# BRISBANE CITY COUNCIL

# REFERENCE SPECIFICATIONS FOR ENGINEERING WORK

# S230 STRUCTURAL STEEL

## AMENDMENT REGISTER

|  |  |  |  |
| --- | --- | --- | --- |
| Ed/Rev Number | Section Number | Description | Date |
| 1.0 |  | Original issue | Oct 2001 |
| 2.0 | 2.3 | Test certification requirements clarified. | Apr 2014 |
| 3.0 | General | External References Updated and Corrected | May 2016 |
| 1.3 | Reference list expanded to show all referenced documents |
| 4.0 | General | Document name changed from ‘Reference Specifications for Civil Engineering Work’ to ‘Reference Specifications for Engineering Work’ | Mar 2021 |

(Page Left Intentionally Blank)

## TABLE OF CONTENTS

1.0 GENERAL 1

1.1 Section Content 1

1.2 Standards 1

1.3 References 1

1.4 Adjoining Elements 1

2.0 QUALITY 1

2.1 Inspection 1

2.2 Tests 2

2.3 Contractor’s Submissions 2

3.0 MATERIALS AND COMPONENTS 3

4.0 execution 4

4.1 Fabrication 4

4.2 Bolting 4

4.3 Welding 5

4.4 Erection 5

5.0 finishes 5

5.1 Identification Marks 5

5.2 Surface Preparation 5

5.3 Protective Coatings 6

5.4 Gavalnising 6

(Page Left Intentionally Blank)

## GENERAL

### Section Content

Specified in this section: The provision, fabrication, erection, connection, grouting, galvanising and shop painting of heavy structural steelwork.

### Standards

|  |  |  |
| --- | --- | --- |
| Australian Standard | AS 1111 | ISO metric hexagon bolts and screws – Product grade C – Bolts |
| Australian/New Zealand Standard | AS/NZS 1252 | High strength steel bolts with associated nuts and washers for structural engineering |
| Australian/New Zealand Standard | AS/NZS 1554.1 | Structural steel welding – Welding of steel structures |
| Australian Standard | AS 1627.1 | Metal finishing – Preparation and pretreatment of surfaces |
| Australian/New Zealand Standard | AS/NZS 2312.1 | Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings – Paint coatings |
| Australian/New Zealand Standard | AS/NZS 2312.2 | Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings – Hot dip galvanizing |
| Australian/New Zealand Standard | AS/NZS 3678 | Structural steel – Hot-rolled plates, floorplates and slabs |
| Australian/New Zealand Standard | AS/NZS 3679.1 | Structural steel – Hot-rolled bars and sections |
| Australian/New Zealand Standard | AS/NZS 3679.2 | Structural steel – Welded I sections |
| Australian/New Zealand Standard | AS/NZS 4100 | Steel structures |
| Australian/New Zealand Standard | AS/NZS 4600 | Cold-formed steel structures |
| Australian/New Zealand Standard | AS/NZS 4680 | Hot-dip galvanized (zinc) coatings on fabricated ferrous articles |
| Australian/New Zealand Standard | AS/NZS 4791 | Hot-dip galvanized (zinc) coatings on ferrous open sections, applied by an in-line process |
| Australian/New Zealand Standard | AS/NZS 4792 | Hot-dip galvanized (zinc) coatings on ferrous hollow sections, applied by a continuous or a specialized process |

### References

Refer to the following other Reference Specifications for Engineering Work:

|  |  |
| --- | --- |
| S110 | General Requirements |

### Adjoining Elements

Provide for the fixing of adjoining building elements to be fixed to or supported on the structural steel.

## QUALITY

### Inspection

Witness points – off-site

*Refer annexure*. Give sufficient notice so that inspection may be made at the following stages:

* Materials including welding consumables before fabrication.
* Testing of welding procedures and welder qualification tests.
* Commencement of shop fabrication.
* Commencement of welding.
* Before placement of root runs of complete penetration butt welds.
* Completion of fabrication before surface preparation.
* Surface preparation before shop painting.
* Completion of protective coating before delivery to site.

Witness points – on-site

*Refer annexure*. Give sufficient notice so that inspection may be made at the following stages:

* Steelwork on site before erection.
* Tensioning of bolts in categories 8.8/TB and 8.8/TF.
* Steelwork and column bases erected on site, before grouting, encasing, site painting or cladding.
* Anchor bolts in position before casting in.
* Commencement of encasing.

### Tests

Non-destructive weld examination

Standard: To *AS/NZS 1554.1*.

Non-destructive examination (NDE): Conduct to the requirements of Table 2.1. *Refer annexure.*

Radiographic and ultrasonic inspection: Have the examination performed by an independent testing authority.

