

HIGH-STRENGTH STRUCTURAL
BOLTING ASSEMBLIES
FOR PRELOADING
BS EN 14399-9:2018
**DIRECT TENSION INDICATORS,
NUT & BOLT FACE WASHERS**



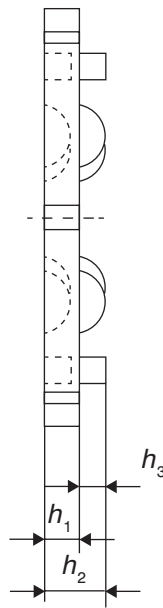
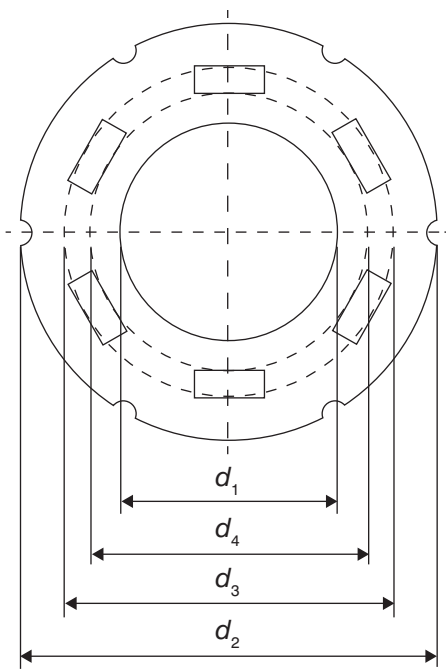
EN14399-1
Cert No:
0038/CPR/4006773/B



BAPPP

Group of Companies

Dimensions For Direct Tension Indicators



Key

- d_1 internal diameter
- d_2 external diameter
- d_3 protrusion tangential external diameter
- d_4 protrusion tangential internal diameter
- h_1 material thickness (excluding protrusions)
- h_2 height over protrusions (including protrusions)
- h_3 height of protrusions

Nominal size d (nominal thread diameter of associated bolt)	Internal diameter d_1		External diameter d_2		Material thickness (excluding protrusions) h_1	Height over protrusions (including protrusions) h_2	Height of protrusions h_3	Protrusion tangential external diameter d_3	Protrusion tangential internal diameter d_4
	min.	max.	min.	max.	min.	max.	min.	max.	min.
M12	12,75	12,85	26,0	32,5	2,5	5,5	0,8	20,0	13,85
M16	16,75	16,85	35,0	36,8	3,0	6,0	0,8	25,0	17,85
M20	20,95	21,05	41,0	46,0	3,5	6,5	0,8	29,0	22,05
M22	23,05	23,15	46,5	50,6	4,0	7,0	0,8	33,0	24,15
M24	25,15	25,25	50,0	55,2	4,0	7,0	0,8	38,0	26,25
M27	28,30	28,40	54,0	62,1	4,0	7,0	0,8	43,0	29,40
M30	31,45	31,55	59,0	69,0	4,0	7,0	0,8	46,5	32,55
M36	37,75	37,85	78,0	83,0	4,0	7,5	0,8	56,0	38,85

Specifications & Reference Standards For Direct Tension Indicators

Material	Steel	
General requirements	BS EN 14399-1 and BS EN 14399-2	
Heat treatment	hardened and tempered or controlled rolled and tempered	
Maximum hardness	380 HV	
Finish - Coating ^a	Uncoated	as processed ^c
	Sherardized ^b	BS EN ISO 17668
	Others	to be agreed ^d
Associated bolts and nuts	BS EN 14399-3, BS EN 14399-4, BS EN 14399-7 or BS EN 14399-8	
Associated washers	BS EN 14399-5 or BS EN 14399-6	
Acceptability	For acceptance procedure, see BS EN ISO 3269:2000 ^e .	
^a The direct tension indicators shall not be electroplated or subjected to any process that could result in hydrogen embrittlement.		
^b Sherardizing is considered to provide corrosion protection equivalent to hot dip galvanizing.		
^c "As processed" means the normal finish resulting from manufacture with a light oil coating.		
^d Other coatings may be negotiated between the purchaser and the manufacturer providing they do not impair the mechanical properties or functional characteristics. Coatings of cadmium or cadmium alloys are not permitted.		
^e For acceptance criteria use 0,65 AQL, Ac = 0; see BS EN ISO 3269:2000		

