

SECTION 90

STEELWORK (BS 5400)

Application of standards and codes of practice

- 1** Steelwork including handrailing, walkways and bearings forming part of the bridge steelwork fabrication shall comply with BS 5400: Part 6 as qualified or amended by this and the following Clauses.

Steel bearings made by specialist manufacturers shall comply with Section 100: Bearings.

All numbers within the heading margin are the relevant clause numbers within BS 5400: Part 6.

(90.001)

Structural steels generally 3.1

- 2** Steel, bolts, nuts, washers, load indicating washers, rivets, swaged collar grooved rivets and shear connectors shall be supplied by manufacturers and/or suppliers who have quality systems approved to BS EN ISO 9002 or BS EN ISO 9003 by a body accredited by the United Kingdom Accreditation Service (UKAS) or manufacturers and/or suppliers who have quality systems that can be demonstrated to the Employer's Representative to be equivalent.

A record of the source of, and test certificates for steel, bolts, nuts, washers, load indicating washers, rivets, swaged collar grooved rivets, and shear connectors shall be maintained by the Contractor.

3.1.1

Delete BS 5400: Part 6, clause 3.1.1 and the following shall apply.

Structural steels shall comply with the requirements of BS EN 10 025, BS EN 10 113: Parts 1, 2 and 3, BS EN 10 155, BS EN 10 210: Part 1 or BS 7668 as applicable and shall be to the grades specified in such British Standards and as shown on the Contract Drawings.

Steel supplied shall, after all heat treatment associated with the fabrication (including welding, hot forming and correction of distortion) maintain the minimum mechanical properties specified in the above British Standards.

The ladle analysis for each grade of steel shall be supplied.

Options BS EN 10 025

For structural steel supplied in accordance with BS EN 10 025, the following options shall apply.

- | | |
|-----------|---|
| Option 5 | Maximum carbon equivalent value to be as stated in table 4. |
| Option 6 | Additional chemical elements to be recorded for steel grade S355. |
| Option 10 | Steel to comply with the improved properties perpendicular to the surface in BS EN 10 164, where shown by the letters 'TTP' to designate 'through thickness properties' on the Contract Drawings. |

- Option 11 Steel to be suitable for hot dip galvanizing where shown on the Contract Drawings as galvanized.
- Option 12 Steel to be submitted to specific inspection and testing as specified in Clause 90.005.
- Option 13 This option may be invoked at the discretion of the Contractor.
- Option 16 This option may be invoked at the discretion of the Contractor.

**BS EN 10 113
Parts 1, 2 and 3**

For structural steel supplied in accordance with BS EN 10 113: Parts 1, 2 and 3, the following options shall apply.

- Option 2 Maximum carbon equivalent value to be as stated in BS EN 10 113: Part 2, table 2, or BS EN 10 113: Part 3, table 2 as appropriate.
- Option 6 Steel to comply with the improved properties perpendicular to the surface in BS EN 10 164, where shown by the letters 'TTP' to designate 'through thickness properties' on the Contract Drawings.
- Option 7 Steel to be suitable for hot dip galvanizing where shown on the Contract Drawings as galvanized.
- Option 9 This option may be invoked at the discretion of the Contractor.
- Option 10 If steel is stamped, 'low stress' stamps as specified in Clause 90.004l shall be used.

BS EN 10 155

For structural steel supplied in accordance with BS EN 10 155, the following options shall apply.

- Option 4 A maximum carbon equivalent value of 0.52% for grade S355 and 0.44% for grade S275 is required.
- Option 6 If steel grade S355WP is specified, the impact values shall be verified.
- Option 7 Steel to be submitted to inspection and testing which shall be as specified in Clause 90.005.
- Option 8 This option may be invoked at the discretion of the Contractor.
- Option 9 This option may be invoked at the discretion of the Contractor.

**BS EN 10 210:
Part 1**

For structural steel hollow sections supplied in accordance with BS EN 10 210: Part 1, the following options shall apply.

- Option 1.1 A product analysis shall be carried out.

