PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Concrete Repairs - Section 03 30 00.

1.2 APPLICABLE PUBLICATIONS

.1 The most recent revision of the following:

.1 Conform with the requirements of the Ontario Building code (latest edition) and all amendments and all local, Municipal and Provincial building by-laws and ordinances

.2 Canadian Standards Association CSA-A23.1 Concrete Materials and Methods of Construction

.3 Canadian Standards Association CSA-A23.2 Methods of Test for Concrete.

.4 Design and Construction of Buildings Structures with Fibre-Reinforced Polymers – S806-12.

.5 Specification for Fibre-Reinforced Polymers – S807-10

1.3 APPROVAL

.1 Obtain Departmental Representative written approval prior to use of any composite reinforcement product. Proposals for use of alternate products will be considered; however, the stipulated price submitted must include one of the approved systems and shall show the alternate systems as a separate price.

1.4 SUBMISSION AND DESIGN REQUIREMENTS

.1 The Contractor shall submit two (2) copies of manufacturer's specifications for all products incorporated into the composite reinforcement process.

1.5 SOURCE QUALITY CONTROL

.1 Qualification of workmen: provide at least one person who shall be present on site at all times during execution of this portion of the work who is thoroughly familiar with the type of material being installed and who shall direct all work performed under this section.

.2 Qualification of the contractor: The contractor shall have at least 5 years of experience in concrete restoration and shall have completed three similar projects involving the application of external composite reinforcing to concrete

1.6 STORAGE AND PROTECTION

.1 Use all means necessary to protect carbon fiber fabric reinforcing and epoxy paste adhesive before, during and after installation and to protect installed work and material of other trades.

.2 Use all necessary precautions to maintain identification of epoxy components and mixing instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Carbon Fiber Fabric for structural strengthening of the concrete piers in tension and shear: The carbon fiber fabric shall meet or exceed the following criteria:

.1	Shelf Life	unlimited
.2	Tensile Strength	3800 MPa (551 Ksi)
.3	Carbon Content	96%
.4	Tensile Modulus	242 GPa (35 Msi)
.5	Elongation	1.55%
.6	Density	1.8 g/cm^3(0.065Lb/in^3)

.2 Epoxy Adhesive: Shall be combatable with the Carbon Fiber fabric material and shall provide the required properties as a matrix when applied with the carbon Fibre Fabric.

.1 Material shall be a non-sag paste consistency with a pot life over 90 minutes at 10°C(50°F).

.2 The material shall meet or exceed the following criteria:

.1	Tensile Strength	30 MPa (4353 psi)
.2	Flexural Modulus of E	3.8 GPa (55.1 x 10^4 psi)
.3	Elongation at break	1.5%

.3 Matrix properties with epoxy shall meet or exceed the following Criteria:

.1	Tensile Strength	1120 MPa ($1.62x10^3$ Psi)
.2	Tensile Modulus	100000 MPa ($14.5x10^6$ Psi)

.4 Protection Coat of the matrix and concrete surfaces shall meet or exceed the following Criteria:

.1	Drying time 8°C (45°F)	24H
.2	Drying time 20°C (45°F)	12 H
.3	Tensile strength	1.3 MPa (190 Psi)
.4	Elongation at break	500% at 23°C (73°F)

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

.1 Prepare the surface by sandblasting or grinding (CSP 3-4). Remove any dust or loose particles by means of an industrial vacuum cleaner. The surface must be clean, free from grease and oil and should be dry with the maximum substrate moisture content < 4 % by weight.

.2 The surface to be bonded must be level, with no irregularities or protrusion > 0.5 mm (20 mils). The adhesive tensile strength of the substrate being strengthened must be at least 1.5 MPa (218 psi). All corners of the structure must be rounded to a radius of 10 mm (3/8 in).

3.2 MIXING OF EPOXY ADHESIVE

.1 Proportion both components as directed by manufacturer's instructions. Place in clean container and mix thoroughly with a paddle until uniform in colour. Mix only that quantity that can be used within the product shelf life.

3.3 APPLICATION

.1 Follow manufacturer's instructions.

.2 Do not disturb for 24 hours (min).final clean-up

END OF SECTION - 03 25 00

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PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 N/A

1.2 MEASUREMENT PROCEDURES

.1 Heating of water and aggregates and providing cold weather protection will not be measured but considered incidental to work.

.2 Cooling of concrete and providing hot weather protection will not be measured but considered incidental to work.

.3 Supply and installation of anchor bolts, nuts and washers and anchor grouting will not be measured but considered incidental to work of related Section.

1.3 REFERENCES

.1 All codes, standard specifications and by-laws referred to in this section shall be current editions including all revisions, addenda and supplements.

.1 Conform to the Ontario Building Code and the Occupational Health and Safety Act

.2 CAN/CSA-A3000, Cement

.3 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction

.4 CAN/CSA-A23.2, Test Methods and Standard Practices for Concrete

.5 CAN/CSA-A23.3, Design of Concrete Structures

.6 CAN/CSA-A283, Qualification Code for Concrete Testing Laboratories

.7 SSPC, Surface Preparation Standards

1.4 SUBMISSIONS

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

.2 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CAN/CSA-A23.1.

.3 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CAN/CSA-A23.1.

.4 Upon request submit to Departmental Representative specifications of the chosen acceptable proprietary materials as listed under Part 2 of this Section.

.5 Shop drawings showing complete details of connections to the structure, including pockets, inserts and loadings for items to be connected to and supported by the structure.

.6 Shop drawings showing typical shoring details signed and sealed by a professional Engineer licensed in Ontario or applicable Province.

1.5 QUALITY ASSURANCE

.1 Upon request, submit proposed quality control procedures for Departmental Representative review for the following items:

.1 Falsework erection.

.2 Hot weather concrete.

.3 Cold weather concrete.

.4 Curing.

.5 Finishes.

.6 Formwork removal.

.7 Joints.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with applicable local, provincial and national regulations. Include for tipping fees associated with landfills and recycling depots.

.2 Use trigger operated spray nozzles for water hoses.

.3 Designate a cleaning area for tools to limit water use and runoff.

.4 Carefully coordinate the specified concrete work with weather conditions.

.5 Ensure emptied containers are sealed and stored safely for disposal away from the public.

.6 Prevent plasticizers, water-reducing agents and air-entraining agents from entering drinking water supplies or streams. Using appropriate safety precautions collect liquid or solidify liquid with an inert, non-combustible material and remove for disposal.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Portland cement: to CAN/CSA-A3000.

.2 Supplementary cementing materials: to CAN/CSA-A3000.

.3 Cementitious hydraulic slag: to CAN/CSA-A3000.

.4 Water: to CAN/CSA-A23.1.

.5 Aggregates: to CAN/CSA-A23.1. Coarse aggregates to be normal density unless noted otherwise on drawings.

.6 Air entraining admixture: to ASTM C260.

.7 Chemical admixtures: to ASTM C494/C494M. Engineer to approve accelerating or set retarding admixtures during cold and hot weather placing. Calcium chloride or calcium chloride based admixtures are **NOT** permitted.

.8 Concrete retarders to conform to ASTM C494/C494M.

