
 - .9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
 - .10 In locations where new concrete is dowelled to existing work, drill holes in existing concrete (where applicable).
 - .1 Place steel dowels of deformed steel reinforcing bars and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated.
 - .11 Do not place load upon new concrete until authorized by Engineer.
 - .1 Do not proceed with backfilling operations of retaining walls until specified concrete minimum compressive strength has reached a value of 30 MPa.

3.2 CONSTRUCTION

- .1 Do cast-in-place concrete work in accordance with CSA-A23.1/A23.2.
- .2 Sleeves and inserts:
 - .1 Do not permit penetrations, sleeves, ducts, pipes or other openings to pass through joists, beams, column capitals or columns, except where indicated or approved by Engineer.
 - .2 Where approved by Engineer, set sleeves, ties, pipe hangers and other inserts and openings as indicated or specified elsewhere.
 - .3 Sleeves and openings greater than 100 x 100 mm not indicated, must be reviewed by Engineer.
 - .4 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of modifications from Engineer before placing of concrete.
 - .5 Check locations and sizes of sleeves and openings shown on drawings.
 - .6 Set special inserts for strength testing as indicated and as required by non-destructive method of testing concrete.
- .3 Anchor bolts:

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- .1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
 - .4 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100% contact over grouted area.
 - .5 Hardening.
 - .1 Apply floor hardener at locations indicated on architectural drawings at rate considered as light in accordance with manufacturer's written instructions.
 - .6 Sealing.
 - .1 Apply floor treatment at locations indicated on architectural drawings in accordance with Sealer manufacturer's written instructions.
 - .7 Finishing and curing:
 - .1 Unless noted otherwise, finish, cure and protect concrete in accordance with CAN/CSA-A23.1/A23.2.
 - .2 Curing and protection of concrete during cold weather (when temperature is at or below 5°C or when there is a probability of temperature falling below 5°C within 24 hours of placing) should go on until concrete cylinders stored on site have reached a compressive strength of 30 MPa.
 - .3 Curing and protection of the concrete should go on until concrete cylinders stored on site have reached 70% of the specified compressive strength at 28 days.
 - .4 Interior floor slabs to be left exposed, to receive epoxy, carpet, sheet vinyl or other covering requiring a smooth surface: initial finishing operations followed by final finishing comprising mechanical floating and steel trowelling as specified in CAN/CSA-A23.1/A23.2 to produce hard, smooth, dense trowelled surface free from blemishes.
 - .5 Floor slabs to receive mortar bed for ceramic or quarry tile: screed to correct grade to provide broomed texture.
 - .6 Equipment pads (where applicable): provide smooth trowelled surface.
 - .7 Use procedures as reviewed by Engineer or those noted in CSA-A23.1/A23.2 to remove excess bleed water. Ensure surface is not damaged.
 - .8 Use curing compounds compatible with applied finish on concrete surfaces. Applied finish on concrete: in accordance with manufacturer's instructions. Provide written declaration that compounds used are compatible.
 - .9 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.
 - .8 Waterstops:
 - .1 Where indicated on architectural drawings, install waterstops to provide continuous water seal.
 - .2 Do not distort or pierce waterstop in way as to hamper performance.
 - .3 Do not displace reinforcement when installing waterstops.
 - .4 Use equipment to manufacturer's requirements to field splice waterstops.
 - .5 Tie waterstops rigidly in place.
 - .6 Use only straight heat sealed butt joints in field.

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- .7 Use factory welded corners and intersections unless otherwise approved by Engineer.
 - .9 Joint fillers:
 - .1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Engineer.
 - .2 When more than one piece is required for joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.
 - .3 Locate and form isolation, construction and expansion joints as indicated.
 - .4 Install joint filler.
 - .5 Use 12 mm thick joint filler to separate slabs-on-grade from vertical surfaces and extend joint filler from bottom of slab to within 12 mm of finished slab surface unless indicated otherwise.

3.3 SURFACE TOLERANCE

- .1 Concrete tolerance in accordance with CSA-A23.1/A23.2.

3.4 FIELD QUALITY CONTROL

- .1 Site tests: conduct following test in accordance with Section 01 40 00 - Quality Requirements.
 - .1 Concrete pours.
 - .2 Slump tests.
- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Engineer for review in accordance with CSA-A23.1/A23.2.
 - .1 Ensure testing laboratory is certified in accordance with CSA A283.
- .3 Ensure test results are distributed for discussion at pre-pouring concrete meeting between testing laboratory and Engineer.
- .4 Non-Destructive Methods for Testing Concrete: in accordance with CSA-A23.1/A23.2.
- .5 Inspection or testing by Consultant will not augment or replace Contractor quality control nor relieve Contractor of his contractual responsibility.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 30 00 – Administrative Requirements.
- .2 Section 01 74 00 – Cleaning and Management.
- .3 Section 04 26 19 – Reinforced Unit Masonry.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A325M-00, Specification for High-Strength Bolts for Structural Steel Joints Metric.
 - .1 ASTM A325 or A490 Test for Slip Coefficient and Creep Resistance in Accordance with the Research Council on Structural Connections for Structural Bolts.
 - .2 ASTM A500-03a Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - .3 ASTM A572/A572M-04 Standard Specification for High-Strength Low-Alloy Columbian-Vanadium Structural Steel.
 - .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-85.10-99, Protective Coatings for Metals.
 - .3 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturer's Association (CPMA).
 - .1 CISC/CPMA 1-73a, A Quick-drying One-coat Paint for use on Structural Steel.
 - .4 Canadian Standards Association (CSA International)
 - .1 CAN/CSA G40.20/G40.21-98, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA-G164-M92(R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CAN/CSA-S16-01, Limit States Design of Steel Structures.
 - .4 CAN/CSA-S136-94(R2001), Cold Formed Steel Structural Members.
 - .5 CSA-S136.1-95(R2001), Commentary on CSA Standard S136.
 - .6 CSA W47.1-92(R2001), Certification of Companies for Fusion Welding of Steel Structures.
 - .7 CSA W55.3-1965(R1998), Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
 - .8 CSA W59-M1989(R2001), Welded Steel Construction (Metal Arc Welding) Metric.
 - .5 The Society for Protective Coatings (SSPC)
 - .1 SSPC-SP-1 Solvent Cleaning
 - .2 SSPC-SP-2 Hand Tool Cleaning

- .3 SSPC-SP-3 Power Tool Cleaning
- .4 SSPC-SP-6 / NACE No. 3 Commercial Blast Cleaning
- .5 SSPC-SP-11 / Power Tool Cleaning to Bare Metal

1.3 DESIGN REQUIREMENTS

- .1 Structural design in conformance with the provincial building code latest edition, and the National Building Code of Canada 2010, latest edition.
- .2 Structural materials method and design in conformance with the latest edition of all applicable standards and codes.
- .3 Design details and connections in accordance with requirements of CAN/CSA-S16 and CAN/CSA-S136 with CSA-S136.1 to resist forces, moments, shears and allow for movements indicated.
- .4 Shear connections:
 - .1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction" when connection for shear only (standard connection) is required.
 - .2 If shears are not indicated, select or design connections to resist 50% of the shear capacity of the web of the weaker framing member, unless noted otherwise.
- .5 Design all connections as "Bearing Type Connection", except for moment connections which shall be "Friction Type".
- .6 Design vertical/lateral bracing and corrections in accordance with requirements of CAN/CSA-S16 for seismic-load-resisting system of Conventional Construction type ($R_D=1.5$, $R_0=1.3$).
- .7 Submit sketches and design calculations stamped and signed by qualified professional engineer licensed in Province of New Brunswick, Canada for non standard connections.
- .8 All discrepancies in details and dimensions shall be brought to the attention of the engineer prior to commencing related work. Drawings are not to be scaled.
- .9 Importance category of building: Normal

1.4 SHOP DRAWINGS

- .1 Submit shop drawings including fabrication and erection documents and materials list in accordance with Section 01 30 00 – Administrative Requirements.
- .2 Erection drawings: indicate details and information necessary for assembly and erection purposes including:
 - .1 Description of methods.
 - .2 Sequence of erection.
 - .3 Type of equipment used in erection.
 - .4 Temporary bracings.

- .3 Ensure Fabricator drawings showing designed assemblies, components and connections are stamped and signed by qualified professional engineer licensed in the province of New Brunswick, Canada.

1.5 QUALITY ASSURANCE

- .1 Provide structural steel Fabricator's affidavit stating that materials and products used in fabrication conform to applicable material and products standards specified and indicated.

Part 2 Products

2.1 MATERIALS

- .1 Structural steel:
 - .1 To CAN/CSA-G40.20/G40.21, Grade 350W or to ASTM A572, Grade 50 for W, HP and WT shapes.
 - .2 To CAN/CSA-G40.20/G40.21, Class C, Grade 350W or to ASTM A500, Class C, Grade 50 for hollow structural sections.
 - .3 To CAN/CSA-G40.20/G40.21, Grade 300W for other shapes and plates.
- .2 Anchor rods: to ASTM A193, Grade B7, unless indicated otherwise on drawings.
- .3 Expansion anchors: KB-TZ 19 mm x 254 mm Kwik Bolt TZ expansion anchor by Hilti (unless indicated otherwise) or approved equal.
- .4 Bolts, nuts and washers: to ASTM A325M, unless indicated otherwise.
- .5 Welding materials: to CSA W59 and certified by Canadian Welding Bureau.
- .6 Hot dip galvanizing (where applicable): galvanize steel, where indicated, to CAN/CSA-G164, minimum zinc coating of 600 g/m².
- .7 Shear studs (where applicable): to CSA W59, Appendix H.
- .8 Steel elements concealed below finish floor grade
 - .1 Protective coating: surface tolerant high solids (85% ± 2%) epoxy mastic coating.

