



Model Specification for the Purchase of Structural Bolting Assemblies and Holding Down Bolts

1.0 Introduction

This specification is for the purchase of structural bolting assemblies and holding down bolts for constructional steelwork and should be used in conjunction with the *National Structural Steelwork Specification for Buildings* (7th edition) and the *Steel Bridge Group: Model Project Specification for the Execution of Steelwork in Bridge Structures*.

Acceptance of structural fasteners from a supplier is conditional on the supplier complying with the full requirements of this model specification.

2.0 General

All fasteners to Tables 1 and 2 shall be supplied with a colour coded system. The colour coding system shall identify the diameter of the fastener and the type of protective treatment used. Example colour coding systems for the fastener diameter shown on the bag or drum and protective treatment shown on a label are given below. Manufacturers/suppliers may use alternative colour coding systems provided the system is agreed with the purchaser in advance; especially if fasteners above M30 diameter are supplied. Other forms of packaging are allowed if agreed between parties.

Fastener diameter

M12	=	RED
M16	=	BLUE
M20	=	YELLOW
M24	=	GREEN
M30	=	BLACK

Type of protective treatment

Electroplating	=	BLUE
Galvanized	=	ORANGE
Sherardized	=	PINK

If a technical non-conformity is discovered after delivery, the supplier shall replace the product or rectify the problem immediately and make available to the purchaser the results of the corrective action taken.

2.1 Thread lengths

Thread lengths to be provided in accordance with the product specifications unless longer or non-standard thread lengths are agreed between the purchaser and the supplier at the time of order.

3.0 Technical Specification

Fasteners shall be supplied in accordance with the following tables or in the case of proprietary fasteners in accordance with clauses 4 and 5.

Fasteners complying with Tables 1 to 6 included shall not be welded.

Fasteners outside the scope of BS EN ISO 898-1 (See section 5 c) e.g., $d > 39$ mm) may also be supplied in accordance with this specification provided the requirements in Tables 2 and 3 of BS EN ISO 898-1 are complied with. In such circumstances it is recommended that the requirements are discussed and agreed between the specifier and manufacturer of the fasteners prior to order. For property classes 8.8 and 10.9 refer to sections 8 and 9 of this specification.

Higher property class bolts must not be substituted for lower grade ones without the prior approval of the designer / purchaser. The substitution of higher property class nuts is permitted.

Note: Fasteners supplied in accordance with Tables 3, 4, 5 and 6 are not CE Marked as EN 15048-1: 2016 has not yet been cited in the Official Journal of the European Union although it permits the use of National Standards. Notwithstanding this issue these fasteners may still be used in steelwork designed and executed to the requirements of the Eurocodes and The Building Regulations.

