

STRUCTURAL **BOLTING** GUIDE



EN15048-1

Cert No:

0038/CPR/4006773/C



EN14399-1

Cert No:

0038/CPR/4006773/B

BAPP

Group of Companies

The **BAPP** Group of Companies founded in 1972 has now become the largest independent stockist and distributor of industrial fasteners and associated products in the UK



BAPP Group Limited is an extremely successful business, having grown organically since its inception over 45 years ago, to become the UK's largest supplier and stockist of industrial fasteners to the Engineering, Construction and Offshore sectors.

BAPP are fully approved as a manufacturer, by Lloyds Register, to produce CE marked fastenings to BS EN14399 and BS EN15048. The company is at the leading edge of EC fastener legislation. We offer all of our clients a 24-hour technical advice service and we aggressively pursue cost-down through 'value engineering' with them.

Service is truly the backbone of our offering and is probably the single biggest factor in our growth to becoming a £26m fastener business. The company carries stock valued in excess of £10m within our global distribution centres. We have grown by being flexible and agile enough to respond to our customer's most urgent needs.

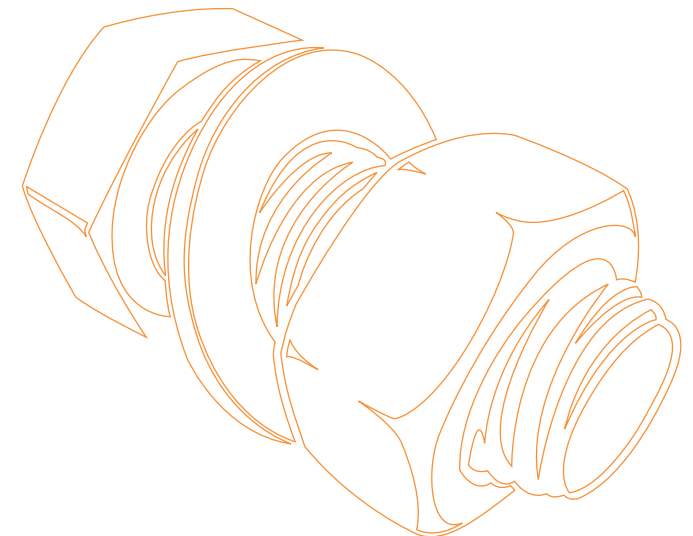
BAPP has exported its fastenings to job sites and factories across the globe for over 20 years gaining invaluable experience and expertise and winning accolades for its competence in complex Project Management tasks.

At BAPP high-quality fasteners are extremely competitively priced. We recognise and understand the efforts of senior executives everywhere to reduce costs, whilst maintaining optimum product integrity. To that end, BAPP was one of the first European fastener companies to global outsource its manufacturing. Over the past 30 years, intimate partnerships have been established with our 'supply side'.

Our manufacturing philosophy is a facet of our business that differentiates us from our competitors. All of our partner factories are annually audited and provide components in strict compliance with the 110 page 'BAPP Specification Handbook', detailing everything from the stringent tests that need to be carried out to the world-class packaging and documentation for which we are well known.

Finally, I can assure you with certainty that BAPP will never promise anything that we knowingly cannot achieve and I hope that the contents of this document will both reassure you and assist us both in developing a mutually successful partnership together.

Dean G Cook
Chairman



Non Pre-Load Bolt Assemblies SB

BS EN 15048-1 & 2:2007

ISO 4017 Setscrew Dimensions. Classes 8.8SB & 10.9SB

Thread <i>d</i>	<i>P</i>	<i>a</i>		<i>c</i>		<i>d_a</i>	<i>d_w</i>		<i>e</i>		<i>k</i>				<i>k_w^b</i>		<i>r</i>	<i>s</i>				
		max. ^a	min.	max.	min.		min.	min.	min.	min.	min.	max.	min.	max.	min.	min.		min.	min.	min.	min.	min.
M12	1.75	5.3	1.75	0.60	0.15	13.7	16.63	16.47	20.03	19.85	7.68	7.32	7.79	7.21	5.12	5.05	0.6	18	17.73	17.57		
M16	2	6	2	0.80	0.20	17.7	22.49	22.00	26.75	26.17	10.18	9.82	10.29	9.71	6.87	6.8	0.6	24	23.67	23.16		
M20	2.5	7.5	2.5	0.80	0.20	22.4	28.19	27.70	33.53	32.95	12.715	12.285	12.85	12.15	8.60	8.51	0.8	30	29.67	29.16		
M24	3	9	3	0.80	0.20	26.4	33.61	33.25	39.98	39.55	15.215	14.785	15.35	14.65	10.35	10.26	0.8	36	35.38	35.00		
M30	3.5	10.5	3.5	0.80	0.20	33.4	-	42.75	-	50.85	-	-	19.12	18.28	-	12.80	1	46	-	45.00		
M36	4	12	4	0.80	0.20	39.4	-	51.11	-	60.79	-	-	22.92	22.08	-	15.46	1	55	-	53.80		

