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| **Section Cover Page** |
| **Section 05 05 05**  **2019-06-05 Steel Testing and Inspection** |

This Master Specification Section contains:

.1 This Cover Page

.2 Specification Section Text:

**1. General**

1.1 Intent

1.2 Related Work Specified in Other Sections

1.3 Definitions

1.4 Reference Documents

1.5 Quality Assurance

1.6 Administrative Requirements

**2. Products**

2.1 Reports: General

**3. Execution**

3.1 Testing: General

3.2 Source Quality Assurance

3.3 Site Quality Assurance

|  |  |
| --- | --- |
| **TS** Technical Specification |  |
| Infrastructure  Technical Specification System | Page 1 |

# General

## Intent

### This section is included for the information of the Contractor to coordinate their activities with the inspection and testing agency retained by the Province.

### The Province is responsible for establishing the Quality Assurance (QA) program and the Contractor is responsible for implementing and maintaining the design, fabrication and erection related Quality Control (QC) functions and procedures.

### Steel testing and inspection is part of the QA program to be performed by one or more qualified independent inspection and testing agencies retained and paid for by the Province.

### The Contractor shall include costs for coordination with the Province’s appointed inspection and testing agencies only; do not include any costs for QA inspection and testing. Costs for QC functions and procedures are the responsibility of the Contractor.

### Inspection and testing carried out by the Province’s inspection and testing agency is intended to confirm that the Contractors and Steel Sub‑Contractor’s QC and QA procedures are functioning effectively:

#### The Contractor and Steel Sub‑Contractors’ own QC and QA procedures shall be capable of confirming that the Work is performed in accordance with the Contract Documents.

.2 The Province’s inspection and testing is not intended to serve as any part of the Contractor and Steel Sub‑Contractor’s QC and QA.

.3 The purpose of the steel testing and inspection program is to inspect, sample, and test a sufficient number of members, details and procedures, and a sufficient quantity of material, in order to determine if the structural work is proceeding in general accordance with the Contract requirements.

.4 The Contractor and Steel Sub‑Contractor shall cooperate fully with the Province’s testing agencies by allowing free access to all parts of the work for the purpose of testing and review at all times. Prior to the commencement of work, the schedule of shop fabrication and field construction shall be provided to the testing agency. The Contractor / Steel Sub‑Contractor shall notify the Province’s testing agency when work is ready for review.

.5 The testing agency is responsible to the Province and has the authority to, and is expected to reject any work not meeting the Contract requirements.

### Terms of reference for the inspection and testing services for structural steel, open web steel joists and steel deck include, but are not limited to, the following:

#### The inspection and testing agency is responsible for review of the work performed by the Contractor, Steel Sub‑Contractor and reporting to the Province that the work is in compliance with the applicable References and Contract Documents.

#### The inspection and testing agency shall not take any instructions from the Contractor or Steel Sub‑Contractor.

#### The responsibility for quality of construction and compliance with Contract Documents rests solely with the Contractor. Inspection and testing by the Province shall not be deemed to relieve the Contractor of any of his/her obligations.

#### The Consultant will make all engineering decisions with respect to rejection criteria and rework required and inform the Province.

## related work specified in other sections

### Section 01 33 00 – Submittal Procedures

### Section 01 45 00 – Quality Control

### Section 05 12 00 – Structural Steel Framing

### Section 05 21 19 – Open Web Steel Joists

### Section 05 30 00 – Metal Decking

### Section 05 50 00 – Metal Fabrications

## Definitions

### Quality Management Plan: Quality Management Plan performed by the Steel Sub‑Contractor capable of confirming that the work of steel fabrication and erection is conducted in accordance with the Contract Documents. The Province’s Site and Source Quality Assurance requirements in this section do not replace or eliminate the requirement of the Contractor to perform their own Quality Management Plan.

### Site Quality Assurance: Inspections and testing performed during the installation of components and that is further defined as site assembled or installed work occurring as a part of execution; work that is not performed in the shop or off site.