Test compression loads at 0,40 mm gap

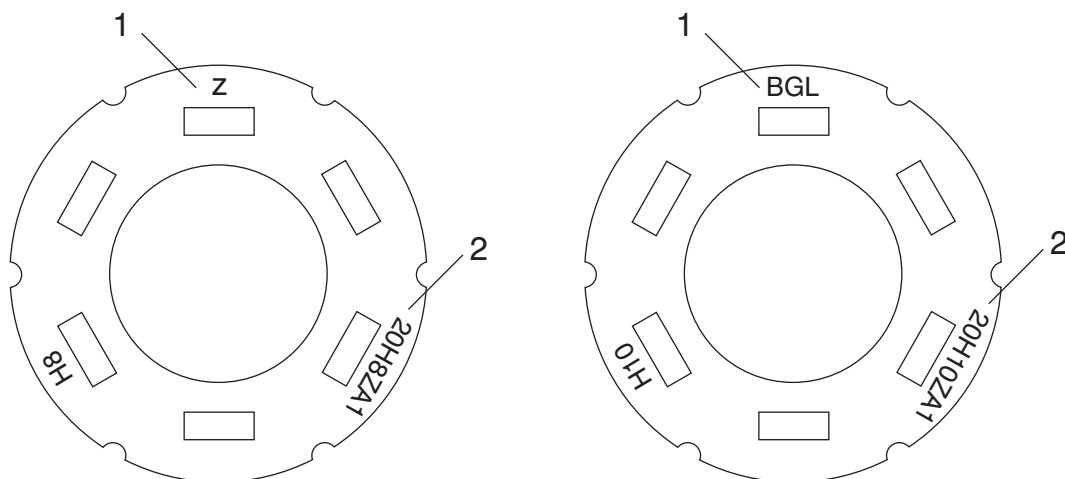
Nominal size <i>d</i> (nominal thread diameter of associated bolt)	Compression load			
	Designation H8		Designation H10	
	min.	max.	min.	max.
M12	47	56	59	71
M16	88	106	110	132
M20	137	164	172	206
M22	170	204	212	254
M24	198	238	247	296
M27	257	308	321	385
M30	314	377	393	472
M36	458	550	572	688
NOTE These minimum values are equal to $0,7 f_{ub} \times A_s$ in accordance with BS EN 1993-1-8.				

Marking of Direct Tension Indicator Washers

Direct tension indicators shall be marked with the identification mark of the manufacturer of the bolting assembly, and H8 or H10 as appropriate.

The marking shall be indented into the direct tension indicator face from which the protrusions project.

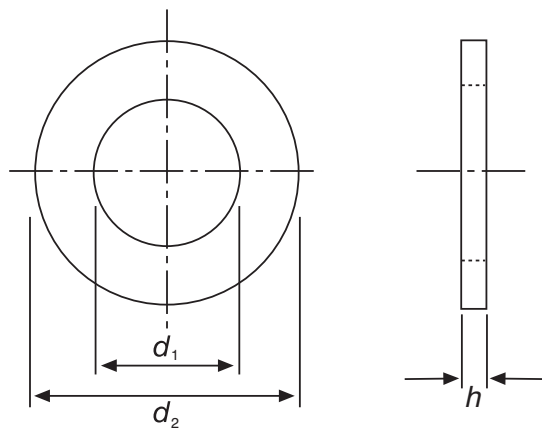
It is recommended to stamp lot number on the face of the direct tension indicator.



Key

- 1 Identification mark of the manufacturer of the bolting assembly
- 2 Lot number of the Direct Tension Indicator

Dimensions for Nut Face Washers (HN) & Bolt Face Washers (HB)



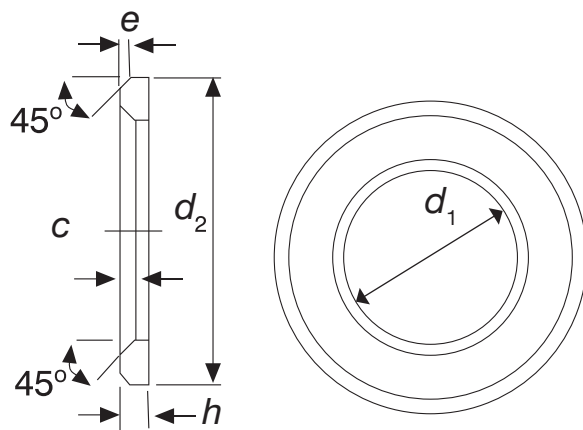
Key

d_1 internal diameter
 d_2 external diameter
 h thickness

Dimensions of nut face washers (HN)

Nominal size d (nominal thread diameter of associated bolt)	Internal diameter		External diameter		Thickness	
	d_1		d_2		h	
	min.	max.	min.	max.	min.	max.
M12	12,1	12,35	22,7	24	2,7	4,3
M16	16,1	16,35	27,7	29	3,7	4,3
M20	20,1	20,40	34,4	36	3,7	4,3
M22	22,3	22,60	37,4	39	3,7	4,3
M24	24,2	24,50	41,4	43	3,7	4,3
M27	27,2	27,55	46,4	48	4,4	5,6
M30	30,2	30,55	50,1	52	4,4	5,6
M36	36,2	36,55	60,1	62	5,4	6,6

NOTE The washers are intended to fit over the threaded portion of the shank only. In some cases the washer internal diameter, d_1 , is less than the bolt shank maximum diameter specified in BS EN 14399-3 and BS EN 14399-4.