^a Values in accordance with a_{max} normal series, in ISO 3508. ^b $k_{wmin} = 0.7 k_{min}$

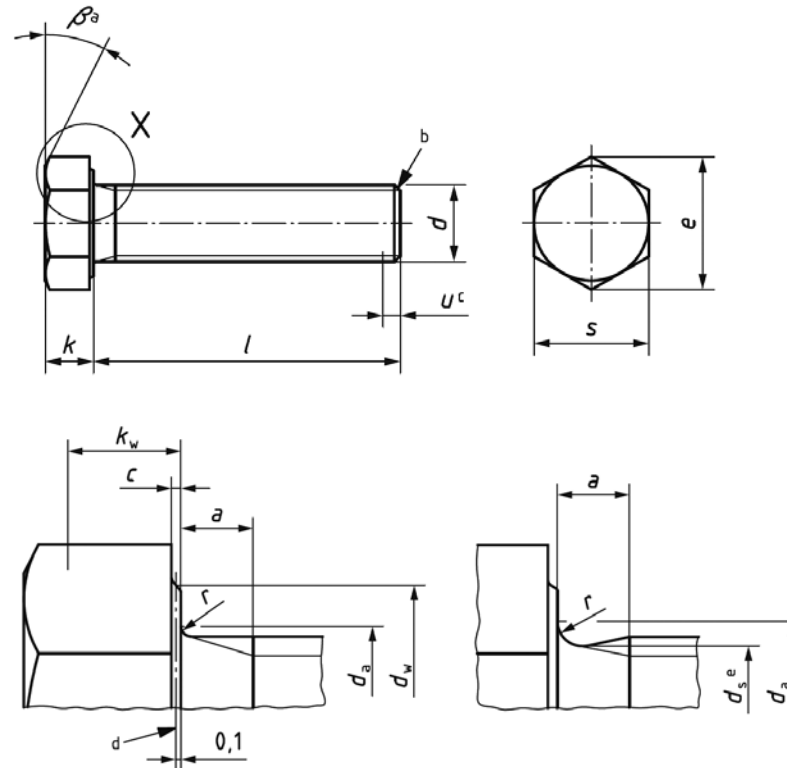
ISO 4017 Setscrew Mechanical Properties. Class 8.8SB

Bolt Thread Dia. <i>d</i>	Tensile Strength	Proof Load	Elongation	Hardness Rockwell HRC	
	N/mm ² min.	N/mm ² min.	% min.	min.	max.
M12	830.00	660.00	12.00	23.00	34.00
M16	830.00	660.00	12.00	23.00	34.00
M20	830.00	660.00	12.00	23.00	34.00
M22	830.00	660.00	12.00	23.00	34.00
M24	830.00	660.00	12.00	23.00	34.00
M27	830.00	660.00	12.00	23.00	34.00
M30	830.00	660.00	12.00	23.00	34.00
M36	830.00	660.00	12.00	23.00	34.00

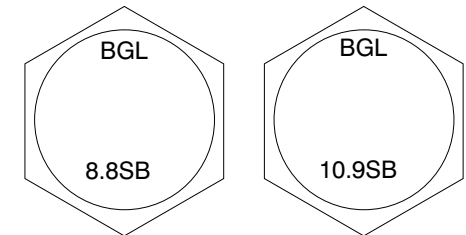
BS EN 15048 Assemblies also require a Charpy Impact Test to ISO 148-1

Material		Steel
General Req.	International Standard	ISO 8992
Thread	Tolerance Class	6g
	International Standards	ISO 724, ISO 965-1
Mechanical Properties	Property class ^a	8.8SB or 10.9SB
	International Standards	ISO 898-1
Tolerances	Product grade	$d \leq 24$ mm and $l \leq 10 d$ or 150 mm ^a : A $d > 24$ mm or $l > 10 d$ or 150 mm ^a : B
	International Standard	ISO 4759-1
Finish - Coating		As Processed Requirements for electroplating are specified in ISO 4042. Requirements for hot dip galvanized coatings are specified in ISO 10684. Additional requirements or other finishes or coatings shall be agreed between the supplier and the purchaser.
Surface integrity		Limits for surface discontinuities are specified in ISO 6157-1.
Acceptability		Acceptance inspection is specified in ISO 3269.

^a Whichever is the shorter.



BS EN 15048 Head Marking



IMPORTANT NOTE

It is a requirement of BS EN 15048 that the bolt, nut and washer assembly is supplied by one manufacturer who is responsible for the function of the assembly. All the components are identified with the manufacturer's mark. The coating of the assembly is under the control of the manufacturer.