.9 Non-shrink grout: premixed dry pack grout: composition of non-metallic aggregate, Portland cement with sufficient water for the mixture to retain its shape when made into a ball by hand and capable of developing compressive strength of 35 MPa at 28 days.

.10 Dry Pack: compound consisting of non-metallic aggregate, cement and sufficient water for the mixture to retain its shape when made into a ball by hand and capable of developing compressive strength of 35 MPa at 28 days.

.11 Pre-moulded joint fillers:

.1 Bituminous impregnated fiber board: to ASTM D1751.

.2 Sponge rubber: to ASTM D1752, Type I, flexible grade.

.12 Weep hole tubes: galvanized steel or plastic with minimum 40 mm (1¼") inside diameter.

.13 Wedge anchors and Chemical Adhesive anchors shall be stainless steel unless written approval by Departmental Representative.

.14 Patching Mortar:

.1 Base plate grout:

.1 Non-shrink grout 25 MPa

.15 Formed Vertical:

.1 C-1 exposure, 50 mm (2") slump.

.2 Maximum Aggregate size 10 mm.

.3 Shall be a polymer-modified, with corrosion inhibitor, cementitious, two-component, fast setting mortar.

.4 28 days Comp. Strength: 35MPa (min) – ASTM C109

.5 28 days Bond Strength: 17MPa (min) – ASTM C882

.6 21 Day Tensile Splitting Strength: 5MPa (min) – ASTM C496

.16 Cement Slurry Bonder:

.1 Shall consist of one part Portland Type 10 Cement to one part fine aggregate with sufficient water to form a heavy cream consistency.

.2 Bond Strength – Steel: 1-2 MPa – CAN A23.2-6B

.3 Bond Strength – Concrete: 2-3 MPa – CAN A23.2-6B

.4 Bond Stength – Wet on wet: 20.7MPa @ 14days – ASTM C882

.17 Formwork Materials:

.1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121: SEL TF grade.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Obtain Engineer's approval before placing concrete. Provide 48 hours notice prior to placing of concrete.

.2 In locations where new concrete is dowelled to existing work, drill holes in existing concrete. Place steel dowels of deformed steel reinforcing bars and pack solidly with epoxy anchorage; hold dowels in position until set time has elapsed in accordance with the epoxy manufacturers' written specification and requirements.

.3 Provide equipment and materials capable of maintaining adequate temperature, humidity, and protection during the placement of concrete.

.4 Formwork is to be clean of all dirt, chips, sawdust, water, snow, ice and other foreign matter prior to placement of new concrete.

.5 Prior to placing concrete obtain Departmental Representative's approval of proposed method of concrete protection during placement and curing.

.6 Reinforcement:

.1 Ensure reinforcement and inserts are braced or sufficiently anchored as not to be displaced or disturbed during concrete placement.

.2 Reinforcing shall be prepared by sandblasting to a near white condition to remove all corrosion including underside. Wire cleaning will not be permitted.

.3 Cover to reinforcing is as follows:

.1 Vertical wall 30 mm (1 3/16").

.2 Vertical column 50 mm (2").

.3 Parking deck slab bottom 30 mm (1 3/16").

.4 Where cover cannot be obtained seek direction from Departmental Representative to chase reinforcement allowing the bar to be pushed in or to burm out the repair concrete/mortar.

.5 Where existing reinforcement has a steel loss of 10% or more replace, or add new providing the following tension lap beyond corrosion at both ends:

.1	10M	380 mm (15").
.2	15M	560 mm (22").
.3	20M	760 mm (30").
.4	25M	1170 mm (46").

.5 For larger bars request direction from Departmental Representative.

.6 For a contact lap secure new bar tight to existing, and for a spaced lap, install no greater than 1/5 lap length away from existing.

.7 Prior to placing of concrete obtain Engineer's approval of proposed method for protection of concrete during placing and curing.

.8 Concrete Surface:

.1 After sandblasting is complete the repair area shall be thoroughly cleaned with compressed air. Review the repair areas and remove any loose or cracked concrete material.

.2 All repair areas are to be saturated with potable water a minimum 2 hours prior to concrete placement.

.3 Just prior to placement of new concrete apply cement slurry to the concrete substrates using a stiff brush. Do not allow slurry to dry prior to concrete placement. Mix the cement slurry with Portland cement and potable water to a 'cream-like' consistency.

.9 Pumping of concrete is permitted only after review of equipment and mix.

.10 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.11 Maintain shoring and formwork at newly placed concrete areas until written confirmation has been issued by the Departmental Representative. Formwork is to be maintained until the newly placed concrete has attained a minimum 75% of its specified strength.

3.2 FORMWORK

.1 Fabricate and install formwork for the underside of slab soffits, and vertical faces.

.2 Forms are to be aligned and fitted to match the lines and levels of the existing adjacent concrete.

.3 Where possible provide for and install a drip edge provided for in the formwork. Ensure drip edge joints are tight and fit together. Mitre 90-degree joints. Size to be 5/8" half round diameter or as required matching existing.

3.3 CONSTRUCTION

.1 Complete cast-in-place concrete work in accordance with CAN/CSA-A23.1.

.2 Anchor bolts:

.1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.

.2 With approval of Engineer, epoxy anchor bolts in preformed holes or holes drilled after concrete has set. Drilled holes to be as per manufacturer's recommendations.

.3 Protect anchor bolt holes from water accumulations, snow and ice build-up.

.3 Placing Concrete:

.1 Notify the Departmental Representative, for review of the preparations, at least 48 hours prior to any concrete placement operations are to proceed.

.2 Concrete are to be conveyed to the site by methods that will prevent the segregation or loss of material. Maximum time between adding mix water and complete discharge of the concrete into the forms is 120 minutes. Exemptions to this time frame will only be permitted with the approval of the Departmental Representative.

.3 Conveying and placement equipment shall be such that when concreting has started, the depositing of concrete shall be at such a rate and of such sequence that the concrete is at all times sufficiently plastic to ensure proper bonding of successive layers or panels.

.4 Internal vibrators shall be applied at the point of deposit in the areas of freshly placed concrete, allowed to sink by their own weight in the concrete until they penetrate into the previous layer of concrete. They shall be withdrawn immediately at the same rate at which they sank, moved about 300 mm (12") to a new location and the process repeated.

Extreme care shall be taken to ensure that internal type vibrators due not disturb the reinforcing steel or the forms.

.5 Plastic coated vibrators shall be used to consolidate concrete reinforced with epoxy coated bars.

.6 Where concrete is exposed to exterior, do not place concrete when it is raining or likely to rain. If rain begins after concrete is placed and before it is set, protect with waterproof covers until set.

.7 Placement of repair mortars is to at maximum lifts and intervals as recommended by manufacturer.

.4 Cold Weather Conditions:

.1 When air temperature is at or below or expected to be at or below 5^{o}C, conform to the requirements of CAN/CSA A23.1including, but not limited to the following:

.1 Job Preparation.

.2 Concrete temperature.

.3 Concrete Placing.

.4 Protection Requirements and Methods.

.5 Heated Enclosures.

.6 Protective Covers and Insulation.

.7 Cooling after protection.

.8 Cold-Weather Curing.

.2 All materials and equipment needed for adequate protection and curing shall be on hand and ready for use before concrete placement has started.

.5 Hot Weather Protection:

.1 Conform with the requirements of CAN/CSA A23.1and the recommendations of ACI Standard 305.

