

1 GENERAL

1.1 SUMMARY

1.1.1 General Conditions and Division 1, General Requirements, govern Work of this Section.

1.1.2 Maintain on site a copy of latest edition of CSA Standards S16 and S136.

1.1.3 Maintain on site a set of final reviewed Shop Drawings which incorporate all changes and corrections.

1.2 DESCRIPTION

1.2.1 Work Supplied by This Section but Installed by Others

03 10 00: Concrete Forming and Accessories: to install anchors

1.2.2 Related Work Specified in Other Sections

03 10 00: Concrete Forming and Accessories

03 30 00: Cast-in-Place Concrete

04 20 00: Unit Masonry

05 12 00: Structural Steel Framing

09 90 00: Painting and Coating

1.2.3 Co-operation with Work of Other Sections

Check *Project* Drawings and Specifications for requirements of other Sections which will affect installation of *Work* of this Section.

1.2.4 Co-operation with Consultant

Before commencing *Work*, review with *Consultant*, *Work* performed under this Section.

1.2.5 Work Included:

Provide all labour, materials, methods, equipment, and accessories to design, supply, fabricate, and erect the steel roof decking shown on the Drawings, specified herein, and as required for a complete and proper installation, including, but not limited to, the following:

- .1 Steel roof decking.
- .2 Welding or fasteners.
- .3 Cutting of openings for other Sections.
- .4 Reinforcement for openings up to 450 mm [18"] across flutes.
- .5 Sheet metal closure and cover plates.
- .6 Coating touch-up.

1.3 QUALITY ASSURANCE

1.3.1 Reference Standards

All referenced standards listed following shall be the edition referenced by the applicable Building Code in force at the date noted on the Structural Drawings for the Building Permit application. Where Building Code does not reference the listed standards, the current published edition shall be followed.

The following Reference Standards shall govern *Work* of this Section, except where they are in conflict with requirements imposed by this Specification in which case the latter shall govern. Standards referenced by following Standards apply but are not necessarily repeated in following list.

- .1 Ontario Building Code, (OBC).
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A47/A47M, Standard Specification for Ferritic Malleable Iron Castings
 - .2 ASTM A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
 - .3 ASTM A307, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
 - .4 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process
 - .5 ASTM A792/A792M, Specification for Steel Sheet, 55% Aluminum-Zinc Alloy Coated by Hot-Dip Process.
 - .6 ASTM F3125/F3125M, Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 830 MPa (120 ksi) and 1040 MPa (150 ksi) Minimum Tensile Strength
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.
- .4 Canadian Sheet Steel Building Institute (CSSBI)
 - .1 CSSBI 10M, Standard for Steel Roof Deck.
 - .2 CSSBI B13, Design of Steel Deck Diaphragms, including all issued Errata and Addenda
- .5 Canadian institute of Steel Construction (CISC)
 - .1 Code of Standard Practice for Structural Steel.
 - .2 Handbook of Steel Construction
- .6 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.
 - .2 CISC/CPMA 2-75, A Quick-Drying Primer for Use on Structural Steel.
- .7 Canadian Standards Association International (CSA)
 - .1 CSA S16, Design of Steel Structures.
 - .2 CSA S136, North American Specification for the Design of Cold-Formed Steel Structural Members
 - .3 CSA W47.1, Certification of Companies for Fusion Welding of Steel
 - .4 CSA W55.3, Certification of Companies for Resistance Welding of Steel and Aluminium.
 - .5 CSA W59, Welded Steel Construction (Metal Arc Welding).
 - .6 CSA W178.1, Certification of Welding Inspection Organizations.
 - .7 CSA W178.1, Certification of welding inspection organizations
 - .8 CSA W178.2, Certification of welding inspectors

1.3.2 Qualifications

- .1 Design of steel roof deck in accordance with paragraph **Error! Reference source not found.** shall be by a Professional Engineer licensed in the Province of Ontario, experienced in the design of steel roof deck.
- .2 Steel deck design engineer shall be insured against professional liability in accordance

with Section 74 subsection (1) of Regulation 941 of the Ontario Professional Engineers Act. The alternative of compliance with subsection (2) is not acceptable.

