

# STRUCTURAL STEELWORK

## Contents

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<i>Clause</i>	<i>Title</i>	<i>Page</i>
1801	General . . . . .	248
1802	Surface Preparation and Protection Against Corrosion . . . . .	248
1803	Amendments and Additions to BS 5400 : Part 6 : 1999 . . . . .	248

# Structural Steelwork

## 1801 General

- 1 Structural steelwork shall be as described in Appendix 18/1 and the Drawings referred to therein and shall comply with the requirements of this Series.
- 2 Unless otherwise described in Appendix 18/1, Materials, Workmanship, Inspection and Testing, Handling, Transport and Erection, Supply, Measurement and Weighing of Structural Steelwork shall comply with the Specification Clauses of BS 5400 : Part 6 : 1999 all as amended by Clause 1803.

## 1802 Surface Preparation and Protection Against Corrosion

- 1 Unless otherwise described in Appendix 18/1 the surface preparation and corrosion protection of structural steelwork shall comply with the 1900 Series.

## 1803 Amendments and Additions to BS 5400 : Part 6 : 1999

### Page i

Insert:

"3.4.4. Stainless steel bolts, nuts and washers".

### Page ii

Insert:

"4.17 Improved atmospheric corrosion resistant steel".

"5.2.3 Testing of bolts, nuts and washers including HSFSG".

### Page iii

Delete:

"7.1 Computed weights".

"7.2 Weighbridge weights".

Table 3A Insert additional table title as follows:

"3A Preliminary tightening of nuts".

### Page 1

- 3.1.1 Delete heading and text of clause and insert the following:

"Structural steels shall comply with the requirements of BS EN 10025, BS EN 10113, BS EN 10137, BS EN 10155, BS EN 10210 or BS 7668, unless otherwise specified in Appendix 18/1, and the options listed in Appendix 18/1 shall apply. Unless otherwise specified, the ladle analysis for each grade of steel shall be supplied. Where specified in Appendix 18/1 the maximum carbon equivalent values for each grade of steel shall not exceed the specified values. The maximum carbon equivalent value for improved atmospheric corrosion resistant steels of grade S355 to BS EN 10155 shall be 0.52%."

- 3.1.2 Delete clause.

Table 1, Delete table.

- 3.1.3, line 2

Delete 'by the Engineer', insert "in Appendix 18/1".

- 3.1.4 Delete heading of clause and insert the following:

**"3.1.4 Internal imperfections"**.

- 3.1.4.1, line 2

Delete 'laminations', insert "internal imperfections".

- 3.1.4.3, line 1

Delete 'by the Engineer', insert "in Appendix 18/1".

- 3.1.4.3, line 2

Delete 'laminations', insert "internal imperfections".

**Page 2**

3.1.5 Delete 'by the Engineer', insert "in Appendix 18/1".

3.1.6 Delete text of clause and insert the following:

"The steel supplier shall supply inspection documents in accordance with the requirements of the specified Standard and the options given in Appendix 18/1."

3.2, line 2

Delete 'by the Engineer', insert "in Appendix 18/1".

3.3, line 5

Delete 'by the Engineer', insert "in Appendix 18/1".

3.4.1, line 1

Delete 'by the Engineer', insert "in Appendix 18/1".

3.4.1, after paragraph 2

Insert additional paragraph as follows:

"The chemical composition of bolts and nuts for improved atmospheric corrosion resistant steel shall comply with ASTM Standard A325-89 Type 3 Grade A or equivalent."

3.4.2, after paragraph 1

Insert additional paragraph as follows:

"The chemical composition of washers for improved atmospheric corrosion resistant steel shall comply with ASTM Standard A325-89 Type 3 Grade A or equivalent."

3.4.3, line 1

Delete 'by the Engineer', insert "in Appendix 18/1".

3.4.3, after paragraph 1

Insert additional paragraph as follows:

"The chemical composition of high strength friction grip bolts, nuts and washers for

improved atmospheric corrosion resistant steel shall comply with ASTM Standard A325-89 Type 3 Grade A or equivalent."

Insert additional clause 3.4.4 as follows:

**"3.4.4 Stainless steel bolts, nuts and washers.** Unless otherwise described in Appendix 18/1, stainless steel bolts and nuts shall comply with steel Grade A4 and property class 80 to BS 6105 and washers with steel Grade 316 S 31 or 316 S 33 in the softened condition, to BS 1449 : Part 2. Dimensions and tolerances shall comply with:

ISO 4014 for bolts

ISO 4032 for nuts

BS 4320 Form C for flat washers.