3.4 FINISH TREATMENT OF SLAB SURFACES

.1 Finishing:

.1 Finish concrete in accordance with CAN/CSA-A23.1.

.2 Screed and finish the surface of the repairs to provide for drainage, or to match surrounding concrete inclusive of texture, architectural detail, etc.

.3 Finish edges to match the existing adjacent surfaces.

.4 Clean rough edges and rub or grind smooth transitions between new and existing surfaces.

.5 Clean leakage and other spillage marks from the adjacent surfaces.

.6 Repair using repair mortar, any honeycomb or minor voids in the concrete. If Engineer deems honeycomb or new repair unacceptable and non-repairable, area to be removed and repaired according this Section at Contractors expense.

.7 Unless otherwise shown or specified, slabs to receive waterproofing shall be finished with a Steel Trowel Finish to Class A classification.

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

.2 Sealing and Curing:

.1 Curing to conform to the requirements of CAN/CSA A23.1 and to CAN/CSA S413 including but not limited to the following:

.1 Basic Curing Period.

.2 Additional Curing for Durability.

.3 Additional Curing for Structural Safety.

.4 Methods for Curing.

.5 Cold Weather Curing.

.6 Hot Weather Curing.

.7 Curing for Accelerated Strength Development.

.8 Additional Curing for Mass Concrete.

3.5 FIELD QUALITY CONTROL

.1 General:

.1 Conform to the requirements of CAN/CSA A23.1

.2 Provide a competent and experienced supervisor or foreman who shall be present on the site continuously throughout each working day.

.3 Review by Departmental Representative. or materials testing will not augment or replace Contractor quality control nor relieve him of his contractual responsibility.

.4 Notify the Departmental Representative.(s) 48 hours in advance of closing-in of formwork for a review of the preparations.

.2 Routine Review and Testing:

.1 Upon request, submit the quality control logs of the Redi-Mix Concrete Supplier.

.2 Review and testing of concrete and concrete materials will be carried out by an approved Testing Laboratory designated by Owner in accordance with CAN/CSA-A23.1. Costs will be carried from allowances in Contract.

.3 Obtain representative samples of fresh concrete for each fraction over 5 cubic metres placed in one day, or if directed by Departmental Representative..

.4 Perform a standard slump test to conform to CAN/CSA A23.2 for every batch of concrete delivered to site.

.5 Where concrete is specified to be air entrained, perform standard air entrainment tests to conform with CAN/CSA A-23.2 for each set of specimens.

.6 Three specimens moulded in cylindrical moulds, stored, and laboratory cured to conform with CAN/CSA-A23.2 shall comprise a strength test. One specimen shall be compression tested at 7 days and the remaining two at 28 days.

.7 During Cold Weather placement, one additional specimen shall be made and shall be stored on the job site under conditions similar to the concrete it represents. This specimen shall be compression tested at 7 days after sampling.

.8 Non-destructive Methods for Testing Concrete shall be in accordance with CAN/CSA-A23.2.

.3 Reports:

.1 Concrete cylinder reports shall contain the following information: whether specimens laboratory or field cured, date cast, date received in lab, date tested, unit weight of concrete, specified 28 day strength, correlate the exact location of each pour with the test cylinders in question, concrete supplier, person who cast the specimen, time mixer charged, time cylinder cast, measured slump before and after super plastisizers, temperature of concrete and air, air content(if specified), whether water was added at the site, and by who's authority, nominal aggregate size, type of admixtures (including synthetic fibres), exposure classification or mix designation, project identification and with sequential numerical identification.

.2 Should a crushed cylinder show a test result below that which is anticipated, the reviewing company shall immediately advise the Structural Departmental Representative. by telephone of such occurrence in order to expedite curing or remedial measures which may be waived.

.3 The reviewing company shall supply written reports of tests of materials and reinforcing steel, giving all pertinent information required by the appropriate standard.

.4 Defective Concrete:

.1 Concrete not meeting the requirements of the specification and drawings shall be considered Defective Concrete.

.2 Defective Concrete and concrete not conforming to lines, details, quality and grade specified or as shown on the drawings shall be modified or replaced at no cost to the Bid Price.

.3 Cores drilled and tested from areas in question, as directed by the Departmental Representative. and in accordance with CAN/CSA A23.1and/or load testing of the structural elements in accordance with the requirements of the Departmental Representative. shall be done at no increase to the Bid Price.

.5 Protection:

.1 Fully protect exposed concrete finishes from damage and staining.

END OF SECTION - 03 30 00

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Concrete Repairs - Section 03 30 00.

1.2 APPLICABLE PUBLICATIONS

.1 The most recent revision of the following:

.1 Conform with the requirements of the Ontario Building code (latest edition) and all amendments and all local, Municipal and Provincial building by-laws and ordinances

.2 Canadian Standards Association CSA-A23.1 Concrete Materials and Methods of Construction

.3 Canadian Standards Association CSA-A23.2 Methods of Test for Concrete.

1.3 APPROVAL

.1 Obtain Departmental Representative's written approval prior to use of any crack injection product.

1.4 SUBMISSION AND DESIGN REQUIREMENTS

.1 The Contractor shall submit two (2) copies of manufacturer's specifications for all products incorporated into the crack injection process.

1.5 MATERIALS AND INSTALLATION REQUIRMENTS

.1 The spacing of the injection ports shall be designed to achieve full depth penetration of the cracks.

.2 The temperature of the exterior concrete and the ambient temperature shall be a minimum of 5 $^{\circ}$C during preparation injection and curing.

.3 All instillation procedures and details shall be completed in full accordance with manufacturer's instructions.

.4 Where details shown on the drawings or in the specification are not in accordance with manufacturer's requirements, notify Departmental Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Epoxy Injection shall meet or exceed the following properties

.1	Shelf life	2 years.
.2	Pot life	20 min
.3	Compressive strength ASTM D695-28 Days	61 MPa (8847 Psi)
.4	Modulus of elasticity ASTM D695-28 Days	1.8 GPa (2.6x10 Psi)
.5	Tensile strength ASTM D638-14 Days	37 MPa (5366 Psi)
.6	Shear strength ASTM D732-14 Days	30 MPa (4351 Psi)

.7

.2 Injection Ports

.1 The injection ports shall be approved plastic inserts. Surface mounted ports are not acceptable.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

.1 Grind surface of all cracks to remove all paint, dirt and debris.

.2 Place a layer of quick setting cement, epoxy or polyester gel along the length of the crack to contain injection resin. Containment material must be of sufficient strength and thickness in order to withstand the forces incurred during the grouting process.

.3 Mark out the location of all injection ports, agree on spacing with Departmental Representative

3.2 CRACK INJECTION

.1 Epoxy Injection

.1 Drill the ports to a minimum of 12mm in depth with a vacuum attached swivel drill chuck and hollow drill bits.

.2 Epoxy the plastic injection ports in place and seal between the cracks using containment epoxy. Do not carry out water testing until the epoxy has completely cured

.3 Commence injection (using a hand gun, pressure pot or injection machine, the pressure shall not exceed 0.2 MPa) at the lowest port on a vertical face. Continue injection until pure uncontaminated material flows from the adjacent port. Cap the injection prot and proceed with the adjacent port until all ports have been injected.

