# SERIES NG 1800
# STRUCTURAL STEELWORK

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# STRUCTURAL STEELWORK

## NG 1800 (08/14) General

### NG 1800.1 (04/21) Introduction and basis of execution

**1** (08/14) These Notes for Guidance are primarily for assistance in the development of appropriate contract specific specifications for structural steelwork where Series 1800 is used as the basis for the execution of the structural steelwork.

**2** (04/21) Guidance is given on the selection of contract specific requirements for inclusion in the contract specific Appendix 18/1 using NG Sample Contract Specific Appendix 18/1 of this Series.

**3** (04/21) The recommendations in PD 6705-2:2020 have been used as the basis for the specification of options allowed by and additional information required by BS EN 1090-2:2018.

**4** (08/14) Background information on selected technical requirements is also given.

### NG 1800.2 (04/21) Clause numbering and cross referencing

**1** (04/21) Each Clause and sub-Clause in this Series relates to the Clause or sub-Clause in Series 1800 that has the same numerical reference number as the Clause or sub-Clause in this Series.

**2** (04/21) The numerical sequence of sub-Clauses in this Series is incomplete, as many of the Series 1800 sub-Clauses do not require notes for guidance.

**3** (04/21) The numbering of paragraphs within a Clause or sub-Clause in this Series bears no specific relationship to the numbering of paragraphs in the related Clause or sub-Clause in Series 1800.

**4** (04/21) The guidance given in paragraphs in this Series is relevant to all paragraphs in the related Series 1800 Clause or sub-Clause, except where paragraphs in this Series follow a bracketed numbered heading.

**5** (04/21) Where there is a bracketed numbered heading within a Clause or sub-Clause in this Series, the subsequent paragraph(s) provide guidance that relates to the paragraph(s) in the related Series 1800 Clause or sub-Clause with the same number(s) as the bracketed number(s) in the bracketed numbered heading. The bracketed numbered heading gives a description of the subject matter of the guidance that is given in the subsequent paragraphs.

**6** (04/21) Cross reference to a specific sub-Clause within this Series is by sub-Clause number.

**7** (04/21) Cross reference to a bracketed numbered heading within this Series is by sub-Clause number followed by the bracketed number(s).

### NG 1800.3 (08/14) Options and additional requirements

**1** (04/21) Where a sub-Clause in this Series gives advice on completion of contract specific requirements in the contract specific Appendix 18/1, the heading is followed by (18/1). Where a sub-Clause in this Series gives advice on completion of contract specific requirements in a contract specific appendix related to another Series, the heading of the sub-Clause in this Series is followed by (XX/Y), where XX/Y refers to the Series Appendix in question. For example, for contract specific Appendix 19/1 relating to Series 1900, the abbreviation (19/1) is used.

### NG 1800.6 (04/21) CE/UK Marking

### NG 1800.6.1 (08/14) General

**1** (08/14) The harmonised standard for structural steel components is BS EN 1090-1:2009+A1:2011.

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### NG 1800.6.3 (08/14) Component specification reference (18/1)

**1** (04/21) For the purpose of identifying the component specification as defined in BS EN 1090-1:2009+A1:2011, it should be given the reference number designated as follows:

CS1800-mm/yyyy:****-**

where:

CS1800 denotes a component specification based on Series 1800 including the contract specific Appendix 18/1 requirements for the contract.

mm/yyyy is the month and year of issue of the Series 1800.

**** is the customer's contract reference number (not less than 3 characters).

** is the issue number of the component specification.

This should apply irrespective of the extent to which the Manufacturer's organisation has any design responsibility.

**2** (04/21) The component specification reference number should be given in the contract specific Appendix 18/1.

## NG 1801 (08/14) Scope

**1** (08/14) The Series 1800 should be applied to the execution of all steelwork for new highway works, except where specifically covered either fully or in part, by another Series in Volume 1 of the Manual of Contract Documents for Highway Works.

**2** (04/21) The Series 1800 should also be applied to the execution of the steelwork for modification works to existing highway structures including strengthening, upgrading, replacement, repair or other modification.

**3** (04/21) The application of the Series 1800 is restricted to the execution of structural steelwork whose design conforms to BS EN 1993, the relevant parts of BS EN 1994, and if applicable BS EN 1998, including the UK National Annexes and the Published Documents and other non-contradictory complementary information referenced therein, and whose execution is within the scope of BS EN 1090-2:2018.

## NG 1802 (08/14) Normative References

**1** (04/21) Normative references already given in BS EN 1090-2:2018 and Series 1800 are not repeated in this Clause.

**2** (04/21) Additional normative references relevant to this Series are:

a) BS EN 1993-1-4:2006+A1:2015, Design of steel structures - Part 1-4: General rules - Supplementary rules for stainless steels, published by BSI.

b) BS EN 1998, Design of structures for earthquake resistance, published by BSI.

c) PD 6705-2:2020, Structural use of steel and aluminium – Part 2: Execution of steel bridges to BS EN 1090-2 – Guide, published by BSI.

d) CG 300, Technical Approval of Highway Structures, Design Manual for Roads and Bridges.

e) CD 361, Weathering Steel for Highway Structures, Design Manual for Roads and Bridges.

## NG 1803 (08/14) Terms and Definitions

### (04/21) (1) Quantified service category (QSC)

**1** (04/21) This term is defined in PD 6705-2:2020, 3.1. The methods for determination and designation of QSC levels are given in PD 6705-2:2020, B.2 and B.3. See also NG 1804.1.1(2).

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# NG 1804 (08/14) Specifications and Documentation

## NG 1804.1 (08/14) Execution specification

### NG 1804.1.1 (08/14) General (18/1)

(08/14) **(1) Appendix 18/1**

**1** (04/21) All items listed in NG Sample Contract Specific Appendix 18/1 should be addressed for each contract and the appropriate column completed in the contract specific Appendix 18/1 to indicate whether an item is:

a) applicable or not applicable;

b) is defined on the contract specific drawings listed in contract specific Appendix 0/4; or

c) is defined in a document appended to the contract specific Appendix 18/1.