Key

d_1 internal diameter
 d_2 external diameter
 h thickness
 c inside chamfer
 e outside chamfer

Dimensions of bolt face washers (HB)

Nominal size d (nominal thread diameter of associated bolt)	Internal diameter		External diameter		Thickness		Inside chamfer		Outside chamfer	
	d_1		d_2		h		c		e	
	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
M12	13	13,27	23,48	24	2,7	3,3	1,6	1,9	0,50	1,0
M16	17	17,27	29,48	30	3,7	4,3	1,6	1,9	0,75	1,50
M20	21	21,33	36,38	37	3,7	4,3	2,0	2,5	0,75	1,50
M22	23	23,33	38,38	39	3,7	4,3	2,0	2,5	0,75	1,50
M24	25	25,33	43,38	44	3,7	4,3	2,0	2,5	0,75	1,50
M27	28	28,52	49	50	4,4	5,6	2,5	3,0	1,0	2,0
M30	31	31,62	54,80	56	4,4	5,6	2,5	3,0	1,0	2,0
M36	37	37,62	64,80	66	5,4	6,6	2,5	3,0	1,25	2,50

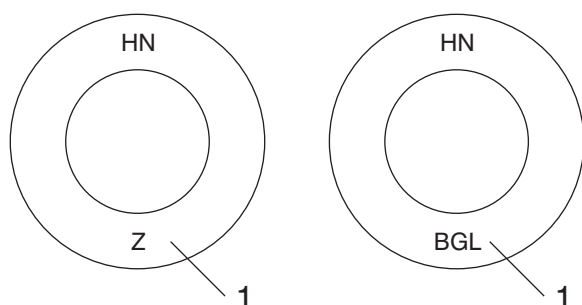
Specifications & Reference Standards for Nut Face Washers (HN) & Bolt Face Washers (HB)

Material	Steel	
General requirements	BS EN 14399-1 and BS EN 14399-2	
Heat treatment	hardened and tempered	
Hardness ^a	Rockwell hardness	38 HRC to 45 HRC
	European Standard	BS EN ISO 6508-1
	Vickers hardness	372 HV30 to 448 HV30
	European Standard	BS EN ISO 6507-1
Tolerances	Product grade	C ^b
	Standard	BS EN ISO 4759-3
Finish - Coating ^c	Uncoated	as processed ^d
	Sherardized	BS EN ISO 17668
	Others	to be agreed ^e
Associated bolts and nuts	BS EN 14399-3, BS EN 14399-4, BS EN 14399-7 or BS EN 14399-8	
Associated washers	BS EN 14399-5 or BS EN 14399-6	
Acceptability	For acceptance procedure, see BS EN ISO 3269:2000.	
^a In case of dispute, the Vickers hardness test shall be the referee test method.		
^b Except as otherwise specified in Tables 6 and 7.		
^c These washers shall not be electroplated or subjected to any process that could result in hydrogen embrittlement.		
^d "As processed" means the normal finish resulting from manufacture with a light oil coating.		
^e Other coatings may be negotiated between the purchaser and the manufacturer providing they do not impair the mechanical properties or functional characteristics. Coatings of cadmium or cadmium alloys are not permitted.		

Marking of Nut Face and Bolt Face Washers

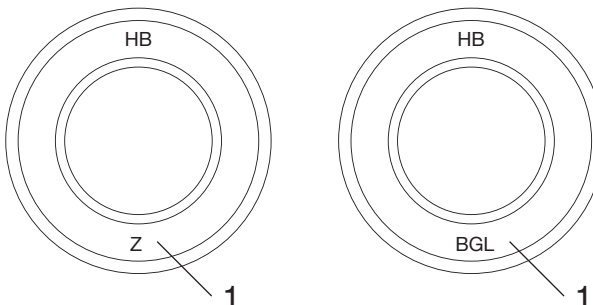
Nut face washers (HN)

Nut face washers (HN) shall be marked with the identification mark of the manufacturer of the bolting assembly and the letters HN. The marking shall be indented into one face.



Bolt face washers (HB)

Bolt face washers (HB) shall be marked with the identification mark of the manufacturer of the bolting assembly and the letters HB. The marking shall be indented into one face.



Key

1 Identification mark of the manufacturer of the bolting assembly

Normative References

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS EN ISO 17668, Zinc diffusion coatings on ferrous products - Sherardizing - Specification (ISO 17668)

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

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

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

BS EN 14399-4, High-strength structural bolting assemblies for preloading - Part 4: System HV - Hexagon bolt and nut assemblies

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

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

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

BS EN 14399-8, High-strength structural bolting assemblies for preloading - Part 8: System HV - Hexagon fit bolt and nut assemblies

BS EN ISO 3269:2000, Fasteners — Acceptance inspection (ISO 3269:2000)

BS EN ISO 4759-3, Tolerances for fasteners — Part 3: Washers for bolts, screws and nuts — Product grades A, C and F (ISO 4759-3)

BS EN ISO 6507-1, Metallic materials — Vickers hardness test — Part 1: Test method (ISO 6507-1)

BS EN ISO 6508-1, Metallic materials — Rockwell hardness test — Part 1: Test method (ISO 6508-1)

BS EN ISO 7500-1, Metallic materials — Calibration and verification of static uniaxial testing machines
- Part 1: Tension/compression testing machines — Calibration and verification of the force-measuring system (ISO 7500-1)

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