.4 After the injection material has completely cured all ports shall be removed.

3.3 FINAL CLEAN-UP

.1 Upon completion, remove all debris and excess material from the site.

.2 Wash with water all surfaces, including concrete slab, wall, signage, doors, etc., to remove dust. Use high pressure washing except at areas adjacent to exposed lights or sprinkler head, etc., which may be damaged. Low pressure cleansing and brushing as necessary will be required in these areas.

.3 Prior to leaving the site accompany the Departmental Representative in a final inspection of all work areas.

END OF SECTION - 03 64 23

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 N/A

1.2 REFERENCES

.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 A653/A653 M- Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 ASTM A792/A792M- Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.2 Canadian Standards Association (CSA)

.1 CSA W55.3, Certification of Companies for Resistance Welding of Steel and Aluminum.

.2 CSA W59, Welded Steel Construction (Metal Arc Welding) (Metric Version).

.3 CAN/CSA S136, North American Specification for the Design of Cold-Formed Steel Structural Members.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.181-Ready-Mixed Organic Zinc-Rich Coating.

.4 Canadian Sheet Steel Building Institute (CSSBI)

.1 CSSBI 50M- Lightweight Steel Framing Binder.

.2 CSSBI S5, Guide Specification for Wind Bearing Steel Studs.

.3 CSSBI Fact Sheet #3, Care and Maintenance of Prefinished Sheet Steel Building Products.

.4 CSSBI Technical Bulletin Vol. 7, No. 2, Changing Standard Thicknesses for Canadian Lightweight Steel Framing Applications.

1.3 SUBMITTALS

.1 Indicate design loads, member sizes, materials, design thickness exclusive of coatings, coating specifications, connection and bracing details, screw sizes and spacing, and anchors.

.2 Indicate locations, dimensions, openings and requirements of related work.

.3 Indicate welds by welding symbols as defined in CSA W59.

.4 Submit samples of framing components and fasteners to Owner’s Representative.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Protect steel studs during transportation, site storage and installation in accordance with CSSBI Sheet Steel Facts #3.

.2 Handle and protect galvanized materials from damage to zinc coating.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Steel: to CSA S136, fabricated from ASTM A653/A653M, Grade 230 steel.

.2 Zinc coated steel sheet: quality to A653M, with Z275 designation zinc coating.

.3 Aluminum-zinc alloy coated steel sheet: to ASTM A792M, commercial quality, grade 37 with AZ180 coating, regular spangle surface, chemically treated for unpainted finish.

.4 Welding materials: to CSAW59 and certified by Canadian Welding Bureau.

.5 Screws: pan head, self-drilling, self-tapping sheet metal screws, corrosion protected to minimum requirements of CSSBI, (minimum coating thickness of 0.008 mm of zinc), length to suit application, but not less than 5.0 mm longer than twice the thickness of steel.

.6 Anchors: concrete expansion anchors or other suitable drilled type fasteners.

.7 Bolts, nuts, washers: hot dipped galvanized to ASTM A123/A123M, 600 g/m2 zinc coating.

.8 Touch up primer to repair damaged or cut metallic coatings: zinc rich, to CAN/CGSB 1-GP-181.

2.2 STEEL STUD DESIGNATIONS

.1 Colour code steel studs in accordance with CSSBI Technical Bulletin Vol. 7, No.2.

2.3 METAL FRAMING

.1 Steel studs: to CSA S136, fabricated from zinc coated steel, depth as indicated. Minimum steel thickness of 1.52 mm.

.2 Stud tracks: fabricated from same material and finish as steel studs, depth to suit.

.1 Bottom track: single piece.

.2 Top track: single piece track or double track or slotted single top track.

.3 Bridging: fabricated from same material and finish as studs, 38 x 12 x 1.22 mm minimum thickness.

.4 Angle clips: fabricated from same material and finish as studs, 38 x 38mm x depth of steel stud, 1.22 mm minimum thickness.

.5 Tension straps and accessories: as recommended by manufacturer.

2.4 SOURCE QUALITY CONTROL

.1 Prior to commencement of work, submit:

.1 Two certified copies of mill reports covering material properties.

PART 3 - EXECUTION

3.1 GENERAL

.1 Do welding in accordance with CSA W59.

.2 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

.3 Do work in accordance with CSSBI S5.

3.2 ERECTION

.1 Erect components to requirements of reviewed shop drawings.

.2 Anchor tracks securely to structure at 800 mm oc maximum, unless lesser spacing prescribed on shop drawings.

.3 Erect studs plumb, aligned and securely attached with two screws minimum, or welded in accordance with manufacturer's recommendations.

.4 Seat studs into bottom tracks and top track. Gap between end of stud and web of track not to exceed 4.0 mm. Secure studs with two (2) screws minimum (in top and bottom tracks), or in accordance with manufacturer's recommendations.

.5 Allow minimum deflection gap of 16.5 mm for double track or slotted single top track.

.6 Install studs at not more than 50.0 mm from abutting walls, openings, and each side of corners and terminations with dissimilar materials.

.7 Brace steel studs with horizontal internal bridging at 1200 mm maximum. Fasten bridging to steel clips fastened to steel studs with screws or by welding.

.8 Frame openings in stud walls to adequately carry loads by use of additional framing members and bracing as detailed on shop drawings.

.9 Touch up welds with coat of zinc rich primer.

3.3 ERECTION TOLERANCES

.1 Plumb: not to exceed 1/500th of member length.

.2 Camber: not to exceed 1/1000th of member length.

.3 Spacing: not more than 3.0 mm from design spacing.

.4 Gap between end of stud and track web: not more than 4.0 mm.

3.4 CUTOUTS

.1 Maximum size of cutouts for services as follows:

Member Depth	Across Member Depth	Along Member Length	Centre to Centre Spacing (mm)
92	40 max.	105 max.	600 min.
102	40 max.	105 max.	600 min.
152	65 max.	115 max.	600 min.

.2 Limit distance from centerline of last unreinforced cutout to end of member to less than 300 mm.

END OF SECTION - 05 41 00

PART 1 - GENERAL

1.1 RELATED SECTIONS

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

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.34, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

.2 Underwriters Laboratories Canada (ULC)

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

1.3 SUBMITTALS

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

.1 Product characteristics.

.2 Performance criteria.

.3 Limitations.

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

.3 Quality assurance submittals:

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

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

1.4 MOCK-UPS

.1 Construct mock-up of sheet vapour barrier installation including one lap joint, one inside corner and at one electrical box. Mock-up may be part of finished work.

.2 Mock-up will be used to judge workmanship, substrate preparation, and material application.

.3 Allow two (2) working days for inspection of mock-up by Owner's Representative before proceeding with vapour barrier work.

.4 When accepted, mock-up will demonstrate minimum standard of quality required for this work.

PART 2 - PRODUCTS

2.1 SHEET VAPOUR RETARDER

.1 Polyethylene film: to CAN/CGSB-51.34, 0.15mm thick with a water vapour permeance of not greater than 45 ng/(P·s·m2), flame spread rating of less than 150 to CAN/ULC S102.

2.2 ACCESSORIES

.1 Joint sealing tape: air resistant pressure sensitive adhesive tape, type recommended by vapour barrier manufacturer, 50 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere.