Table 1: MATCHING ORDINARY ASSEMBLIES			
Property Class	Incorporating fully threaded length bolts		
	Bolt	Nut ⁽¹⁾	Washer
4.6	BS EN ISO 4018	BS EN ISO 4034 (Property Class 5) ⁽³⁾	BS EN ISO 7091 (100HV)
8.8	BS EN ISO 4017 ⁽²⁾	BS EN ISO 4032 ⁽²⁾ (Property Class 8) ⁽³⁾	BS EN ISO 7091 (100HV)
10.9	BS EN ISO 4017 ⁽²⁾	BS EN ISO 4032 ⁽²⁾ (Property Class 10) ⁽³⁾⁽⁴⁾	BS EN ISO 7091 (100HV)
Incorporating part threaded length bolts			
4.6	BS EN ISO 4016	BS EN ISO 4034 (Property Class 5) ⁽³⁾	BS EN ISO 7091 (100HV)
8.8	BS EN ISO 4014 ⁽²⁾	BS EN ISO 4032 ⁽²⁾ (Property Class 8) ⁽³⁾	BS EN ISO 7091 (100HV)
10.9	BS EN ISO 4014 ⁽²⁾	BS EN ISO 4032 ⁽²⁾ (Property Class 10) ⁽³⁾ ⁽⁴⁾	BS EN ISO 7091 (100HV)
<p>(1) Nuts of a higher property class may also be used</p> <p>(2) Bolts of property classes 8.8 and 10.9 to BS EN ISO 4014 or BS EN ISO 4017 (dimensions and tolerances of BS EN ISO 4016 or BS EN ISO 4018) may also be used, with matching nuts of the same property classes to BS EN ISO 4032 (dimensions and tolerances of BS EN ISO 4034).</p> <p>(3) Nuts for galvanized or sherardized bolts shall be tapped over-size to tolerance 6AZ to accommodate the thickness of galvanizing/sherardizing. This over-tapping reduces the strength of the nut and therefore a nut that has a proof load higher than the minimum ultimate tensile load of the assembly must be used. Nuts for galvanized or sherardized 4.6 bolts shall be property class 8; nuts for galvanized or sherardized 8.8 bolts shall be property class 10 and nuts for galvanized or sherardized 10.9 bolts shall be property class 12 to BS EN ISO 4033.</p> <p>(4) The BS EN ISO 4033 nut standard does not include sizes M22, M27, M33 or sizes greater than M36; it is therefore not possible to supply assemblies in these diameters which comply with this Model Specification for property class 10.9 in the hot dip galvanized or sherardized condition.</p>			

Table 2: MATCHING PRELOADED ASSEMBLIES⁽¹⁾⁽²⁾			
	System HR		System HRC
	Hexagon bolt	Countersunk bolt	HRC bolt⁽³⁾
Bolt/nut assembly	BS EN 14399-3	BS EN 14399-7	BS EN 14399-10
Bolt marking	HR	HR	HRC
Nut marking	HR	HR	HR or HRD
Property class	8.8/8;8.8/10 or 10.9/10	8.8/8; 8.8/10 or 10.9/10	10.9/10
Washers	BS EN 14399-5 or BS EN 14399-6		
Washer marking	H		
DTI ⁽⁴⁾ , nut and bolt face washers	BS EN 14399-9		At user's discretion
DTI marking ⁽⁴⁾	H8 or H10		
Nut face washer marking	HN		
Bolt face washer marking	HB	Not applicable	
<p>(1) In terms of suitability for preloading, fasteners shall meet the test requirements of BS EN 14399-2 and any additional testing specified in the product standard.</p> <p>(2) Bolt lengths shall be selected to ensure that a minimum number of four full threads (in addition to the thread run-out) remain clear between the bearing surface of the nut and the unthreaded part of the shank.</p> <p>(3) Commonly known as a “tension control bolt”. BS EN 14399-10 system HRC assemblies with calibrated preload depend on accurate control of the torque-tension characteristics to achieve the specified axial tensile loads as with other torque methods.</p> <p>(4) DTI – direct tension indicator.</p>			

Table 3: HOLDING DOWN ASSEMBLIES			
Property class	Bolt	Nut⁽¹⁾	Washer⁽⁴⁾
4.6	BS 7419	BS EN ISO 4032 ⁽²⁾ (Property Class 5) ⁽³⁾	BS EN ISO 7091 (100HV)
8.8	BS 7419	BS EN ISO 4032 ⁽²⁾ (Property Class 8) ⁽³⁾	BS EN ISO 7091 (100HV)
<p>(1) Nuts of a higher property class may also be used.</p> <p>(2) Nuts of property classes to BS EN ISO 4032 with dimensions and tolerances of BS EN ISO 4034 may also be used.</p> <p>(3) Nuts for galvanized or sherardized bolts shall be tapped over-size to tolerance 6AZ to accommodate the thickness of galvanizing/sherardizing. This over-tapping reduces the strength of the nut and therefore a nut that has a proof load higher than the minimum ultimate tensile load of the assembly must be used. Nuts for galvanized or sherardized 4.6 bolts shall be property class 8 and nuts for galvanized or sherardized 8.8 bolts shall be property class 10.</p> <p>(4) As an alternative BS 4320 form G may be used.</p>			