**2** (04/21) The complete list of contract specific drawings given in contract specific Appendix 0/4 and any documents appended to the contract specific Appendix 18/1 should contain all the necessary contract specific specification requirements.

**3** (04/21) Where a requirement identified in NG Sample Contract Specific Appendix 18/1 only applies to specific parts of the work, the appropriate text should be added to the relevant contract specific drawings either as a general note or notes relating to specific details or components. If a requirement applies more widely this should be added to the first contract specific drawing as a general note applying to all subsequent contract specific drawings or be included in a document appended to the contract specific Appendix 18/1 with reference to it from the relevant contract specific drawing(s).

(04/21) **(2) Determination and designation of QSC**

**1** (04/21) Structural steel components for which no fatigue loading specification is required to be applied as part of the design process may be deemed to require a QSC of F56.

**2** (04/21) Structural steel components for which a fatigue loading specification has been applied as part of the design process should be checked for conformance to QSC F56 stressing levels using the procedure in PD 6705-2:2020, B.2.2. It should be noted that many structures requiring a fatigue check may entirely conform to F56.

**3** (08/14) Any components or parts of components which do not conform to F56 stressing levels, should be rechecked for F71 and if necessary F90 and above.

**4** (04/21) If F56 is applicable everywhere in the structure a general note should be added to all of the contract specific drawings for that structure listed in contract specific Appendix 0/4 with the wording 'QSC F56 applies to all parts'.

**5** (04/21) In the event that there are specific locations in the structure where a QSC exceeding F56 is required, a note should be added to the relevant contract specific drawing(s) for that structure with the wording 'QSC F56 applies to all parts except where a higher QSC is indicated'.

**6** (04/21) Specific locations where QSCs higher than F56 apply should be identified on the contract specific drawings, together with the applicable stress directions, using the method in PD 6705-2:2020, Figure B.1. The extent of the zone where the higher QSC applies should be shown. A note should be added to indicate that the method for designating QSC is as defined in PD 6705-2:2020, Annex B. Alternatively, where the higher QSC applies to a complete component or a major part of a component, a note may be added to that part of the contract specific drawing illustrating the component so designated. The note should include the direction(s) for which the QSC applies.

**7** (04/21) F36 requirements have been included in Series 1800 to provide for the possibility of allowing relaxations to be considered during execution to an F56 requirement in the event that a non-conformance is found which would have serious implications or present difficulties if it had to be rectified and has stress levels at the non-conformance location which meet the requirements of F36. See also PD 6705-2:2020, B.3.3. Any such relaxation should be agreed with the Overseeing Organisation prior to being implemented.

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**NG 1804.1.2** (08/14) **Execution classes**

**1** (04/21) The background information in PD 6705-2:2020, 5.4 and 6.1 is applicable to all structural steelwork applications within the scope of Series 1800.

**2** (04/21) For all technical requirements in BS EN 1090-2:2018 that are differentiated on the basis of execution class, the appropriate execution classes are given in each relevant sub-Clause in Series 1800. The execution classes specified in Series 1800 apply in all cases.

## NG 1805 (08/14) Constituent Products

**NG 1805.1** (08/14) **General (18/1)**

**1** (08/14) Properties of constituent products not covered by a standard shall include all relevant characteristic values and their testing requirements necessary for assuring their structural performance.

**NG 1805.3** (08/14) **Structural steel products**

**NG 1805.3.1** (08/14) **General (18/1)**

**1** (08/14) The use of structural steel products which do not conform to the relevant European product standard, where such a European product standard exists, should not be specified.

**2** (04/21) The grade, quality and if appropriate, coating weights, finishes, and any required options permitted by the relevant product standard for structural steel products should be included in the contract specific Appendix 18/1.

**NG 1805.3.2** (08/14) **Thickness tolerances**

**1** (04/21) The background information given in PD 6705-2:2020, C.1 is applicable to all structural steelwork applications within the scope of Series 1800.

**NG 1805.3.3** (08/14) **Surface conditions (18/1)**

(04/21) **(1), (2) Surface conditions for plates, wide flats and sections (18/1)**

**1** (04/21) The background information given in PD 6705-2:2020, C.2 is applicable to all structural steelwork applications within the scope of Series 1800.

**2** (04/21) For plates, wide flats and sections, any special restrictions on the permitted surface condition classes should be specified (A or B to BS EN 10163-2 for plates and wide flats; C or D to BS EN 10163-3 for sections). The repair subclass (subclass 1, 2 or 3) should not be specified in the contract specific Appendix 18/1, as this is already specified in 1805.3.3.

**NG 1805.3.4** (04/21) **Additional properties (18/1)**

**1** (04/21) Any requirements that are additional to those covered by 1805.3.4 (1) and (2), together with the locations where the requirements apply, should be included in the contract specific Appendix 18/1.

**2** (04/21) The background information given in PD 6705-2:2020, C.4 on Z testing of through thickness properties is applicable to all structural steelwork applications within the scope of Series 1800. This will be relevant to any decision as to whether improved deformation properties (Z testing) should be specified, and requirements included in contract specific Appendix 18/1.

(08/14) **(1), (2) Internal discontinuity class**

**1** (04/21) The background information given in PD 6705-2:2020, C.3 is applicable to all structural steelwork applications within the scope of Series 1800.

**NG 1805.4** (08/14) **Steel castings (18/1)**

**1** (04/21) The guidance and background information given in PD 6705-2:2020, 7.3 and C.5 is applicable to all structural steelwork applications within the scope of Series 1800 and should be followed in the case of cast products designed by the designer or supplied as a proprietary product by a sub-contractor.