2.2 FABRICATION

- .1 Fabricate structural steel in accordance with CAN/CSA-S16, CAN/CSA-S136 and in accordance with reviewed shop drawings.
- .2 Install shear studs in accordance with CSA W59 (where applicable).
- .3 Continuously seal all HSS members by continuous welds and provide drain holes at low points, unless indicated otherwise. Grind smooth.
- .4 Weld metal connections to members, as required, for anchorage of masonry.

2.3 SHOP PAINTING (PRIMER)

- .1 Apply one coat of CISC/CMPD 1-73a primer in shop to all steel surfaces to achieve minimum dry film thickness of 2.0 mils.

Part 3 Execution

3.1 GENERAL

- .1 Structural steel work: in accordance with CAN/CSA-S16 and CAN/CSA-S136.
- .2 Welding: in accordance with CSA W59.
- .3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

3.2 MARKING

- .1 Mark materials in accordance with CAN/CSA G40.20/G40.21. Do not use die stamping. If steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.
- .2 Match marking: shop mark bearing assemblies and splices for fit and match.

3.3 ERECTION

- .1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16, CAN/CSA-S136 and in accordance with reviewed erection drawings.
- .2 Field cutting or altering structural members: to approval of Engineer.
- .3 Clean with mechanical brush and touch up painting system to bolts, rivets, welds and burned or scratched surfaces at completion of erection.
- .4 Continuously seal members by continuous welds where indicated. Grind smooth.
- .5 Steel Contractor shall supply all temporary bracing required to maintain plumbness and stability of steel frame during erection until x-bracing have been erected and roof diaphragm completed.
- .6 No openings shall be cut in structural members, unless indicated otherwise on drawings or proper approval is received from Engineer.
- .7 Grout under base plates using procedures in accordance with manufacturer's recommendations, which result in 100% contact over grouted area.

3.4 FIELD QUALITY CONTROL

- .1 Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Engineer.

- .2 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Engineer.
- .3 Owner will pay costs of tests referred in item .1.
- .4 Inspection of connections will be carried out during steel erection. The Contractor shall cooperate with and assist the testing company by providing access to all parts of the work as required.
- .5 Contractor shall be responsible for their own quality control. Inspection by an independent inspector, the Architect and/or the Engineer will not increase or replace Contractor quality control nor relieve them of their contractual responsibility.
 - .1 Test shear studs in accordance with CSA W59.

3.5 FIELD PAINTING

- .1 Touch up damaged surfaces and surfaces to meet the shop applied painting systems unless specified otherwise.
- .2 Protection:
 - .1 Cover all immediate and adjacent surfaces that are not scheduled for the particular application. This should include all adjacent areas that could be affected by overspray.
 - .2 Mask or remove any finish hardware not scheduled for painting.
 - .3 Cover or otherwise protect all surrounding sensitive equipment, including electrical boxes.
 - .4 Special care shall be exercised to prevent painting over equipment tags and plates, information placards, and color coded safety and warning apparatus.
 - .5 During coating application place placards outside of immediate area indicating that painting is in progress.
- .3 Clean-up:
 - .1 At completion of application and repair Contractor shall remove from site all evidence of equipment, unused paint materials, and miscellaneous items and sundries.
 - .2 All spent materials and containers shall be removed from job site and properly disposed.
 - .3 Contractor shall remove all masking, tarpaulins, protective seals, and signage, from all items previously covered and protected.
- .4 Steel elements concealed below finish floor grade
 - .1 Prepare all steel surfaces to SSPC-SP11 (Power Tool Cleaning to Bare Metal)
 - .2 Apply surface tolerant high solids epoxy mastic coatings to manufacturer's recommendation. Apply in two coats of 5.0 mils each.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 American National Standards Institute/National Particleboard Association (ANSI/NPA)
 - .1 ANSI/NPA A208.1-2009 Particleboard.
- .2 ASTM International
 - .1 ASTM A123/A123M-15, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM A153/A153M-09 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - .3 ASTM A307-14 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength.
 - .4 ASTM A653/A653M-15, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .5 ASTM D 5055-13e1, Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists.
 - .6 ASTM D 5456[14b, Standard Specification for Evaluation of Structural Composite Lumber Products.
 - .7 ASTM F1667-13 Standard Specification for Driven Fasteners: Nails, Spikes and Staples.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-11.3-M87, Hardboard.
 - .2 CAN/CGSB-71.26-M88, Adhesive for Field-Gluing Plywood to Lumber Framing for Floor Systems.
- .4 Canadian Wood Council
 - .1 Wood Design Manual 2010 (R2014) Edition
 - .2 Engineering Guide for Wood Frame Construction 2014
- .5 CSA International
 - .1 CAN/CSA-A123.2-03 (R2013), Asphalt Coated Roofing Sheets.
 - .2 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.
 - .3 CSA O86-14 Engineered Design in Wood
 - .4 CSA O112.9-10, Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).
 - .5 CSA O121-08 (R2013), Douglas Fir Plywood.
 - .6 CSA O141-05 (R2014), Softwood Lumber.
 - .7 CSA O151-09 (R2014), Canadian Softwood Plywood.
 - .8 CSA O153-13, Poplar Plywood.
 - .9 CSA O325-07 (R2012), Construction Sheathing.
 - .10 CAN/CSA-S406-92 (R2008), Construction of Preserved Wood Foundations.

- .11 CAN/CSA-Z809-08, Sustainable Forest Management.
- .6 Forest Stewardship Council (FSC)
 - .1 FSC-STD-01-001-2004, FSC Principle and Criteria for Forest Stewardship.
- .7 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber 2010.
- .8 National Research Council Canada (NRC)
 - .1 National Building Code of Canada 2015 (NBC).
- .9 South Coast Air Quality Management District (SCAQMD), California State (SCAQMD)
 - .1 SCAQMD Rule 1168-A2005, Adhesives and Sealants Applications.
- .10 Sustainable Forestry Initiative (SFI)
 - .1 SFI-2015-2019 Standard.
- .11 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S706-09, Standard for Wood Fibre Insulating Boards for Buildings.

1.2 QUALITY ASSURANCE

- .1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.

1.3 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.
 - .2 Include manufacturer's pre-engineered floor, ceiling and roof joist span charts, and manufacturer's pre-engineered installation details.
 - .3 Submit certified test reports for prefabricated structural members from approved independent laboratory indicating compliance with specifications for specified performance characteristics and physical properties.
 - .4 Submit CCMC Product Evaluation Report for engineered wood products.
 - .5 Submit manufacturer's installation instructions.
- .3 Shop Drawings:

- .1 For structural applications or conditions beyond the scope of the manufacturer's pre-engineered design information, submit drawings stamped and signed by professional engineer registered or licensed in Province of NB, Canada.
- .2 Include on drawings:
 - .1 Design data in accordance with CAN/CSA-O86 and CWC Engineering Guide for Wood Frame Construction.
 - .2 Indicate configuration and spacing of joists, hanger and connector types, fasteners, locations and design values; bearing details.
 - .3 Submit stress diagrams or print out of computer design indicating design loads for members. Indicate allowable load and stress increase.
 - .4 Indicate arrangement of webs or other members to accommodate ducts and other specialties.

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 dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store materials off ground with moisture barrier at both ground level and as a cover forming a well-ventilated enclosure, with drainage to prevent standing water.
 - .3 Store wood I-beams and I-joists on edge.
 - .4 Stack, lift, brace, cut and notch engineered lumber products in strict accordance with manufacturer's instructions and recommendations.
 - .5 Store and protect architecturally exposed lumber from nicks, scratches, and blemishes.
 - .6 Replace defective or damaged materials with new.
 - .7 Store separated reusable wood waste convenient to cutting station and work areas.

Part 2 Products

2.1 STRUCTURAL FRAMING

- .1 Lumber: softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:
 - .1 CSA O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
- .2 Plant fabricated structural wood:

- .1 Proprietary prefabricated I-joists of solid, laminated veneer lumber glue laminated lumber flanges or oriented strandboard panel web, with factory pre-punched knock-out holes for electrical services and ventilation holes for roof joists.
- .2 Proprietary prefabricated open web parallel chord joists of solid, laminated veneer lumber glue laminated lumber flanges or oriented strandboard panel web, and ventilation holes for roof joists with factory pre-punched knock-out holes for electrical services.
- .3 Adhesive: Exterior rated phenol-formaldehyde or phenol-resorcinol: to CSA O112.9.
- .4 Plant fabrication with quality control in accordance with ASTM D 5055.
- .3 Structural Composite Lumber (SCL) in accordance with ASTM D 5456, for following uses:
 - .1 Laminated veneer lumber (LVL): hip and valley rafters, headers and beams as indicated.
 - .2 Parallel strand lumber (PSL): headers and beams as indicated.
 - .3 Laminated strand lumber (LSL): studs as indicated.
 - .4 Oriented strand lumber (OSL): studs as indicated.
- .4 Plywood, OSB and wood based composite panels: to CSA O325.
- .5 Canadian softwood plywood (CSP): to CSA O151, standard construction.