.2 Sealant: compatible with vapour retarder, recommended by vapour retarder manufacturer, to Section 07 92 00 - Joint Sealants.

.3 Staples: minimum 6 mm leg.

.4 Moulded box vapour barrier: factory-moulded polyethylene box for use with recessed electric switch and outlet device boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

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

.2 Install sheet vapour retarder on warm side of exterior wall and ceiling space assemblies prior to installation of gypsum board to form continuous retarder.

.3 Install Sheet Vapour retarder under stone cover in crawl space to form continuous retarder.

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

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

3.2 EXTERIOR SURFACE OPENINGS

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

3.3 PERIMETER SEALS

.1 Seal perimeter of sheet vapour barrier as follows:

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

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

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

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

3.4 LAP JOINT SEALS

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

.1 Attach first sheet to substrate.

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

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

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

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

3.5 ELECTRICAL BOXES

.1 Seal electrical switch and outlet device boxes that penetrate vapour barrier as follows:

.1 Install moulded box vapour barrier or wrap boxes with film sheet providing minimum 300 mm perimeter lap flange.

.2 Apply sealant to seal edges of flange to main vapour barrier and seal wiring penetrations through box cover.

3.6 CLEANING

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

END OF SECTION - 07 26 00

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PART 1 - GENERAL

1.1 REFERENCES

All codes, standard specifications and by-laws referred to in this section shall be current editions including all revisions, addenda and supplements.

.1 ASTM A606 – Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.

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

.3 ASTM A792/A792M – Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

.4 CSA B111 – Wire Nails, Spikes and Staples.

.5 CAN/CGSB 51.32M – Sheathing, Membrane, Breather Type.

.6 CAN/CGSB 93.1M – Sheet, Aluminum Alloy, Prefinished, Residential.

.7 SMACNA – Sheet Metal and Air Conditioning Contractors National Association – “Architectural Sheet Metal Manual”

1.2 STORAGE AND HANDLING

.1 Do not store metals in direct contact with the earth, road surface, or roof deck. Place suitable supports under the metal upon delivery to protect it from scratching or puncturing membrane, membrane flashing or absorbing moisture from the surrounding terrain or deck.

.2 Store all materials in waterproof covered trailers.

.3 Store caulking at +5ºC minimum.

.4 Handle and store products in a manner to prevent damage and deterioration.

.5 Remove and replace damaged products at own expense and to the satisfaction of the Quality Observer and Departmental Representative.

.6 Apply materials in accordance with the manufacturer’s recommendations.

1.3 EXAMINATION

.1 Examine the Drawings and Specifications to determine the extent of the work involved, together with other necessary data affecting the work, as in no circumstances will any claims against the Owner be allowed resulting from failure to ascertain the extent of such work herein described or implied.

1.4 PREPARATORY WORK

.1 Prior to application of flashings, examine membrane flashings and ensure any defect of level or construction is corrected before proceeding with the work.

1.5 SAFETY AND PROTECTION

.1 References:

.1 CAN/CSA S269.2M: Access Scaffolding for Construction Purposes.

.2 FCC No. 301: Standard for Construction Operations.

.2 Protect existing finishes from damage due to traffic and materials handling until completion of the building.

1.6 WARRANTY

.1 The Contractor shall supply the Owner with a 1 year material and workmanship warranty on Contractor letterhead.

PART 2 - PRODUCTS

2.1 PRE-FINISHED STEEL FLASHINGS

.1 All standards, regulations and specifications listed herein are considered to be the latest available edition.

.2 Compatibility between materials is essential. Use only materials that are known to be compatible when incorporated in a completed assembly.

.3 Prefinished Metal Flashing: 24 gauge Weather X Series (0.457mm) steel to standard ASTM A653A/A653M with G90 (Z275) zinc coating. Colour selected by Owner from manufacturer's standard colour range.

.4 Cleats and Hook Strips Not Otherwise Specified: Two gauges heavier of matching materials of flashing being employed. Minimum 22 gauge (0.050").

.5 Solder: Block solder 50% tin, 50% lead to ASTM B32. Use only rosin flux.

2.2 ACCESSORIES

.1 Touch-up paint: As recommended by pre-finished material manufacturer.

.2 Sealant: as per Section 07 92 00.

2.3 FASTENERS

.1 Use galvanized, copper, aluminium or stainless steel nails or screws as most compatible with materials being employed.

.2 Nails: Annular threaded of length to penetrate into bases minimum 1" (25 mm). No. 8 screws to penetrate wood 0.75" (19mm) at 24" (600mm) o.c.

.3 Exposed Fasteners: No.10 hex head cadmium plated with neoprene and solid washers. Consult manufacturer for screw type and sizing for materials being secured. Provide caps for screw heads to match colour of flashing as specified or shown.

2.4 FABRICATION

.1 Fabricate all possible work in shop in 8' (2.4m) lengths by standard fabrication methods. On high vertical sections install metal in 4' (1.2m) section as specified and detailed. Profiled metal to be cold rolled.

.2 Form bends with straight sharp lines, angles and corners into true planes, free from twists, buckles, dents and other visual distortions.

.3 Double-back exposed metal edges at least 0.5" (13mm). Raw edges will not be permitted.

.4 Supply all accessories required for installation of sheet metal work of this Section.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Install sheet metal flashings at walls required to protect the membrane flashings as shown on the drawings, or otherwise required.

.2 Sheet metal work shall be installed to cover the entire area it protects and shall be watertight under all service and weather conditions. Install in a uniform manner, level, true to line, free of dents, warping and distortion.

.3 Install sheet metal with concealed fasteners at lock joints. Exposed fastening will be permitted only with the approval of the Departmental Representative. Space all fasteners evenly in an approved manner. Use lead plugs and screws where fasteners are exposed, otherwise use concrete drive fasteners where metal flashings are installed over concrete or masonry.

.4 Install underlay under sheet metal, installed directly over wood or masonry surfaces. Overlap joints 2" (51mm) and turn up 3" (76mm) at edges where horizontal surfaces intersect vertical planes.

.5 Join sheet metal by “S” lock seams, to permit thermal movement. Fill all joints with caulking as flashing is being installed. Clean off all excessive material visible subsequent to installation. Space joints evenly where exposed. Form inside and outside corners by means of raised seams. Lock seams and caulk all overlaps to ensure water tightness. Do not use pop rivets.

3.2 FINISH

.1 At project’s conclusion, leave surface and adjacent work areas free of damage and clean of debris. Finished surfaces of formed metal flashings shall be free of oil canning, dents and be perfectly colour matched. Changes in colour between sheets and dented or oil canned surfaces that detract from the visual appearance of finished product will be rejected. Remove and replace damaged, defaced or defective work.

.2 Paint all exposed metal due to cutting

.3 After erection touch-up finish surfaces damaged during handling and erection in conformance with manufacturer’s recommendations. Refinish shop applied finishes as approved by Departmental Representative.

.4 Remove deposits or protections and wash metals left unpainted and exposed to view as specified by metal manufacturer.

3.3 CLEAN-UP

.1 Daily as the work proceeds and on completion, remove all surplus materials and debris resulting from the foregoing work.

.2 Remove all stains, caulking or other adhesive from all affected surfaces.

