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| **Section Cover Page** |
|  **Section 05 21 19****2019-06-05 Open Web Steel Joists** |
| Refer to “Green Building Notes” page for additional guidance for projects following a sustainable rating system.Revise Green Building requirements if the Province has determined that the work of this Contract is not to attain a sustainable rating system certification. |

This Master Specification Section contains:

.1 This Cover Sheet

.2 Green Building Notes

.3 Specification Section Text:

**1. General**

1.1 Related Work Specified in Other Sections

1.2 Reference Documents

1.3 Design Criteria

1.4 Administrative Requirements

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1.6 Quality Assurance

1.7 Delivery, Storage and Handling

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**2. Products**

2.1 Materials

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2.3 Fabrication

2.4 Surface Preparation and Shop Priming

**3. Execution**

3.1 Erection

**Green Building Notes:**

If the project is **not** designated to use a sustainable rating system it is still be prudent to leave in relevant green building requirements as part of an effort towards sustainability.

**Review and incorporate requirements from the following documents into the project:**

Section 1.0 “Sustainability” and “Appendix G – Green Building Standards” of the “Technical Design Requirements for Alberta Infrastructure Facilities”

<http://www.infrastructure.alberta.ca/doctype486/TechDesignRequirements.pdf>

**LEED Specific Documents (if required):**

LEED Project Delivery Process Manual

<http://www.infrastructure.alberta.ca/Content/docType486/Production/LEED_PD_Manual.pdf>

LEED Project Delivery Process Manual – Appendices

<http://www.infrastructure.alberta.ca/Content/docType486/Production/LEED_PD_Appendices.pdf>

All documents can be found on Infrastructure’s Technical Resource Centre, Guidelines and Standards page: <http://www.infrastructure.alberta.ca/992.htm> In order to meet the LEED EQ 4.2 Credit(Indoor Air Quality - Low Emitting Materials: Paints and Coatings), site applied touch-up primer on interior applications must meet GS-11, Green Seal Paints and Coatings, Third Edition, January 1, 2010. Maximum VOC content must be less than 250 g/l. There is no LEED requirement for restricting VOC content in paint of any kind for use in exterior applications.

1. General
	1. RELATED WORK SPECIFIED IN OTHER SECTIONS

.1[Section 01 32 16 – LEED Submittal Forms]

.2 [Section 01 35 18 – LEED Requirements]

.3 [Section 01 35 20 – Environmental Procedures]

.4 Section 01 74 19 – Waste Management and Disposal

.5 Section 05 05 05 – Steel Testing and Inspection

.6 Section 05 12 00 – Structural Steel Framing

.7 Section 05 50 00 – Custom Metal Fabrications

* 1. REFERENCE DOCUMENTS

*SPEC NOTE: Latest versions of the following standards to be used*

* + 1. American Society for Testing and Materials (ASTM):
			1. ASTM A108-13 Standard Specifications for Steel Bars, Carbon, Cold-Finished, Standard Quality
		2. Canada Green Building Council (CaGBC):
			1. LEED Canada 2009 Rating System LEED Canada for New Construction and Major Renovations. LEED Canada for Core and Shell Development. Website: [www.cagbc.org](http://www.cagbc.org)
		3. Canadian Institute of Steel Construction (CISC):

.1 Code of Standard Practice for Structural Steel, 8th Edition, 2015

.2 Steel Joist Facts, 2nd Edition, 1980

* + 1. 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

* + - 1. CISC/CPMA 2-75 A Quick-Drying Primer for Use on

 Structural Steel

* + 1. Canadian Standards Association (CSA):
			1. CSA G40.20-13/G40.21-13 General Requirements for Rolled or Welded Structural Quality Steels / Structural Quality Steels
			2. CSA S16-14 Design of Steel Structures
			3. CSA S136-16 North American Specification for the Design of Cold-Formed Steel Structural Members
			4. CSA W47.1-09 (R2014) Certification of Companies for Fusion Welding of Steel Structures
			5. CSA W59-13 Welded Steel Construction (Metal Arc Welding)
			6. CSA W186-M1990 (R2016) Welding of Reinforcing Bars in Reinforced Concrete Construction
		2. Green Seal: Standards:
			1. GS-11-15 Paints and Coatings, Edition 3.2, October 26, 2015
		3. International Organization for Standardization (ISO):