- Option I.2 Maximum carbon equivalent value to be as stated in table A2 for non alloy grades.
- Option I.3 Ladle analysis to be reported in the inspection certificate in accordance with Clause 90.005.
- Option I.4 Maximum carbon equivalent value to be as stated in table B2 for grades S275 and S355.
- Option I.5 Ladle analysis limits for steel grade S460 are required.
- Option I.7 Steel to be suitable for hot dip galvanizing where shown on the Contract Drawings as galvanized.
- Option I.8 Weld repair to the body of structural steel hollow sections not to be permitted.
- Option I.9 Steel to be submitted to specific inspection and testing as specified in Clause 90.005.

BS 7668

For structural steel hollow sections supplied in accordance with BS 7668, the following options shall apply.

- Option B4 Maximum carbon equivalent value as stated in table B1.
- Option B7 No repair by welding shall be carried out.
- Option B8 Marking using a continuous white paint line is required.
- Option B12 This option may be invoked at the discretion of the Contractor.

Surface conditions

Surface conditions of plates and wide flats shall comply with Class B Subclass 3 of BS EN 10 163: Part 2. The surface conditions of sections shall comply with Class D Subclass 3 of BS EN 10 163: Part 3.

When verification of the surface condition is carried out by the manufacturer, the surface condition shall be recorded on the manufacturer's certificate in accordance with Clause 90.005.

When verification of the surface condition is carried out by the Contractor, the programme and method of verification shall be submitted to the Employer's Representative, a minimum twenty one days prior to verification being carried out.

The surface of the steel material before surface preparation and application of protective treatment shall comply with rust grades A or B in accordance with BS 7079: Part A1. Material which is pitted (grades C and D) shall not be used.

Steelwork orders

All orders for steelwork shall include the following words:

"Bridge Structure- No Repair Welding To Be Carried Out."

3.1.2

Delete BS 5400: Part 6, clause 3.1.2.

Appendix A

Delete BS 5400: Part 5, Appendix A, clause A.1.1, and the following shall apply.

Rivets shall be manufactured from round bar material grade S275 or grade S355JO as applicable in accordance with BS EN 10 025, and the additional requirements in BS 5400: Part 6, appendix A, clauses A.1.2, A.1.3, A.2 and A.3, subject to the following amendments.

In BS 5400: Part 6, Appendix A, clause A.1.3.1, delete "grade 43A" and insert "grade S275".

In BS 5400: Part 6, Appendix A, clause A.1.3.2, delete "grade 50C" and insert "grade S355JO".

(90.002)

Internal
imperfections
3.1.4

- 3 Reference to 'laminations' in BS 5400: Part 6, clause 3.1.4 shall be replaced by 'internal imperfections'.

Where BS 5400: Part 6, clause 3.1.4.1 refers to DD2I, the following methods and quality grades of BS 5996 shall be used:

DD2I

BS 5996 equivalent

C
E

B4
E

In addition to BS 5400: Part 6, clause 3.1.4.1, end plates, a band of flange or web plate 25 times the plate thickness either side of an intermediate stiffener, bearing stiffener or intermediate diaphragm and a band of deck plate 25 times the plate thickness either side of a stiffening member where connected by welding shall not have internal imperfections exceeding B4 of Table I of BS 5996.

In BS 5400: Part 6, clause 3.1.4.2, delete 'DD2I' and insert 'BS 5996'.

When testing for internal imperfections is carried out by the manufacturer, the results shall be shown on the manufacturer's certificate in accordance with Clause 90.005.

When testing for internal imperfections is carried out by the Contractor, the programme and method of testing to demonstrate compliance with the above 'quality' grades shall be submitted to the Employer's Representative, a minimum twenty one days prior to testing being carried out.

(90.003)

Marking
3.1.5

- 4 Delete BS 5400: Part 6, clause 3.1.5 and the following shall apply.

Steel shall be marked in accordance with the relevant British Standard listed in Clause 90.002.

A method of marking which identifies individual components shall be agreed with the Employer's Representative before cutting plates or sections. The method shall ensure that all components can be traced back to their unique certification.