END OF SECTION - 07 62 00

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PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 09 91 23 – Interior Painting

.2 Section 05 41 00 - Structural Metal Stud Framing

1.2 REFERENCES

.1 All codes, standard specifications and by-laws referred to in this section shall be current editions including all revisions, addenda and supplements.

.1 ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.2 ASTM C514 - Nails for the Application of Gypsum Board.

.3 ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.

.4 ASTM C645 - Specifications for Non-Structural Steel Framing Members.

.5 ASTM C665 - Mineral-Fibre Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

.6 ASTM C754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board.

.7 ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.

.8 ASTM C1002 - Steel Self-Piercing, Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.9 ASTM C1288 - Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets.

.10 ASTM C1396/C1396M - Standard Specification for Gypsum Board.

.11 ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne-Sound Transmission Loss of Building Partitions and Elements.

.12 GA-201 (Gypsum Association) - Gypsum Board for Walls and Ceilings.

.13 GA-214 (Gypsum Association) - Recommended Specification: Levels of Gypsum Board Finish.

.14 GA-216 (Gypsum Association) - Application and Finishing of Gypsum Board.

.15 GA-254 - Fire-Resistant Gypsum Sheathing.

.16 GA-600 (Gypsum Association) - Fire Resistance Design Manual.

.17 GA-801 (Gypsum Association) - Handling Gypsum Board.

.18 UL - Fire Resistance Directory.

.19 ULC - Fire Resistance.

1.3 SUBMITTALS FOR REVIEW

.1 Section 01 33 00 – Submittal Procedures.

.2 Product Data:

.1 Provide data on gypsum board, gypsum sheathing, cementitious backer board, joint tape, and accessories.

1.4 QUALITY ASSURANCE

.1 Perform Work in accordance with ASTM C840, GA-201, GA-214, GA-216, GA-254 and GA-600. Maintain one copy on site.

.2 Applicator Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

.3 Handling Gypsum Board: Comply with GA-801.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

.1 As manufactured by CGC Inc. or approved equal

2.2 FRAMING MATERIALS

.1 Joists, Studs and Tracks: Specified in Section 05 41 00.

.2 Fasteners: Screws to ASTM C514, ASTM C1002 and GA-216

2.3 GYPSUM BOARD MATERIALS

.1 Interior Gypsum Board: ASTM C1396/C1396M, fire resistive type, UL, ULC, or ITS rated; 15.9 mm (5/8”) thick, maximum available length in place; ends square cut, tapered and beveled edges. For interior installation only.

2.4 ACCESSORIES

.1 Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.

.2 Corner Bead: To GA-216, Galvanized steel sheet, minimum 0.59 mm overall thickness zinc coating Z275 (25 gsg) (0.0247"), ASTM A525M, minimum width of flanges 28.6 mm (1 1/8") for 12.7 mm (1/2") thick board and 31.8 mm (1 1/2") for 15.9 mm (5/8") thick board.

.3 Casing Bead: To GA-216, Galvanized steel sheet, minimum 0.59 mm overall thickness zinc coating Z275 (25 gsg) (0.0247"), ASTM A525M, designed for finishing with joint compound.

.4 Joint Materials: ASTM C475, GA-201 and GA-216 reinforcing tape, joint compound, adhesive, and water. All materials to be compatible with the specified gypsum board.

.5 Gypsum Board and Sheathing Fasteners (interior): ASTM C1002, Type S12 (for steel studs) or Type W (for wood studs) and GA-216.

.6 Exterior Sheathing Fasteners: Wafer head, corrosion resistant, type S-12, length as required, Tru-Fast WP fastener, as distributed by Perma-grip, or an approved equal.

.7 Batt Insulation: Non-combustible, water resistant, vapour permeable, semi rigid mineral wool batt insulation made from slag and basalt rock, conforming to CAN/ULC S702-09 with a density of 45 kg/m^3 (2.8 lb/ft^3).

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Examine site conditions and surfaces to ensure that they are in satisfactory condition for the commencement of the work of this section.

.2 Examine work or other trades for defects and discrepancies and report them to the Departmental Representative/owner in writing. Do not proceed with work until surfaces are satisfactory.

.3 Carry out work of this Section only when temperature is maintained and controlled in range of 13°C to 21°C (55°F to 70°F), for at least 24 hrs before installing gypsum board and is so maintained until joint cement and adhesives are cured.

.4 Provide adequate ventilation to eliminate excessive moisture before commencing and during work to ensure proper drying of joint filler and adhesive. Do not force dry adhesive and joint treatment.

.5 Examine substrate for compliance with applicable requirements, installation tolerances and other conditions affecting installation of gypsum board. Do not proceed until unsatisfactory conditions have been corrected. Beginning of installation shall indicate acceptance of substrate conditions.

3.2 GYPSUM BOARD INSTALLATION

.1 Install gypsum board in accordance with GA-201, GA-216 and GA-600 and in accordance with the manufacturer's written instructions.

.2 Erect single layer board or first layer in a double layer application in most economical direction, with ends and edges occurring over firm bearing.

.3 Use screws when fastening gypsum board to metal stud framing. Screws to be spaced at 300 mm on centre (12") for wall applications and 200 mm (8") on centre for ceiling applications. If this layer is the first of a double layer application, screws to be spaced at 600 mm on centre (24") for wall applications and 300 mm (12") on centre for ceiling applications. Fasteners to be installed at all studs at the spacing specified.

.4 Double Layer Applications: Place second layer perpendicular to first layer. Offset joints of second layer from joints of first layer by a minimum of 300 mm (12"). Screws, secured through both layers into the studs, to be spaced at 300 mm (12") on centre for wall applications and 200 mm (8") on centre for ceiling applications

.5 Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.

3.3 FINISHING

.1 Provide levels of gypsum board finish for locations as follows, in accordance with Gypsum Association GA 214, "Recommended Specification: Levels of Gypsum Board Finish".

.2 All areas to be finished to Level 4.

.3 Taping (Level 1):

.1 Butter taping compound into inside corners and joints.

.2 Center tape over joints and press down into fresh compound.

.3 Remove excess compound.

.4 Tape joints of gypsum board above suspended ceilings.

.4 First coat (Level 2):

.1 Use taping or all-purpose drying-type compound.

.2 Immediately after bedding tape, apply skim coat of compound and allow to dry completely in accordance with manufacturer's instructions.

.3 Apply first coat of compound over flanges of trim and accessories, and over exposed fastener heads and finish level with board surface.

.5 Second coat (Level 3): After first coat treatment is dried, apply second coat of compound over tape and trim, feathering compound 2 inches beyond edge of first coat.

.6 Third coat (Level 4):

.1 After second coat has dried, sand surface lightly and apply thin finish coat to joints, fasteners and trim, feathering compound 2 inches beyond edge of second coat.

.2 Allow third coat to dry. Apply additional compound, and touch-up and sand, to provide surface free of visual defects, tool marks, and ridges, and ready for application of finish.

.7 Skim coat (Level 5):

.1 Apply skim coat of topping or all-purpose drying-type compound over exposed surfaces of gypsum board.

.2 After skim coat has dried, touch-up and sand to provide surface free of visual defects, tool marks, and ridges, and ready for application of finish.

.8 Recess fasteners protruding above panel surface. Fill fasteners depressions.