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**NG 1805.5** (08/14) **Welding consumables**

**1** (04/21) The guidance given in PD 6705-2:2020, C.6 is applicable to all structural steelwork applications within the scope of Series 1800.

**NG 1805.6** (08/14) **Mechanical fasteners**

**NG 1805.6.4** (08/14) **Structural bolting assemblies for preloading (18/1)**

**1** (04/21) The background information given in PD 6705-2:2020, C.7 is applicable to all structural steelwork applications within the scope of Series 1800.

**2** (04/21) Any decision to use stainless steel bolts for preloaded applications should take account of the requirements and recommendations in BS EN 1090-2:2018, 8.8 and 8.9, and of the warnings in BS EN 1993-1-4:2006+A1:2015, 2.2.2 where slip resistance is required.

**NG 1805.6.7** (08/14) **Foundation bolts (18/1)**

**1** (04/21) Reinforcing steels should not be specified for foundation bolts subject to applied tensile forces in service or during execution.

**NG 1805.6.8** (08/14) **Locking devices (18/1)**

**1** (08/14) Preloaded assemblies installed and tightened in accordance with the Series 1800 requirements will normally be resistant to loosening. Prevailing torque type nuts should not therefore be used as a substitute for nuts conforming to BS EN 14399 when used with bolts conforming to BS EN 14399 in preloaded joints. Non-preloaded assemblies in locations subject to vibration should incorporate locking devices.

**NG 1805.9** (04/21) **Grouting materials (18/1)**

**1** (08/14) Guidance on the specification of bedding mortar is given in Series NG 2600, Clause NG 2601.

**NG 1805.10** (04/21) **Expansion joints for bridges (23/1)**

**1** (04/21) Guidance on the specification of expansion joints is given in Series NG 2300, Clause NG 2301. Requirements for type and characteristics of expansion joints should be included in the contract specific Appendix 23/1.

**NG 1805.11** (04/21) **High strength cables, rods and terminations (18/1)**

**1** (08/14) The specification of materials and corrosion protection should be agreed with the Overseeing Organisation.

**NG 1805.12** (04/21) **Structural bearings (18/1) (21/1)**

(04/21) **(1) Bridge bearings (21/1)**

**1** (04/21) Guidance on the specification of bridge bearings is given in Series NG 2100, Clause NG 2101. Requirements for bridge bearings should be included in the contract specific Appendix 21/1.

(04/21) **(2) Structural bearings other than bridge bearings (18/1)**

**1** (04/21) The guidance given in PD 6703 on the specification of structural bearings other than bridge bearings, including the preparation of bearing schedules, should be followed.

## NG 1806 (08/14) Preparation and Assembly

**NG 1806.2** (08/14) **Identification (18/1)**

**1** (08/14) In addition to the restrictions in 1806.2 (2) and (3), stamped, punched or drilled marks may be prohibited where visual or other detriment to the surface finish is likely to occur.

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**NG 1806.4** (08/14) **Cutting**

**NG 1806.4.4** (08/14) **Hardness of free edge surfaces (18/1)**

**1** (04/21) The background information given in PD 6705-2:2020, C.8 is applicable to all structural steelwork applications within the scope of Series 1800.

**2** (08/14) The relaxation of hardness requirements for machine plasma cut edges should not be permitted in the case of energy absorbing elements, where plastic deformation may occur in the event of accidental impact.

**NG 1806.5** (04/21) **Shaping**

**NG 1806.5.3** (04/21) **Flame Straightening**

**NG 1806.5.3.1** (04/21) **General**

**1** (04/21) The background information given in PD 6705-2:2020, C.9 is applicable to all structural steelwork applications within the scope of Series 1800.

**NG 1806.5.4** (08/14) **Cold forming (18/1)**

**1** (04/21) For stainless steel, the minimum bend radii should not be less than those given in BS EN 1090-2:2018, 6.5.4 c) or d) as appropriate, unless tests have been carried out to verify that tighter radii do not result in cracking.

**NG 1806.6** (08/14) **Holing**

**NG 1806.6.3** (08/14) **Execution of holing**

**1** (04/21) The background information given in PD 6705-2:2020, C.10 is applicable to all structural steelwork applications within the scope of Series 1800.

(04/21) **(2) Slotted holes**

**1** (04/21) Slotted holes should not be specified in zones with a QSC above F112.

**NG 1806.7** (08/14) **Cut outs (18/1)**

(04/21) **(1) Minimum radius for re-entrant corners and notches (18/1)**

**1** (04/21) For QSC F36 and below, smaller radii may be acceptable.

**NG 1806.9** (04/21) **Assembly (18/1)**

(04/21) **(1), (2) Connections for temporary components (18/1)**

**1** (04/21) In specifying any requirements for connections for temporary components, consideration should be given to the reinstatement or sealing of holes and the removal or otherwise of temporary components attached by welds. Areas where connections for temporary components are not permitted should be identified. See also NG 1807.5.6.

**NG 1806.10** (08/14) **Assembly check (18/1)**

**1** (04/21) A full or staged trial assembly should be required where it is necessary to prove fit up between components and critical dimensions especially where tolerances on overall geometry or joint fit-up are small. This applies particularly to bolted joints with butting faces.

**2** (04/21) A full or staged trial assembly of a superstructure should be required where any of the following apply:

a) erection operations are to be undertaken within restricted possession times;

b) construction is likely to be on the programme critical path;

c) the vertical camber is critical to the correct dead weight stress distribution in continuous main girders, particularly in cable stayed or suspension bridges; or

d) fit-up tolerances are small in latticed structures which contain heavy members and rigid joints.

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**3** (04/21) Where a full or staged trial assembly is required it should comprise all steelwork, ancillary steelwork, bearings and components, including those that may affect site installation, all supported together in their correct alignment and level. Specific detailed requirements should be included in the contract specific Appendix 18/1.