- .3 Undertake *Work* of this Section only by a *Contractor* with demonstrated experience in fabrication and erection of steel roof deck and accessories.
- .4 Undertake welding only by fabricators certified under Division 2.1 by Canadian Welding Bureau under CSA W47.1 for fusion welding of steel structures and CSA W55.3 for resistance welding of structural components.
- .5 Except where specified otherwise, welding to be in accordance with CSA W59 by welders qualified for steel deck welding by the Canadian Welding Bureau.

1.3.3 Tolerances

- .1 Upon completion of fabrication, verify that depth of deck is not more than 1 mm [1/32"] under the design depth, and that the cover width of steel roof deck does not exceed design width by more than 10 mm per metre [3/8" per 40"] of width.
- .2 Lay and position roof deck within a tolerance of plus or minus 12 mm [½"] with respect to edges of deck parallel to flutes and centrelines of columns and building exterior lines.

1.3.4 Independent Inspection and Testing

- .1 Inspection and testing of materials, fabrication and erection of *Work* of this Section, may be performed by an Inspection and Testing Company appointed by *Owner*.
- .2 Be aware that *Contractor* retains sole responsibility for quality control of *Work* and that performance or non-performance of Inspection and Testing Company does not limit, reduce, or relieve *Contractor* of responsibility for complying with requirements of the *Contract Documents*.
- .3 Inspection and Testing Company shall be certified by Canadian Welding Bureau, in Category 1, Buildings, under CSA W178.1.
- .4 Welding inspectors and supervisors shall be certified by Canadian Welding Bureau to CSA W178.2.
- .5 Payment for specified *Work* performed by Inspection and Testing Company will be made from cash allowance specified in Section 01 21 00.

1.3.5 Field Quality Verification

Inspection and Testing Company, when appointed shall verify:

- .1 that mill tests are properly correlated to materials.
- .2 base steel thickness, depth and dimensions of profile and zinc coating thickness.
- .3 that erection and fastening comply with requirements of reviewed Shop Drawings and Contract Documents.
- .4 that Underwriters' Laboratories of Canada (ULC) ratings for products and systems are applicable.
- .5 roof deck welders CWB certification.
- .6 that coating touch up conforms to *Specification* requirements.
- .7 by pry tests adequacy of floor deck welds to supports.

1.4 DESIGN

1.4.1 Design roof deck and fasteners in conformance with CSSBI 10M Article 8.6.

1.4.2 Design deck to span continuously over at least 4 supports (3 spans) wherever possible. Avoid single span deck wherever possible.

- 1.4.3 Design roof deck and fasteners to support the most critical of:
- .1 Dead plus live or snow loads shown on Drawings and specifications, but not less than uniform factored load 3.5 kPa for strength (as per CSSBI 10M Clause 8.6.5);
 - .2 Concentrated loads stipulated in Ontario Building Code Table 4.1.5.9;
 - .3 Maximum deflection of 1/240 of the span under uniform unfactored live or snow load shown on Drawings but not less than 1.9 kPa (as per CSSBI 10M Clause 8.6.5). Deflection under specified live load shall not exceed 1/360th of span when plaster or gypsum board ceilings are hung directly from deck

1.4.4 Design the roof deck and fasteners to resist the following minimum gross wind specified uplift loads as shown on the drawings. The following loads have been multiplied by an ULS importance factor $I_w = 1.25$ but do not include a load factor. Areas "r", "s", "e", "or", "os" and "oc" are as defined in the User's Guide to the Ontario Building Code 2012, Figure 4.1.7.6.C. The dead load of the roof deck construction may be deducted from these uplifts, after applying relevant load factors for wind load, and dead load resisting uplift.

