SERIES 1800
STRUCTURAL STEELWORK

Contents

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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 (05/01) 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 (05/01) Unless otherwise described in Appendix 18/1 the surface preparation and corrosion protection of structural steelwork shall comply with Series 1900.

1803 (05/01) Amendments and Additions to BS 5400 : Part 6 : 1999

Page i

Delete 3.1.2

"Structural steels complying with the requirements of other specifications"

Amend 3.1.4

Delete "Laminar defects", insert "Internal discontinuities"

Amend 3.1.6

Delete "Manufacturer's inspection document", insert "Inspection document"

Insert "3.4.4 Tension control bolts, nuts and washers"

Insert "3.4.5 Stainless steel bolts, nuts and washers."

Page ii

4.4.4 Delete Heading, insert "High strength friction grip and tension control bolts, nuts and washers."

4.5.3 Delete "Holes for high strength friction grip bolts", insert "Holes for high strength friction grip and tension control bolts"

Insert "4.17 "Steels with improved atmospheric corrosion resistance"

Amend 5.2.2

Delete "laminations", insert "internal discontinuities"

Insert "5.2.3 Testing of bolts, nuts and washers including high strength friction grip bolts".

Insert "5.2.4 Testing of tension control bolts, nuts and washers"

Amend 5.3

Delete "laminations", insert "internal discontinuities"

Page iii

Delete

"7.1 Computed weights"

"7.2 Weighbridge weights"

Tables

Delete Table 1 "Performance requirements for structural steels"

Table 3A Insert additional table title as follows:

"3A Preliminary tightening of nuts"

Page 1

3.1.1 lines 4 and 8

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

Insert additional sentence at end of paragraph

"The maximum carbon equivalent value for steels with improved atmospheric corrosion resistance 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".

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3.1.4 Delete heading of clause and insert the following:

"3.1.4 **Internal discontinuities"**

3.1.4.1 line 2

Delete "laminations", insert "internal discontinuities".

3.1.4.1.a) line 4

Delete "level B4 of BS 5996 : 1993", insert "class S_1 of BS EN 10160 : 1999"

3.1.4.1.b) line 4

Delete "level B4 of BS 5996 : 1993", insert "class S_1 of BS EN 10160 : 1999"

3.1.4.1.c) line 3

Delete "level E of BS 5996 : 1993", insert "class E_1 of BS EN 10160 : 1999"

3.1.4.1.d) line 5

Delete "level B4 of BS 5996 : 1993", insert "class S_1 of BS EN 10160 : 1999"

3.1.4.2 line 1 Delete "toe", insert "tee"

3.1.4.2 line 2

Delete "laminations", insert "internal discontinuities"

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 discontinuities"

3.1.4.3 line 4

Delete "BS 5996", insert "BS EN 10160 : 1999"

Page 2

3.1.5 Line 3

Delete "as specified by the Engineer", insert "as specified in Appendix 18/1"

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

"3.1.6 **Inspection documents**

The steel supplier shall supply inspection documents in accordance with the requirements of the designated Standards as specified in Clause 3.1.1 and the options given in Appendix 18/1."

3.1.8 line 3

Add "or other relevant Standards."

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 line 3

Delete "one of ".

3.4.1 after paragraph 2

Insert additional paragraph as follows:

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

Insert additional clause 3.4.4 as follows:

"3.4.4 **Tension control bolts, nuts and washers.**

Unless otherwise described in Appendix 18/1, tension control bolts, nuts and washers shall comply with Society of Steel Construction of Japan - Document JSS II-09-1981.

The chemical composition of tension control bolts, nuts and washers for steels with improved atmospheric corrosion resistance shall comply with ASTM Standard A325-89 Type 3 Grade A or equivalent."

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Insert additional clause 3.4.5 as follows:

"3.4.5 **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:

BS EN 24014 for bolts

BS EN 24032 for nuts

BS 4320 Form C for flat washers.

BS 3410 for taper washers."