## NG 1807 (08/14) Welding

### NG 1807.1 (08/14) General (18/1)

(04/21) **(1), (2) BS EN ISO 3834 quality requirements (18/1)**

**1** (04/21) Relaxations from the quality requirements for EXC3/4 should not be permitted for structures where any of the following conditions apply:

a) The structure is classified in a Category higher than Category 0 (to CG 300);

b) Steel grades above S355 are used; or

c) a QSC level higher than F56 is required for any detail, component or structure (or part thereof).

**2** (04/21) The general guidance given in PD 6705-2:2020, C.11 for bridges is also applicable in principle to other structural steelwork applications within the scope of Series 1800.

### NG 1807.3 (04/21) Welding processes

**1** (04/21) The guidance given in PD 6705-2:2020, 9.1 relating to welding processes is applicable to all structural steelwork applications within the scope of Series 1800.

### NG 1807.4 (08/14) Qualification of welding procedures and welding personnel

### NG 1807.4.1 (08/14) Qualification of welding procedures

#### NG 1807.4.1.1 (04/21) General (18/1)

**1** (04/21) The background information given in PD 6705-2:2020, C.12 is applicable to all structural steelwork applications within the scope of Series 1800.

#### NG 1807.4.1.2 (08/14) Qualification of welding procedures for processes 111, 114, 12, 13 and 14

**1** (08/14) Attention is drawn to the need to carry out impact tests for certain joint types according to BS EN ISO 15614-1.

**2** (04/21) The background information on procedure test imperfection acceptance given in PD 6705- 2:2020, C.13 is applicable to all structural steelwork applications within the scope of Series 1800.

### NG 1807.4.3 (08/14) Welding co-ordination

**1** (04/21) The background information given in PD 6705-2:2020, C.14 is applicable to all structural steelwork applications within the scope of Series 1800.

### NG 1807.5 (08/14) Preparation and execution of welding

### NG 1807.5.6 (08/14) Temporary attachments (18/1)

**1** (04/21) Details of any temporary attachments known to be required for execution, and those required by the Constructor, should be added to the contract specific Appendix 18/1.

**2** (04/21) The background information given in PD 6705-2:2020, C.15 is applicable to all structural steelwork applications within the scope of Series 1800.

(04/21) **(1) Restrictions on the use of temporary welded attachments (18/1)**

**1** (04/21) In addition to the limitations of 1807.5.6 (1), temporary welded attachments may also be prohibited for reasons of, for example, distortion control, fit up of parts, visual appearance and damage to corrosion protection.

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**NG 1807.5.9** (08/14) **Butt welds**

**NG 1807.5.9.2** (08/14) **Single sided welds (18/1)**

**1** (04/21) The background information given in PD 6705-2:2020, C.16 is applicable to all structural steelwork applications within the scope of Series 1800.

**NG 1807.6** (08/14) **Acceptance criteria**

**1** (04/21) The background information given in PD 6705-2:2020, C.24 is applicable to all structural steelwork applications within the scope of Series 1800.

**NG 1807.6.2** (04/21) **Fatigue Requirements**

**1** (04/21) The method of specification and the acceptance criteria given in BS EN 1090-2:2018, 7.6.2 should not be used in place of those given in Tables 18/7 to 18/10 for specific inspection of production welds. See 1812.4.2.5 and 1812.4.2.6. The reasons for not using the option of BS EN 1090-2:2018, 7.6.2 are given in the third paragraph of PD 6705-2:2020, C.24.

**NG 1807.7** (04/21) **Welding of stainless steels (18/1)**

**1** (04/21) In developing requirements for connections involving different stainless steel types welded to each other or to other steels, guidance should be sought from appropriate experts in corrosion and welding technologies.

## NG 1808 (08/14) Mechanical Fastening

**NG 1808.2** (08/14) **Use of bolting assemblies**

**NG 1808.2.1** (08/14) **General (18/1)**

**1** (04/21) The background information on welding of fasteners given in PD 6705-2:2020, C.17 is applicable to all structural steelwork applications within the scope of Series 1800.

(04/21) **(2) Welding of property class 4.6 nuts, bolts and washers (18/1)**

**1** (04/21) The use of welding on property class 4.6 nuts, bolts and washers should only be specified where:

a) the QSC of the parent metal is not greater than F36;

b) the welded component is not coated; and

c) neither the diameter of the bolt nor the thickness of the parent metal is more than 12mm.

(04/21) **(3) Orientation of bolting assemblies (18/1)**

**1** (04/21) The orientation of bolting assemblies may be critical for reasons of, for example, visual appearance, corrosion resistance, accessibility of tools, and operational clearances.

**NG 1808.5** (04/21) **Tightening of preloaded bolting assemblies**

**NG 1808.5.1** (04/21) **General (18/1)**

**1** (04/21) The background information on minimum preloading force given in PD 6705-2:2020, C.19 is applicable to all structural steelwork applications within the scope of Series 1800.

(08/14) **(1), (2), (3) Fit up of preloaded joints (18/1)**

**1** (04/21) The background information on joint fit up given in PD 6705-2:2020, C.18 is applicable to all structural steelwork applications within the scope of Series 1800.

**2** (04/21) To achieve adequate contact between the friction surfaces in preloaded lap joints, the out-of-plane bending stiffness of cover plates should be limited. This may be achieved by using two plates of half the thickness each when the thickness of the original cover plate exceeds the bolt size. The option to use two cover plates of half the thickness in preloaded lap joints may be permitted subject to conformance to BS EN

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1993-1-8 bolt spacing limitations, unless there are other design reasons why this should not be permitted. If considered necessary, any measures permitted to limit the out-of-plane bending stiffness of cover plates should be described in the contract specific Appendix 18/1.