2.2 ACCESSORIES

- .1 Subflooring adhesive: to CAN/CGSB-71.26, cartridge loaded.
- .2 General purpose adhesive: to CSA O112.9.
- .3 Nails, spikes and staples: to ASTM F1667.
- .4 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.
- .5 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.
- .6 Joist hangers, connectors and fasteners: in accordance with accepted shop drawings, minimum 1 mm thick sheet steel, galvanized to minimum ZF001] coating designation.
- .7 Nailing discs: flat caps, minimum 25 mm diameter, minimum 0.4 mm thick, sheet metal, fibre, formed to prevent dishing. Bell or cup shapes not acceptable.
- .8 Roof sheathing H-Clips: formed "H" shape, thickness to suit panel material, extruded 6063-T6 aluminum alloy type approved by Consultant.
- .9 Fastener Finishes:
 - .1 Galvanizing: to CAN/CSA-G164, use galvanized fasteners for exterior work and interior highly humid areas.
 - .2 Proprietary corrosion resistant fasteners for pressure- preservative treated lumber: as recommended by manufacturer for material and service conditions and as specified in Section 06 05 73.
 - .3 Plated finish: use cadmium plated fasteners for interior work.

- .10 Wood Preservative: as specified in Section 06 05 73- Wood Treatment.
- .11 Sill Plate Gasket: Closed cell polyethylene foam gasket in width to match sill plate width, 6 mm thick.

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

3.2 SYSTEMS INTEGRATION

- .1 Install air barrier and vapour retarder sheeting around framing members to ensure continuity of protection and to lap and seal to main sheets.
- .2 Install insulation in exterior wall framing cavities that will not be accessible after completion of framing.
- .3 Install sill plate gasket in continuous lengths between concrete surfaces and wood framing.

3.3 FRAMING INSTALLATION

- .1 Install engineered framing and plant fabricated structural wood components, including all hangers, connectors and fasteners, in accordance with accepted shop drawings and manufacturers' instructions.
- .2 Install members true to line, levels and elevations, square and plumb.
- .3 Construct continuous members from pieces of longest practical length.
- .4 Install spanning members with "crown-edge" up.
- .5 Select exposed framing for appearance. Install [lumber] [panel] materials so that grade-marks and other defacing marks are concealed or are removed by sanding where materials are left exposed.
- .6 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- .7 Countersink bolts where necessary to provide clearance for other work.
- .8 Install specified panel product for each application.
- .9 Install combined subfloor and underlay with panel end-joints located on solid bearing, staggered at least 800 mm.
 - .1 In addition to mechanical fasteners, floor panels secure floor subflooring to floor joists using glue. Place continuous adhesive bead in accordance with manufacturer's instructions, single-bead on each joist and double-bead on joists where panel ends butt.

- .10 Install wall sheathing in accordance with manufacturer's printed instructions and requirements of NBC.
- .11 Install roof sheathing in accordance with requirements of NBC.
- .12 Use nailing disks for soft sheathing as recommended by sheathing manufacturer.

3.4 FURRING AND BLOCKING

- .1 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding, and other work as required.
- .2 Install furring to support siding applied vertically where 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.
- .3 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .4 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized steel fasteners.
- .5 Install sleepers as indicated.

3.5 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 06 10 00 – Rough Carpentry.
- .2 Section 06 18 00 – Glued-Laminated Structural Units.

1.2 REFERENCES

- .1 National Lumber Grades Authority
 - .1 NLGA Standard Grading Rules for Canadian Lumber 2005.
- .2 CSA-086-09, Engineering Design in Wood (Limit States Design).

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

- .1 Materials and products in accordance with Section 01 60 00 – Product Requirements.

2.2 MATERIALS

- .1 Wood decking: to NLGA standard Grading Rules for Canadian Lumber Commercial grade Spruce-Pine-Fir Commercial Grade, predrilled at 750 mm on centre for lateral spiking, single tongue and groove and "Veed" one side. Kiln dry decking to 15% maximum moisture content.
- .2 Decking lengths: 1.8 to 6 m or longer with a minimum of 90% planks exceeding 3 m. Square end trimmed. For single spans shorter than 3 m use decking of same length as span.
- .3 Nails: to CSA B111, hot dipped galvanized finish; sizes as recommended in CAN/CSA O86. Supply 200 mm spiral spikes for lateral nailing.
- .4 Splines: galvanized metal, as recommended by decking manufacturer.
- .5 Wood preservative: by Division 9.

Part 3 Execution

3.1 INSTALLATION

- .1 Do wood deck work in accordance with CAN/CSA O86 except where specified otherwise.

-
- .2 Install decking in accordance with CAN/CSA O86, controlled random pattern (Figure 2.2).
 - .3 Provide minimum of one bearing support for each plank except extend cantilevers over two supports. Install sloping deck with tongues up. Join butt ends with splines to assure tight square fit.
 - .4 Stagger end joints in adjacent planks minimum of 0.5 m. Separate joints in same area by at least two intervening courses. Avoid joints in first fifth of end spans. Minimize joints in middle third of span.
 - .5 Apply preservative to end cuts where pressure treated lumber is specified.

3.2 CLEANING

- .1 Remove tool marks, bruises, and scratches.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 This Section includes requirements for supply and installation of shop-fabricated wood trusses using light-gauge metal connection plates and truss accessories required for a complete structural system with the following components:
- .2 This Section requires delegated design, engineering analysis and preparation of sealed and signed shop drawings performed by a qualified, supporting professional engineer registered or licensed in NB, Canada who is retained by the truss fabricator responsible for fabrication of wood trusses described in this Section.

1.2 RELATED REQUIREMENTS

- .1 Section 06 05 73 – Wood Treatment
- .2 Section 06 10 53 – Miscellaneous Rough Carpentry

1.3 REFERENCE STANDARDS

- .1 ASTM International (ASTM):
 - .1 ASTM A653/A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
 - .2 ASTM A780/A780M-20, Standard Practice for Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings
 - .3 ASTM D7612-21, Standard Practice for Categorizing Wood and Wood-Based Products According to their Fiber Sources
 - .4 ASTM F1667-13 Standard Specification for Driven Fasteners: Nails, Spikes and Staples
- .2 CSA Group (CSA)
 - .1 CSA B111 74 Wire Nails, Spikes and Staples
 - .2 CSA O86 Consolidation-14, Engineering Design in Wood.
 - .3 CSA S347-14, Method of Test for Evaluation of Truss Plates Used in Lumber Joints.
 - .4 CSA W47.1-19, Certification of Companies for Fusion Welding of Steel.
- .3 Forest Stewardship Council (FSC)
 - .1 FSC-STD-01-001-2015, FSC Principle and Criteria for Forest Stewardship
- .4 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber 2017
 - .2 NLGA SPS-1-2013, Fingerjoined Structural Lumber
 - .3 NLGA SPS-2-2013, Machine Graded Lumber
 - .4 NLGA SPS-4-2020, Fingerjoined Machine Graded Lumber

- .5 National Research Council Canada (NRC)
 - .1 National Building Code of Canada (NBC) 2015
 - .2 Canadian Construction Materials Centre (CCMC), Registry of Product Evaluations
- .6 Truss Plate Institute of Canada (TPIC)
 - .1 BCSI Canada 2014, Building Component Safety Information Book, Guide to Good Practice for Handling, Installing, Restraining and Bracing of Metal Plate Connected Wood Trusses
 - .2 TPIC - 2019, Truss Design Procedures and Specifications for Light Metal Plate Connected Wood Trusses (Limit States Design).
 - .3 TPIC TB4-2020, Design for Corrosive Environments
- .7 Sustainable Forestry Initiative (SFI)
 - .1 SFI-2015-2019 (extended through December 2021) SFI Forest Management Standard

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordination: Coordinate temporary protective measures required by this Section to prevent exposure to weather and other deleterious environmental conditions in accordance with Section 01 35 43 – Environmental Procedures.

1.5 SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Action Submittals (to be provided before starting any work of this Section):
 - .1 Product Data:
 - .1 submit truss fabricator’s installation instructions, special handling criteria, installation sequence, and printed product literature and data sheets describing product characteristics, performance criteria, physical size, finish and limitations of hardware components required for installation.
 - .2 Shop Drawings: Prepare and submit shop drawings in accordance with the Truss Plate Institute of Canada (TPIC) Truss Design Drawing requirements indicating connection details, erection sequence, framing details and the following:
 - .1 Special Requirements: Identify special structural modifiers (if any) that may be required by local AHJ.
 - .2 Wood Truss Drawings: Indicate applicable TPIC Truss Design Procedures and CSA O86 engineering requirements, including the following:
 - .3 Indicate stress diagram or print out of computer design indicating design load for truss members - include allowable load and stress increase.
 - .4 Indicate arrangement of webs or other members to accommodate ducts and other specialties.
 - .5 Indicate adjustments to lumber and connector plate design values based on conditions of use (if any).

- .6 Indicate connector plate types, thickness, size and location at each joint, except where symmetrical configurations allow for centreline illustration of joints.
- .7 Indicate connection requirements for truss to bearing, truss or girder ply to ply and site-assembled splices.
- .8 Indicate end connections of trusses to resist uplift and lateral reactions.
- .9 Supporting professional engineer registered or licensed in NB, Canada, is required to seal and sign design solutions presented in submitted shop drawings prepared under their supervision.
- .3 Placement Drawings: Submit placement and layout drawings for review by Consultant including the following:
 - .1 Indicate sequence of installation and erection, and temporary bracing requirements.
 - .2 Label truss and girder layouts using the same identification numbers indicated on shop drawings described in Subparagraph 1.6.2.2 above.
 - .3 Indicate partitions being used as bearing walls.
 - .4 Indicate hanger type used for connecting trusses to girder trusses and beams.
 - .5 Indicate connection requirements for truss to bearing, truss or girder ply to ply and site-assembled splices when not indicated on shop drawings described in Subparagraph 1.6.2.2 above.

