

STRUCTURAL STEELWORK

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Structural Steelwork

NG 1801 General

1 The Notes for Guidance should be read in conjunction with Clause 5.3 of BS 5400 : Part 10 : 1980 where appropriate and BS 5400 : Part 6 : 1999. With regard to the latter document, the following amendments and additions shall apply to Annex B, Guidance Clauses:

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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 Delete heading and text of clause and insert the following:

"The carbon equivalent value of steel is one of the factors affecting the need for preheat treatment (see Appendix E of BS 5135 : 1984). This is important for the larger thicknesses and/or higher strength steels, and consideration should be given to specifying the maximum carbon equivalent value for such material.

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 National Roads Authority.

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 imperfections".

3.1.4, paragraph 1, lines 2, 7 & 9

Delete 'laminations' and insert 'internal imperfections'.

3.1.4, paragraph 1, line 4

Delete 'the Engineer should clearly indicate', insert "clear indication should be given to".

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 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."

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."

3.9, line 1

Add to end of first sentence "or equivalent in later editions of BS."

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.

Insert additional clause 4.4.5 as follows:

"4.4.5 **High strength friction grip 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.

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

Insert additional clause 4.4.6 as follows:

"4.4.6 **Washers.** The extension of the threaded portion of a bolt within the thickness of the connected parts may affect the design strength of the bolt (see BS 5400 : Part 3)."

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 finish machining 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 improved atmospheric corrosion resistant steels, alloys increase the hardness and this has to be taken into account in selecting welding procedures. The carbon equivalent value may be calculated from the ladle analysis on the mill sheets if the percentages of all the relevant elements necessary for the calculation of carbon equivalent values are also included in the analysis. Otherwise either special chemical analysis should be undertaken to ascertain the percentage of all the relevant elements necessary for the calculation of the carbon equivalent value, or the maximum permissible carbon equivalent value should be assumed for this purpose. 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. For butt welds in material 12 mm thick or less, the degree of weld metal dilution is normally sufficient to ensure uniform weathering and colour without the need for electrodes with improved atmospheric corrosion resisting properties. For fillet welds, the degree of weld metal dilution is insufficient to ensure uniform weathering and therefore electrodes of matching chemical

composition should be used in all single run fillet welds and capping runs of multi-run fillet welds. All electrodes should be chosen such that after a reasonable period the surface colour of the resultant welds matches that of the connected plates. Special care is necessary to ensure that the electrodes are stored and handled strictly in accordance with BS 5135."

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."

Insert additional clause 4.17 as follows:

"4.17 **Improved atmospheric corrosion resistant steel.** 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

Delete 5th paragraph

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, line 6

Delete 'by the Engineer', insert "on the Drawings".

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 571, BS EN 970, BS EN 1435, BS 3923 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 J]*.
- 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 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 *[3.1.3J]*
 - (e) internal imperfections *[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, 4.4, 4.4.4]*
 - (j) welding consumables and procedures *[3.5/]*
 - (k) cast iron *[3.10]*
 - (l) interchangeability of parts *14.1]*
 - (m) fabrication tolerances *[4.2.2, 4.2.3]*
 - (n) plate edge grinding or machining *[4.3.3J]*
 - (o) HSFG 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 *14.8]*; straightening and flattening *[4.9]*
 - (u) tie rod fabrication *[4.11]*
 - (v) pin hole fabrication *[4.13]*
 - (w) formation of camber *[4.14]*
 - (x) marking for erection *14.15]*
 - (y) rectification and testing of defects *[4.16, 5.3]*
 - (z) improved atmospheric corrosion resistant steel *[4.17]*
 - (aa) procedure trial weld testing *(5.4.1.1, 5.4.1.2]*
 - (bb) production weld testing *[5.5.1.1, 5.5.1.2, 5.5.2]*
 - (cc) checking of deviations *[Table 7, 5.6.6]*
 - (dd) temporary erection *[5.9]*
 - (ee) lines and levels of completed structure *[6.3.1]*
 - (ff) spare bolt supply *[7.3]*