Repairs: Repair faulty welds revealed by non-destructive examination and repeat the examination.

Table 2.1 – NDE schedule

|  |  |  |
| --- | --- | --- |
| Type of weld and category | Examination method | Extent of total length of weld type |
| Fillet welds | Visual inspection | 100% |
| Butt welds, GP | Visual inspection | 100% |
| Butt welds, SP | Visual inspection | 100% |
| Butt welds, SP | Radiographic or ultrasonic inspection | 10% |

### Contractor’s Submissions

Samples

Surface finish: Minimum 0.1 m2.

Weld: Minimum 300 mm run of weld.

Subcontractors

Submit names and contact details of proposed fabricator and installer.

Shop drawings

General: Submit shop drawings showing the following information.

* Relevant details of each assembly, component and connection.
* Information relative to fabrication, surface treatment, transport and erection.

Particular: Include the following information.

* Identification.
* Steel type and grade.
* Dimensions of items.
* Required camber, where applicable.
* Fabrication methods including, where applicable, hot or cold forming and post weld heat treatment.
* Location, type and size of welds or bolts.
* Weld categories and bolting categories.
* Orientation of members.
* Surface preparation methods and coating system.
* Procedures necessary for shop and site assembly, and erection.
* Temporary works such as lifting lugs, support points, temporary cleats and bracing which are required for transport and erection of the structural steelwork.
* Required fixings for adjoining building elements.

Number of copies: For each drawing, supply not less than three copies in the form of prints on paper, or one copy in the form of a reproducible transparency.

Fabrication: Do not commence fabrication until permission to use the relevant shop drawings has been obtained.

Tests

Steel: Submit evidence that the steel used in the work complies with the cited material standards as detailed in the relevant Australian Standards.

Acceptable evidence: Certified mill test reports, or test certificates issued by the mill as required by the relevant Australian Standards.

Alternative: Have the steel tested by a certified independent testing authority (e.g. NATA certified laboratory) for compliance with the chemical composition and mechanical test requirements of the cited material standard.

Galvanising: Submit evidence that galvanising complies with the relevant Australian Standards.

Materials and components

Masonry anchors: If masonry anchors are required or proposed for the support or fixing of structural steel, submit evidence of the anchor capacity to carry the load.

Execution

Splicing: If splicing of structural members is intended, submit proposals.

Welding procedures: Submit details of proposed welding procedures, using the form in Appendix C of *AS/NZS 1554.1*.

Erection: If members cannot be properly erected, give notice.

Identification marks: Submit details of proposed marking for high strength structural bolted connections in work exposed to view.

Distortions: If a member is distorted during the galvanising process, submit proposals for straightening.

## MATERIALS AND COMPONENTS

Steel type and grade

Cold formed sections: To *AS/NZS 4600*.

Steel grade: Generally to the requirements of Table 3.1. *Refer annexure*.

Table 3.1 – Steel grade schedule

|  |  |
| --- | --- |
| Type of steel | Grade |
| Universal beams and columns, parallel flange channels, large angles to *AS/NZS 3679.1* | 300 |
| Flat, small angles, taper flange beams and columns to *AS/NZS 3679.1* | 250 |
| Welded sections to *AS/NZS 3679.2* | 300 |
| Hot rolled plates, floor plates and slabs to *AS/NZS 3678* | 250 |
| Hollow sections to *AS 1163* |  |
| * Circular sections less than 265 mm outside diameter | C250 |
| * Sections other than the above | C350 |
| Cold formed purlins and girts to *AS 1397* | G450 Z350 |
| Steel rails to *AS 1085.1* | One grade only |

All steel to have product identification as required by the relevant Australian Standard.

Members

General: Uncontaminated.

Bolts, nuts and washers

General: Hot dipped galvanised, corrosion free, coated in oil and in serviceable condition.

Standard: To *AS/NZS 1252*.

## EXECUTION

### Fabrication

Splicing: Provide structural members in single lengths.

Beam camber: If beam members have a natural camber within the straightness tolerance, fabricate and erect them with the camber up.

Site work: Other than work shown on the shop drawings as site work, do not fabricate or weld structural steel on site.

### Bolting

Connection bolts

Connection bolts: For connection bolts not shown on the drawings, provide snug tight bolting category 8.8/S. *Refer annexure*.

Bolting category 8.8/TF: Contact surfaces to be clean, as rolled and free from applied finishes.

Foundation bolts

General: Provide each foundation bolt with 2 nuts and 2 oversize washers and provide sufficient thread to permit the levelling nut to be set below the base plate.

Hexagonal commercial bolts: To *AS 1111.1*.

Hexagonal nuts: Class 5.