1.6 QUALITY ASSURANCE

- .1 Qualifications: When requested by Consultant, provide proof of qualifications as described in Article 1.6, Submittals.
 - .1 Truss Fabricators: Obtain shop-fabricated structural wood trusses and accessories from a single fabrication source qualified in accordance with CWTA National Quality Standard that can provide evidence of In-Plant Qualification Program recognized by regional wood truss associations or other proof of manufacturing and design capability acceptable to the Consultant.
 - .2 Truss Plate Manufacturer: Provide evidence that plates used for truss manufacturing are manufactured to meet testing requirements of CSA S347, and are listed in the Registry of Product Evaluations published by Canadian Construction Materials Centre (CCMC), or other proof of manufacturing capability acceptable to the Consultant.
 - .3 Welded Connection Fabricator: Provide welded connections fabricated in a shop certified by CWB to CSA W47.1, Division 1 or 2.1.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Delivery and Acceptance Requirements: Deliver, handle, store and protect materials in accordance with truss fabricator's written instructions, and in accordance with BCSI Canada.
- .2 Storage and Handling Requirements:

- .1 Provide bearing supports and bracings to prevent bending, warping and overturning of trusses, in accordance with truss fabricator's written instructions and in accordance with BCSI Canada
- .2 Store and protect materials from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the truss fabricator
- .3 Keep materials dry
- .4 Store trusses on hard, dry and level surface
- .5 Do not store truss lumber in direct contact with ground
- .6 Do not expose trusses to prolonged weather exposure

1.8 SITE CONDITIONS

- .1 Site Measurements: Verify dimensions by site measurements before fabrication and indicate measurements on shop drawings where shop-fabricated wood trusses are indicated to fit between or around other construction. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- .2 Established Dimensions: Establish dimensions and proceed with fabricating shop-fabricated wood trusses without site measurements where site measurements cannot be made without delaying the Work. Coordinate construction to ensure that actual site dimensions correspond to established dimensions; allow for trimming and fitting.

Part 2 Products

2.1 DESCRIPTION

- .1 Regulatory Requirements: Fabricate trusses, bracing and bridging in accordance with CSA O86 using truss joint components tested in accordance with CSA S347, and using products bearing accredited stamp with the manufacturer's name and certificate number, grade, CCMC certificate number (if applicable) and quality control agency.
 - .1 Qualification Markings: Apply CWTA Plant Qualification marking or tag or other plant certification agency accredited by the Standards Council of Canada to each truss assembly in a readily visible location.
 - .2 Loading: Design trusses to account for minimum uniform and minimum concentrated loadings stipulated in NBC commentary applicable to metal plate connected wood trusses.
 - .3 Loading Markings: Apply additional special markings at point load locations other than truss heels on each truss, and on bottom chord of bottom bearing, parallel chord trusses.
- .2 Lumber Grades: Provide lumber products that are all sides finished (S4S) in nominal dimensions required for the project; grade marked by accredited agencies of the Canadian Lumber Standards Accreditation Board and that conform to National Grading Rules published by NLGA.
 - .1 Grading: Machine Grading, Visual Grading, or Both
 - .2 Moisture Content: Kiln Dry, 19% or less
 - .3 Structural Design Properties: Strength and related properties in accordance with CSA O86 and NLGA SPS 2

- .4 Acceptable Alternate Products: Lumber products meeting requirements of the American Lumber Standards Committee designated ALS Program Lumber and that are accepted by the Canadian Lumber Standards Accreditation Board, may be acceptable for the Project when proof of compliance with strength and related properties meeting CSA O86 are submitted before purchasing any structural wood products
- .3 Fastenings: to CAN/CSA O86.

2.2 DESIGN CRITERIA

- .1 Design Responsibility: Truss fabricator is required to retain a supporting professional engineer registered or licensed in NB, Canada, experienced in the design and detailing of light metal plate connected wood trusses in accordance with TPIC Truss Design Procedures using engineering properties listed in CSA O86 for components described in this Section, and as follows:
 - .1 Loads and forces shown on Drawings are not factored, unless specifically indicated otherwise.
 - .2 The supporting professional engineer will provide the following in accordance with governing standards described in this Section:
 - .1 design of wood truss members for Serviceability Limit States described in TPIC Truss Design Procedures, and as indicated on Drawings
 - .2 design and detailing of wood truss members, bracing and bridging based on design loading and spacing indicated on Drawings
 - .3 design and detailing of connections not specifically detailed on the Drawings
 - .4 details of dimensions to accommodate mechanical services passing through truss members indicated on Drawings
 - .5 written confirmation that components are fabricated in accordance to shop drawings submitted for the Consultant's review
- .2 Structural Performance Requirements: Design shop-fabricated structural wood component connections to allow for building movements without damage or over stressing, connection failures, and imparting undue strain on fasteners and anchors. Also take into account the following structural performance requirements:
 - .1 Wet Service Conditions Modifier: Not Required
 - .2 Dead Loads: Dead loads as indicated on Drawings
 - .3 Live Loads: Live loads as indicated on Drawings
 - .4 Roof Loads: Roof loads as indicated on Drawings
 - .5 Snow Loads: Snow loads as indicated on Drawings
 - .6 Exterior Wind Loads: Wind loads q_{50} for deflection and for strength, modified by importance factors, building exposure, gust effect factors, and pressure coefficients in accordance with structural commentaries and also accounting for the following:
 - .1 Wind Design Data: Location specific data from the NBC
 - .7 Live Load Deflection Limit: $L/360$
- .3 Modifications to Design: Supporting professional engineer registered or licensed in NB, Canada is required to account for changes to dimension and bearing capacities inherent with their Products where they are used to establish the Bid Price, while keeping in mind the following:
 - .1 Changes to placement of girder trusses and other loadbearing elements indicated on Drawings will not be permitted without before the acceptance from the Consultant

- .2 Changes that modify design criteria described by the Consultant will not be permitted without before the acceptance from the Consultant
- .3 No adjustment to contract price will be considered where manufactured or fabricated component sizes must change to account for design loads indicated on Drawings

2.3 MATERIALS

- .1 Truss Framing: Provide wood materials meeting truss fabricator's design requirements and meeting Structural Performance Requirements listed above, and as follows:
 - .1 Preservative treatment of dimensional lumber, refer to Section 06 05 73 – Wood Treatment
 - .2 Fire Retardant Treated Wood (FRTW): Fire retardant treatment of dimensional lumber, refer to Section 06 05 73 – Wood Treatment
 - .3 Sizes: Lumber sizes as described in TPIC Truss Design Procedures.
 - .4 Finger joined Materials: Not allowed
 - .5 Grade: Provide No. 2 Grade and better materials
 - .6 Species Group: Spruce Pine Fir (SPF)
 - .7 Selection for Appearance: Not Required
 - .8 Acceptable Alternate Products: Consultant will permit use of truss grade structural composite lumber that meets requirements of TPIC Truss Design Procedures
- .2 Truss Plates: Provide truss plates meeting requirements of CSA S347, manufactured from galvanized steel sheet meeting requirements of ASTM A653/A653M, having zinc coating designation Z275, and as follows:
 - .1 Grade: Structural steel sheet or high strength, low alloy steel sheet as determined by truss fabricator's supporting professional engineer registered or licensed in NB, Canada, based on loads and use conditions identified by consultant.
 - .2 Duplex Coating: Not Required.
 - .3 Truss Anchors and Hangers: Provide truss anchors and hangers meeting requirements of CSA O86, manufactured from galvanized steel sheet meeting requirements of ASTM A653/A653M, having zinc coating designation Z275; types and configurations as indicated on drawings and as follows:
 - .1 Roof Truss Tie-Downs: Brackets rated for wind uplift loads indicated above

2.4 ACCESSORIES

- .1 Wood Framing and Blocking: Provide sawn lumber materials as specified in Section 06 10 53 – Miscellaneous Rough Carpentry.
- .2 Anchors: Post-installed anchors to substrate materials supplied and installed by this Section, refer to Section 04 05 19 – Masonry Anchorage and Reinforcing and Section 01 61 00 – Common Product Requirements.
- .3 Setting Plates: For setting plates and embedded items supplied in accordance to this Section that are installed in accordance to other Sections, refer to Section 05 50 00 – Metal Fabrications.

- .4 Driven Fasteners: Steel nails, spikes, brads, and staples meeting requirements of ASTM F1667 or CSA B111. Ensure length is sufficient to penetrate connecting solid wood materials.
 - .1 Exterior Work: Hot-dipped galvanized
 - .2 Interior High Humidity Work: Hot-dipped galvanized
 - .3 Interior Work: Electroplated zinc plated, or cadmium plated
 - .4 Pressure Treated Materials: Refer to Section 06 05 73 – Wood Treatment

2.5 FABRICATION

- .1 Fabricate wood trusses based on the reviewed shop drawings that were created in accordance with TPIC Truss Design Procedures at an accredited truss plant participating in CWTA In-Plant Qualification Program and with the following:
 - .1 Assemble truss members in design configuration required for Project
 - .2 Assemble truss members using jigs or other means to maintain uniformity and accuracy of assembly with joints closely fitted to meet tolerances listed by TPIC Truss Design Procedures
 - .3 Account for design camber and roof slopes when positioning truss members

2.6 SOURCE QUALITY CONTROL

- .1 In-Plant Testing and Inspections:
 - .1 Test a minimum of three (3) trusses of each type as described in CWTA In-Plant Qualification Program and submit a report indicating that tested trusses represent trusses used for the Project
 - .2 Indicate any manufacturing and material variances described in Appendix G of TPIC Truss Design Procedures
 - .3 Conduct in plant testing and inspections in accordance with CSA S347
 - .4 Document any follow-up repairs, rework or replacement of trusses for non conforming materials or variances in workmanship
 - .5 Supporting professional engineer registered or licensed in NB, Canada, will direct all follow up repairs and rework and validate that trusses delivered to the Project meet specified requirements

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 Consultant
 - .2 Inform Consultant of unacceptable conditions immediately upon discovery
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Consultant

3.2 PREPARATION

- .1 Concentrated Load Prevention: Prevent concentrated loads on trusses until required bracing and sheathing is installed; do not permit stacking of sheathing bundles, lumber and other materials on unsheathed trusses.