### Source Quality Assurance: Inspections and testing performed during fabrication of components and that is further defined as shop assembled or manufactured products; work that is not performed on site.

### Testing Agency: Shall mean the inspection and testing agency responsible to the Province.

### Non‑destructive Testing: Shall mean magnetic particle, ultrasonic or radiographic testing as determined appropriate by the Testing Agency.

## Reference documents

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

### Canadian Standards Association (CSA):

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| .1 | CSA S16-14 | Design of Steel Structures |
| .2 | CSA G40.20-13 | General Requirements for Rolled or Welded Structural Quality Steel |
| .3 | CSA G40.21-13 | Structural Quality Steel |
| .4 | CSA W47.1-09 (R2014) | Certification of Companies for Fusion Welding of Steel |
| .5 | CSA W55.3-08 (R2013) | Certification of Companies for Resistance Welding of Steel and Aluminum |
| .6 | CSA W59-13 | Welded Steel Construction (Metal Arc Welding) |
| .7 | CSA W178.1-14 | Certification of Welding Inspection Organizations |
| .8 | CSA W178.2-14 | Certification of Welding Inspectors |

### Canadian Welding Bureau (CWB Group Industry Services):

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| --- | --- | --- |
| .1 | CWB 113E/07-1 | Weld Quality & Examination Methods Study Guide |

### Canadian Sheet Steel Building Institute (CSSBI):

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| .1 | CSSBI 10M-13 | Standard for Steel Roof Deck |
| .2 | CSSBI 12M-17 | Standard for Composite Steel Deck |

### Other Applicable References:

### .1 Alberta Building Code 2014

### .2 Reviewed Shop Drawings for the project

## quality assurance

.1 The Quality Assurance requirements listed in this Section are specific to the Province’s inspection and testing agency; refer to technical specification sections for Contractor’s quality assurance requirements.

.2 Qualifications: Provide proof of qualifications when requested by Consultant:

#### Testing Agency: Inspection and testing agency shall be experienced in all aspects of the required work as described in this Section; and shall be independent from the Consultant, structural steel Contractor, open web steel joist Contractor, steel deck Contractor, and the supplier of post-installed fastening systems.

#### Testing and Inspection Personnel: Use personnel that have completed work of a similar scope and complexity to that required for this Project.

.3 Certification: Provide proof of the following during the course of the Work:

#### Agency Welding Certificates: Provide proof indicating that inspection and testing agency is certified CSA W178.1 for welding inspection Building Category.

#### Personnel Welding Certificates: Provide proof indicating that personnel examining welds and that are employed by the inspection and testing agency are Canadian Welding Bureau (CWB) certified Welding Inspectors or a person with equivalent qualifications.

## Administration Requirements

#### Review work of Quality Control: notify Consultant of non‑compliant workmanship or materials within one (1) day of discovery.

#### Invoicing - Prepare detailed monthly invoices addressed to the Province and submit to the Consultant for review.

# Products

## reports: General

### Provide required information in accordance with Submittal Procedures and General Requirements.

#### Inspection Reports: Submit a report of each inspection detailing the following for each review:

##### Name and Certificate Number of welders involved.

##### Copy of welding procedure for all welds not pre‑qualified by CSA W59

##### Identification mark of members reviewed and compliance status.

#### Final Report: Submit a final report summarizing all previous reports and specifically stating a belief as to the compliance of the work, signed by the testing agency’s certified inspector responsible for the testing and inspection program. Certify all welds and connections and include confirmation that required repairs have been completed. The final report shall be submitted under the seal and signature of a Professional Engineer registered in the Province of Alberta. Send copies of the final report to the following:

##### Province

##### Consultant

##### General Contractor

##### Structural Steel Trade Contractor

# Execution

## testing: General

### Inspection and Testing Agency Coordination: Inspection and testing agency is required to coordinate with the Contractor for notification requirements regarding the timing of testing and inspections, and as follows:

#### Coordinate inspection and testing activities with Contractor; be aware of current work schedule and bring to the attention of the Consultant any testing or inspection requirement apparently being overlooked.