(08/14) **(4), (5) Part turn method**

**1** (04/21) The background information on the part turn method given in PD 6705-2:2020, C.22 is applicable to all structural steelwork applications within the scope of Series 1800.

(08/14) **(6) Torque method (18/1)**

**1** (04/21) The guidance on suitable use of the torque method given in PD 6705-2:2020, 10.2.3 and C.20 is applicable to all structural steelwork applications within the scope of Series 1800.

**NG 1808.5.4** (08/14) **Combined method**

**1** (04/21) The background information given in PD 6705-2:2020, C.21 is applicable to all structural steelwork applications within the scope of Series 1800.

**NG 1808.8** (04/21) **Use of special fasteners and fastening methods (18/1)**

**1** (04/21) The following matters should be considered, in addition to procedure testing, in specifying the use of special fasteners and fastening methods:

a) Tolerances on hole diameter, alignment of holes and initial gaps between parts;

b) Specification and calibration of tightening equipment;

c) Training and qualification of operatives;

d) Sequence of installation and tightening; and

e) Inspection and acceptance criteria of installed fasteners.

## NG 1809 (08/14) Erection

**NG 1809.4** (08/14) **Survey**

**NG 1809.4.1** (08/14) **Reference system (18/1)**

**1** (08/14) A reference temperature of 15°C is widely used in the UK. This may not apply to all fabrication shops or site works, particularly if in colder or hotter climates.

**NG 1809.5** (08/14) **Supports, anchors and bearings**

**NG 1809.5.3** (08/14) **Maintaining suitability of supports (18/1)**

**1** (08/14) Where settlements and/or differential settlements of supports are expected to be of a magnitude that would be critical to the design, estimates of the amount of settlements and /or differential settlements anticipated during construction and the limits beyond which compensation is required should be given.

**NG 1809.5.4** (08/14) **Temporary supports (18/1)**

**1** (08/14) If packings are to be left in position it should be confirmed that they will not be detrimental to the performance of the structure.

## NG 1810 (08/14) Surface Treatment

**NG 1810.1** (04/21) **General (18/1) (19/1) (19/5)**

(08/14) **(5) Friction surfaces (18/1)**

**1** (08/14) In specifying requirements for friction surfaces in slip resistant connections, reference should be made to Series 1900, Clause 1906 and Series NG1900, Clause NG1906.



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(08/14) **(9) Procedure qualification of dipping process (18/1)**

**1** (08/14) Expert advice should be sought in specifying requirements for procedure qualification of the dipping process for components that are to be galvanized after manufacture.

(08/14) **(10) Overcoating of galvanised surfaces (18/1)**

**1** (08/14) Expert advice should be sought in specifying requirements for the inspection, checking and qualification of the preparation to be carried out before subsequent overcoating of galvanised components.

(04/21) **(13) Inspection of galvanized components (18/1)**

**1** (04/21) Expert advice should be sought on identifying components or details that may be particularly susceptible to liquid metal assisted cracking, and on the appropriate scope and method of NDT to be used.

**NG 1810.6** (04/21) **Sealing of spaces (18/1) (19/1)**

**1** (04/21) The internal treatment system for enclosed spaces should be specified in the contract specific Appendix 19/1, and should be in accordance with Series 1900.

**NG 1810.7** (08/14) **Surfaces in contact with concrete (18/1)**

**1** (04/21) In specifying specific requirements for coating surfaces in contact with concrete, reference should be made to Series 1900, Clause 1917 and Series NG1900, Clause NG1917.

## NG 1811 (08/14) Geometrical Tolerances

**NG 1811.1** (08/14) **Tolerance types (18/1)**

**1** (08/14) Special tolerances should not be such as to relax any of the essential tolerances in 1811.2, otherwise structural performance may be impaired.

**2** (04/21) Where camber requirements are critical, the support locations and loads to be applied when cambers are measured during trial assembly and/or during erection together with specified tolerances on camber under those conditions should be included in the contract specific Appendix 18/1.

**NG 1811.3** (08/14) **Functional tolerances**

**NG 1811.3.3** (08/14) **Alternative criteria (18/1)**

**1** (08/14) The alternative criteria in 1811.3.3 should only be used if there are particular reasons why those in 1811.3.2 are not appropriate.

## NG 1812 (08/14) Inspection, Testing and Correction

**NG 1812.2** (08/14) **Constituent products and components**

**NG 1812.2.1** (08/14) **Constituent products (18/1)**

(04/21) **(1) Specific testing of proprietary products (18/1)**

**1** (04/21) Specific testing of proprietary products not covered by the European or International standards referenced in BS EN 1090-2:2018 should be specified, eg special fasteners, tension connectors or mechanical components required for articulation, movement or control of displacement. This should include prototype testing to provide evidence of structural performance to prove the design and establish quality criteria, and production tests to provide evidence that the quality requirements are being met in all supplied items.

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**NG 1812.4** (08/14) **Welding**

**NG 1812.4.2** (08/14) **Inspection after welding**

**NG 1812.4.2.3** (04/21) **Routine inspection and testing**

**1** (04/21) The background information given in PD 6705-2:2020, C.23 is applicable to all structural steelwork applications within the scope of Series 1800.

**NG 1812.4.2.4** (04/21) **Project specific inspection and testing**

**1** (04/21) Weld inspection classes should not be used to classify specific welds for inspection in place of the requirements in 1812.4.2.4

**2** (04/21) BS EN 1090-2:2018, Annex L should not be used for determining the extent of supplementary testing of welds in place of Tables 18/4, 18/5 and 18/6.

**3** (04/21) The background information given in PD 6705-2:2020, C.23 is applicable to all structural steelwork applications within the scope of Series 1800.