Table 4: CUP BOLTS and COUNTERSUNK BOLTS IN NON-PRELOADED ASSEMBLIES			
Property class	Bolt	Nut⁽¹⁾	Washer
4.6 ⁵	BS 4933	BS EN ISO 4032 ⁽²⁾ (Property Class 5) ⁽³⁾	BS EN ISO 7091 (100HV)
8.8 ⁵	BS 4933	BS EN ISO 4032 ⁽²⁾ (Property Class 8) ⁽³⁾	BS EN ISO 7091 (100HV)
10.9	BS 4933	BS EN ISO 4032 ⁽²⁾ (Property Class 10) ⁽³⁾	BS EN ISO 7091 (100HV)
<p>(1) Countersunk bolts subject to tensile loads, e.g., direct tension or prying, should only be supplied with a screwdriver slot head unless the alternative can be demonstrated to not adversely affect the bolt loadability to BS EN ISO 898-1 or BS EN 15048-2. (see 8.2)</p> <p>(2) Nuts of a higher property class may also be used.</p> <p>(3) Nuts of property classes to BS EN ISO 4032 with dimensions and tolerances of BS EN ISO 4034 may also be used.</p> <p>(4) Nuts for galvanized or sherardized bolts shall be tapped over-size to tolerance 6 AZ to accommodate the thickness of galvanizing/sherardizing. This over-tapping reduces the strength of the nut and therefore a nut that has a proof load higher than the minimum ultimate tensile load of the assembly must be used. Nuts for galvanized or sherardized 4.6 bolts shall be property class 8 and nuts for galvanized or sherardized 8.8 bolts shall be property class 10.</p> <p>(5) <i>The availability of countersunk fasteners below property class 10.9 is limited and therefore the use of property class 10.9 should be considered prior to specifying.</i></p>			

Table 5 Ordinary Tie Bar Assemblies⁽¹⁾		
Material	Steel	
Thread	Tolerance Class	6g or 8g ⁽²⁾
	Standards	BS 3643-1 and BS 3643-2
Mechanical properties	Property Classes	d ≤ 39mm: 4.6, 8.8, 10.9
	Standard	BS EN ISO 898-1
Tolerance	Product grade	C ⁽³⁾
	Standard	BS EN ISO 4759-1
Associated nuts	Standards	BS EN ISO 4032, BS EN ISO 4034 and BS EN ISO 4033 ⁽⁴⁾
	Property Classes	5, 8, 10, 12 ⁽⁴⁾
	Standard	BS EN ISO 898-2
	Thread Tolerance	6H, 7H or 6AZ
	Standards	BS 3643-2 or BS ISO 965-5
Associated washers (if required)	Standards	BS EN ISO 7091
	others	to be agreed ⁽⁵⁾
Suitability test	Standard	BS EN 15048-2
<p>(1) These ordinary tie-bar assemblies are threaded bars supplied with nuts and, if required, washers and are suitable for non-preloaded applications.</p> <p>(2) The tolerance class is at the option of the manufacturer, dependant on the manufacturing method, and applies before hot dip galvanizing or coating with any thick protective coating.</p> <p>(3) Other product grades may be supplied by agreement between the purchaser and the manufacturer.</p> <p>(4) Recommended bolt and nut combinations are shown in Table 6.</p> <p>(5) Other washers may be supplied by agreement between the purchaser and the manufacturer.</p>		

Table 6: Matching Ordinary Tie Bar Assemblies		
Property Class Tie Bar	Nut⁽¹⁾	Washer (if required)
4.6	BS EN ISO 4032 ⁽²⁾ (Property Class 5) ⁽³⁾	BS EN ISO 7091 ⁽⁵⁾ (100 HV)
8.8	BS EN ISO 4032 ⁽²⁾ (Property Class 8) ⁽³⁾	BS EN ISO 7091 ⁽⁵⁾ (100 HV)
10.9	BS EN ISO 4032 ⁽²⁾ (Property Class 10) ⁽³⁾⁽⁴⁾	BS EN ISO 7091 ⁽⁵⁾ (100 HV)