3.4 ADJUSTMENT AND CLEANING

.1 Remove all surplus material and debris resulting from work on a daily basis and on completion.

.2 Make good defective work and ensure that surfaces are smooth and within tolerances to receive paint finish.

END OF SECTION - 09 29 00

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 78 00 - Closeout Submittals.

1.2 REFERENCES

.1 Environmental Protection Agency (EPA)

.1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings).

.2 Master Painters Institute (MPI)

.1 MPI Architectural Painting Specifications Manual.

.3 Society for Protective Coatings (SSPC)

.1 SSPC Painting Manual, Volume Two, Systems and Specifications Manual.

.4 National Fire Code of Canada.

1.3 QUALITY ASSURANCE

.1 Contractor shall have a minimum of five years proven satisfactory experience. When requested, provide a list of last three comparable jobs including, job name and location, specifying authority, and project manager.

.2 Qualified journeymen shall be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.

.3 Conform to latest MPI requirements for interior painting work including preparation and priming.

1.4 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

.1 Provide paint products meeting MPI "Environmentally Friendly" E2 or E3 ratings based on VOC (EPA Method 24) content levels.

.2 Where indoor air quality (odour) is a problem, use only MPI listed materials having a minimum E2 or E3 rating.

1.5 SCHEDULING

.1 Submit work schedule for various stages of painting to Owner’s Representative for approval. Submit schedule minimum of two (2) working days in advance of proposed operations.

.2 Obtain written authorization from Owner’s Representative for any changes in work schedule.

.3 Schedule painting operations to prevent disruption of occupants in and about the building.

1.6 SUBMITTALS

.1 Submit product data and manufacturer's installation/application instructions for each paint and coating product to be

.2 Submit product data for the use and application of paint thinner.

.3 Submit WHMIS MSDS - Material Safety Data Sheets. Indicate VOCs during application and curing.

.4 Upon completion, submit records of products used, records to be included in Operating and Maintenance Manuals. List products in relation to finish system and include the following:

- .1 Product name, type and use
- .2 Manufacturer's product number
- .3 Colour numbers
- .4 MPI Environmentally Friendly Classification System Rating
- .5 Manufacturer's Material Safety Data Sheets (MSDS)

.5 Submit full range colour sample chips to indicate where colour availability is restricted.

.6 Submit duplicate 200 x 300 mm sample panels of each paint with specified paint or coating in colours, gloss/sheen and textures required to MPI Painting Specification Manual standards submitted on the following substrate materials:

- .1 3 mm steel plate for finishes over metal surfaces.
- .2 13 mm birch plywood for finishes over wood surfaces.
- .3 50 mm concrete block for finishes over concrete or concrete masonry surfaces.
- .4 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.

.7 When approved, sample panels shall become acceptable standard of quality for appropriate on-site surface with one of each sample retained on-site.

1.7 QUALITY CONTROL

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

.2 When requested by Owner's Representative, prepare and paint designated surface, area, room or item (in each colour scheme) to requirements specified herein, with specified paint or coating showing selected colours, gloss/sheen, textures and workmanship to MPI Painting Specification Manual standards for review and approval. When approved, surface, area, room and/or items shall become acceptable standard of finish quality and workmanship for similar on-site work.

1.8 EXTRA MATERIALS

.1 Submit maintenance materials from same product run as products installed in accordance with Section 01 78 00 - Closeout Submittals. Package products with protective covering and identify with descriptive labels.

.2 Submit one - four litre can of each type and colour of finish coating. Identify colour and paint type in relation to established colour schedule and finish formula.

.3 Deliver to Owner's Representative and store where directed.

.4 Provide certificate signed by staff that extra materials have been received in order.

1.9 DELIVERY, HANDLING AND STORAGE

.1 Deliver, store, handle materials in accordance with product requirements, and manufacture instructions.

.2 Deliver and store materials in original containers, sealed, with labels intact.

.3 Labels shall clearly indicate:

.1 Manufacturer's name and address.

.2 Type of paint or coating.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.4 Remove damaged, opened and rejected materials from site.

.5 Provide and maintain dry, temperature controlled, secure storage.

.6 Observe manufacturer's recommendations for storage and handling.

.7 Store materials and supplies away from heat generating devices.

.8 Store materials and equipment in a well ventilated area with temperature range 7º C to 30º C.

.9 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.10 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Owner's Representative. After completion of operations, return areas to clean condition to approval of Departmental Representative.

.11 Remove paint materials from storage only in quantities required for same day use.

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

.13 Fire Safety Requirements:

.1 Provide minimum one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.10 WASTE MANAGEMENT AND DISPOSAL

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

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

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

.4 Ensure emptied containers are sealed and stored safely.

.5 Unused paint, coating materials must be disposed of at official hazardous material collections site as approved by Owner's Representative.

.6 Paint, stain and wood preservative finishes and related materials (thinners, and solvents) are regarded as hazardous products and are subject to regulations for disposal.

.7 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.8 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.9 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground follow these procedures:

.1 Retain cleaning water for water-based materials to allow sediments to be filtered out.

.2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.

.3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.

.4 Dispose of contaminants in approved legal manner in accordance with hazardous waste regulations.

.5 Empty paint cans are to be dry prior to disposal or recycling (where available).

1.11 SITE CONDITIONS

.1 Heating, Ventilation and Lighting:

.1 Ventilate enclosed spaces.

.2 Perform no painting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10°C for 24 hours before, during and after paint application until paint has cured sufficiently.

.3 Where required, provide continuous ventilation for seven days after completion of application of paint.

.4 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities shall be provided by General Contractor.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless specifically pre-approved by the specifying body, Paint Inspection Agency and the applied product manufacturer, perform no painting work when:

.1 Ambient air and substrate temperatures are below 10°C.

.2 Substrate temperature is over 32°C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer’s prescribed limits.

.4 The relative humidity is above 60% or when the dew point is less than 3°C variance between the air/surface temperature.

.2 Perform no painting work when the maximum moisture content of the substrate exceeds:

.1 12% for concrete and masonry (clay and concrete brick/block).

.2 15% for wood.

.3 12% for plaster and gypsum board.

.3 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "cover patch test".

.4 Test concrete, masonry and plaster surfaces for alkalinity as required.

.3 Surface and Environmental Conditions:

.1 Apply paint finish only in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint only to adequately prepared surfaces and to surfaces within moisture limits noted herein.

.3 Apply paint only when previous coat of paint is dry or adequately cured.

.4 Additional Interior Application Requirements:

.1 Apply paint finishes only when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

.2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Owner's Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.

.2 Paint materials for paint systems shall be products of a single manufacturer.

.3 Low odor products. Whenever possible, select products exhibiting low odor characteristics. If two products are otherwise equivalent, select the product with the lowest odor. Only qualified products with E2 or E3 "Environmentally Friendly" rating are acceptable for use on this project.

.4 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, shall:

.1 be water-based, water soluble, water clean-up.

.2 be non-flammable.

.3 be manufactured without compounds which contribute to ozone depletion in the upper atmosphere.

.4 be manufactured without compounds which contribute to smog in the lower atmosphere.

.5 do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.

.5 Water-borne surface coatings must be manufactured and transported in a manner that steps of process, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).

.6 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavelant chromium or their compounds.

.7 Water-borne surface coatings must have a flash point of 61.0°C or greater.