3.3 ERECTION

- .1 Installation Requirements:
 - .1 Erect wood trusses in accordance with reviewed shop drawings, fabricator's written instructions, and in accordance with BCSI Canada
 - .2 Make adequate provisions for handling and erection stresses
 - .3 Exercise care to prevent out-of-plane bending of trusses
 - .4 Install temporary horizontal and cross bracing to hold trusses plumb and in safe condition until permanent bracing and decking are installed
 - .5 Install permanent bracing, bridging and sheathing in accordance with reviewed shop drawings, before the application of loads to trusses
 - .6 Do not cut or remove any truss component without written confirmation by Consultant, and supporting professional engineer registered or licensed in NB, Canada
- .2 Bracing Requirements:
 - .1 Install permanent lateral bracing as indicated on shop drawings, in size and grade described, and fastened at locations shown using number and size of nails described on truss shop drawings
 - .2 Restrain lateral movement of bracing using permanently installed cross bracing at ends of each truss run and evenly spaced at intervals of six (6) metres or less
 - .3 Restrain top chord of trusses to prevent lateral movement using sheathing or permanent bracing as indicated on shop drawings
 - .4 Install lateral ties evenly spaced at intervals of three (3) metres or less; with additional permanent lateral bracing as indicated on shop drawings
- .3 Site Modifications: Cutting, notching or drilling of shop-fabricated wood trusses arising from site conditions that do not meet fabricator's standard details will not be permitted without fabricator's written recommendations, as directed by the Consultant.
- .4 Damaged Components:
 - .1 Do not use shop-fabricated wood truss components that exhibit visible damage; damaged components will require replacement with material of same quality and performance as specified Products
 - .2 Notify Consultant and supporting professional engineer immediately of any damage to wood truss components
 - .3 Supporting professional engineer registered or licensed in NB, Canada, will recommend repair or replacement procedures as directed by the Consultant
 - .4 No work for repair or replacement of damaged components will be permitted without Consultant's written instructions
- .5 Protective Coatings: Clean and prepare exposed surfaces of metal connector plates; brush apply primer and one coat of protective coating.

3.4 SITE QUALITY CONTROL

- .1 Truss Fabricator's Site Services: Truss fabricator's supporting professional engineer registered or licensed in NB, Canada, will review completed construction to verify that installation of wood truss system is in accordance with shop drawings and placement drawings. Other site services include:
 - .1 Review products supplied under this Section and confirm that wood truss system handling, installation and erection, protection and cleaning of its products is in accordance with fabricator's written instructions
 - .2 Truss fabricator's site services and recommendations include product use recommendations and periodic site visits for inspection of product installation in accordance with truss fabricator's instructions
 - .3 Schedule site visits to review work at the following stages:
 - .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 after completion of work of this Section, and after cleaning is completed
 - .4 Submit written reports in format acceptable to Consultant, to verify compliance of Work with Contract.

3.5 CLEANING

- .1 Progress Cleaning: Clean in accordance with Section 01 74 00 - Cleaning.
 - .1 Leave Work area clean at the end of each day
- .2 Final Cleaning: Upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 00 - Cleaning

3.6 CLOSEOUT ACTIVITIES

- .1 Non-Conforming Work: Consultant will confirm correction and verification procedures with manufacturer, and instruct Trade Contractor responsible for work of this Section on repair procedures or replacement of non-conforming work.
- .2 Adjusting: Repair damage to adjacent materials caused by installation of materials specified in this Section.
- .3 Repairs:
 - .1 Replace wood trusses that are damaged or do not meet requirements
 - .2 Apply touch-up coating materials to provide minimum dry film thickness recommended by coating system manufacturer
 - .3 Repair damaged galvanized coatings on exposed surfaces with galvanized repair coating in accordance with ASTM A780/A780M and truss plate manufacturer's written instructions

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 30 00 – Administrative Requirements.
- .2 Section 06 10 00 – Rough Carpentry.
- .3 Section 06 15 00 – Wood Decking.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A307-10, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM A653/A653M-10, Standard 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 B111-1974 (R2003), Wire Nails, Spikes and Staples.
 - .2 CSA G40.20-04/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .3 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .4 CSA O86-09, Engineering Design in Wood.
 - .5 CSA O112.9-10, Evaluation of adhesives for structural wood products (exterior exposure).
 - .6 CAN/CSA-O122-06 (R2011), Structural Glued-Laminated Timber.
 - .7 CAN/CSA-O177-06 (R2011), Qualification Code for Manufacturers of Structural Glued-Laminated Timber.
 - .8 CAN/CSA-S16-09, Design of Steel Structures.
 - .9 CSA W47.1-09, Certification of Companies for Fusion Welding of Steel.
- .3 Forest Stewardship Council (FSC)
 - .1 FSC-STD-01-001 (V4-0) EN, FSC Principles and Criteria for Forest Stewardship.
 - .2 FSC-STD-20-002 (V3-0) EN, Structure, content and local adaptation of Generic Forest Stewardship Standards.
- .4 Health Canada / Workplace Hazardous Materials Information System (WHMIS).
- .5 Canadian Construction Material Centre (CCMC)
 - .1 CCMC's Registry of Product Evaluations, October 1st, 2000 On-line Edition (updated quarterly).

1.3 SUBMITTALS

- .1 Submit in accordance with Section 01 30 00 – Administrative requirements.

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- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for glued-laminated construction and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit WHMIS MSDS in accordance with 01 30 00 – Administrative Requirements.
 - .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of New Brunswick, Canada.
 - .2 Submit erection drawings in accordance with CSA S16 and CSA O86.
 - .3 Shop drawings for members: indicate stress grade, service grade and appearance grades, shop applied finishes, camber, cuts, ledgers, holes and connection details.
 - .4 Certifications: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .1 Submit manufacturer's plant certification based on the material evaluation report listed in the Registry of Product Evaluations published by the Canadian Construction Material Centre (CCMC) or the product report published by a certification agency accredited by the Standards Council of Canada at completion of fabrication.
 - .5 Test and Evaluation Reports: submit certified test reports from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
 - .6 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.
 - .7 Prepare sample of typical beam to beam, beam to column and x-bracing connection details for approval of Engineer. Samples to be judged upon alignment of surfaces, exposed fasteners and aesthetics. When approved, sample units will serve as a standard for workmanship, appearance and material acceptable for entire project.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Manufacture structural glued-laminated members in plant certified as meeting requirements of CSA O177.
 - .2 Submit certificate of conformity based on the material evaluation report listed in the Registry of Product Evaluations published by the Canadian Construction Material Centre (CCMC) or the product report published by a certification agency accredited by the Standards Council of Canada at completion of fabrication.
 - .3 Fabricator for welded steel connections to be certified to CSA W47.1.
 - .4 Place, on glued-laminated or cross-laminated members, the material evaluation report number listed in the Registry of Product Evaluations published by the Canadian Construction Material Centre (CCMC) or the product report number published by a certification agency accredited by the Standards Council of Canada indicating manufactured in certified plant.

.5 Certification of material protective sealer.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 60 00 – Products Requirements and with manufacturer’s written instructions.
- .2 Delivery and Acceptance Requirements:
 - .1 Deliver materials to site in original factory packaging, labeled with manufacturer’s name and address.
 - .2 Apply protective sealer to glued-laminated units before shipping unless specified otherwise.
 - .3 Wrap architectural grade members prior to leaving plant with a moisture resistant wrapping.
 - .4 Use padded, non-marring slings for handling glued-laminated members.
 - .5 Protect corners with wood blocking.
 - .6 Make adequate provision for delivery and handling stresses.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground and in accordance with manufacturer’s recommendations in clean, dry, well-ventilated area.
 - .2 Slit underside of membrane covering during storage at site without defacing member.
 - .3 Store glued-laminated units and protect from weather, block off ground and separate with stripping, so air may circulate around faces of members.
 - .4 Cover glued-laminated units with opaque moisture resistant membrane if stored outside.
 - .5 Store and protect glued-laminated products from nicks, scratches, and blemishes.
 - .6 Replace defective or damaged materials with new, unless written approval by the manufacturer.

Part 2 Products

2.1 MATERIALS

- .1 Laminating stock:
 - .1 Glued-laminated: Spruce FSC Certified, based on the material evaluation report listed in the Registry of Product Evaluations published by the Canadian Construction Material Centre (CCMC).
 - .2 Columns and beams to be 24F-E.
- .1 Adhesive: to CSA O112.10, to grade of service required in accordance with CAN/CSA-O122.
 - .1 Urea-formaldehyde free.
- .2 Sealer for glued-laminated members: penetrating type, clear, non-yellowing liquid.
- .3 Fastenings:

- .1 Split ring connections: hot rolled carbon steel, SAE 1010, in accordance with SAE handbook.
- .2 Shear plate connectors.
 - .1 Pressed steel type: hot rolled carbon steel, SAE 1010, in accordance with SAE handbook.
 - .2 Malleable iron type: to ASTM A47/A47M, grade 350.
- .3 Lag screws: to ASME B18.2.1.
- .4 Bolts: to ASTM A307.
- .5 Side plates: to CSA-G40.20/G40.21 or ASTM A36.
- .6 Drift pins: to ASTM A307.
- .7 Glued-laminated timber rivets: hot dip galvanized to CSA-G40.20/G40.21 or ASTM A36.
- .8 Nails and spikes: to CSA B111.
- .9 Wood screws: to ASME B18.2.1.
- .4 Shop coat primer for steel connections: to CAN/CGSB-1.40.
- .5 Galvanizing: to CAN/CSA-G164, hot dipped, minimum zinc coating of 610 g/m².
- .6 Preservative/Coatings/Paint Finish: by Division 9.