.1 For widths of "s", "e" and "r":	
: Central roof area "r"	1.38 kPa
: Edge strips "s"	1.78 kPa
: Corner areas "e"	3.44 kPa
.2 For overhanging (beyond wall) roof, areas "os", "oc" and "or":	
: Central roof area "or" and edge strips "os"	1.86 kPa
: Corner areas "oc"	3.09 kPa

- 1.4.5 Design roof deck and fastening, including side lap fastening, for diaphragm action and to resist diaphragm shears shown on Drawings.
- 1.4.6 Provide fastenings to supports to resist the specified loadings, and at not greater than: 400 mm [16"] spacing or 2 flute spacings whichever is the lesser. Provide arc spot welds not less than 20 mm [3/4"] top diameter.

1.5 SUBMITTALS

1.5.1 Professional Liability Insurance

Submit proof of design engineer's professional liability insurance coverage specified in subparagraph 1.3.2.2.

1.5.2 Calculations

Submit design calculations if requested by *Consultant*.

1.5.3 Shop Drawings

- .1 Submit erection drawings in accordance with Section 01 30 00 and as specified below.
- .2 Copies of Contract Drawings utilized as erection drawings are not permitted without written permission from the *Consultant*.
- .3 Each shop drawing submitted shall bear signature and seal of Professional Engineer responsible for deck design.
- .4 Indicate: design loading; base steel thicknesses and steel grade of material; zinc or metallic coating designations; ULC fire rating and test design specification number if applicable; deflection criteria; layout of units; framing and supports; required minimum bearing; anchorages; size and spacing of fastening to meet uplift and diaphragm action; openings and their reinforcement; accessories; and details of construction including

- closures or cover plates and warping of deck to provide slopes for drainage.
- .5 Prior to submission to *Consultant*, *Contractor* shall review all shop drawings. By this review, *Contractor* represents to have determined and verified all field measurements, site conditions, materials, catalogue number and similar data, and to have checked and coordinated each shop drawing with requirements of *Work* and of *Contract Documents*. *Contractor's* review of each shop drawing shall be indicated by stamp, date and signature of a responsible person. Shop Drawings not reviewed by the contractor will be rejected.
 - .6 At time of submission, *Contractor* shall notify *Consultant* in writing of any deviations in shop drawings from requirements of *Contract Documents*.
 - .7 *Consultant* will review and return shop drawings in accordance with an agreed schedule. Be aware that *Consultant's* review of Shop Drawings is for conformity to design concept and for general arrangement, and that Design Engineer responsible for *Work* of this Section retains responsibility as Engineer of Record, and that *Contractor* retains responsibility for errors and omissions in Shop Drawings and responsibility for meeting all requirements of *Contract Documents*.
 - .8 *Contractor* shall make changes in shop drawings which *Consultant* may require, consistent with *Contract Documents*, and resubmit unless otherwise directed by *Consultant*. When resubmitting, *Contractor* shall notify *Consultant* in writing of revisions other than those requested by *Consultant*.
 - .9 Show locations of sheet lengths, sheet quantities, thicknesses, metallic coating designations, and all fastening types, sizes and spacing.
 - .10 **Submit shop drawings** for review before any *Work* commences, in pdf format, and distribute as follows, unless otherwise specified in Division 1.
 - : to *Consultant*;
 - : to Structural Engineer;
 - : to Inspection and Testing Company after review comments have been incorporated on the shop drawings.

1.5.4 Inspection Reports

Inspection and Testing Company shall:

- .1 Submit reports at least weekly when shop and site *Work* of this Section is in progress.
- .2 Submit inspection reports in pdf format and distribute as follows, unless otherwise specified in Division 1:
 - : to *Consultant*;
 - : to Architect;
 - : to *Contractor*;
 - : to Trade Contractor.
- .3 Sign report by inspector who performs inspection, and describe progress of *Work*, deficiencies found and corrective actions taken.
- .4 Include deficiency list of outstanding items from previous reports, and comment on status.