ISO 4032 Nut Dimensions. Classes 8SB & 10SB

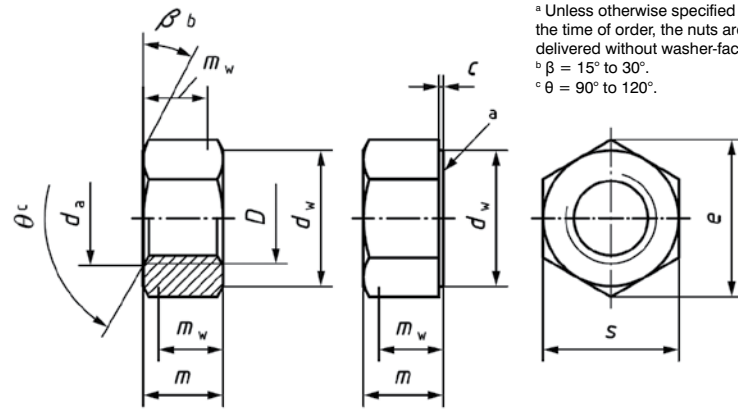
Thread d	P^a	c		d_a		d_w	e	m		m_w	s	
		max.	min.	max.	min.	min.	min.	max.	min.	min.	max.	min.
M12	1.75	0.60	0.15	13.00	12.00	16.60	20.03	10.80	10.37	8.30	18.00	17.73
M16	2.00	0.80	0.20	17.30	16.00	22.50	26.75	14.80	14.10	11.30	24.00	23.67
M20	2.50	0.80	0.20	21.60	20.00	27.70	32.95	18.00	16.90	13.50	30.00	29.16
M24	3.00	0.80	0.20	25.90	24.00	33.30	39.55	21.50	20.20	16.20	36.00	35.00
M30	3.50	0.80	0.20	32.40	30.00	42.80	50.85	25.60	24.30	19.40	46.00	45.00
M36	4.00	0.80	0.20	38.90	36.00	51.10	60.79	31.00	29.40	23.50	55.00	53.80

^a P is the pitch of the thread

ISO 4032 Nut Proof Loads. Classes 8SB & 10SB

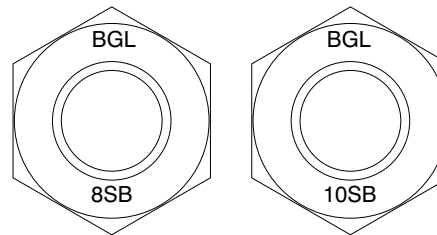
Nut Thread Diameter	Proof Load (KN)	
	8SB	10SB
M12	74.2	88.5
M16	138.2	164.9
M20	225.4	259.7
M24	324.8	374.2
M30	516.1	594.7
M36	751.6	866.0

Material		Steel
General Requirements	International Standard	ISO 8992
Thread	Tolerance Class	6H
	International Standards	ISO 724, ISO 965-1
Mechanical Properties	Property Class	8SB or 10SB
	International Standards	ISO 898-2
Tolerances	Product grade	$D \leq M16$: A $D > M16$: B
	International Standard	ISO 4759-1
Finish - Coating	As Processed	
	Requirements for electroplating are specified in ISO 4042.	
	Requirements for hot dip galvanized coatings are specified in ISO 10684.	
Additional requirements or other finishes or coatings shall be agreed between the supplier & the purchaser.		
Surface integrity	Limits for surface discontinuities are specified in ISO 6157-2.	
Acceptability	Acceptance inspection is specified in ISO 3269.	



^a Unless otherwise specified at the time of order, the nuts are delivered without washer-face.
^b $\beta = 15^\circ$ to 30° .
^c $\theta = 90^\circ$ to 120° .

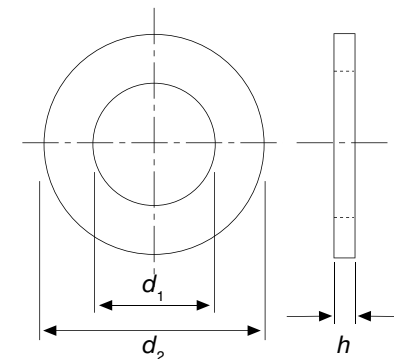
BS EN 15048 Head Marking



ISO 7091 Washer Dimensions (100 HV Min.)

Nominal Size of Bolt or Screw	Inside Diameter d_1		Outside Diameter d_2		Thickness h	
	max	min	max	min	max	min
M12	13.93	13.50	24.00	22.70	2.80	2.20
M16	17.93	17.50	30.00	28.70	3.60	2.40
M20	22.52	22.00	37.00	35.40	3.60	2.40
M24	26.52	26.00	44.00	42.40	4.60	3.40
M30	33.62	33.00	56.00	54.10	4.60	3.40
M36	40.00	39.00	66.00	64.10	6.00	4.00

Material		Steel
Mechanical Properties	Hardness Class	100 HV
	Hardness range	100 HV to 200 HV
Tolerances	Product grade	C
	International Standard	ISO 4759-3
Finish - Coating	As Processed	
	Requirements for electroplating are specified in ISO 4042.	
	Requirements for hot dip galvanized coatings are specified in ISO 10684.	
Additional requirements or other finishes or coatings shall be agreed between the supplier and the purchaser.		
Workmanship	Parts shall be free of irregularities or detrimental defects. No protruding burrs shall appear on the washer.	
Acceptability	Acceptance procedure covered in ISO 3269.	