(1) Nuts of a higher property class may also be used.
(2) Nuts of property classes to BS EN ISO 4032 with the dimensions and tolerances of BS EN ISO 4034 may also be used.
(3) Nuts for galvanized or sherardized tie bars shall be tapped over-size to tolerance 6AZ to accommodate the thickness of galvanizing/sherardizing. This over-tapping reduces the strength of the nut and therefore a nut that has a proof load higher than the minimum ultimate tensile load of the assembly must be used. Nuts for galvanized or sherardized 4.6 tie bars shall be property class 8; nuts for galvanized or sherardized 8.8 tie bars shall be property class 10 and nuts for galvanized or sherardized 10.9 tie bars shall be property class 12 to BS EN ISO 4033.
(4) The BS EN ISO 4033 nut standard does **not** include sizes M22, M27, M33 or sizes greater than M36; it is therefore not possible to supply assemblies in these diameters which comply with this Model Specification for property class 10.9 in the hot dip galvanized or sherardized condition.
(5) Other washers may be supplied by agreement between the purchaser and the manufacturer.

If specified coatings are required, they shall be provided by the fastener manufacturer and comply with the requirements of the standards listed in Table 7.

Table 7: PROTECTIVE COATINGS	
Galvanizing	BS EN ISO 10684
Zinc Electroplating	BS EN ISO 4042
Sherardizing	BS 7371-8

Note: Attention is drawn to the risk of hydrogen embrittlement during electroplating or hot dip galvanizing of 10.9 bolts. Further guidance is given in Section 9.0 of this Model Specification.

4.0 Proprietary Products

All proprietary items shall be used in accordance with the manufacturer's recommendations and instructions if relevant.

5.0 CE Marking (or UK equivalent)

All fastener assemblies manufactured to harmonised BS EN standards shall be supplied complete with CE marking – or UK equivalent - as follows and a Declaration of Performance shall be available:

Note: This may be on a website

- Ordinary (non-preloaded) assemblies to BS EN 15048-1
- Preloaded assemblies to BS EN 14399-1

Note: Only fastener assemblies consisting of bolts, nuts and washers as stipulated in BSEN 15048-1 and BSEN 14399-1 may be CE marked to these harmonised standard and hence are supplied from one manufacturer as sets. Individual bolts, nuts and washers may not be CE marked by different manufactures and subsequently assembled.

Fasteners supplied as proprietary items shall either be CE marked – or UK equivalent - as being in accordance with a European Technical Approval – or UK equivalent - or be treated as special fasteners to BS EN 1090-2. Special fasteners shall only be used if the manufacturer publishes suitable product information in the form of a component specification and provides a declaration of conformity that the fasteners have been supplied in accordance with the component specification.

Note: A common example of a special fastener to BS EN 1090-2 would be ‘shoulder-bolts’ used in expansion joints. Fasteners manufactured from structural steel intended to be welded would also be an example of a special fastener to BS EN 1090-2. Washer plates are steelwork complying the requirements of BS EN 1090-2 and not covered by this specification.

6.0 Inspection certificates

All goods shall be supplied with a Type 3.1 Inspection certificate from the manufacturer/supplier to BS EN 10204: 2004 verifying compliance with this specification. If the fastener is surface coated this shall be included.

The manufacturer’s Inspection certificate and the supplier’s Inspection certificate which is traceable to the manufacturer’s Inspection certificate must be retained by the supplier for a period of not less than 10 years and made available on request.

When agreed with the purchaser, the supplier may provide a certificate of conformance created by the supplier that references the original manufacturer’s conformance documents. The original manufacturer’s conformance documents shall be retained by the supplier and the supplier’s certificate of conformance shall be traceable to the manufacturer’s original conformance documents.