**NG 1812.4.2.5** (04/21) **Visual inspection of welds**

**1** (04/21) The background information on acceptance criteria for final acceptance of welds given in PD 6705-2:2020, C.24 is applicable to all structural steelwork applications within the scope of Series 1800.

**NG 1812.4.2.6** (04/21) **Supplementary NDT methods**

**1** (04/21) The background information on acceptance criteria for final acceptance of welds given in PD 6705-2:2020, C.24 is applicable to all structural steelwork applications within the scope of Series 1800.

**NG 1812.7.3** (04/21) **Survey of geometrical position of connection nodes**

**NG 1812.7.3.1** (04/21) **Survey methods and accuracy (18/1)**

(04/21) **(2) Thickness monitoring of weather resistant steels (18/1)**

**1** (04/21) Requirements for the residual material thickness measurement monitoring of weather resistant steels should be specified to meet the requirements given in CD 361. These should include details of:

a) the measurement locations including location coordinate and identification reference system;

b) the method of measurement to be used for the initial measurements; and

c) the method to be used for recording the locations and initial measurements.

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# (08/14) NG SAMPLE CONTRACT SPECIFIC APPENDIX 18/1: REQUIREMENTS FOR STRUCTURAL STEELWORK

(08/14)

*[The compiler should include here the:]*

**Contract Title:**……

**Structure Reference:**……

**Component Specification Reference:** CS1800-mm/yyyy:****-** *[See NG 1800.6.3]*

Note: The component specification comprises Series 1800 (issue as dated in the component specification reference) and this contract specific Appendix 18/1, which includes the drawings and documents referred to in the table below.

*[The compiler should complete the following table providing an appropriate entry(s) for every Series 1800 Clause Reference given in the left column. Note * against a Clause reference in the left column indicates that guidance/ background information is given within the related Series NG 1800 Clause. The * indication shall be removed from the contract specific Appendix 18/1]*

(04/21)

| | | | **Contract specific drawings and documents that give related structural steelwork requirements** | |
|---|---|---|---|---|
| **Series 1800 Sub-Clause reference** (paragraph number in ( )) | **Additional Information Required** | **Applicable or Not** (✓ if applicable; × if not applicable) | **See drawings listed in contract specific Appendix 0/4** *[The compiler should provide drawing reference(s)]* | **See appended documents** *[The compiler should provide document reference(s)]* |
| **1804 – Specifications and Documentation** | | | | |
| 1804.1.1* | **Execution Specification, General** – drawing numbers of all drawings in contract specific Appendix 0/4, and document references of all appended documents that give all the necessary requirements for the execution of the steelwork. | ✓ | | |
| 1804.2.1 | **Quality documentation** – Hold-points or requirements to witness inspections or tests, and any consequent access requirements. | | | |
| **1805 – Constituent Products** | | | | |
| 1805.1* | **Constituent Products, General** – properties of products not covered by listed standards. | | | |
| 1805.3.1* | **Structural Steel Products, General** – grades, qualities and if appropriate, coating weights, finishes and any required options permitted by product standards for steel products. | | | |
| 1805.3.3 (1), (2)* | **Surface conditions** – for plates, wide flats and sections, any special restrictions on the required surface condition class. | | | |

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| | | | Contract specific drawings and documents that give related structural steelwork requirements | |
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| 1805.3.3 | **Surface conditions** – additional requirements related to special restrictions on either surface imperfections or repair of surface defects by grinding in accordance with BS EN 10163, or with BS EN 10088 for stainless steel. | | | |
| 1805.3.3 | **Surface conditions** – surface finish requirements for other products. | | | |
| 1805.3.4* | **Additional properties** – Additional requirements for testing on constituent products, improved deformation properties perpendicular to the surface, delivery conditions of stainless steels or processing conditions. | | | |
| 1805.4* | **Steel castings** – Grades, grade suffixes, finishes and options for steel castings. | | | |
| 1805.6.3 | **Structural bolting assemblies for non-preloaded applications** – property classes of bolts and nuts, and any required options permitted by product standards for structural bolting assemblies for non-preloaded applications. | | | |
| 1805.6.3 | **Structural bolting assemblies for non-preloaded applications** – technical delivery conditions for some bolting assemblies. | | | |
| 1805.6.3 | **Structural bolting assemblies for non-preloaded applications** – full details for the use of insulation kits. | | | |
| 1805.6.4* | **Structural bolting assemblies for preloading** – property classes of bolts and nuts and any required options permitted by product standards for structural bolting assemblies for preloading. | | | |
| 1805.6.4* | **Structural bolting assemblies for preloading** – where stainless steel bolts can be used in preloaded applications. | | | |
| 1805.6.7* | **Foundation bolts** – where reinforcing steels may be used for foundation bolts together with the steel grade. | | | |
| 1805.6.8* | **Locking devices** – where locking devices are required. | | | |
| 1805.6.8 | **Locking devices** – if products other than those in the referred standards are to be used. | | | |
| 1805.6.9.2 | **Taper washers** – dimensions for taper washers. | | | |
| 1805.6.11 | **Special fasteners** – special fastener not standardised in CEN or ISO standards, as well as any tests necessary. | | | |
| 1805.9* | **Grouting materials** – grouting materials to be used. | | | |