#### Coordinate a common marking protocol for all parts or joints that have been reviewed and accepted.

#### Coordinate work of this Section with Section 01 45 00 – Quality Control; notify Consultant of non-compliant workmanship or materials within one (1) day of discovery.

### Where stated in this Section, the frequency of inspection or testing is the initial frequency with which the testing and inspection agency shall perform their activities. As the Contractor’s own QA and QC program demonstrates its effectiveness during the course of the project, the frequency of testing and inspection by the Province’s inspection and testing agency may be adjusted in consultation with the Province, Contractor, and the Consultant:

#### Immediately inform the Consultant when sufficient number of shop or site visits are not clearly identified and make a recommendation for additional shop or site visits to form an opinion as to the compliance of the work.

#### Immediately inform the Consultant when fabrication and erection conditions are such that a reduced program of testing and inspection is deemed appropriate or an increased program of testing and inspection is deemed necessary to form an opinion as to the compliance of the work.

### Additional tests may be directed by the Consultant, or requested by the Contractor:

#### Costs of tests requested by the Consultant will be paid by the Province.

#### Costs of tests requested by the Contractor will be paid by the Contractor.

### Where the frequency of inspection and testing is not specifically stated in this Section, the Province’s inspection and testing agency shall make a recommendation to the Consultant.

### Identify with a distinguishing mark all parts or joints that have been reviewed and accepted.

## Source Quality assurance

*SPEC NOTE: The Consultant to review and modify requirements below as appropriate.*

### Structural Steel and Open Web Steel Joists:

#### Review correlated mill test certificates for compliance with specified material.

#### Review structural steel and confirm that steel is supplied by an acceptable source in accordance with the requirements of the Contract Documents; confirm that source of steel sections is clearly identified with raised lettering embossed on at least one face of the steel sections.

#### Randomly check and record member dimensions, thicknesses, lengths and fabrication details for tolerance; +/- [10%] of columns, and +/- [5%] total of beams and girders.

#### Check milling of columns and base plates.

#### Examine coatings and application to verify compliance.

#### Visually examine designated members for compliance with requirements of Architecturally Exposed Steel.

#### Random examination of loading to ensure proper handling and shipping.

### Welding:

#### Review shop welding procedures and welders’ qualification certificates for the processes required.

#### Perform a visual review of all types of welds for size, length and workmanship.

#### Perform magnetic particle inspection of randomly selected welds (5 to 10% of connections).

#### Perform ultrasonic examination of 100% of complete penetration welds subject to tension and of 10% of those subject to compression.

#### Perform a visual review of all types of welds and workmanship of embedded plates.

#### Perform ultrasonic examination of splices of truss chord members; 100% of tension splices and 10% of compression splices.

### Headed Shear Connectors and Stud Rails:

#### Review supplier, grade, diameter, length, and head geometry for compliance.

#### Perform [100%] visual review of connector welds.

#### Perform Bend tests in accordance with CSA W59 if visual review indicates less than full 360-degree flash and hammer strike makes a dull sound indicating incomplete fusion.

### Reports: Report the following for each review of shop fabricated work:

#### Name and Certificate Number of welders involved.

#### Identification mark of members reviewed and compliance status.

## Site Quality assurance

*SPEC NOTE: The Consultant to review and modify requirements below as appropriate.*

### Structural Steel Framing and Open Web Steel Joists:

#### Review structural steel Erector’s welding procedures and welders’ qualification certificates for the procedures required.

#### Examine steel for shipping and handling damage.

#### Randomly examine erected work for fit-up, dimensions, tolerances, alignment and plumbness; include checking by instrument a minimum of 10% of beams and 10% of columns in the building for plumbness, alignment, and tolerance.

