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**SERIES NG 1800**  
**STRUCTURAL STEELWORK**

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# STRUCTURAL STEELWORK

## NG 1801 General

1 (05/01) The Notes for Guidance should be read in conjunction with Clause 5.3 of BS 5400 : Part 10 : 1980, as amended by amendment No.1 1999, where appropriate and the Guidance Clauses given in Annex B of BS 5400 : Part 6 : 1999 with the following amendments and additions:

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3.1, line 3

Delete “without obtaining the specific approval of the Engineer.”

3.1, line 5

Delete “the Engineer requires material”, insert “material is required”.

3.1.1 line 6

Delete “The Engineer should consider”, insert “Consideration should be given to”

Insert the following additional paragraphs:

“Where the details of the ladle analysis of additional elements are required, e.g. for calculation of carbon equivalent values, the relevant option should be specified. Product analysis is more costly than ladle analysis and should only be invoked with the prior agreement of the Overseeing Organisation.

Specifying of maximum carbon equivalent values should be considered for the following materials, when welding is involved:

- (a) Grade S275 steels over 50 mm thick
- (b) Grade S355 steels over 30 mm thick
- (c) Grade S420 or S460 steels, all thicknesses”.

3.1.2 Delete clause.

3.1.4 Delete heading of clause and insert the following:

“3.1.4 **Internal discontinuities**”.

3.1.4 Paragraph 1, lines 2 & 7

Delete “laminations”, insert “internal discontinuities”.

3.1.4 Paragraph 1, line 3

Delete “the Engineer should clearly indicate”, insert “clear indication should be given to”.

3.1.4 Paragraph 2 line 3

Delete “BS 5996”, insert “BS EN 10160”

3.1.4 Paragraph 2 line 3

Delete “to a grade specified in the contract”, insert “or as otherwise specified in Appendix 18/1”

3.1.4 Paragraph 3 line 1

Delete “Any material found to be defective due to laminations may still be used at the discretion of the Engineer”.

3.1.4 Paragraph 4 line 1

Delete “the Engineer should consider”, insert “consideration should be given to”.

3.1.4 Paragraph 5 line 4 Delete “BS 5996”, insert “BS EN 10160”

3.1.4 Paragraph 6 line 1

Delete “the Engineer should consider”, insert “consideration should be given to”

3.1.5 Delete clause and substitute:

“In determining the scope of any additional marking requirements, the ease of identification of different material grades (including suffixes) by variations in sectional shape or dimensions should be taken into account.”

Additional paragraph to be added

“Where steels with improved atmospheric corrosion resistance are marked on their surface for identification, the marking material shall be such that it can be easily and completely removed after fabrication.”

Insert additional clause 3.4.4 as follows:

“3.4.4 **Stainless steel bolts, nuts and washers.**

A4-80 stainless steel bolts and nuts to BS 6105 should normally be specified but in certain bridge parapet applications (other than attachment systems) the proprietary system may recommend A4-70 or equivalent.”

3.10.2 line 1

Delete “The Engineer should specify the appropriate”, insert “Appropriate”.

Add “should be specified” at the end of the paragraph.

4.2.2 Paragraph 2, line 5

Delete “by the Engineer”.

4.2.3 line 2

Delete “the Engineer should specify”.

Add “should be specified” at the end of the paragraph.

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4.3.3 Paragraph 2, line 1

Delete “the Engineer should specify”.

Add “should be specified” at the end of the paragraph.

4.3.6 Delete heading

Insert “**Contact surfaces for high strength friction grip and tension control bolted connections**”

Insert additional clause 4.4.4 as follows:

“4.4.4 **High strength friction grip and tension control bolts, nuts and washers.**

Attention is drawn to the need for tightening to a pattern, generally by working from the centre of a group of bolts to the outside. This procedure should be followed both for the preliminary and final tightening. As layers are drawn together during the application of the preliminary bedding torque, the first bolts tightened in a group may be found to relax and require further tightening until the specified bedding torque is achieved.

**Preliminary tightening of tension control bolts**

The preferred methods of preliminary tightening of tension control bolts are as follows:

- a) Using a standard impact wrench with a deep socket to pull all surfaces into contact without involving the spline or
- b) Using manual spanners to snug all bolts bringing all surfaces into contact or
- c) Using the shear wrench, but only snugging bolts, not shearing off the spline.

Load indicating bolts and washers should not normally be used with steels with improved atmospheric corrosion resistance because they may permit the ingress of water.

(02/03) Unless otherwise described in Appendix 18/1, tension control bolts complying with Society of Steel Construction of Japan - Document JSS II-09-1996 may be used to replace high strength friction grip bolts to BS 4395 of the same nominal diameter on a one for one basis or to

form connections designed to suit the actual performance characteristics of the bolts.

Tension control bolts, nuts and washers normally conform to BS 4395-2.”

4.7.1 before paragraph 1

Insert “The main structural joints requiring welder approval tests should be specified.”

4.7.1 after paragraph 1

Insert additional paragraphs as follows:

“Electro slag and Fusarc type welding should not be used where fracture toughness is a critical design parameter, e.g. joints in areas of high applied tensile stress or severe restraint.

Welds for temporary attachments can act as stress raisers and increase the risk of fatigue. Critical areas where such welding is not permitted should be specified.

Where, in addition to specifying that a weld be dressed flush, it is required that the surface grinding be in a particular direction, e.g. for certain fatigue considerations, this requirement should also be specified.