BS 3410 for taper washers."

3.5, paragraph 2, line 1

Delete 'agreed with the Engineer', insert "specified in Appendix 18/1".

**Page 3**

3.10.1, line 4

Delete 'by the Engineer', insert "in Appendix 18/1".

4.1, line 1

Delete 'by the Engineer', insert "in Appendix 18/1".

4.2.2, line 1

Delete 'agreed with the Engineer', insert "specified in Appendix 18/1".

4.2.3, line 2

Delete 'by the Engineer', insert "in Appendix 18/1".

**Page 4**

4.3.3, (e)

Delete 'approved by the Engineer'.

4.3.3, (f)

Delete 'grade 43', insert "grade S275".

4.3.3, last paragraph line 2  
Delete 'by the Engineer', insert "in Appendix 18/1".

4.3.6, line 1  
Delete 'by the Engineer', insert "in Appendix 18/1".

4.4, line 2  
Delete 'or approved by the Engineer', insert "in Appendix 18/1".

4.4.1 Delete clause.

4.4.2 Delete clause.

4.4.3 Delete clause.

4.4.4, line 4  
Delete 'by the Engineer', insert "in Appendix 18/1".

4.4.4, after paragraph 1  
Insert additional paragraphs and table as follows:

"For improved atmospheric corrosion resistant steel, load indicating bolt heads or washers shall not be used.

Where bolts and nuts in compliance with BS 4395 : Part 1 are tightened by the part turn method, the value of bedding torque for the preliminary tightening shall be as in Table 3A.

Load indicating washers and their use shall comply with BS 7644 Parts 1 and 2. Bolts shall be tightened in two stages, to an appropriate sequence and pattern."

**Table 3A: Preliminary Tightening of Nuts**

Nominal dia. of bolt	Bedding torque $\pm 10\%$
mm	Nm
16	80
20	160
22	210
24	270
27	340
30	460

4.4.5, paragraph 1  
Delete the second sentence (lines 3 to 6).

4.4.5, Delete second paragraph.

4.5.1 Delete heading and replace with the following:  
"Holes for rivets and bolts except high strength friction grip bolts"

4.5.1, line 7  
Delete 'approved by the Engineer', insert "specified in Appendix 18/1"

**Page 5**

4.5.2 Delete clause.

4.5.3, line 1  
Delete 'by the Engineer', insert "in Appendix 18/1".

4.6, paragraph 3, line 3  
Delete 'by the Engineer', insert "in Appendix 18/1".

4.7.1, paragraph 1, line 1  
Delete 'by the Engineer', insert "in Appendix 18/1".

4.7.1, paragraph 1, line 5  
Delete 'subject to the approval of the Engineer', insert "as specified in Appendix 18/1".

4.7.1, paragraph 2, line 5  
Delete 'for the approval of the Engineer', insert "and Appendix 18/1".

4.7.1, paragraph 2, line 8  
Delete 'without the approval of the Engineer'.

4.7.1, paragraph 3, line 1  
Delete 'by the Engineer', insert "in Appendix 18/1".

4.7.1, paragraph 3, line 3  
Delete 'agreed with the Engineer', insert "as specified in Appendix 18/1".

4.7.1, paragraph 3, line 5

Delete 'to the satisfaction of the Engineer.'

4.7.1, paragraph 5, line 1

Delete 'the Engineer has specified that the'.

4.7.1, paragraph 6, (c)

Delete 'or another method agreed by the Engineer'.

4.7.1, after paragraph 6

Insert additional paragraphs as follows:

"Unless otherwise described in Appendix 18/1, all butt welds shall be complete penetration welds made between prepared fusion faces.

In the fabrication of built-up assemblies, all butt welds in each component part shall be completed, whenever possible, before the final assembly.

Temporary welded attachments shall not be used on otherwise unwelded members, except where required in Appendix 18/1.

For improved atmospheric corrosion resistant steels, electrodes of matching chemical composition to the parent metal shall be used for butt welds, single run fillet welds and for capping runs of multi-run fillet welds. However, unless stated otherwise in Appendix 18/1, basic covered hydrogen controlled electrodes without improved atmospheric corrosion resisting properties may be used for butt welds in material 12 mm thick or less."

4.7.2, paragraph 1, line 1

Delete 'by the Engineer', insert "in Appendix 18/1".

4.7.2, paragraph 2, line 3

Delete 'for the approval of the Engineer', insert "and Appendix 18/1".