CE
EN15048-1
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Non Pre-Load Bolt Assemblies SB

BS EN 15048-1 & 2:2007

ISO 4017 Setscrew Dimensions. Class A4-80SB

Thread <i>d</i>	<i>P</i>	<i>a</i>		<i>c</i>		<i>d_a</i>	<i>d_w</i>		<i>e</i>		<i>k</i>				<i>k_w^b</i>		<i>r</i>	<i>s</i>				
		max. ^a	min.	max.	min.		min.	min.	min.	min.	max.	min.	max.	min.	min.	min.		min.	min.	max.	min.	min.
M12	1.75	5.3	1.75	0.60	0.15	13.7	16.63	16.47	20.03	19.85	7.68	7.32	7.79	7.21	5.12	5.05	0.6	18	17.73	17.57		
M16	2	6	2	0.80	0.20	17.7	22.49	22.00	26.75	26.17	10.18	9.82	10.29	9.71	6.87	6.8	0.6	24	23.67	23.16		
M20	2.5	7.5	2.5	0.80	0.20	22.4	28.19	27.70	33.53	32.95	12.715	12.285	12.85	12.15	8.60	8.51	0.8	30	29.67	29.16		
M24	3	9	3	0.80	0.20	26.4	33.61	33.25	39.98	39.55	15.215	14.785	15.35	14.65	10.35	10.26	0.8	36	35.38	35.00		
M30	3.5	10.5	3.5	0.80	0.20	33.4	-	42.75	-	50.85	-	-	19.12	18.28	-	12.80	1	46	-	45.00		
M36	4	12	4	0.80	0.20	39.4	-	51.11	-	60.79	-	-	22.92	22.08	-	15.46	1	55	-	53.80		

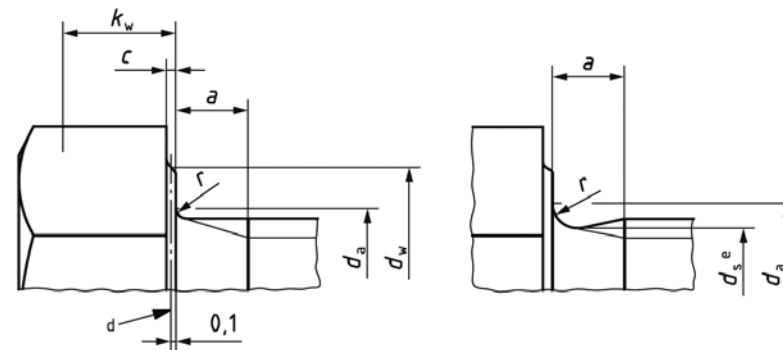
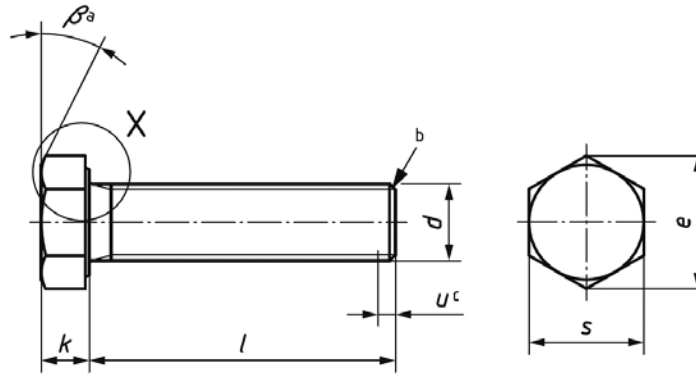
^a Values in accordance with a_{max} normal series, in ISO 3508. ^b $k_{w,min} = 0.7 k_{min}$

ISO 4017 Setscrew Mechanical Properties. Class A4-80SB

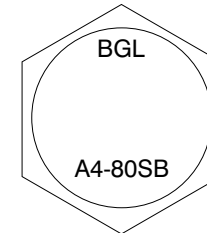
Bolt Thread Dia. <i>d</i>	Tensile Strength	Stress at 0.2% Permanent Strain	Elongation After Fracture
	MPa min.	MPa min.	mm min.
M12	800.00	600.00	0.3 <i>d</i>
M16	800.00	600.00	0.3 <i>d</i>
M20	800.00	600.00	0.3 <i>d</i>
M22	800.00	600.00	0.3 <i>d</i>
M24	800.00	600.00	0.3 <i>d</i>
M27	800.00	600.00	0.3 <i>d</i>
M30	800.00	600.00	0.3 <i>d</i>
M36	800.00	600.00	0.3 <i>d</i>

BS EN 15048 Assemblies also require a Charpy Impact Test to ISO 148-1

Material	Stainless Steel	
General Requirements	International Standard	ISO 8992
Thread	Tolerance Class	6g
	International Standards	ISO 724, ISO 965-1
Mechanical Properties	Property Class	A4-80SB
	International Standards	ISO 3506-1
Tolerances	Product grade	$d \leq 24$ mm and $l \leq 10 d$ or 150 mm ^a : A $d > 24$ mm or $l > 10 d$ or 150 mm ^a : B
	International Standard	ISO 4759-1
Finish - Coating	Clean and Bright	
Acceptability	Acceptance inspection is specified in ISO 3269.	
^a Whichever is the shorter.		