2.2 FABRICATION

- .1 Fabricate members to following classifications:
 - .1 Stress grade:
 - .2 Glued-laminated: Spruce-Pine 24F-1.9EX for beams and columns, for bending, compression and/or tension members, to the material evaluation report listed in the Registry of Product Evaluations published by the Canadian Construction Material Centre (CCMC).
 - .3 Service grade:
 - .1 Glued-laminated timber: Exterior.
 - .4 Appearance grade:
 - .1 Glued-laminated timber: Architectural Exposed (Quality).
- .2 Mark laminated members for identification during erection. Marks not to be visible in final assembly.
- .3 Do not apply sealer to areas which are to receive stained finish or preservative treatment.
- .4 Design connections to CSA O86, and CSA S16 unless specifically detailed, to resist shears, moments and forces indicated.
 - .1 Fabricate in accordance with CSA S16.
- .5 Galvanize connections after fabrication.

Part 3 Execution

3.1 EXAMINATION

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

3.2 PRESERVATIVE TREATMENT

- .1 Pressure treat all members with preservative in accordance with CAN/CSA O80 Series after fabrication.

3.3 ERECTION

- .1 Protect protective sealer from damage before erection.
 - .1 Touch up damaged areas on site with specified sealer.
- .2 Erect glued-laminated members in accordance with for construction erection drawings.
- .3 Brace and anchor members until permanently secured by structure.
- .4 Make adequate provisions for erection stresses.
- .5 Splice and join only at locations as indicated on for construction erection drawings.
- .6 Do not field cut or alter members without manufacturer's approval. If approved, preservative treat cut ends.
- .7 Erect glued-laminated decking in accordance with for construction erection drawings.
 - .1 Install glued-laminated decking in a single/ or multiple/span continuous pattern as indicated on the drawings (no controlled random pattern).
 - .2 When possible, stagger end joints in adjacent elements over supports.
 - .3 Nail decking to supports and adjacent courses as shown on the drawings. When the underside of the decking is to have an architecture appearance, particular care must be taken when nailing the decking to supports or to adjacent elements, and when nailing other miscellaneous framing to the wood decking, that nails do not penetrate through the full thickness of the decking.

3.4 FIELD QUALITY CONTROL

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, protecting and cleaning of product..
 - .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.

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- .3 Ensure manufacturer's representative is present before and during critical periods of installation.
 - .4 Schedule site visits:
 - .1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.
 - .2 Twice during progress of Work at 25% and 60% complete.
 - .3 Upon completion of the Work, after cleaning is carried out.

3.5 CLEANING

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

3.6 PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 03 30 00 – Cast-in-Place Concrete.

1.2 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C 208-95(2001), Specification for Cellulosic Fiber Insulating Board.
 - .2 ASTM C 591-01, Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
 - .3 ASTM C 612-04, Standard Specification for Mineral Fibre Block and Board Thermal Insulation.
 - .4 ASTM C 726-05, Standard Specification for Mineral Fiber Roof Insulation Board.
 - .5 ASTM C 728-05, Standard Specification for Perlite Thermal Insulation Board.
 - .6 ASTM C 1126-04, Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
 - .7 ASTM C 1289-05a, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 - .8 ASTM E 96/E 96M-05, Standard Test Methods for Water Vapour Transmission of Materials.
- .2 Canadian Gas Association (CGA)
 - .1 CAN/CGA-B149.1-05, Natural Gas and Propane Installation Code Handbook.
 - .2 CAN/CGA-B149.2-05, Propane Storage and Handling Code.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 71-GP-24M-77(R1983), Adhesive, Flexible, for Bonding Cellular polystyrene Insulation.
- .4 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S604-M91, Standard for Type A Chimneys.
 - .2 CAN/ULC-S701-05, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.
 - .3 CAN/ULC-S702-97, Standard for Thermal Insulation, Mineral Fibre, for Buildings.
 - .4 CAN/ULC-S704-03, Standard for Thermal Insulation Polyurethane and Polyisocyanurate, Boards, Faced.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

- .1 Product Data:

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- .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 at appropriate recycling facilities.
 - .2 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material.
- Part 2 Products**
- 2.1 INSULATION**
- .1 Underslab and foundation insulation: expanded polystyrene, to CGSB 51-GP-20M, Type 4 of thickness indicated.
 - .1 Type: 4.
 - .2 Compressive strength: 275 kPa (40 psi) minimum.
 - .3 Thickness: 2 - 51mm layers.
 - .4 Size: as required.
 - .5 Edges: square.
- 2.2 ACCESSORIES**
- .1 Tape as recommended by insulation board's 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 WORKMANSHIP

- .1 Install insulation to maintain continuity of thermal protection to building elements and spaces.
- .2 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.
- .3 Offset both vertical and horizontal joints in multiple layer applications.
- .4 Do not enclose insulation until it has been inspected and approved by Engineer.

3.3 EXAMINATION

- .1 Examine substrates and immediately inform Engineer-Architect 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 PERIMETER FOUNDATION INSULATION

- .1 Install boards horizontally under the entire concrete slab as indicated on drawings. Lay boards on level compact fill.

3.5 CLEANING

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

END OF SECTION

Part 1 General

1.1 GENERAL

- .1 All provisions of the Bidding Requirements, Contract Forms, Conditions of Contract and Division 1 – General Requirements apply to and govern this Section.

1.2 RELATED WORK

- .1 Section 31 23 33-01 – Excavating, Trenching and Backfilling.
- .2 Section 03 20 00 – Concrete Reinforcing.
- .3 Section 03 30 00 – Cast-In-Place Concrete.
- .4 Section 07 21 13 – Rigid Insulation.

1.3 WORK INCLUDED

- .1 Final grading and compaction of granular base.
- .2 Supply, grading and compacting of sand fill beneath the insulation (coordinate for installation of subsoil heating piping in sand layer).
- .3 Installation of board insulation.
- .4 Concrete rink slab including reinforcement, supports and inserts (coordinate for installation of rink chairs).
- .5 Hardening, finishing and curing of slab.

1.4 WORK NOT INCLUDED

- .1 Plastic piping and rink chair supports by Mechanical Contractor.

1.5 REFERENCE STANDARDS

- .1 CAN/CSA-A23.1-14: Concrete Materials and Methods of Concrete Construction.
- .2 CAN/CSA-A23.2-14: Methods of Test for Concrete.
- .3 CSA CAN3-A23.3-04: Design of Concrete Structures for Buildings.
- .4 Do concrete work to the reference standards unless noted otherwise, including storage, proportioning, mixing, placing, compacting, screeding, surfacing, testing, curing (in hot and cold weather), design and use of forms, and placing of reinforcement.

1.6 QUALIFICATIONS

- .1 Only pre-approved specialty firms will be accepted as qualified for installation of ice rink slab.

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- .2 Submit proof of installation of similar slabs which have been in continuous satisfactory operation for not less than two years.

1.7 INSPECTION AND TESTING

- .1 Testing of sub-base, structural fill and concrete will be carried on by a testing company designated by the Engineer. Testing company costs will be paid by Owner.
- .2 Compaction tests of sub-base and structural fill will be made on the basis of one test per 50 square metres of floor area.
- .3 Submit proposed mix designs for approval to testing company.
- .4 The testing company will supervise pouring and finishing of the slabs. Concrete tests will be carried out by the testing company at the commencement of the pour, near the end of the pour and at the one-third and two-thirds points of the pour. Each test will consist of a set of three cylinders. In addition, the slump, air content and temperature of the concrete will be monitored continuously by the testing company.

1.8 GUARANTEE

- .1 Provide a recognized Surety Company's Guarantee Bond, indemnifying of Owner for a period of two (2) years against damage caused by cracking, shrinking, dusting of concrete or any other defects under this Contractor's control. This shall form a specific guarantee to the Owner.

Part 2 Products

2.1 MATERIALS

- .1 Granular Fill: as per details on Drawing F2C.
- .2 Rigid Insulation: to CAN/CGSB-51.20-M, Type 4, two (2) layers of 51 mm thick, square edge, with a minimum compressive strength of 275 kPa (40 psi).
- .3 Wire Mesh: to CSA G30.5-M, 152 x 152 x MW18.7 x MW 18.7 welded wire fabric flat sheets only.
- .4 Reinforcing Bars: to CAN/CSA-G30.18, Grade 400.
- .5 Reinforcing Accessories: provide wire ties, spacers and supports required to properly install and secure reinforcing, ice rink piping and slab inserts.
- .6 Water and Aggregates: to CAN/CSA-A23.1 except that at least 25% of all coarse aggregate shall be crushed material.
- .7 Cement: to CAN/CSA-A3001, normal Type GU.
- .8 Water Reducing Admixtures: to ASTM C-494 (to be used only where essential to obtain characteristics noted).

- .9 Floor Hardener: non-metallic dry-shake floor hardener such as “MasterTop 100” by Master Builders Ltd., or approved equal.