7.0 Service temperature

If bolts are intended for use at a service temperature below -20°C, the purchase order shall specify the temperature at or below which the bolts have a minimum impact strength of 27J according to BS EN ISO 898-1.

8.0 Quality Management

8.1 ISO 9001 and National Highways Sector Scheme 3

Manufacturers, importers, suppliers, and distributors of structural fasteners shall be ISO 9001 certified by a certification body accredited by UKAS or equivalent European accreditation organisation which is party to a multi-lateral agreement (MLA) with UKAS. For projects in the UK manufacturers, importers, suppliers, and distributors of structural fasteners shall comply with National Highways Sector Scheme 3 (NHSS3). This applies to all structures not just highway structures. For projects outside the UK, it is recommended that the scheme is adopted by all suppliers and distributors of structural fasteners and shall be adopted by suppliers and distributors of all structural fasteners supplied for use in the UK.

The manufacturer, importer, supplier, or distributor shall have a system of receipt and despatch in place to ensure continued traceability from manufacture to despatch of the goods to the client.

Verification of continued quality assurance/quality control by the manufacturer shall be provided by the importer, supplier, or distributor

8.2 Inspection, testing and product requirements

For all fasteners supplied under this specification, manufacturers test reports must be provided for each manufacturing lot¹ of fasteners. For assemblies, suitability test results, in accordance with EN 14399-2 or EN 15048-2, must be reported. Tests to confirm all mechanical properties must also be reported in accordance with BS EN ISO898-1 tables 8-11 as applicable. The 'Re-tempering test' and 'Torsional test' are only carried out as an alternative test for given properties when agreed between parties. Carburisation tests must be performed in accordance with clause 9.11.2 of BS EN ISO898-1:2013 whenever possible. When not possible, testing should be carried out in accordance with the reference methods described in test 7, table 9 of this specification (normal sample quantities still apply). Surface hardness testing to clause 9.11.3 of BS EN ISO898-1:2013 is only acceptable where the alternative reference test described in table 9 is not possible.

Bolts supplied in accordance with table 4 are included in the above. However, those supplied with an internal head fastening detail, other than a screwdriver slot, (e.g., Allen Key socket) are unlikely to be capable of satisfying the tensile and suitability tests due to weakness at the head to shank location. These bolt types are not preferred and must not be specified for use in connections where they are subject to tension loads unless they can be demonstrated to provide full loadability by satisfying the requirements of BS EN ISO898-1 tables 8-11 and EN 15048-2 as applicable. Tension may arise from tensile or prying forces in the connection or as a result of bending at the head due to shear load applied to the shank. Where the designer deems the use of bolts without full loadability to be acceptable, this must be stated by the purchaser at the time of order. In this case manufacturers tests should be in accordance with table 10 of BS EN 898-1 with the exception of tensile tests which may be carried out on a machined test piece, produced from a finished fastener, and performed in accordance with table 12 of BS EN 898-1 and sub-clause 9.7. All fasteners >M39 must be fully loadable in tension to the requirements of BS EN ISO898-1 tables 8-11 as applicable.

For fasteners manufactured and tested outside of the UK/EU, each manufacturing lot¹ of product shall be subjected to sample inspection and mechanical testing at the point of entry into the UK marketplace (or EU marketplace) and shall be organized by the manufacturer, importer, supplier, or distributor in accordance with 8.2.1 or 8.2.2.

¹ Note: A manufacturing lot is described as a quantity of products of a single property class and size, manufactured from bar, wire or rod from a single cast, processed through the same steps at the same time or over continuous time period through the same heat treatment process and / or coating process, if any.

Same heat treatment or coating process means:

- for a continuous process, the same treatment cycle without any setting modification.
- for a discontinuous process, the same treatment cycle, or identical consecutive loads (batches).