BS EN 15048 Head Marking



IMPORTANT NOTE

It is a requirement of BS EN 15048 that the bolt, nut and washer assembly is supplied by one manufacturer who is responsible for the function of the assembly. All the components are identified with the manufacturer's mark. The coating of the assembly is under the control of the manufacturer.

ISO 4032 Nut Dimensions. Class A4-80SB

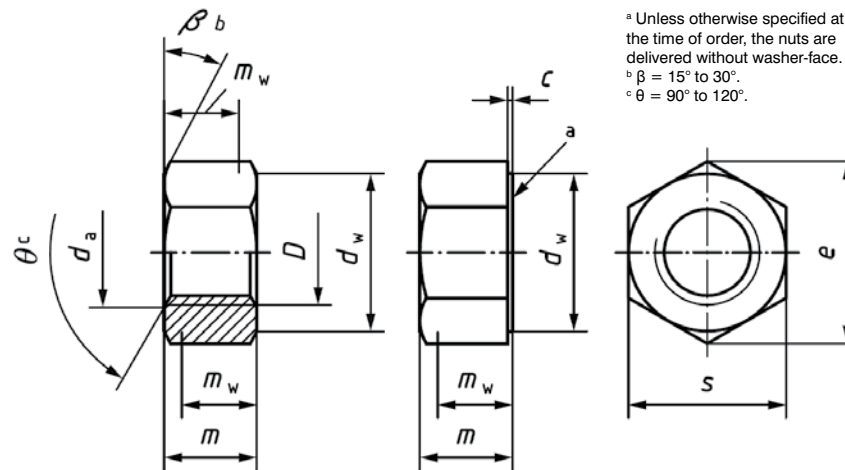
Thread <i>d</i>	<i>P</i> ^a	<i>c</i>		<i>d_a</i>		<i>d_w</i>	<i>e</i>	<i>m</i>		<i>m_w</i>	<i>s</i>	
		max.	min.	max.	min.	min.	min.	max.	min.	min.	max.	min.
M12	1.75	0.60	0.15	13.00	12.00	16.60	20.03	10.80	10.37	8.30	18.00	17.73
M16	2.00	0.80	0.20	17.30	16.00	22.50	26.75	14.80	14.10	11.30	24.00	23.67
M20	2.50	0.80	0.20	21.60	20.00	27.70	32.95	18.00	16.90	13.50	30.00	29.16
M24	3.00	0.80	0.20	25.90	24.00	33.30	39.55	21.50	20.20	16.20	36.00	35.00
M30	3.50	0.80	0.20	32.40	30.00	42.80	50.85	25.60	24.30	19.40	46.00	45.00
M36	4.00	0.80	0.20	38.90	36.00	51.10	60.79	31.00	29.40	23.50	55.00	53.80

^a *P* is the pitch of the thread

ISO 4032 Nut Proof Loads. Class A4-80SB

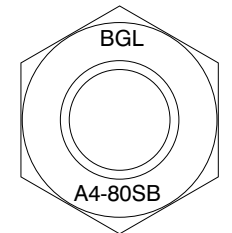
Nut Thread Dia.	Property Class
	A4-80SB
	MPa Min.
M12	800
M16	800
M20	800
M24	800
M30	800
M36	800

Material		Stainless Steel
General Requirements	International Standard	ISO 8992
Thread	Tolerance Class	6H
	International Standards	ISO 724, ISO 965-1
Mechanical Properties	Property Class	A4-80SB
	International Standards	ISO 3506-2
Tolerances	Product grade	<i>D</i> ≤ M16: A <i>D</i> > M16: B
	International Standard	ISO 4759-1
Finish - Coating		Clean and Bright A method for passivation is specified in ISO 16048.
Acceptability		Acceptance inspection is specified in ISO 3269.



^a Unless otherwise specified at the time of order, the nuts are delivered without washer-face.
^b $\beta = 15^\circ$ to 30° .
^c $\theta = 90^\circ$ to 120° .