.8 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:

.1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

.2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.

.9 Water-borne paints and stains, and water borne varnishes must meet a minimum "Environmentally Friendly" E2 rating.

2.2 COLOURS

.1 Owner's Representative will provide Colour Schedule after contract award.

.2 Selection of colours will be from manufacturers full range of colours.

.3 Where specific products are available in a restricted range of colours, selection will be based on the limited range.

.4 Second coat in a three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

.1 Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials is allowed only with Owner's Representative written permission.

.2 Paste, powder or catalyzed paint mixes shall be mixed in strict accordance with manufacturer's written instructions.

.3 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.

.4 Thin paint for spraying according in strict accordance with paint manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Owner's Representative.

.5 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

.1 Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following values:

Gloss Level Category	**Units @ 60**b	**Units @ 85**b
G1 - matte finish	max. 5	max. 10
G2 - velvet finish	max. 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	> 85	

.2 Gloss level ratings of painted surfaces shall be as specified herein.

2.5 INTERIOR PAINTING SYSTEMS

.1 The following paint formulas requires a three coat finish as indicated in the MPI Architectural Painting Specifications Manual.

.2 Concrete Vertical Surfaces: including horizontal soffits

.1 INT 3.1A Latex G5 finish (over sealer).

.3 Concrete Horizontal Surfaces: floors and stairs

.1 INT 3.2B Alkyd floor enamel low gloss finish.

.4 Clay Masonry Units: pressed and extruded brick

.1 INT 4.1A Latex G5 finish.

.5 Concrete Masonry Units: smooth and split face block and brick.

.1 INT 4.2A Latex G5 finish.

.6 Structural Steel and Metal Fabrications: columns, beams, joists, etc.

.1 INT 5.1E Alkyd G5 finish.

.7 Galvanized Metal: doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etc.

.1 INT 5.3A Latex G5 finish.

.8 Dimension Lumber: columns, beams, exposed joists, underside of decking, etc.

.1 INT 6.2D Latex G5 finish (over latex primer).

.9 Dressed Lumber: including doors, door and window frames casings, mouldings, etc.

.1 INT 6.3T Latex G5 finish (over latex primer).

.10 Wood Paneling and Casework: partitions, panels, shelving, millwork, etc.

.1 INT 6.4C Semi-transparent stain finish.

.11 Wood Floors and Stairs: including hardwood flooring, etc.

.1 INT 6.5B Polyurethane varnish gloss finish (over stain).

.2 INT 6.5C Polyurethane varnish gloss finish.

.12 Plaster and Gypsum Board: gypsum wallboard, drywall, “sheet rock type material”, etc and textured finishes:

.1 INT 9.2A Latex G5 finish (over latex sealer) for walls.

.2 INT 9.2A Latex G1 finish (over latex sealer) for ceilings.

.13 Canvas and Cotton coverings:

.1 INT 10.1B Alkyd G5 finish.

.14 Painting of interior game line layouts with colours as noted on approved game line layout drawing on interior resilient (gymnasium) flooring to be by others in accordance with MPI Architectural Painting Specification.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 GENERAL

.1 Perform preparation and operations for interior painting in accordance with MPI Painting Specifications Manual except where specified otherwise.

.2 Apply all paint materials in accordance with paint manufacturer's written application instructions.

3.3 PROTECTION

.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage. If damaged, clean and restore such surfaces as directed by Owner's Representative.

.2 Cover or mask floors, windows and other ornamental hardware adjacent to areas being painted to prevent damage and to protect from paint drops and splatters. Use non-staining coverings.

.3 Protect items that are permanently attached such as Fire Labels on doors and frames.

.4 Protect factory finished products and equipment.

.5 Protect passing pedestrians, building occupants and general public in and about the building.

.6 Remove electrical cover plates, light fixtures, surface hardware on doors, door stops, bath accessories and other surface mounted fittings and fastenings prior to undertaking any painting operations. Store for re-installation after painting is completed.

.7 As painting operations progress place "WET PAINT" signs in occupied areas to approval of Owner's Representative.

3.4 EXAMINATION

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Owner's Representative all damage, defects, unsatisfactory or unfavorable conditions before proceeding with work.

.2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to Owner's Representative. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

.3 Maximum moisture content as follows:

.1 Plaster and wallboard: 12%

.2 Masonry/Concrete: 12%

.3 Concrete Block/Brick: 12%

.4 Wood: 15%

3.5 CLEANING AND PREPARATION

.1 Clean and prepare surfaces in accordance with MPI Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:

.1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.

.2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly.

.5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.

.6 Use trigger operated spray nozzles for water hoses.

.7 Many water-based paints cannot be removed with water once dried. However, minimize the use of kerosene or any such organic solvents to clean up water-based paints.

.2 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pre-treatment as soon as possible after cleaning and before deterioration occurs.

.3 Sand existing surfaces with intact, smooth, high gloss coatings to provide adequate adhesion for new finishes.

.4 Where possible, prime surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

.1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.

.2 Apply wood filler to nail holes and cracks.

.3 Tint filler to match stains for stained woodwork.

.5 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

.6 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes blowing with clean dry compressed air, or vacuum cleaning.

.7 Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.

.8 Do not apply paint until prepared surfaces have been accepted by Owner's Representative.

3.6 APPLICATION

.1 Method of application to be as approved by Owner's Representative. Apply paint by brush, roller, air sprayer, airless sprayer. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:

.1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.

.2 Work paint into cracks, crevices and corners.

.3 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple.

.4 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.

.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray application:

.1 Provide and maintain equipment that is suitable for intended purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.

.2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

.3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.

.4 Brush out immediately all runs and sags.

.5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Owner's Representative.

.5 Apply coats of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.7 Sand and dust between coats to remove visible defects.

.8 Finish tops of cupboards, cabinets and projecting ledges, both above and below sight lines as specified for surrounding surfaces.

.9 Finish closets and alcoves as specified for adjoining rooms.

.10 Finish top, bottom, edges and cut-outs of doors after fitting as specified for door surfaces.

3.7 MECHANICAL/ELECTRICAL EQUIPMENT

.1 In finished areas: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as noted otherwise.

.2 In boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.

.3 In other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.

.4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.5 Do not paint over nameplates.

.6 Keep sprinkler heads free of paint.

.7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

.8 Paint disconnect switches for fire alarm system and exit light systems in red enamel.

.9 Paint all fire protection piping red.

.10 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

.11 Do not paint interior transformers and substation equipment.

3.8 FIRE SEPARATIONS

.1 Contractor to stencil on both sides of fire rated partitions the fire rating for that assembly (i.e.: **1 HR FIRE SEPARATION**).

.2 Stenciled fire ratings to be minimum 100 mm high **RED** letters, minimum 150 mm above finished ceilings, and minimum 2400 mm o.c. along partition.

3.9 FIELD QUALITY CONTROL

.1 Field inspection of interior painting operations to be carried out by Owner's Representative.

.2 Advise Owner's Representative when each applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

.3 Co-operate with Owner's Representative and provide access to all areas of the work.

.4 Standard of Acceptance:

.1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.10 RESTORATION

.1 Clean and re-install all hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust to approval of Owner's Representative. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Owner's Representative.

END OF SECTION

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