.1 ISO/IEC 17025:2005 General Requirements for the Competence

of Testing and Calibration Laboratories

* + 1. Master Painters Institute (MPI):
			1. Master Painters Institute Green Performance Standard GPS-1-12
		2. The Society for Protective Coatings (SSPC):
			1. SSPC SP-3-2004 Power Tool Cleaning
			2. SSPC SP-6 Commercial Blast Cleaning
		3. American Institute of Steel Construction (AISC):
			1. Vibrations of Steel‑Framed Structural Systems Due to Human Activity, 2nd Edition, 2016.
	1. DESIGN CRITERIA
		1. Design members, connections and other work not detailed on drawings, but necessary for completion of the Work, in accordance with dimensions [and loadings] indicated on drawings, and requirements of Alberta Building Code, CSA S16 and CSA S136, the Canadian Institute of Steel Construction (CISC) “Code of Standard Practice for Structural Steel” and “Steel Joist Facts”.
		2. The deflection due to live load shall not exceed 1/360 of the span unless noted otherwise on the drawings.
		3. More stringent deflection limit is typically specified for joists parallel to and near relatively rigid end walls or support lines. This is to provide a gradual increase in deflection perpendicular to the joist span as one moves away from the end wall / support line to mitigate buildup of stresses in the roof / floor deck and components of the building envelope.
		4. Vibration Control for Floors – The Structural Consultant shall coordinate with the Steel Fabricator to ensure that the Vibration Criteria are satisfied. Consultant to specify the minimum moment of inertia required of the floor joists for vibration control.
	2. ADMINISTRATIVE REQUIREMENTS
		1. Coordination:
			1. Where structural steel is scheduled to be finish painted, ensure that shop paint primer is compatible with painting coats specified in Division 09, Painting and Finishing Schedules, [and product meets MPI GPS-1 standard for maximum allowable VOC content].
	3. SUBMITTALS
		1. Product Data:
			1. Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
		2. Shop Drawings:
			1. Submit shop drawings and product data prior to commencement of fabrication.
			2. Shop Drawings shall include shop details and erection diagrams and shall indicate framing and grid lines, bearing and anchorage details, framed openings, accessories, schedule of materials, camber and loadings, fasteners, method of torquing bolts, and welds using American Welding Society basic weld symbols.
			3. Shop drawings for work designed by fabricator shall bear the stamp and signature of a Professional Engineer registered in the Province of Alberta.
		3. Test and Evaluation Reports
			1. The Province may appoint and pay for services of a testing agency to perform testing and inspection of work of this Section. Refer to Section 05 05 05.
			2. Notify the Province prior to commencement of fabrication work so that testing and inspection may be properly scheduled.
			3. When defects are revealed, the Province may request additional testing and inspection at the Contractor's expense.
		4. Manufacturer Reports:
			1. Submit three copies of certified mill test reports for the materials used.
				1. Where mill test reports originate from a mill outside of Canada or the United States of America, the Contractor shall have mill test reports verified by a certified laboratory in Canada by testing the material to the specified material standards, including boron content. The testing laboratory shall be certified to ISO/IEC 17025 by an organization accredited by the Standards Council of Canada for the tests required. Samples for testing shall be collected by personnel employed by the certified laboratory. A verification letter shall be provided by the certified laboratory that includes at a minimum, the applicable mill test reports, testing standards, date of verification testing, and declaration of material compliance with Contract requirements. The verification letter shall be signed by an authorized officer of the certified laboratory.
		5. Code Adherence:
			1. The Contractor shall submit, [with the tender][before starting work], written evidence of qualification of the steel fabricators and erectors for welding under Canadian Welding Bureau requirements.
			2. The Contractor shall submit, [with the tender][before starting work], written evidence of ability to weld reinforcing steel to structural steel in accordance with CSA W186.
		6. Sustainable Design Submittals:
			1. LEED Submittals: submit LEED submittal forms for Credit MR 4 in accordance with Section 01 35 18 - LEED Requirements and the following:
				1. Documentation identifying quantity by weight of recycled content in steel product if content is over 25% and to be claimed as such toward LEED credits.
			2. LEED Submittals: submit LEED submittal forms for Credit MR 5 in accordance with Section 01 35 18 LEED Requirements and the following:
				1. Regional Materials: provide evidence that project incorporates required percentage [20] [30]% of regional materials/products, showing their cost, distances from extraction to manufacture and manufacture to project site, and total cost of materials for project.
			3. Submit shop paint primer manufacturer's product data [verifying compliance with MPI Green Performance Standard GPS-1-08, for VOC content].
			4. Submit product data for site applied spot-primer for interior applications verifying compliance with GS-11, Paints and Coatings, for VOC content.
	4. QUALITY ASSURANCE
		1. Welding shall be undertaken only by a company approved by the Canadian Welding Bureau to the requirements of CSA W47.1, Certification of Companies for Fusion Welding of Steel Structures.
	5. DELIVERY, STORAGE, AND HANDLING
		1. Delivery and Acceptance Requirements:
			1. Deliver open web steel joists in accordance with joist manufacturer’s written instructions; label open web steel joists with same marks as used for fabrication and erection documents.
		2. Storage and Handling Requirements:
			1. Protect open web steel joists from corrosion, deformation, and other damage during site storage and handling in accordance with joist manufacturer’s written instructions.
		3. Waste Management and Disposal:
			1. Separate waste materials for [reuse] [and] [recycling] in accordance with Section 01 74 19 - Management and Disposal.
	6. QUALIFICATIONS
		1. The open web steel joist Fabricator shall have a minimum of five (5) years of experience in the fabrication of open web steel joists.
		2. The Steel Joist Erector shall have a minimum of five (5) years of experience in the erection of open web steel joists.
		3. Steel fabricators and erectors must be certified under requirements of CSA W47.1 as required by CSA S16.
		4. Welding procedures, welders and welding operations shall be qualified in accordance with Canadian Welding Bureau Standards.
	7. EXAMINATIONS
		1. Examine and verify all measurements critical to the work of this contract.
	8. TESTING AND FIELD REVIEW
		1. See Section 05 05 05 – Steel Testing and Inspection.
		2. Prior to the commencement of work provide a schedule of shop fabrication to the Province, Consultant, and the Testing Agency.
1. Products
	1. MATERIALS
		1. Steel:  structural quality to CSA G40.20 and CSA G40.21.