3.5 paragraph 1 line 4 after BS 5135

Insert "and the recommendations given in BS EN 1011-1"

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

4.2.3 line 1

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

4.2.4.1 line 4

Delete "HSFG bolted joints", insert "high strength friction grip or tension control bolted joints."

Page 4

4.3.3 e) line 2

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 Heading

Delete "high strength friction grip", insert "high strength friction grip and tension control"

4.3.6 line 1

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

4.3.6 line 2

Delete " high strength friction grip", insert "high strength friction grip and tension control"

4.4 line 2

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

4.4.2 Delete clause.

4.4.3 Delete clause.

4.4.4 Delete heading.

Insert **"High strength friction grip and tension control bolts, nuts and washers"**

4.4.4 line 4

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

Insert additional paragraphs and table as follows:

"Unless otherwise described in Appendix 18/1, compliance of tension control bolts, nuts and washers shall be as given in Society of Steel Construction of Japan – Document JSS II-09-1981. Use of tension control bolts, nuts and washers shall be as given in BS 4604 : Parts 1 & 2.

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.

For steels with improved atmospheric corrosion resistance, load indicating bolt heads or washers shall not be used.

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TABLE 3A: Preliminary Tightening of Nuts

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

Preliminary tightening of tension control bolts

The Contractor shall demonstrate the proposed method of preliminary tightening of the tension control bolts without damage to the spline of the bolt."

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 and tension control 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 Delete heading and replace with the following:

"Holes for high strength friction grip and tension control bolts"

4.5.3 line 1

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

4.5.3 line 2

Delete "high strength friction grip bolts", insert "high strength friction grip and tension control bolts".

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 4

Delete "for the approval of the Engineer", insert "for the approval of the Overseeing Organisation".

4.7.1 Paragraph 2, line 8

Delete "without the approval of the Engineer",

Insert after paragraph 2 of 4.7.1

"All welders shall be approved to BS EN 287 Part 1 and BS EN 1418. The tests shall include in addition an application test on unusual joint details as specified in Appendix 18/1, on which the welder is to be approved to work. Welders shall be subject to reapproval in accordance with BS EN 287 and BS EN 1418. Testing shall be by a laboratory appropriately accredited by UKAS for weld testing. Approval shall be by an Independent Inspecting Authority using Registered Welding Engineers, Registered Welding Quality Engineers or Welding Inspectors certified by the Certification Scheme for Weldment Inspection Personnel (CSWIP) or equivalent."

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 "agreed with the Overseeing Organisation".

4.7.1 Paragraph 3, line 4

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) line 4

Delete "or another method agreed by the Engineer", insert "or another method agreed by the Overseeing Organisation".

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.

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

The consumables used for the welding of steels with improved atmospheric corrosion resistance shall be matching consumables, containing approximately ½% Copper and other alloy elements for Submerged Arc Welding (SAW), Manual Metal Arc (MMA) and Metal Active Gas (MAG) processes. Alternatively, they shall be either 1Cr ½Mo or 2 Nickel for SAW; or 1Cr ½Mo or 2 ½ Nickel for MMA and MAG processes.

The following alternative consumables to the above shall be permitted:

i) For single run fillet welds up to 8mm leg length using the MAG or SAW process use C-Mn consumables.

ii) For butt welds formed by a single run from each side use C-Mn consumables.

iii) For multi-run fillet welds, the body of the weld made from C-Mn consumables with capping runs made using consumables in accordance with the above second paragraph.

iv) For multi-run butt welds, the body of the weld made with C-Mn consumables with capping runs and any exposed edges being capped with consumables in accordance with the above second paragraph.

The top surface of all butt welds on bottom flanges of beams in steels with improved atmospheric corrosion resistance shall be ground flush. Where such welds are only capped with consumables from the above second paragraph, allowance for grinding shall be made in the thickness of the capping. Where any weld that is only capped with consumables from the above second paragraph might require grinding to allow non-destructive testing, allowance for grinding shall be made in the thickness of the capping."

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 6

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; 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; trials on material over 40 mm thick shall be deemed to cover all material over a range of 10 mm thickness up to the tested thickness.

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".