**BS EN 15048
Nut Markings**



Pre-Load Bolt Assemblies HR

BS EN 14399-3:2015

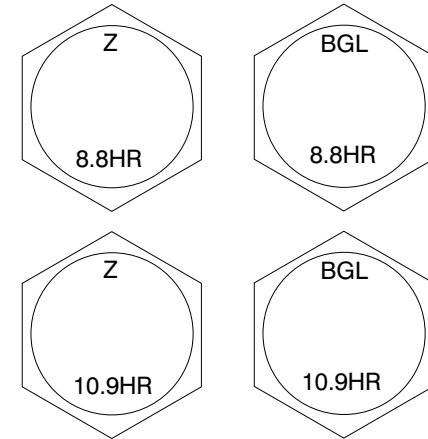
BS EN 14399-3 HR Bolt Dimensions. Classes 8.8 & 10.9

Thread <i>d</i>	<i>P</i> ^a	<i>b</i> (ref.)			<i>c</i>		<i>d_a</i>	<i>d_s</i>		<i>d_w</i>		<i>e</i>			<i>k</i>		<i>k_w</i>	<i>r</i>	<i>s</i>	
		<i>b</i>	<i>c</i>	<i>d</i>	max.	min.	max.	max.	min.	max.	min.	min.	nom.	max.	min.	min.	min.	max.	min.	max.
M12	1.75	30	-	-	0.8	0.4	15.2	12.70	11.30	e	20.1	23.91	7.5	7.95	7.05	4.90	1.2	22	21.16	
M16	2.00	38	44	-	0.8	0.4	19.2	16.70	15.30		24.9	29.56	10	10.75	9.25	6.50	1.2	27	26.16	
M20	2.50	46	52	65	0.8	0.4	24.4	20.84	19.16		29.5	35.03	12.5	13.40	11.60	8.10	1.5	32	31.00	
M22	2.50	50	56	69	0.8	0.4	26.4	22.84	21.16		33.3	39.55	14	14.90	13.10	9.2	1.5	36	35.00	
M24	3.00	54	60	73	0.8	0.4	28.4	24.84	23.16		38.0	45.20	15	15.90	14.10	9.9	1.5	41	40.00	
M27	3.00	60	66	79	0.8	0.4	32.4	27.84	26.16		42.8	50.85	17	17.90	16.10	11.3	2.0	46	45.00	
M30	3.50	66	72	85	0.8	0.4	35.4	30.84	29.16		46.6	55.37	18.7	19.75	17.65	12.4	2.0	50	49.00	
M36	4.00	78	84	97	0.8	0.4	42.4	37.00	35.00		55.9	66.44	22.5	23.55	21.45	15.0	2.0	60	58.80	

^a *P* is the pitch of the thread
^b For lengths $l_{nom} \leq 125$ mm
^c For lengths $125 \text{ mm} < l_{nom} \leq 200$ mm
^d For lengths $l_{nom} > 200$ mm
^e $d_{w \text{ max}} = s_{\text{actual}}$

Bolt/Nut/Washer Assembly System HR	
General Requirements	BS EN 14399-1
Materials & Manufacture	BS EN 14399-3
Marking	HR
Property Classes	8.8/8 10.9/10
Washer(s)	BS EN 14399-5 or BS EN 14399-6
Marking	H
Suitable Test for Preloading	BS EN 14399-2
"K" Class Designation	"K0 & K2" Class

BS EN 14399-3 HR Head Marking



Key

- a incomplete thread $u \leq 2P$
- b 15° to 30°

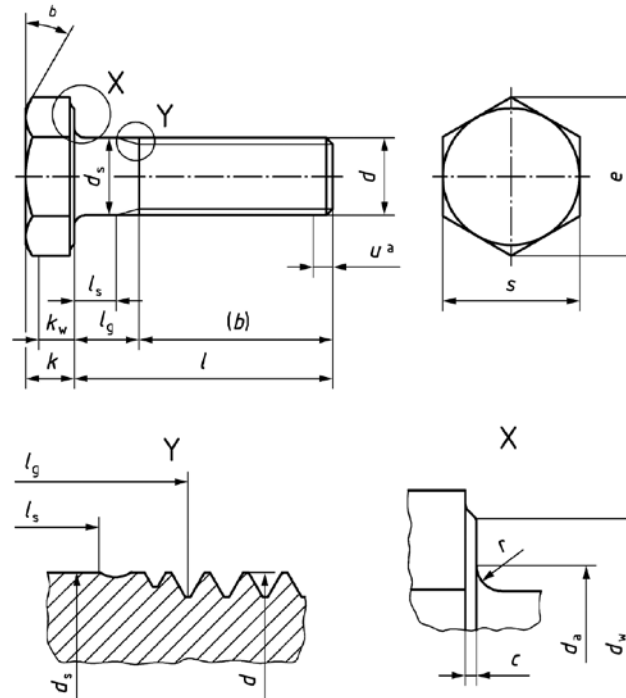
IMPORTANT NOTE

It is a requirement of BS EN 14399 that the bolt, nut and washer assembly is supplied by one manufacturer who is responsible for the function of the assembly. All the components are identified with the manufacturer's mark. The coating of the assembly is under the control of the manufacturer.