1.6 PRODUCT HANDLING

- 1.6.1 Comply with requirements of CSSBI 10M, Clause 8.10. Where storage is necessary, tilt bundles for drainage, block bundles off ground for effective drainage and ventilation, block bundles to prevent sagging, and store away from chemically corrosive substances such as but not limited to salt, cement and fertilizer, away from contaminating materials such as diesel oil, paint and grease, and away from site traffic.
- 1.6.2 Coordinate *Work* of this Section with Sections responsible for structural bearing members. Deliver

and install steel decking at locations directed in accordance with construction schedule to allow steel decking to serve as safety planking during steel erection.

1.7 WASTE MANAGEMENT AND DISPOSAL

- 1.7.1 Separate and recycle waste materials in accordance with Section 01 74 21, Constructions/Demolition Waste Management and Disposal.
- 1.7.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- 1.7.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate manner on-site, for recycling in accordance with Waste Management Plan.
- 1.7.4 Divert unused metal from landfill to metal recycling facility approved by *Consultant*.
- 1.7.5 Dispose of unused paint material at official hazardous material collections site approved by *Consultant*.
- 1.7.6 Do not dispose of paint material into sewer system, streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

2 PRODUCTS

2.1 UNIT PRICES

- 2.1.1 Unit prices requested as a part of the *Tender* shall include design as applicable, preparation and submittal of necessary Shop Drawings, fabrication, transport and *Work* erected in place.

2.2 MATERIALS

- 2.2.1 **Sheet Steel:** Provide new material conforming to one of following Specifications:
 - .1 To ASTM A653/A653M, minimum nominal base steel thickness 0.76 mm [0.03"] , or greater as required to support loads shown on drawings, minimum zinc coating designation ZF75 interior roof areas, and Z275 for exterior canopies.
- 2.2.2 **Closures:** As indicated in accordance with manufacturer's recommendations.
- 2.2.3 **Zinc-Rich Paint:** to CAN/CGSB-1.181.
Acceptable Products:
 - : ZRC Cold Galvanizing Compound, by ZRC Worldwide, Marshfield, MA. (available in Ontario from Kerry Industries, Scarborough, ON).
 - : Zinc Clad 5, by Sherwin Williams, Markham, ON.

2.3 FABRICATION

- 2.3.1 Fabricate steel roof deck in accordance with requirements of reviewed Shop Drawings, Contract Documents and Reference Standards, and in particular CSSBI 10M, Article 5.
- 2.3.2 Fabricate steel deck sections by rolling sheet steel to form integral ribs and interlocking side laps.

2.3.3 **Steel Roof Deck:** 38 mm maximum deep profile,, interlocking side laps.

3 EXECUTION

3.1 EXAMINATION

3.1.1 Check Contract Documents for requirements of other Sections which will affect installation of Work of this Section.

3.1.2 Before commencement of laying steel roof deck, confirm that Work of Sections on which Work of this Section is dependent is properly installed in the correct location.

3.1.3 Make necessary field measurements to ensure the proper fit of Work of this Section.

3.2 ERECTION

3.2.1 Erect steel roof in accordance with requirements of reviewed Shop Drawings, Contract Documents, and Reference Standards, Regulatory Authorities, and in particular requirements of CSSBI 10M, Clauses 7 and, and as specified herein

3.2.2 Fasten deck to supporting structural steel by arc spot welding.

3.2.3 Erection *Work*, including field welding, shall be the responsibility of the steel deck Fabricator and shall be carried out by Fabricator's erection crews or Fabricator's approved erector.

3.2.4 When arc spot welding is used, erect deck only by erectors qualified in accordance with CSA W47.1. Perform welding only by welders qualified for deck welding by the Canadian Welding Bureau.

3.2.5 Band and sling employing steel wire rope and choker type sling or multi-lift beams, steel deck being hoisted to the working level.

3.2.6 Place bundles so as to avoid overloading the structure.

3.2.7 Before leaving the site each day:

- .1 Align and secure in place all deck sheets.
- .2 Secure loose bundles of steel deck sheets.
- .3 Lower to ground all loose sheets.