4.7.5 Paragraph 1 line 3

After the word "appropriate" delete "," insert "."

Delete "but not before the rectification procedure has been approved by 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 Header

Delete **"laminations"**, insert **"discontinuities"**.

4.16 line 5

Delete "laminations", insert "discontinuities"

4.16 line 5

Delete " with the approval of the Engineer and using a procedure complying with the requirements of BS 5135", insert "in accordance with the standards designated in Clause 3.1.1 and requirements specified in Appendix 18/1".

Insert additional clause 4.17 as follows:

"4.17 Steels with improved atmospheric corrosion resistance

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 Sa2½ to BS 7079 Part A1 (ISO 8501-1) medium profile in compliance with Clause 1901.

Faying surfaces of high strength friction grip and tension control bolted joints shall be blast cleaned to Sa2½ to BS 7079 Part A1 (ISO 8501-1) medium profile in compliance with Clause 1901 and so maintained until assembly. Concrete piers, abutments and other areas specified in Appendix 18/1 shall be protected against rust staining during construction."

Insert after paragraph 1 of 5.2.1

"Suitable personnel shall be provided to carry out testing of production welds as specified in Appendix 18/1. Personnel conducting visual inspections shall have a nationally recognised certificate of competence appropriate to the type of welding being inspected. Personnel conducting non-destructive testing (NDT) shall be certified according to a nationally recognised certification scheme appropriate to the equipment used and the weld groups inspected. Evidence of training and qualification shall be retained and made available for examination when required. The results of all weld inspections shall be recorded."

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

"Acceptance levels for internal discontinuities

Testing to show compliance with the requirements of 3.1.4 shall be carried before fabrication."

Insert additional clause 5.2.3 as follows:

"5.2.3 Testing of bolts, nuts and washers including high strength friction grip bolts.

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."

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Insert additional clause 5.2.4 as follows:

"5.2.4 Testing of tension control bolts, nuts and washers.

The frequency of sampling and testing of tension control bolts, nuts and washers shall be in compliance with Society of Steel Construction of Japan – Document JSS II-09-1981 or BS 4395 for equivalent tests"

5.3 Delete heading of clause and insert the following:

"Surface defects and edge discontinuities"

5.3 Paragraph 1 line 2

Delete "laminations", insert "discontinuities".

5.3 Paragraph 1, line 3

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/mm² the energy absorption requirement shall be:

18 J or

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

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

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/mm² the energy absorption requirement shall be:

18 J or

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

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

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

5.4.1.2 Paragraph a) 3), last two lines

Delete lines and insert the following:

"... 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 4

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

5.4.1.2 Paragraph e) paragraph 2 last line

delete "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", insert "specified in Appendix 18/1".

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.

5.5.2.1 Paragraph 1 line 6

Delete "by the Engineer", insert "by the Overseeing Organisation".

5.5.2.1 Paragraph 3 line 3

Delete "to the Engineer", insert "to the Overseeing Organisation".

Page 11

5.5.2.3.2 Paragraph 1 line 4

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

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5.5.2.3.4 Paragraph 2 line 1

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

Page 12

5.5.2.4.2 Paragraph 3 line 3

Delete "laminations", insert "internal discontinuities".

Page 13

In Figure 2 replace "h_6" with "h_5" and "$H_{4.6}$" with "$H_{4.5}$".

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 8

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 1

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 give 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 "if allowed in Appendix 18/1".

5.9 line 1

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

5.9 line 2

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 5

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 b) line 2

Delete "high strength friction grip bolts", insert "high strength friction grip and tension control bolts"

7.3 Paragraph 2, line 6

Delete "by the Engineer".

Page 18

Table 8, column 4,

Delete "by the Engineer".

Table, Notes to table 8 note 2

Delete "as agreed with the Engineer".

Page 19

Table, Notes to table 8 note 2

Delete "as agreed with the Engineer".

Page 20

Table, Notes to table 8 note 2

Delete “as agreed with the Engineer”.

Page 21

Table, Notes to table 8 note 2

Delete “as agreed with the Engineer”.

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