8.2.1 Property class 4.6 in all diameters and 8.8 and 10.9 up to M39

Sample inspection and testing shall be completed in accordance with table 8. The entity conducting the inspection and testing must as a minimum be part of an ISO9001 certified management system.

Table 8: Inspection and testing requirements property class 4.6 in all diameters and 8.8 and 10.9 up to M39					
Property	Reference	Sample quantity		Requirements	
		8.8 and below	10.9		
1	Visual and dimensional inspection	Product standard	3	5	As per the product standard
2	Strength under wedge ³	ISO898-1:2013 section 9.1	3	5	ISO898-1:2013
3	Core hardness ²	ISO898-1:2013 section 9.9.4.2	3	5	ISO898-1:2013
4	Carburization Test ^{2,4}	ISO898-1:2013 section 9.11.2 ⁵ Or As per figure 2 of this MPS	-	5	Each reading must meet ISO898-1:2013 and the difference between the hardness readings shall be equal to or less than 30HV
5	Suitability test ^{1,3}	EN 14399-2 or EN 15048-2	3	5	EN 14399-2 or EN 15048-2

¹ Only conducted on assemblies
² Bolts and studs which have a length of more than 390mm shall be hardness tested in this manner at both ends of the fastener
³ Bolts not required to provide full loadability due to head fastening details, see 8.2, do not require these tests but alternatively should be subjected to tensile tests on a machined sample as described in 8.2 using the same sample quantities noted in the table above.
⁴ If a reading is high (i.e., >390 HV – hard spot) then 2 further readings may be taken, on the same test sample, adjacent to the first reading. If both additional readings meet the acceptance criteria, then the fastener may be accepted provided all other tests are within specification.
⁵ This test method is not applicable for fasteners with rolled threads that are formed after heat treatment, the alternative test on an unthreaded section of the shank described in table 9 test 7 of this MPS shall be used. Surface hardness testing to ISO898-1:2013 section 9.11.3 may only be used for fasteners where the reference tests are not suitable, i.e. Fully threaded fasteners which have been thread rolled after heat treatment.

8.2.2 Diameters above M39 property classes 8.8 and 10.9 only

Bolts and studs shall be produced from steel in accordance with ISO898-1:2013 table 2 with the following restrictions: the as cast (mill certificate) percentage content of both Phosphorous and Sulphur shall be less than or equal to 0.015%.

Mechanical testing shall be completed at an ISO17025 accredited laboratory within the EU – or UK equivalent - in accordance with table 9, all mechanical testing shall be conducted prior to any surface coating being applied. (Visual and dimensional inspection does not need to be conducted at an ISO17205 accredited laboratory)

Table 9: Inspection and testing requirements above M39 8.8 and 10.9 only			
Property	ISO898-1:2013 reference	Sample quantity	Requirements
1 Visual and dimensional inspection	---	3	As per the product standard
2 Minimum Tensile Strength, R_m	Section 9.7	1	ISO898-1:2013
3 Stress at 0.2% non-proportional elongation, $R_{p0.2}$			
4 Percentage elongation after fracture, A			
5 Percentage reduction of area after fracture, Z			
6 Vickers hardness, HV 98N ¹	Section 9.9.4.2 ²	1 set of 3 hardness indents at 0.25D/2, 0.5D/2 and 0.75D/2; see figure 1	Each reading must meet ISO898-1:2013 and the difference between the hardness readings shall be equal to or less than 30HV
7 Micro-hardness test, HV 2.942N ¹	Section 9.11.2 ² Or As per figure 2 of this MPS ³	1 set of tests	
8 Impact strength, K_v	Section 9.14	1 set of 3	ISO898-1:2013

¹Bolts and studs which have a length of more than 390mm shall be hardness tested in this manner at both ends of the fastener

²This test method is not applicable for fasteners with rolled threads that are formed after heat treatment, the alternative test on an unthreaded section of the shank described in this MPS shall be used. Surface hardness testing to ISO898-1:2013 section 9.11.3 may only be used for fasteners where the reference tests are not suitable, i.e. Fully threaded fasteners which have been thread rolled after heat treatment.