4.7.2, paragraph 2, line 7

Delete 'without the approval of the Engineer'.

4.7.2, after paragraph 2

Insert additional paragraphs as follows:

"Unless otherwise described in Appendix 18/1, all butt welds shall be complete penetration welds made between prepared fusion faces.

In the fabrication of built-up assemblies, all butt welds in each component part shall be completed, whenever possible, before the final assembly.

Temporary welded attachments shall not be used on otherwise unwelded members, except where required in Appendix 18/1."

Page 6

4.7.3, paragraph 1, line 1

Delete 'When specified by the Engineer and before', insert "Before".

4.7.3, paragraph 1, line 5

Delete 'The samples of material shall be agreed with the Engineer'.

4.7.3, paragraph 2, line 2

Delete 'to the satisfaction of the Engineer'.

4.7.3, after paragraph 3

Insert additional paragraphs as follows:

"For welding trials, where galvanizing or other metal coating of the material is to be applied to a part which is to be subsequently welded in the shop or on site, the same coating shall be applied to the sample material before the procedure trials are made.

For flame cutting, trials on materials 20 mm thick shall be deemed to cover all material up to and including 20 mm thick; trials on material 40 mm thick shall be deemed to cover all material over 20 mm thick up to and including 40 mm thick; material over 40 mm thick shall be tested for every thickness increment of 10 mm. Where required in Appendix 18/1, welding, flame cutting or shearing procedure trials shall be carried out in accordance with the details described therein."

4.7.4, paragraph 3, line 1

Delete 'When specified by the Engineer', insert "Unless specified otherwise in Appendix 18/1".

4.7.4, paragraph 3, line 5

Delete 'The samples of materials and studs shall be agreed with the Engineer'.

4.8, line 9

Delete 'and shall be agreed with the Engineer; accelerated cooling shall not be used without the approval of the Engineer', insert "Accelerated cooling shall not be used unless specified in Appendix 18/1".

4.9, line 5

Delete 'and shall be agreed with the Engineer; accelerated cooling shall not be used without the approval of the Engineer', insert "Accelerated cooling shall not be used unless specified in Appendix 18/1".

4.11, line 3

Delete 'approved by the engineer', insert "specified in Appendix 18/1".

4.11, line 4

Delete 'Where agreed by the Engineer', insert "Unless specified otherwise in Appendix 18/1".

4.13, paragraph 2, line 5

Delete 'agreed with the Engineer', insert "specified in Appendix 18/1".

## Page 7

4.14, line 3

Delete 'by the Engineer', insert "in Appendix 18/1".

4.15, line 4

Delete 'to the Engineer', insert "as specified in Appendix 18/1".

4.15, line 9

Delete 'by the Engineer', insert "in Appendix 18/1".

4.16, line 3

Delete 'the standards designated in 3.1.1. Repair by welding of any surface defect or exposed edge lamination shall only be carried out with the approval of the Engineer and using a procedure complying with the requirements of BS 5135', insert "the specified Standard and the options and further requirements specified in Appendix 18/1."

Insert additional clause 4.17 as follows:

**4.17 Improved atmospheric corrosion resistant steel.** The top surfaces of all butt welds on bottom flanges of beams shall be ground flush.

All surfaces shall be maintained free from concrete, mortar, asphalt, paint, oil, grease and any other debris or contaminants, and, where specified in Appendix 18/1, shall be blast cleaned to assist the formation of a uniform coating. The quality of surface finish shall be clean steel 2nd Quality medium profile in compliance with Clause 1907.

Faying surfaces of high strength friction grip joints shall be blast cleaned to clean steel 2nd Quality medium profile in compliance with Clause 1907 and so maintained until assembly. Concrete piers, abutments and other areas specified in Appendix 18/1 shall be protected against rust staining during construction."

5.2.2 Delete heading and text of clause and insert the following:

"Testing to show compliance with the requirements of 3.1.4 shall be carried out either at the steel mills or by the fabricator in his own works before fabrication."

Insert additional clause 5.2.3 as follows:

**5.2.3 Testing of bolts, nuts and washers including HSFG.** The frequency of sampling and testing of high strength friction grip bolts, nuts and washers shall be in compliance with either Part 1 or 2 of BS 4395 as appropriate.

The frequency of sampling and testing of structural steel and stainless steel, bolts, nuts and washers shall be as defined in BS 4395 : Part 2."

5.3, paragraph 1, line 4

Delete 'Significant edge laminations found shall be reported to the Engineer for his decision'.

5.3, paragraph 2, line 1

Delete 'these', insert "any".