2.2 MIX DESIGN

- .1 Concrete for the rink slab shall have the following characteristics:
- .1 35 MPa minimum compressive strength at 28 days.
 - .2 0.45 maximum water to cement ratio by weight at the end of the delivery hose.
 - .3 Aggregate: Group 1, 14-5 mm nominal size.
 - .4 80mm maximum slump at the supply truck.
 - .5 Super plasticizers to be added at the truck to provide slump of approximately 120 mm at the nozzle for workability to the satisfaction of the installer.
 - .6 Natural air content only (approximately 2%).

Part 3 Execution

3.1 INTERMEDIATE GRADING AND COMPACTION

- .1 From structural fill, raise to elevation 118.500 metres with granular sub-base material specified in Section 32 11 23 in horizontal layers of 300 mm thick maximum. Compact each layer to 95% maximum dry density to ASTM D-1557 (Modified Proctor) using a vibratory roller
- .2 On completion of compaction, arrange for the testing company to conduct compaction tests.

3.2 INSTALLATION OF INSULATION

- .1 Starting at one end of the rink set and maintain insulation exactly level. Apply two (2) layers as shown on drawings. Use a surveyor’s level or a laser system to check the elevation.

3.3 FINAL GRADING AND COMPACTION

- .1 From insulation, raise to elevation 119.050 metres with granular sub-base material specified in Section 32 11 23 in two horizontal layers, 300 mm thick and 150 mm respectively. Compact each layer to 95% maximum dry density to ASTM D-1557 (Modified Proctor) using a vibratory roller.
- .2 Raise to elevation 119.200 metres with Base 31.5 mm crushed gravel specified in Section 32 11 23. Compact to 95% maximum dry density to ASTM D-1557 (Modified Proctor) using a vibratory roller.
- .3 On completion of compaction, arrange for the testing company to conduct compaction tests.

3.4 INSTALLATION OF REINFORCEMENT

- .1 Review reinforcing details with the Architect/Engineer to confirm the pattern required.

- .2 Send details of engineered steel and/or plastic chairs for approval. Once approved, installed the reinforcements support chairs at 900 mm c/c each way.
- .3 Install low layer of wire mesh over entire floor area in position and with overlapped as indicated on drawings.
- .4 Install the support chairs for the upper layer of 16 mm diameter reinforcement bars at a maximum spacing of 900 mm c/c each way.
- .5 Secure the 16 mm diameter reinforcement with steel wire. Reinforcement shall be space at 250 mm c/c each way. Locate the reinforcement lap in order to have less than 50% of rebar interrupted at the same location. Lap the rebar for a minimum distance of 600 mm.

3.5 INSTALL INSERTS

- .1 Install inserts for rink boards and lead plug. Submit certificate that this work was done under the supervision of the refrigeration subcontractor.

NOTE: Final elevations of tops of inserts must be absolutely flush with finished slab surface elevation.

3.6 PLACING CONCRETE

- .1 Notify Engineer and Testing Company minimum of 2 working days prior to placing concrete.
- .2 Obtain Architect/Engineer approvals of reinforcement and piping installation prior to placing concrete.
- .3 Set screeds to ensure a dead level surface finish. The maximum allowable variance in surface elevation of the finished slab along a 3 metre straight edge laid on the slab shall be 3 mm. The maximum allowable variation from the finished elevation is 6 mm +/-.
- .4 Carry out pouring and finishing in a continuous operation. Make arrangements for the changing of working crews so there is no break in the pouring of concrete at any time. Stagger meal hours in order to maintain pour continuity. Have a spare concrete pumper available in case of equipment breakdown to ensure continuous operation.
- .5 After placing, screed concrete and compact with a high-frequency vibratory screed. Further level and compact the slab with a rotary steel trowel with the trowels set fairly flat, using an average of three passes. Carefully remove excess water brought to the surface prior to the final finish.
- .6 Tool edge of rink slab to a smooth bull-nose profile.

3.7 FINISHING CONCRETE

- .1 Apply floor hardener in accordance with manufacturer's recommendations at the rate of 4 kg per square metre.
- .2 Finish concrete slab in a continuous operation under supervision of the testing company. Use mechanical means to ensure a true, level slab, free of all voids and cracks.

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- .3 Protect finished concrete slab from damage during course of construction.

3.8 CURING

- .1 Upon completion of the floor finishing, cure the entire floor area by ponding with clean potable water. Maintain the ponding for a period of at least 7 days if the ambient temperature is above 10°C, at least 14 days if the average ambient temperature is below 10°C.
- .2 Prevent traffic on the slab for two days after slab completion.
- .3 Prevent loading other than foot traffic on the completed slab for a period of seven days.
- .4 Prevent vehicle wheel loading heavier than 900 kg on the completed slab for a period of twenty-eight days or until concrete tests indicate that 35 MPa strength has been achieved.
- .5 Do not circulate refrigerant until the slab has cured for a minimum of twenty-eight days.

3.9 INSERTS

- .1 Install lead plugs being careful not to damage rink piping.

3.10 ADJUSTMENTS

- .1 Make good variations from the specified surface elevation and finish to the satisfaction of the Architect/Engineer.

END OF SECTION

1.1 RELATED SECTIONS

- .1 Section 01 30 00 – Administrative Requirements.

1.2 REFERENCE DOCUMENTS

- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM A123 / A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - .2 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
 - .3 ASTM A500 / A500-21, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
 - .4 ASTM F3125 / F3125M-19a2, Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength
- .2 Canadian Standards Association (CSA International)
 - .1 CSA G40.20-13 / G40.21-13 (R2018), General Requirements for Rolled or Welded Structural Quality Steel / Structural Quality Steel.
 - .2 CSA S16-19, Design of Steel Structures.
 - .3 CSA S478-19, Durability in buildings.
 - .4 CSA W47.1-19, Certification of Companies for Fusion Welding of Steel
 - .5 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
 - .6 CSA W59-18, Welded Steel Construction.
- .3 Canadian Geotechnical Society:
 - .1 Canadian Foundation Engineering Manual, 4th Edition, 2006.

1.3 QUALIFICATIONS/CERTIFICATIONS

- .1 Engage a professional structural engineer registered or licensed in the Province of New Brunswick, fully qualified and experienced in the design of helical screw piles, to be responsible for the design of and supervision of installing these piles.
- .2 The Piling Contractor shall be certified under the Canadian Construction Materials Center (CCMC), part of the National Research Council of Canada, and shall provide proof of certification to the Departmental Representative.
- .3 The Piling Contractor performing the Work of this Section shall have been regularly engaged in screw pile work for a period of not less than five (2) years and shall be properly equipped to execute the Work with experienced and trained personnel.

1.4 DESIGN

- .1 Pile design to be based on Limit States Design approach and designed to conform to the National Building Code of Canada 2015 and to resist minimum loads as indicated on drawings.

- .1 The piles and their attachments/hardware shall be anchored to resist uplift as per requirements of the National Building Code of Canada 2015 and loads as indicated on drawings.
- .2 Pile type and size are to be designed by the Piling Contractor and by an engineer registered in the Province of New Brunswick.
- .2 Geotechnical resistance factors as per the Canadian Foundation Engineering Manual.
- .3 Piles shall have a minimum embedment/frost cover of 2440 mm.
- .4 Submit pile design criteria to the Consultant for review purposes only.

1.5 QUALITY CONTROL

- .1 The Piling Contractor's professional engineer is responsible for this work and is to inspect the fabrication and installation of piles on behalf of the Piling Contractor.
- .2 Perform steel work in accordance with the requirements of CSA S16 unless noted otherwise.
- .3 Screw pile foundation to be designed with sufficient corrosion resistance for a minimum service life of
 - .1 75 years ("Long life" per CSA S478).

1.6 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Prior to commencing the work, the Contractor's engineer is to submit documentation showing evidence of registration in the Province of New Brunswick as well as qualifications and experience. The Contractor's engineer is to further acknowledge in writing that he or she has reviewed the specifications and drawings and is aware that he or she is to inspect the fabrication and installation of the work and certify that the work is completed as specified.
- .3 Product Data: submit manufacturer's printed product literature, specifications and datasheet.
- .4 Mill Certificates: Submit three copies of certified mill test reports for the materials used.
 - .1 Where mill test reports originate from a mill outside of Canada or the United States of America, the Contractor shall have mill test reports verified by a certified laboratory in Canada by testing the material to the specified material standards, including boron content. The testing laboratory shall be certified to ISO/IEC 17025 by an organization accredited by the Standards Council of Canada for the tests required. Samples for testing shall be collected by personnel employed by the certified laboratory. A verification letter shall be provided by the certified laboratory that includes at a minimum, the applicable mill test reports, testing standards, date of verification testing, and declaration of material

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- compliance with Contract requirements. The verification letter shall be signed by an authorized officer of the certified laboratory.
- .5 Calibration Report: Submit copies of certified calibration reports for torque measuring equipment and load test measuring equipment to be used on the project. The calibration shall have been performed within one year of the proposed pile installation date or as recommended by the equipment manufacturer.
 - .6 Shop Drawings:
 - .1 Clearly indicate the following information:
 - .1 Type of pile, sizes and details.
 - .2 Load capacity of each pile.
 - .3 Splice details.
 - .4 Proposed elevation of pile bases.
 - .5 Elevation of top of pile.
 - .6 Pile cap sizes and details.
 - .7 Type and grade of steel.
 - .8 Proposed hardware and attachment details and properties.
 - .2 Prepare shop drawings of piles under the seal and signature of the Piling Contractor's professional engineer responsible for the design.
 - .3 Review of the shop drawings by the Consultant is intended to assist the Contractor and does not relieve the Contractor of responsibility for the completeness and accuracy of the work and its conformance with the contract drawings and specifications.
 - .7 Pile installation report/records signed by a professional structural engineer registered or licensed in the Province of New Brunswick.
 - .1 Date and time of installation.
 - .2 Location of pile and pile identification number.
 - .3 Type of pile, sizes and details.
 - .4 Final load capacity and torsional resistance of each installed pile.
 - .5 Pile termination depth elevations, pile head depths and length of installed piles.
 - .6 Actual inclination of the piles.
 - .7 Comments pertaining to interruptions, obstructions, or other relevant information.
 - .8 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.
 - .9 Closeout submittals:
 - .1 Pile installation report/records signed by the Piling Contractor's professional engineer registered or licensed in the Province of New Brunswick.