.1 Structural steel with boron content exceeding 0.0008% will not be permitted.

* + 1. Welding Materials: to CSA W59.
		2. Shop Paint Primer: [to CISC/CPMA 2-75] [as specified in Division 09, Painting and Finishing Schedules][meeting requirements of MPI GPS-1 standard for VOC content] [to CISC/CPMA 1-73a].
		3. Zinc rich paint and touch-up primer for interior surfaces: meeting requirements of Green Seal Standard GS-11, for VOC content to be less than 250 g/l.
	1. DESIGN
		1. Unless otherwise noted open web steel joists shall be designed by the Specialty Structural Engineer to the reference Standards.
		2. Design joists of the depth and spacing shown on the drawings to carry the loads shown on the drawings in accordance with CSA S16; minimum chord thickness of [XXX mm].
		3. Design open web steel joists and anchorages for uplift forces shown on drawings.
		4. Loads indicated on drawings are not factored, unless specifically indicated otherwise.
		5. Design of bridging for steel joists shall conform to the requirements of CSA S16, unless otherwise indicated on the drawings. Refer to the drawings for areas of non-typical joist bridging and bracing.
		6. Joists shall have a live load deflection of less than 1/360 of the span unless noted otherwise.
		7. Vibration analysis of floors:
			1. Design steel joist framing to provide the minimum moment of inertia shown on the drawings.
			2. Fabrication and erection documents shall include moment of inertia of each floor joist.
			3. Request from Consultant any moments of inertia not shown on drawings.

*SPEC NOTE: Typically, a more stringent deflection limit is specified for joists parallel to and near relatively rigid end walls / support line. This is to provide a gradual increase in deflection perpendicular to the joist span as one moves away from the end wall / support line to mitigate build-up of stresses in the roof / floor deck and components of the building envelope. Also state this requirement on the drawings.*

* + 1. Limit differential live load deflection of joists to adjacent more rigid elements, such as, but not limited to, walls and beams, to [1/50] of the spacing between the joist and adjacent element, unless shown otherwise on drawings.
		2. Line up openings and webs in adjacent joists to allow for passage of pipe, ducts, conduits, etc. Indicate relevant clear opening dimensions on fabrication and erection documents. Make allowance in joist design for support of pipes, ducts, conduits, etc.
		3. Where joists frame into both sides of a support, extend the top chord of the joists to the center of the support, unless shown otherwise.
		4. Where joists frame into one side of a support, extend the top chord of the joists to the far side of the support, unless shown otherwise.
	1. FABRICATION
		1. Fabricate steel joists and accessories in accordance with CSA S16 and CSA S136.
		2. Camber joists to dead load deflection indicated on drawings.
		3. Drill holes in chords where necessary for attachment of wood nailers. [Weld threaded studs to top chord for attachment of wood nailers.] Make allowance for the reduction in cross sectional area of tension flanges.
		4. Fabricate top [and bottom] chord extensions where indicated. [Provide ceiling support extensions to bottom chord as required to support ceiling construction.]
	2. SURFACE PREPARATION AND SHOP PRIMING
		1. Where steel joists are scheduled to be finish painted, prepare surfaces in accordance with Steel Structures Painting Council, [SP-3 Power Tool Cleaning] [SP-6 Commercial Blast Cleaning].
		2. Apply shop paint primer in accordance with CSA S16 [manufacturer’s instructions] to a dry film thickness of 50 to 75 micrometers.
1. Execution
	1. ERECTION
		1. The steel joist erector is fully responsible for erection methods, equipment, workmanship and safety precautions.
		2. Steel joists shall bear on beams as per section 2.2, but in no case shall be less than 65 mm on supporting steel members. Connect to supporting steel with a minimum of 5 mm x 30 mm long fillet weld at each side. Secure to bearing plates on masonry walls in the same manner, bearing 100 mm minimum.
		3. Erect steel joists and bridging in accordance with CSA S16, CSA W59 and CSA S136.
		4. Obtain the Consultant’s approval prior to field cutting or altering of joists or bridging.
		5. Field touch up shop paint primer at bolts, welds and burned or scratched surfaces. Use same primer as applied in shop.

**END OF SECTION**