5.3, paragraph 2, line 2

Delete 'to the satisfaction of the Engineer', insert "in accordance with the relevant Standard and requirements in Appendix 18/1".

5.4.1.1, paragraph 1, line 11

Delete 'to the Engineer', insert "as required in Appendix 18/1".

5.4.1.2, paragraph (a) (1), lines 1 to 6

Delete lines and insert the following:

"For regions with an applied principal tensile stress at the ultimate limit state (ignoring geometric stress concentrations) greater than 100 N/mm<sup>2</sup> the energy absorption requirement shall be:

18 J or

$$\frac{\sigma_y}{355} \times \frac{t}{2} J \quad \text{when } \sigma_y \leq 355 \text{ N/mm}^2$$

$$\left(\frac{\sigma_y}{355}\right)^2 \times \frac{t}{2} J \quad \text{when } \sigma_y > 355 \text{ N/mm}^2$$

whichever is the greater, at the minimum design temperature as specified for material selection,"

5.4.1.2, paragraph (a) (2), lines 1 to 7

Delete lines and insert the following:

"For regions with an applied principal tensile stress at the ultimate limit state (ignoring geometric stress concentrations) less than or equal to 100 N/mm<sup>2</sup> the energy absorption requirement shall be:

18 J or

$$\frac{\sigma_y}{355} \times \frac{t}{4} J \quad \text{when } \sigma_y \leq 355 \text{ N/mm}^2$$

$$\left(\frac{\sigma_y}{355}\right)^2 \times \frac{t}{4} J \quad \text{when } \sigma_y > 355 \text{ N/mm}^2$$

whichever is the greater, at the minimum design temperature as specified for material selection"

5.4.1.2, paragraph (a) (3), last three lines

Delete lines and insert the following:

"... for the weld metal, may be taken as the lesser of the values calculated in accordance with (1) and (2) as appropriate or 27J when testing is to be at -20°C."

**Page 8**

Table 3

Delete in both columns, 'by the Engineer', insert "in Appendix 18/1".

5.4.1.2, paragraph (e)

Delete '(see range of approval in BS EN 288-3)' and 'and approved by the Engineer'.

**Page 9**

5.5.1.1, line 1

Delete 'by the Engineer', insert "in Appendix 18/1".

5.5.1.1, line 12

Delete 'agreed by the Engineer'.

5.5.1.2, paragraph (c), line 5

Delete 'by the Engineer', insert "in Appendix 18/1".

5.5.1.3, paragraph 1

Delete text.

**Page 14**

5.5.4, paragraph 1, (a), line 2

Delete 'to the satisfaction of the Engineer'.

5.5.4, paragraph 1, (b), line 1

Delete 'selected by the Engineer'.

5.5.4, paragraph 2, line 3

Delete 'according to a procedure to be agreed with the Engineer'.

**Page 15**

Table 7, column 4, line 4

Delete 'by the Engineer', insert "in Appendix 18/1".

Table 7, column 4, line 9

Delete 'by the Engineer'.

5.6.1, last paragraph, line 3

Delete 'where required by the Engineer'.

**Page 16**

5.6.6, paragraph 3, line 2

Delete 'to the Engineer who will determine whether the member/component may be accepted without rectification, with rectification, or rejected', insert "as required in Appendix 18/1. Unless specified otherwise in Appendix 18/1, deviations which exceed the tolerances given in table 8 shall be rectified".

5.6.6, paragraph 4, line 5

Delete 'as directed by the Engineer'.

5.8, line 9

Delete 'with the approval of the Engineer', insert "where there will be no loss of strength".

5.9, line 1

Delete 'by the Engineer', insert "in Appendix 18/1".

5.9, line 3

Delete 'to the Engineer's specification'.

6.3.1

Delete text of clause and insert the following:

"Appropriate allowances shall be made for deformation due to permanent loads and the process and sequence of fabrication, erection and construction, so that the completed structure conforms to the lines and levels described in Appendix 18/1."

**Page 17**

7.1

Delete clause.

7.2

Delete clause.

7.3, paragraph 1, line 6

Delete 'by the Engineer', insert "in Appendix 18/1".

7.3 (a), line 1

Delete 'black'.

7.3 (a), line 2

Add "except".

7.3, paragraph 2, line 7

Delete 'by the Engineer'.

**Page 18**

Table 8, column 4, Member/component type 1

Delete 'by the Engineer'.

Table, Notes to table 8

Delete 'a sign convention as agreed with the Engineer', insert "an appropriate sign convention".