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| 1805.10 (1)* | **Expansion joints** – Requirements for expansion joints. | | | *[If applicable – See contract specific Appendix 23/1]* |
| 1805.11* | **High strength cables, rods and terminations** – tensile strength grade and coating of wires. | | | |
| 1805.11* | **High strength cables, rods and terminations** – designation and class of strands. | | | |
| 1805.11* | **High strength cables, rods and terminations** – minimum breaking load and diameter of steel wire ropes and requirements related to corrosion protection. | | | |
| 1805.12 (1)* | **Structural bearings** – Requirements for bridge bearings. | | | *[If applicable – See contract specific Appendix 21/1]* |
| 1805.12 (2)* | **Structural bearings** – Schedule of design requirements and acceptance tests. | | | |
| **1806 – Preparation and Assembly** | | | | |
| 1806.2 | **Identification** – where soft or low stress stamps may not be used for stainless steel. | | | |
| 1806.2* | **Identification** – zones where identification marks are not permitted or shall not be visible after completion. | | | |
| 1806.4.4 (2)* | **Hardness of free edge surfaces** – edge surfaces where the relaxation for machine plasma cutting described in 1806.4.4 (2) is not permitted. | | | |
| 1806.5.4 c), d)* | **Cold forming** – other minimum bending radii for stainless steels to referred grades. | | | |
| 1806.5.4 j) | **Cold forming** – other conditions for circular tubes bending by cold forming. | | | |
| 1806.6.1 | **Dimensions of holes** – special dimensions for movement joints. | | | |
| 1806.6.1 | **Dimensions of holes** – nominal hole diameter for solid rivets for hot riveting. | | | |
| 1806.6.1 | **Dimensions of holes** – dimensions of countersinking. | | | |
| 1806.7 (1)* | **Cut outs** – if re-entrant corners or notches may be rounded off with other minimum values of radius. | | | |
| 1806.8 | **Full contact bearing surfaces** – where full contact bearing surfaces are required. | | | |
| 1806.9 | **Elongation of holes** – holes for which elongation is not permitted. | | | |
| 1806.9 (1)* | **Connections for temporary components** – special requirements applying to connections for temporary components, including those related to fatigue. | | | |

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| 1806.9 (2)* | **Connections for temporary components** – where the removal or addition of permanent material or the introduction of permanent stress concentrating details is permitted. | | | |
| 1806.10 (1)* | **Assembly check** – requirements for whether, and to what extent trial assembly is to be used. | | | |
| **1807 – Welding** | | | | |
| 1807.1 (1)* | **Welding Quality Requirements** – if the BS EN ISO 3834 quality requirements shall conform to the requirements for EXC2. | | | |
| 1807.4.1.1* | **Hollow section joints** – start and stop zones, and methods for hollow section joints. | | | |
| 1807.5.6* | **Temporary attachments** – areas where welding of temporary attachments is not permitted. | | | |
| 1807.5.6 (1)* | **Temporary attachments** – restrictions on the use of temporary welded attachments. | | | |
| 1807.5.9.1 | **Butt welds, general** – the location of butt welds used as splices to accommodate available lengths of constituent products. | | | |
| 1807.5.9.1 | **Butt welds, general** – where a flush surface is required. | | | |
| 1807.5.9.2 (1)* | **Single sided welds** – where the use of permanent steel backing is permitted. | | | |
| 1807.5.13 | **Slot and plug welds** – the dimensions of holes for slot and plug welds. | | | |
| 1807.5.14 | **Other weld types** – requirements for other weld types. | | | |
| 1807.5.16 | **Execution of welding** – requirements for grinding and dressing of the surface of completed welds. | | | |
| 1807.7* | **Welding of stainless steels** – requirements for welding different stainless steels to each other or to other steels, such as carbon steels. | | | |
| **1808 – Mechanical Fastening** | | | | |
| 1808.2.1 | **Use of bolting assemblies, General** – if in addition to tightening, other measures or means are to be used to secure the nuts. | | | |
| 1808.2.1 (2)* | **Welding of mechanical fasteners** – if welding of property class 4.6 nuts, bolts and washers is permitted. | | | |
| 1808.2.1 (3)* | **Orientation of bolting assemblies** – restrictions on the orientation of bolting assemblies. | | | |
| 1808.2.2 | **Bolts** – if nominal fastener diameter may be less than M12 for structural bolting together with requirements. | | | |

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| 1808.2.2 | **Bolts** – dimensions of bolts in connection utilising the shear capacity of the unthreaded shank. | | | |
| 1808.2.4 | **Washers** – dimensions and steel grade of plate washers. | | | |
| 1808.3 | **Tightening of non-preloaded bolting assemblies** – where full contact bearing is required (see 1806.8). | | | |
| 1808.4 | **Preparation of contact surfaces in slip resistant connections** – requirements related to contact surfaces in slip resistant connections for stainless steels. | | | |
| 1808.4 | **Preparation of contact surfaces in slip resistant connections** – required class of contact surfaces in preloaded joints including if the design life of the structure is other than 50 years if the slip factor is to be determined by the test specified in BS EN 1090-2:2018, Annex G (see 1810.1 (5) and BS EN 1090-2:2018, Annex G G.5). | | | |
| 1808.5.1 (2)* | **Cover Plates in Preloaded Joints** – measures permitted to limit the out-of-plane bending stiffness of cover plates. | | | |
| 1808.5.1 (6)* | **Tightening of preloaded bolts, General** – preloaded bolts that shall be tightened by the torque method. | | | |
| 1808.7.2 | **Installation of rivets** – where a flush surface of countersunk rivets is required. | | | |
| 1808.7.3 | **Acceptance criteria** – where outer faces of plies are to be free of indentation by the riveting machine. | | | |
| 1808.8* | **Use of special fasteners and fastening methods** – requirements for use of special fasteners and fastening methods including for any procedure tests. | | | |
| 1808.8 | **Use of special fasteners and fastening methods** – requirements for use of resin injection bolts. | | | |
| **1809 – Erection** | | | | |
| 1809.3.1 | **Erection method** – Camber and presets required in relation to those provided at manufacturing stage. | | | |
| 1809.4.1(1)* | **Reference system** – the reference temperature for setting out and measuring the steelwork if different from 15°C. | | | |
| 1809.5.3* | **Maintaining suitability of supports** – if compensation for settlement of supports is not acceptable. | | | |
| 1809.5.4* | **Temporary supports** – if packings for bridges may be left in position. | | | |