Lock nuts

General: Provide lock nuts for bolts in moving parts or parts subject to vibration and for vertical bolts in tension.

### Welding

Standard: To *AS/NZS 1554.1*.

Weld category: Unless specified otherwise, provide category GP weld. *Refer annexure*.

Weld type: Unless specified otherwise, provide 6 mm continuous fillet weld made using E48XX electrodes or equivalent.  *Refer annexure*.

Site welds: Other than site welds shown on the shop drawings, do not weld on site. Wherever possible locate site welds in positions for down hand welding. Do not weld until correct alignment and preset or camber, have been achieved.

### Erection

Temporary connections: Do not attach cleats except as shown on shop drawings.

Temporary members: Fix temporary members so as not to weaken or deface permanent steelwork.

Hand flame cutting: Do not hand flame cut bolt holes.

Movements: Provide for thermal movements during erection.

Anchor bolts: For each group of anchor bolts provide a template with setting out lines clearly marked for positioning the bolts when casting in.

Grouting at supports: Before grouting steelwork to be supported by concrete, masonry and the like, set steelwork in packing or wedges. Do not grout if the temperature of the base plate or the footing surface exceeds 38°C.

Handling: Do not overstress or deform members or components.

Drifting: Use only to bring members into position. Do not enlarge holes or distort components.

Work exposed to view: Grind smooth the weld but do not reduce to below its nominal size. Perform carefully and accurately any shearing, flame cutting and chipping work. Grind corner and edges that are sharp, marred, or roughened.

Tolerances: Unless specified otherwise, comply with the requirements of AS 4100. *Refer annexure*.

## FINISHES

### Identification Marks

Provide marks or other means for identifying each member, and for the setting out, location, erection and connection of the steelwork and compatible with the finish. If the work includes more than one bolting category, mark bolted connections to show the bolting category.

### Surface Preparation

Methods and classification: To *AS 1627*.

Site connections: After completing the connection, prepare the surface of the connection, adjacent unprimed surfaces and surfaces damaged during erection.

Steel surfaces generally: Remove loose millscale, loose rust, oil, grease, dirt, globules of weld metal, weld slag and other foreign matter. Ensure surfaces are dry.

Abrasive blast cleaning: Do not use silica abrasive for dry blasting. Use phosphate inhibitors when wet blasting.

Steelwork to be encased or in contact with concrete or area which is to be site welded: Abrasive blast cleaning not required.

Non-visible structural steelwork: Surface preparation Class 2½.

Steelwork exposed externally: Surface preparation Class 2½.

Marking: On the contact surfaces of friction type joints, confine the use of marking ink to the minimum necessary for marking hole positions.

### Protective Coatings

General

Requirement: To *AS/NZS 2312*.

Shop work: Apply the primer coat or protective system to the structural steel before delivery to the site.

Transport and handling: Do not damage the paintwork. Do not handle or transport steel members until the paintwork is dry.

Site work: After erection, repair damage to the shop coating and apply coating omitted at site connections.

Protective coating systems: Provide details in the annexure or on the drawing. *Refer annexure*.

Priming

Time delay: Prime the steel surface as soon as possible after surface preparation and before the surface deteriorates, and in any case within 4 hours for shop work and 2 hours for site work. If the surface is contaminated or rust bloomed, repeat surface preparation before priming.

Conditions: Do not prime in adverse ambient conditions.

Fast drying primers: Do not use fast drying primers where surface preparation is less than Class 1.5.

Concrete encasing: Where members are part concrete encased, extend the priming 25 mm into the surface to be encased.

Inaccessible surfaces

Where surfaces will be in contact or near contact after fabrication or erection, apply the finish and allow it to dry before assembly.

### Gavalnising

Standards

Fabricated ferrous articles: To *AS/NZS 4680*.

Ferrous open sections: To *AS/NZS 4791*.

Ferrous hollow sections: To *AS/NZS 4792*.

Structural sections

Cold worked items: Except for hollow sections, anneal to 650°C before galvanising.

Coating mass: Other than nut and bolt thread surfaces, minimum average 600 g/m2. *Refer annexure*.

Coating quality: Continuous, adherent, smooth, evenly distributed, and free from defects detrimental to the end use of the finished article. Defects include lumps, blisters, gritty areas, uncoated spots, acids and black spots, and dross and flux.

Hollow sections: Provide seal plates with breather holes.

Friction type bolted connections

General: Treat contact surfaces to achieve the required slip factor.

Method: Wire brushing or light grit blasting

Repairs

Repair finished to ensure the full integrity of each phase and each coating.

# COMPLETION

Temporary connections: Remove temporary cleats on completion and restore the surface.