³Testing conducted generally in accordance with ISO898-1:2013 but in positions show in figures 1 and 2 respectively

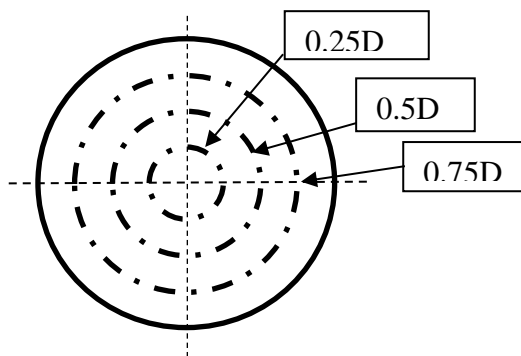


Figure 1 – Hardness positions for HV 98N tests

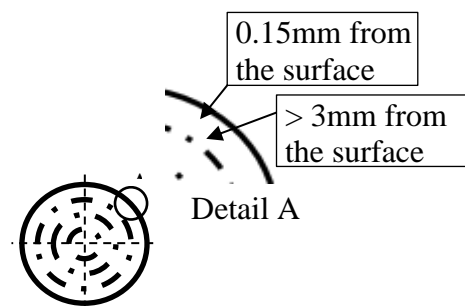


Figure 2 – Hardness positions for HV 2.942N on a cross section of the shank

9.0 Hydrogen Embrittlement in Structural Fasteners

Hydrogen embrittlement occurs when a process used in the production of structural fasteners or from environmental corrosion generates nascent hydrogen that can be absorbed into the steel of the fasteners. The effect of the absorbed hydrogen becomes more critical with the increasing tensile strength of the fastener steel; property class 8.8 is considered to be the highest strength level that does not require special precautions during surface coating treatments.

Methods such as low temperature 'baking' can be used to reduce the possibility of hydrogen embrittlement with higher strength fasteners such as property class 10.9; however, BS 7371 part 1:2009 Annex B includes the following warning.

Most electrolytic and acidic processes are liable to produce hydrogen and, though baking after coating will minimize the risk of failure, the process can never be guaranteed to be completely effective.

There is no known test procedure which can satisfactorily guarantee that the heat treatment (baking) process has successfully eliminated all traces of hydrogen embrittlement from all parts of a processed batch. If the risk of failure is unacceptable, cleaning and coating specifications which do not involve electrolysis from aqueous solutions should be used.

Annex B of BS 7371 part 1:2009 'Avoidance of Hydrogen Embrittlement' gives additional information.

Protective Coatings

Neither the Galvanizing process nor the process of applying a coating by the thermal diffusion of zinc powder e.g. Sherardizing generates nascent hydrogen during the coating process.

However, if prior to coating the pre-cleaning method uses acid (such as pickling) or any other method that generates nascent hydrogen there is a risk of hydrogen embrittlement. With property class 10.9 fasteners acid cleaning is not permitted and other cleaning methods shall be used, such as shot blasting.

The use of electroplating for property class 10.9 fasteners is not recommended.

Property Class 10.9 fasteners may be galvanised or coated via a thermal diffusion method provided the pre-cleaning method conforms to the guidance above.

10.0 References

The following dated standards and specifications are referenced in this specification. For dated references only the edition cited applies.

BS 3643-1:2007. ISO metric screw threads. Principles and basic data, 2007

BS 3643-2:2007. ISO metric screw threads. Specification for selected limits of size, 2007

BS 4933: 2010, ISO metric black cup and countersunk head bolts and screws with hexagon nuts, 2010.

BS 7371-8: 2011, Coatings on metal fasteners – Part 8. Specification for sherardized coatings, 2011.

BS 7419: 2012, Specification for holding down bolts, 2012

BS EN 1090-2: 2018, Execution of steel structures and aluminium structures – Part 2: Technical requirements for steel structures, 2018.