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| 1809.5.4 | **Temporary supports** – if levelling nuts on the foundation bolts under the base plate are to be removed. | | | |
| 1809.5.5(1) | **Grouting and sealing** – requirements for the treatment of steelwork, bearings and concrete surfaces before grouting. | | | |
| 1809.5.5 | **Grouting and sealing –** the method of sealing the edges of a base plate if no grouting is needed. | | | |
| **1810 – Surface Treatment** | | | | |
| 1810.1 (3) | **Surface treatment** – performance specification. | | | *[If applicable – See contract specific Appendix 19/1]* |
| 1810.1 (5)* | **Surface treatment** – requirements for friction surfaces and class of treatment or tests required for surfaces in slip resistant connections (see 1808.4). | | | |
| 1810.1 (6) | **Surface treatment** – corrosion protection and extent of surfaces to be painted at preloaded connections. | | | *[If applicable – See contract specific Appendix 19/5]* |
| 1810.1 (7) | **Surface treatment** – the extent of surfaces that are affected by the pre-loaded bolting assemblies in non-slip resistant connections. | | | |
| 1810.1 (8) | **Foundation bolts** – if the lower embedded part of foundation bolts are not to be left untreated. | | | |
| 1810.1 (9)* | **Galvanizing** – Requirements for procedure qualification of the dipping process if hot dip galvanizing of cold formed components after manufacture is required. | | | |
| 1810.1 (10)* | **Galvanizing** – Requirements for the inspection, checking or qualification of the preparation to be carried out before subsequent overcoating, for galvanized components. | | | |
| 1810.1 (13) | **Hot dip galvanized components** – components or specific locations to be subjected to additional NDT together with the scope and method to be used. | | | |
| 1810.2 | **Preparation of steel substrates** – Requirements for surface cleanliness of stainless steels. | | | |
| 1810.3 | **Weather resistant steels** – requirements for treatment of surfaces of non-weather resistant steels in contact with uncoated weather resistant steels. | | | |
| 1810.5 | **Galvanizing** – where enclosed spaces are to be sealed after hot dip galvanizing and, if so, with what sealant. | | | |
| 1810.6 (1)* | **Surface treatment within enclosed spaces** – Internal treatment system, if enclosed spaces are to be sealed by welding or provided with internal protective treatment. | | | *[If applicable – See contract specific Appendix 19/1]* |

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| | | | Contract specific drawings and documents that give related structural steelwork requirements | |
|---|---|---|---|---|
| **Series 1800 Sub-Clause reference** (paragraph number in ( )) | **Additional Information Required** | **Applicable or Not** (✓ if applicable; × if not applicable) | **See drawings listed in contract specific Appendix 0/4** *[The compiler should provide drawing reference(s)]* | **See appended documents** *[The compiler should provide document reference(s)]* |
| 1810.6 (2) | **Sealing of spaces** – internal spaces that are to be hermetically sealed. | | | |
| 1810.6 | **Sealing of spaces** – the method of sealing wall of sealed enclosed spaces penetrated by fasteners. | | | |
| 1810.7* | **Surfaces in contact with concrete** – specific requirements for coating surfaces in contact with concrete. | | | |
| 1810.9 (2) | **Repairs of coatings to precoated constituent products** – method and extent of repair after cutting or welding. | | | |
| 1810.10 | **Cleaning of stainless steel components** – the method, level and extent of cleaning of stainless steels. | | | |
| **1811 – Geometrical Tolerances** | | | | |
| 1811.1* | **Tolerance types** – additional information related to special tolerances if these tolerances are required. | | | |
| 18.11.2.2.5 (1) | **Shells** – scope of dimensional checking for dimple measurements (see BS EN 1090-2:2018, Table B.11). | | | |
| 1811.2.3.2 | **Continuously supported shells** – special tolerances for continuously supported shells. | | | |
| 1811.3.3* | **Alternative criteria** – where the specified alternative criteria for functional tolerances are to be applied. | | | |
| **1812 – Inspection, Testing and Correction** | | | | |
| 1812.2.1 | **Constituent products** – specific testing requirements for constituent products. | | | |
| 1812.2.1 (1)* | **Constituent products** – specific testing requirements for proprietary products. | | | |
| 1812.5.1 | **Inspection of non-preloaded bolted connections** – requirements for checking the installation of an insulation system. | | | |
| 1812.5.2.1 | **Preloaded bolted connections** – requirements for the inspection and testing of preloaded bolting assemblies used for stainless steels connections. | | | |
| 1812.5.4.1 | **Special fasteners and fastening methods, General** – requirements for the inspection of connections using special fasteners or special fastening methods. | | | |
| 1812.7.1 (1) | **Inspection of trial erection** – requirements for the inspection of a trial erection. | | | |
| 1812.7.3.1 (2)* | **Thickness monitoring** – requirements for residual material thickness monitoring of weather resistant steels. | | | |

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| 1812.7.3.4 | **Location and frequency** – extent of measurements for the survey of geometrical position of connection nodes if other than adjacent to site interconnection nodes. | | | |
| 1812.7.3.4 | **Location and frequency** – conditions of measurements other than under the self weight of steelwork, under which positional accuracy of erected steelwork should be measured. | | | |
| 1812.7.3.6 | **Definition of nonconformity** – an envelope of permissible positions if significant movement of a structure is anticipated that could affect dimensional checking. | | | |
| 1812.7.4 | **Other acceptance tests** – specific requirements including tolerance range on the load, if components of a structure are to be erected to a specific load. | | | |

## Contract Specific Appendix 18/1 Appended Documents

*[The compiler should provide a complete list of the appended documents referred to from the table above. The list should include as a minimum the full title, date of issue, revision and reference number for each document. The documents should be attached to the contract specific Appendix 18/1.]*

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