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- .1 Date and time of installation.
 - .2 Location of pile and pile identification number.
 - .3 Type of pile, sizes and details.
 - .4 Final load capacity and torsional resistance of each installed pile.
 - .5 Pile termination depth elevations, pile head depths and length of installed piles.
 - .6 Actual inclination of the piles.
 - .7 Comments pertaining to interruptions, obstructions, or other relevant information.

1.7 EXISTING STRUCTURES, SERVICES AND UTILITIES

- .1 Confirm and establish the locations and extents of all underground structures, services and utilities in the work area prior to commencement of piling work by notifying the applicable owners, authorities or agencies. Clearly mark such locations to prevent disturbance or damage.
- .2 The Piling Contractor is to undertake a thorough inspection of existing structures and facilities and document any existing damage. The Piling Contractor will be responsible for repairs of any damage caused by piling operations.

1.8 QUALITY ASSURANCE

- .1 Welding to conform to CSA W59 and all welders will hold welding certificates, issued by the Canadian Welding Bureau.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 30 00 – Standard General Requirements.
- .2 Deliver materials in manufacturer's original, undamaged containers with identification labels intact.
- .3 Replace damaged piles as directed by the Consultant.

Part 2 Products

2.1 MATERIALS AND COMPONENTS

- .1 Only new materials are to be used for the fabrication of screw piles.
- .2 Steel pipe shaft: to ASTM A500, Grade C.
- .3 Pile cap plates and helical plates: to CSA G40.21, Grade 300 min..
- .4 Bolts: to ASTM A307 or ASTM F3125.
- .5 Welding: to CSA W59 and W47.1 and certified by the Canadian Welding Bureau.
- .6 Welding electrodes: to CSA W48 Series.

- .7 All piles shall be installed open ended and ends shall be cut to 45°.
- .8 Leading edge of helix shall be sharpened to minimize soil disturbance during installation.
- .9 Helixes are to be formed to a "True Helix" shape. The helix must be formed such that it remains perpendicular to the pipe shaft (within $\pm 2^\circ$) during the entire distance around the pipe shaft.
- .10 All edges on piles shall be ground and clear of burrs or sharp edges.
- .11 Splice piles only with written approval of Consultant.
 - .1 When permitted, provide details for Consultant's review.
 - .2 Design details of splice to bear dated seal and signature of professional engineer registered and licensed in the Province of New-Brunswick.
 - .3 Show all approved splices on the shop drawings.
- .12 If required, Hot Dipped Galvanizing shall be completed by a qualified supplier complying with ASTM A123 for a minimum zinc coating of 610 g/m². The pile shall be galvanized inside and out and free from any galvanizing slag.

2.2 WELDING

- .1 All pipe splicing shall be full strength complete penetration groove welds of the combination of a collar and continuous fillet welds on each end of collar to ensure continuity of pipe.
- .2 Helix shall be welded to the pipe section using a continuous fillet weld on both sides of the helix to pipe connection.
- .3 Welding procedure and welder qualification shall conform to CSA W59 and CSA 47.1.

Part 3 Execution

3.1 PREPARATION

- .1 Protect adjacent structures, services and work of other sections from hazards due to pile drilled operations.
- .2 Arrange sequencing of pile drilling operations and methods to avoid damages to adjacent existing structures.
- .3 When damages occur, remedy damaged items to restore to original or better condition at Contractor's expense.

3.2 INSTALLATION

- .1 Notify the Consultant and inspection or testing firm at least 48 hours prior to any installations on site.

- .2 Ensure that site conditions are adequate to support piling equipment and to allow proper performance of drilling operations.
- .3 Ensure piling equipment is adequate for soil conditions. Piling Contractor is responsible for maintenance of the site grade and restoring any damages caused by the use of inappropriate equipment.
- .4 Do not use piling methods that could cause damage to nearby or existing structures.
- .5 The Contractor will adequately protect all materials and installed piles from the weather or physical abuse which may impair the quality, strength or usefulness of them. Items not so protected and suffering damage due to neglect by the Contractor in this regard will be rejected by the Consultant.
- .6 Install piles where indicated on drawings.
- .7 Should any obstruction be encountered in drilling pile which prevents pile from being placed to the expected tip elevation, or if drilled characteristics indicate that the pile is being damaged in drilled to the specified criteria, the pile will be abandoned or the pile will be removed. An abandoned pile will be cut off 600 mm below the pile cap soffit. An additional pile will be placed at an adjacent location, to be determined by the Consultant.
- .8 Depth and torque tolerances: screw-in piles that reach maximum torque rating before reaching minimum indicated depth shall be subject to the following:
 - .1 Terminate at depth obtained with written approval of Consultant.
 - .2 Modify pile design with approval from Engineer of Record. Replace screw-in pile with smaller and/or fewer helix pile, installed beyond the termination depth of the original screw-in pile.
- .9 Piles will be drilled without interruption until the lengths and drilling criteria shown and specified elsewhere in the Contract Documents are met.
- .10 Construct all piles to the top of pile cut-off elevation.
- .11 Piles will be cut-off normal to the pile axis at the elevation shown on the drawings.
- .12 Discontinue piling operations and immediately notify Consultant in the event that unusual soil conditions are encountered such that pile load capacities cannot be obtained.
- .13 Piles may be increased or decreased in length depending on soil conditions only as directed by the Consultant. Ensure that where pile lengths are increased or decreased, adjacent piles are not undermined or capacities are not reduced.
- .14 The Contractor shall notify the Consultant immediately of any pile not in compliance with the drawings and these specifications.

- .15 The Contractor will immediately notify the Consultant when any movement in an installed pile is detected, giving the reason for movement, such as heave due to adjacent piling, and the measures proposed to correct the movement.
- .16 After erection, touch-up galvanized surfaces damaged during installation with zinc rich coating conforming to SSPC-Paint 20, zinc-rich coating and to ASTM A780
- .17 All field welds, if required, shall be touch-up with zinc rich coating conforming to SSPC-Paint 20, zinc-rich coating and to ASTM A780.
- .18 Pile attachments shall be adjustable in height for a minimum of ± 25 mm.

3.3 EQUIPMENT AND ACCESSORIES

- .1 The Contractor shall provide and operate all necessary equipment for installing the pile foundations. The Contractor will ensure that the piling equipment has sufficient torque to drill piles to design depths indicated on drawings for the work.
- .2 Equipment:
 - .1 Using hydraulic drill head, install helical screw-in piles to depths, torques and positions as indicated on drawings or specifications.
 - .2 Provide torque monitoring device as part of the installation unit or as a separate in-line device capable of recording torque or line pressure. Calibrated torque monitoring data should be made available for review by the Consultant. Torque should be monitored during the entire installation.
 - .3 Torque head should be used that will provide more torque than the minimum required by the Consultant.
 - .4 Connect manufacturer's approved adapters to the installation unit. Pin piers and extensions to the adapter in a safe and controlled manner, using two or more high strength pins. Install screw-in piles in a smooth and continuous manner, rate of advance 5 to 20 rpm. The rate of advance should match the pitch on the pile. Apply sufficient downward pressure to aid in the advancement of the pile into the ground.
 - .5 Use two high strength bolts with nuts per coupler connection or proper weld when welded connection is necessary.

3.4 INSTALLATION TOLERANCES

- .1 Do not deviate from true vertical alignment by more than 2% of pile length.
- .2 Do not deviate from centre of true location by more than 25 mm.
- .3 Do not deviate from specified head elevations by more than 25 mm.

3.5 NON-CONFORMING PILES

- .1 Non-conforming piles are piles that are placed out of position or are damaged and/or piles not conforming to size, length and material specifications.

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- .2 Provide additional piles or supplement piles with additional pile caps to meet specified requirements as directed by the Consultant at no additional cost to the contract.

3.6 FIELD QUALITY CONTROL

- .1 Inspection and testing of materials and workmanship will be carried out by testing laboratory designated by Departmental Representative in accordance with Section 01 30 00 - Standard General Requirements.
- .2 Provide safe access and working areas for testing on site, as required by testing agency and as authorized by Departmental Representative.
- .3 Contractor shall be responsible for their own quality control. Inspection by an independent inspector, the Architect and/or the Engineer will not increase or replace Contractor quality control nor relieve them of their contractual responsibility.

3.7 CERTIFICATION

- .1 Certify at completion of the work all installed by the Piling Contractor under the seal and signature of the Piling Contractor's professional engineer responsible for the work.
- .2 Certify that all piles are capable of developing the capacities specified in the contract specifications and on the drawings.
- .3 Certify that all piles are installed in accordance with the contract documents and the reviewed shop drawings.

3.8 CLEANING

- .1 Clean in accordance with Section 01 00 02 – Standard General Requirements..
 - .1 Leave Work area clean at end of each day.
- .2 Waste Management: Dispose of waste materials in accordance with Section 01 30 00 – Standard General Requirements.

END OF SECTION