Steel shall not be hard-die stamped. 'Low stress' stamps with a maximum indentation depth of 0.25 mm and a minimum radius of 0.25 mm are acceptable.

The Employer's Representative shall be provided with a sketch or sketches which relate these components to their certification and their final place in the structure.

(90.004)

**Steel test and
inspection
certification
3.1.6**

5 Delete BS 5400: Part 6, clause 3.1.6 and the following shall apply.

Test and inspection certificates for all steel, high strength friction grip bolts, nuts, washers, load indicating washers, rivets, swaged collar grooved rivets and shear connectors shall be submitted to the Employer's Representative. Certificates for steel plates, sections and flats shall be traceable to the original cast. Test certificates shall be submitted at least seven days before acceptance is required.

Test and inspection certificates shall include:

- (i) materials specification including options,
- (ii) steel identification including cast numbers, test identification numbers etc,
- (iii) results of mechanical tests,
- (iv) results of ladle analysis, including carbon equivalent value,
- (v) results of tests for internal imperfections,
- (vi) surface condition.

Where the above information is not included in the manufacturer's certificate, the suitability of the steel shall be confirmed by the Contractor by carrying out tests or inspections as appropriate, and a certificate of compliance shall be provided to the Employer's Representative.

Specific inspection and testing of structural steel in accordance with clause 1.3.2 of BS EN 10 204 shall be carried out, and an inspection certificate type 3.1.B as defined in clause 3.1.B of BS EN 10 204 shall be issued.

Written acceptance of the material to be supplied shall be obtained from the Employer's Representative before fabrication commences. The original certificates shall be made available for inspection by the Employer's Representative.

On completion of fabrication the original certificates shall be supplied to the Employer's Representative.

The Employer's Representative shall be permitted to visit all manufacturer's premises to verify that the materials comply with this Specification.

(90.005)

**Minimum
thickness of plates
3.1.7**

6 Delete BS 5400: Part 6, clause 3.1.7 and the following shall apply.

The tolerance class for thickness of hot rolled steel plate shall be class A in accordance with BS EN 10 029.

(90.006)

**Hot rolled sections
3.1.8**

7 Delete BS 5400: Part 6, clause 3.1.8, and the following shall apply.

Tolerances on dimensions and shape of hot rolled sections shall comply with BS 4: Part 1, BS 4848: Part 2, BS EN 10 024, BS EN 10 034 and BS EN 10 056: Part 2, as applicable to section.

(90.007)

**Steel for shear
connectors
3.3**

8 In BS 5400: Part 6, clause 3.3, delete 'BS 4360' and replace with 'BS EN 10 025'.

(90.008)

**Bolts, nuts and
washers for use
with weather
resistant steel
3.4.1, 3.4.2**

9 In addition to BS 5400: Part 6, clauses 3.4.1 and 3.4.2, the chemical composition of bolts, nuts, and washers for use with improved atmospheric corrosion resistant steel shall comply with ASTM Standard A325-89 type 3, grade A or equivalent.

(90.009)

**High strength
friction grip bolts,
nuts and washers
3.4.3**

10 Further to BS 5400: Part 6, clause 3.4.3, high strength friction grip (HSFG) bolts, nuts and washers shall be in accordance with BS 4395: Part 1, except as follows:

- (i) HSFG bolts, nuts and washers for use with improved atmospheric corrosion resistant steel, in which case the chemical composition of HSFG bolts, nuts and washers shall in addition comply with ASTM Standard A325-89 type 3, grade A or equivalent,
- (ii) high strength tension control bolts which shall be in accordance with the Society of Steel Construction of Japan specification JIS B1186.

In addition to BS 5400: Part 6, clause 3.4.3, the following shall apply.

All HSFG bolts shall be supplied and fitted with one standard nut, one standard washer, one load indicating washer of appropriate grade, and a nut face or bolt face washer where necessary, except as follows:

- (i) load indicating bolts are used, when the load indicating washer is not required,
- (ii) high strength tension control bolts are used when the bolt shall be supplied with a nut and washer loosely assembled.