BS EN ISO 9001: 2015, Quality management systems – Requirements, 2015.

BS EN 10204: 2004, Metallic materials, Types of inspection documents, 2004.

BS EN 14399-1: 2015, High-strength structural bolting assemblies for preloading – Part 1: General requirements, 2015.

BS EN 14399-2: 2015, High-strength structural bolting assemblies for preloading – Part 2: Suitability test for preloading, 2015.

BS EN 14399-3: 2015, High-strength structural bolting assemblies for preloading – System HR – Hexagon bolt and nut assemblies, 2015.

BS EN 14399-5: 2015, High-strength structural bolting assemblies for preloading – Part 5: Plain washers, 2015.

BS EN 14399-6: 2015, High-strength structural bolting assemblies for preloading – Part 6: Plain and chamfered washers, 2015.

BS EN 14399-7: 2018, High-strength structural bolting assemblies for preloading – Part 7: System HR – Countersunk head bolts and nut assemblies, 2018.

BS EN 14399-9: 2018, High-strength structural bolting assemblies for preloading – Part 9: System HR or HV – Bolt and nut assemblies with direct tension indicators, 2018.

BS EN 14399-10: 2018, High-strength structural bolting assemblies for preloading – Part 10: System HRC – Bolt and nut assemblies with calibrated preload, 2018.

BS EN 15048-1: 2016, Non preloaded structural bolting assemblies – Part 1: General requirements, 2016.

BS EN 15048-2: 2016, Non preloaded structural bolting assemblies – Part 2: Fitness for purpose, 2016.

BS EN ISO 898-1: 2013, Mechanical properties of fasteners made of carbon steel and alloy steel – Part 1: Bolts, screws and studs, 2013.

BS EN ISO 898-2:2012. Mechanical properties of fasteners made of carbon steel and alloy steel. Nuts with specified property classes. Coarse thread and fine pitch thread, 2012

BS EN ISO 4014: 2011, Hexagon head bolts. Product grades A and B, 2011.

BS EN ISO 4016:2011, Hexagon head screws. Product grades C, 2011.

BS EN ISO 4017: 2014, Hexagon head screws. Product grades A and B, 2014.

BS EN ISO 4018: 2011, Hexagon head screws. Product grade C, 2011.

BS EN ISO 4032: 2012, Hexagon nuts, style 1. Product grades A and B, 2012.

BS EN ISO 4033: 2012, Hexagon nuts, style 2. Product grades A and B, 2012.

BS EN ISO 4034: 2012, Hexagon nuts. Product grade C, 2012.

BS EN ISO 4042: 2018, Fasteners, Electroplated coatings, 2018.

BS EN ISO 4759-1:2001. Tolerances for fasteners. Bolts, screws, studs and nuts. Product grades A, B and C, 2001

BS EN ISO 7091: 2000, Plain washers – Normal series – Product grade C, 2000.

BS EN ISO 10684: 2004, Fasteners – Hot dip galvanized coatings, 2004.

BS ISO 965-5:1998. ISO general purpose metric screw threads. Tolerances. Limits of sizes for internal screw threads to mate with hot-dip galvanized external screw threads with maximum size of tolerance position h before galvanizing, 1998.

National Highways Sector Schemes for Quality Management in Highway Works 3, Stocking and Distribution Activities for Mechanical Fasteners, Published by Sector Scheme Advisory Committee for Mechanical Fasteners (SSACMF), UKAS, 2020.

National Structural Steelwork Specification for Buildings (7th edition), British Constructional Steelwork Association Ltd., 2020.

Steel Bridge Group: Model Project Specification for the Execution of Steelwork in Bridge Structures, Steel Construction Institute, SCI Publication P382, 2012.

11.0 Undertaking

I/we the undersigned agree to supply products in accordance with this specification and any variation from this agreement will be sought in writing.

Signed: _____

Print: _____

Date: _____