#### Review temporary bracing and stability of the steel frame during erection.

#### Confirm that all isolations between hot-rolled and stainless steel are installed correctly and function properly.

#### Perform the following inspections:

##### [100%] visual examination of site welds for size, length and workmanship.

##### Magnetic particle inspection of [100%] of site welds for moment connections.

##### Magnetic particle inspection of randomly selected other site welds (5 to 10% of connections).

##### Ultrasonic examination of 100% of complete penetration welds subject to tension and of 10% of those subject to compression.

##### Review slip-critical connections to confirm that faying surfaces are free from oil and other deleterious substances, and that coatings, if any, are in compliance.

##### Random verification that bolts are tightened in accordance with the turn‑of‑nut method on 10% of connections with pre‑tensioned bolts.

##### Random verification that bolts are snug tight and that connected plies are in firm contact on 10% of other bolted connections.

##### Examine site applied coatings and application for compliance.

##### Review open web steel joist bearings to confirm compliance.

##### Review open web steel joists for compliance of suspended loads and attachments.

##### Base plates and cap plates:

###### Check grouting of column base plates and bearing plates to confirm compliance. Inspect at least three columns to confirm correct grouting procedures are used.

###### Confirm that contact of base plates and levelling plates meets CSA S16 tolerances.

###### Check for full bearing of column sections to base and cap plates.

###### Check special bearing details of sliding expansion joint bearings.

##### Check reinforcement and work around all holes and openings authorized to be cut at site.

### Steel Deck: Perform the following inspections:

#### 100% visual inspection to confirm deck type, profile and galvanizing / coating [check that composite deck units have suitable lugs or deformations to provide composite action with concrete]; obtain and review substantiating test data from Contractor.

#### Random review of deck sheet thickness for +/- 10% of deck.

#### Review the span layout (continuity) of the deck sheet over supports for compliance with the Contract drawings.

#### [100%] visual review of deck side fastening sheet to sheet and fastening to supporting structure.

#### Visually inspect welds for size, spacing, and workmanship.

#### Visually inspect mechanical fasteners for size, type, spacing, and workmanship.

#### Examine condition of supporting members after steel deck has been fastened to determine if supporting members were damaged.

#### Examine openings / cut-outs in the deck and confirm edge reinforcement.

### Headed Shear Connectors: Perform the following inspections:

#### Review supplier, grade, diameter, length, and head geometry for compliance.

#### Confirm that Sub‑Contractor uses proper procedures to determine generator, control unit, and stud welder settings at the start of each production period in accordance with CSA W59.

#### Perform the following inspections:

##### [100%] visual review of connector welds.

#### Perform bend tests in accordance with CSA W59 if visual review indicates less than full 360‑degree flash and hammer strike makes a dull sound indicating incomplete fusion.

### Structural Fasteners: Perform the following inspections:

#### [100%] visual inspection to confirm identification markings

### Post-Installed Fasteners: Perform the following inspections:

#### Initial inspection: encompasses the first ten (10) anchors of each type and size and consists of:

###### Training certificates of installers

###### Drill bit type and size

###### Hole depth

###### Hole cleaning technique

###### Anchor type, size, embedment and installation procedure, including adhesive expiration date and proper dispensing if applicable.

#### Subsequent installations of the same anchor size and type by the same personnel will proceed in the absence of the inspector, unless the inspector deems his presence is required, permanently or randomly.

#### Any change in the anchor product being installed or the personnel performing the installation requires initial re-inspection by the inspector.

#### Proof Testing: unless noted otherwise, proof load tests will be conducted on the initial ten (10) installations of each anchor type and at random on 5% of installed anchors; additional tests may be required where failures occur.

###### Adhesive anchors will be tested to the lesser of 50% of the adhesive limit state bond strength or 80% of the steel anchor yield strength.

###### Expansion anchors will be torque tested to 1.25 times the installation torque specified by the manufacturer.

#### **END OF SECTION**