Material		Steel
General Requirements		BS EN 14399-1 and BS EN 14399-2
Thread	Tolerance Class	6g ^a
	International Standards	ISO 261, ISO 965-2
Mechanical properties	Property Class	8.8 or 10.9
	European Standard	BS EN ISO 898-1
Tolerances	Product Grade	C except: dimensions <i>c</i> and <i>r</i> . Tolerance for lengths ≥ 160 mm ± 4.0 mm
	European Standard	BS EN ISO 4759-1
Finish - Coating ^b	Uncoated	as processed ^c
	Hot Dip Galvanized	BS EN ISO 10684
	Others	to be agreed ^d
Surface Integrity		Limits for surface discontinuities as specified in EN 26157-1.
Acceptability		For acceptance procedure, see BS EN ISO 3269.

^a The tolerance class specified applies to bolts without or before any coating. Hot-dip galvanized bolts are intended for assembly with nuts tapped oversize to 6AZ.
^b Attention is drawn to the need to consider the risk of hydrogen embrittlement in the case of bolts of property class 10.9, when selecting an appropriate surface treatment process (e.g. cleaning and coating), see the relevant coating standards.
^c "As processed" means the normal finish resulting from manufacture with a light coating of oil.
^d Other coatings may be negotiated between the purchaser and the manufacturer provided they do not impair the mechanical properties or the functional characteristics. Coatings of cadmium or cadmium alloy are not permitted.



BS EN 14399-3 HR Nut Dimensions. Classes 8 & 10

Thread <i>d</i>	<i>p</i> ^a	<i>d_a</i>		<i>d_w</i>		<i>e</i>	<i>m</i>		<i>m_w</i>	<i>c</i>		<i>s</i>		<i>t</i>
		max.	min.	max.	min.		max.	min.		max.	min.	max.	min.	
M12	1.75	13.0	12	b	20.1	23.91	10.80	10.37	8.3	0.8	0.4	22	21.16	0.38
M16	2.00	17.3	16		24.9	29.56	14.80	14.10	11.3	0.8	0.4	27	26.16	0.47
M20	2.50	21.6	20		29.5	35.03	18.00	16.90	13.5	0.8	0.4	32	31.00	0.58
M22	2.50	23.7	22		33.3	39.55	19.40	18.10	14.5	0.8	0.4	36	35.00	0.63
M24	3.00	25.9	24		38.0	45.20	21.50	20.20	16.2	0.8	0.4	41	40.00	0.72
M27	3.00	29.1	27		42.8	50.85	23.80	22.50	18.1	0.8	0.4	46	45.00	0.80
M30	3.50	32.4	30		46.6	55.37	25.60	24.30	19.5	0.8	0.4	50	49.00	0.87
M36	4.00	38.9	36		55.9	66.44	31.00	29.40	22.4	0.8	0.4	60	58.80	1.05