Where partial penetration butt welds are required, their throat thickness should be specified (see BS 5135 and BS 5400 : Part 3).

Where it is required for major butt welds to be traced to particular welders, these welds should be so specified (see BS 5135).

For steels with improved atmospheric corrosion resistance the alloys increase the hardenability and this has to be taken into account in selecting welding procedures. Weld procedures should be formulated either for the maximum carbon equivalent that can be encountered or with knowledge of the actual carbon equivalent of the materials that are to be used. Pre-heat requirements should then be determined in accordance with the provisions of BS 5135. Attention is drawn to the facts that BS 5135 provisions do not fully cover the requirements for carbon equivalent values higher than 0.54 and special consultation and procedure trials are required when sufficient previous experience is not available.”

4.7.3 line 1

Delete “The Engineer should give consideration”, insert “Consideration should be given”.

#### 4.7.3 after paragraph 1

Insert additional paragraphs as follows:

“Provision should be made in Appendix 18/1 for procedure trials to arrive at approved procedures before the fabrication of the item concerned.

Samples of materials for welding, flame cutting and shearing procedure trials should as far as possible be selected from available material having the highest carbon equivalent value as determined from ladle analysis. For thick plates in critical areas, product analysis may be necessary to establish the carbon equivalent value of the samples.”

Insert additional clause 4.7.4 as follows:

**“4.7.4 Stud shear connectors: welding and procedure trials.**

See paragraphs 2 and 3 above of 4.7.3.”

#### 4.7.5 Delete heading and text

Insert additional clause 4.17 as follows:

**“4.17 Steels with improved atmospheric corrosion resistance.”**

“Areas requiring special protection during construction should be shown on the Drawings.”

#### 5.4.1.1 Paragraph 2, line 1

Delete “The Engineer may use the hardness tests on procedure test macrosections”, insert “The hardness tests on procedure test macrosections may be used”.

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#### 5.4.1.2 Paragraph 7, line 2

Delete “the Engineer may give consideration”, insert “consideration may be given”.

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#### 5.5.2 Delete text following paragraph 1.

#### 5.5.2 after paragraph 1

Insert additional paragraphs as follows:

“The methods of testing may include combinations of:

- (a) Visual.
- (b) Radiographic.
- (c) Ultrasonic.
- (d) Penetrant dye.
- (e) Magnetic particle.

Reference may be made to the following British Standards for non-destructive methods of examining and testing welds: BS EN 1435, BS 3923 Part 2, BS EN 1714, BS EN 571-1, BS EN 970 and BS 6072.”

**2** Requirements for structural steelwork should be described in Appendix 18/1.

Further guidance and advice on the preparation of an Appendix 18/1 can be found in “The Steel Construction Institute Publication 170”.

# NG SAMPLE APPENDIX 18/1: REQUIREMENTS FOR STRUCTURAL STEELWORK

[The compiler should include here:]

- 1 The drawing numbers of all drawings which give related structural steelwork requirements [1801.1].
- 2 Requirements for Materials, Workmanship, Inspection and Testing, Handling, Transport and Erection, Supply, Measurement and Weighing if different from the requirements of sub-Clause 1801.2.
- 3 Requirements for surface preparation and corrosion protection if different from the requirements of sub-Clause 1802.1.
- 4 (05/01) Particular requirements for Materials, Workmanship, Inspection and Testing, Handling, Transport and Erection, Supply, Measurement and Weighing, as required by BS 5400: Part 6: 1999 as amended by Clause 1803, including the following as appropriate.
  - (a) application of Standards other than BS EN 10025, BS EN 10113, BS EN 10137, BS EN 10155, BS EN 10210 or BS 7668 [3.1.1]
  - (b) option requirements of relevant Standards [3.1.1, 3.1.6]
  - (c) chemical analysis and carbon equivalent values [3.1.1]
  - (d) grades of steel for notch toughness [3.1.3]
  - (e) internal discontinuities [3.1.4.3]
  - (f) inspection documents [3.1.6]
  - (g) rivet steels [3.2]
  - (h) steel for shear connectors [3.3]
  - (i) bolts, nuts and washers [3.4.1, 3.4.3, 3.4.4, 3.4.5, 4.4]
  - (j) welding consumables and procedures [3.5]
  - (k) cast iron [3.10]
  - (l) interchangeability of parts [4.1]
  - (m) fabrication tolerances [4.2.2, 4.2.3]
  - (n) plate edge grinding or machining [4.3.3]
  - (o) high strength friction grip or tension control bolt connection surface treatment [4.3.6]
  - (p) holes for rivets and bolts [4.5.1, 4.5.3]
  - (q) rivet heads [4.6]
  - (r) welding processes and procedures [4.7.1, 4.7.2]
  - (s) welding procedure trials [4.7.3, 4.7.4]
  - (t) bending and pressing [4.8]
  - (u) straightening and flattening [4.9]
  - (v) tie rod fabrication [4.11]
  - (w) pin hole fabrication [4.13]
  - (x) formation of camber [4.14]
  - (y) marking for erection [4.15]
  - (z) rectification and testing of defects [4.16, 5.3]

- (aa) steels with improved atmospheric corrosion resistance [4.17]
- (bb) procedure trial weld testing [5.4.1]
- (cc) production weld testing [5.5.1.1, 5.5.1.2, 5.5.2]
- (dd) checking of deviations [Table 7, 5.6.6]
- (ee) temporary erection [5.9]
- (ff) lines and levels of completed structure [6.3.1]
- (gg) spare bolt supply [7.3]

SUPERSEDED