3.2.8 Placing Floor Deck Units

- .1 Place units with cells aligned end to end and to provide a minimum bearing on structural steel members of 45 mm [1.75"].
- .2 Do not force units into place causing them to distort.
- .3 Lap ends of non-cellular panels no less than 50 mm [2"].

3.2.9 Cutting and Fitting

- .1 Refer to Architectural, Mechanical and Electrical Drawings, in addition to Structural

Drawings, to determine number, sizes and locations of openings required through steel roof deck.

- .2 Cut and fit roof deck and accessories to provide neatly trimmed edges with size and shape to suit opening requirements.
- .3 Protect openings and leave area in a safe condition.

3.2.10 Reinforcement for Openings

Provide reinforcement for openings in accordance with CSSBI 10M, Clause 8.7, and as follows, unless heavier reinforcement is shown on the Drawings or specified:

- .1 For openings up to 150 mm [6"] across the flutes, no reinforcement is necessary if not more than two vertical webs are removed.
- .2 For openings exceeding 150 mm [6"] but less than 300 mm [12"] across the flutes: *Provide* not less than one 51 x 51 x 6.4 mm [2" x 2" x 1/4"] steel angle reinforcement to frame across each side of opening in a direction perpendicular to the flutes. Weld angle to at least two flutes on each side of opening. Alternatively, reinforcement shall be provided based on structural analysis of the loads involved.
- .3 For openings exceeding 300 mm [12"] but less than 450 mm [18"] across the flutes: *Provide* suitable reinforcement based on structural analysis of the loads involved.
- .4 Separate framing will be supplied under Work of Section 05 12 00 for holes with dimensions across flutes greater than 450 mm [18"].

3.2.11 Closures

- .1 Install sheet metal closures in flutes where indicated on Drawings and where required to close openings, as at junction of walls and partitions with deck.
- .2 Install sheet metal cover plates at changes of deck direction, and at ridges and valleys.
- .3 Secure closures and cover plates by either sheet metal screws or welding.

3.2.12 Side Lap Fastening

- .1 Fasten side laps as required to meet design requirements of paragraph 1.4. In no case shall spacing of side lap fastening exceed 900 mm [36"]

3.2.13 Laps and Fastening at Supports

- .1 Fasten deck to supports as required to meet design requirements of paragraph 1.4, and CSSBI recommendations.
- .2 *Provide* not less than 50 mm [2"] end laps, and make end laps only over supports.

3.2.14 Suspended Loads:

Do not suspend ceilings, lights, ducts, piping, or any other item from steel roof decking without written approval of *Consultant*.

3.2.15 Exposed Steel Deck:

Exercise particular care in the erection of exposed steel deck to avoid denting, perforating by welding or otherwise damaging steel floor deck.

3.2.16 **Connections:** Install connections in accordance with CSSBI recommendations as indicated.

3.3 COATING TOUCH-UP

3.3.1 Immediately after erection is complete, wire brush and clean welded areas, rust spots, and

abraded or otherwise damaged areas of zinc coating on decking and shop-applied prime paint on structural members.

3.3.2 Apply two coats of zinc-rich paint to prepared areas of decking.

3.3.3 Apply one coat of compatible prime paint to prepared areas on structural members. Verify that touch-up paint is same type as shop coat.

3.4 **DEFECTIVE WORK**

3.4.1 Failure of supplied or installed steel floor deck and accessories to meet requirements of *Contract Documents* for materials, design, workmanship or tolerances, including dented, perforated or otherwise damaged deck, and which cannot be repaired by approved methods, will be considered defective *Work* performed by this Section.

3.4.2 Repair or replace defectively designed, fabricated or erected *Work* of this Section as directed by Consultant.

3.4.3 *Consultant* is the sole judge of the acceptability of *Work* of this Section.

3.4.4 Pay for any necessary additional inspection and testing, redesign, any necessary repair, removal or demolition of defective *Work*, all corrective measures, new materials and labour of this Section and other impacted Sections, and all other direct or related expenses required to correct defective *Work* of this Section.

– End of Section –