^a *P* is the pitch of the thread

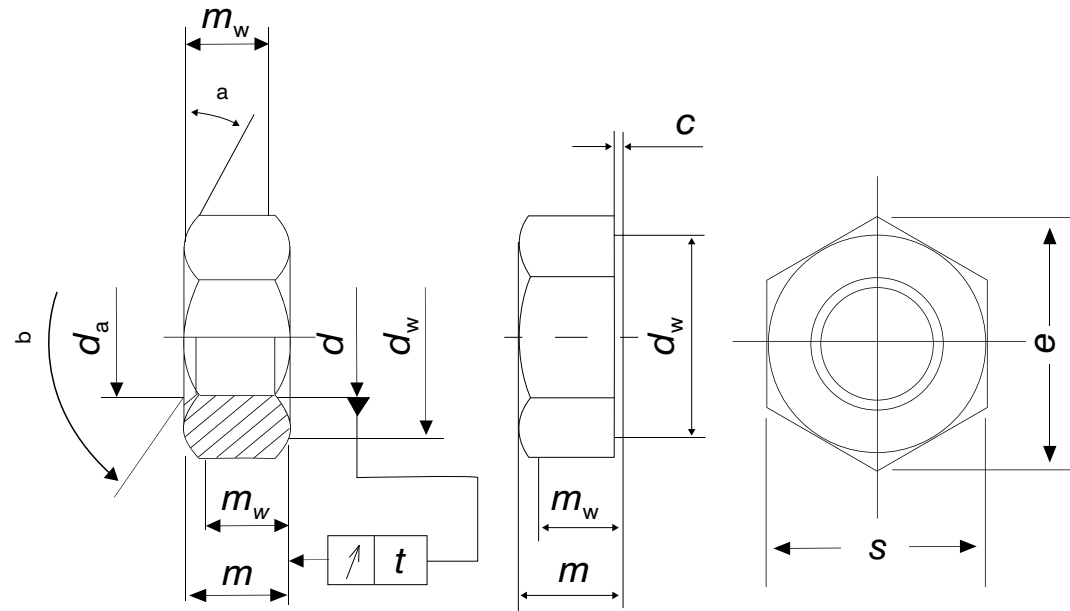
^b *d_w* max = *s* actual

BS EN 14399-3 HR Nut Proof Loads. Classes 8 & 10

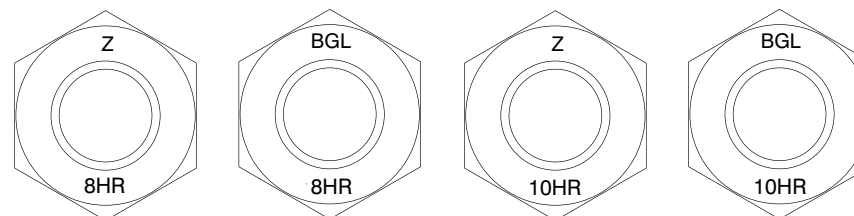
Nut Thread Dia.	Stress Area Test Mandrel mm ²	Property Class	
		8	10
		Proof Load kN	Proof Load kN
M12	84.30	84.30	97.80
M16	157.0	157.0	182.1
M20	245.0	245.0	284.2
M22	303.0	303.0	351.2
M24	353.0	353.0	409.5
M27	459.0	459.0	532.4
M30	561.0	561.0	650.8
M36	817.0	817.0	947.7

Material	Steel			
General Requirements	BS EN 14399-1 and BS EN 14399-2			
Thread	Coating of the Bolt	Uncoated	Hot dip galvanized	Others
	Tolerance Class of the Nut	6H	6AZ	6H ^a
	International Standards	ISO 261, ISO 965-2	ISO 261, ISO 965-5	ISO 261, ISO 965-2, ISO 965-5
Mechanical properties	Property Class	8 ^b or 10 ^b		
	European Standard	BS EN ISO 898-2		
Tolerances	Product Grade	B except for dimensions <i>m</i> and <i>c</i>		
	European Standard	BS EN ISO 4759-1 ^c		
Finish - Coating^b	Uncoated	as processed ^d		
	Hot Dip Galvanized	BS EN ISO 10684		
	Others	to be agreed ^e		
Surface Integrity	Limits for surface discontinuities as specified in BS EN ISO 6157-2			
Acceptability	For acceptance procedure, see BS EN ISO 3269.			

^a For other coatings that need an increased fundamental deviation and according to the relevant standard, oversize tapped nuts with a thread tolerance class up to 6AZ may be used.
^b For mechanical properties, proof load values and hardness values other than those specified see BS EN ISO 898-2.
^c Except tolerance on perpendicularity of bearing face, see BS EN 14399-3.
^d "As processed" means the normal finish resulting from manufacture with a light coating of oil.
^e Other coatings may be negotiated between the purchaser and the manufacturer provided they do not impair the mechanical properties or the functional characteristics. Coatings of cadmium or cadmium alloys are not permitted.



BS EN 14399-3 HR Nut Marking



Pre-Load Bolt Assemblies HV

BS EN 14399-4:2015

BS EN 14399-4 HV Bolt Dimensions. Class 10.9

Thread <i>d</i>	<i>P</i> ^a	<i>b</i> (ref.)	<i>c</i>		<i>d</i> _a	<i>d</i> _s			<i>d</i> _w		<i>e</i>	<i>k</i>				<i>k</i> _w	<i>r</i>	<i>s</i>	
			min.	max.	max.	nom.	min.	max.	min.	max.		min.	max.	min.	max.	min.		max.	min.
M12	1.75	23	0.4	0.6	15.2	12	11.30	12.70	20.1	b	23.91	8	7.55	8.45	5.28	1.2	22	21.16	
M16	2.00	28	0.4	0.6	19.2	16	15.30	16.70	24.9		29.56	10	9.25	10.75	6.47	1.2	27	26.16	
M20	2.50	33	0.4	0.8	24.0	20	19.16	20.84	29.5		35.03	13	12.10	13.90	8.47	1.5	32	31.00	
M22	2.50	34	0.4	0.8	26.0	22	21.16	22.84	33.3		39.55	14	13.10	14.90	9.17	1.5	36	35.00	
M24	3.00	39	0.4	0.8	28.0	24	23.16	24.84	38.0		45.20	15	14.10	15.90	9.87	1.5	41	40.00	
M27	3.00	41	0.4	0.8	32.0	27	26.16	27.84	42.8		50.85	17	16.10	17.90	11.27	2.0	46	45.00	
M30	3.50	44	0.4	0.8	35.0	30	29.16	30.84	46.6		55.37	19	17.95	20.05	12.56	2.0	50	49.00	
M36	4.00	52	0.4	0.8	41.0	36	35.00	37.00	55.9		66.44	23	21.95	24.05	15.36	2.0	60	58.80	

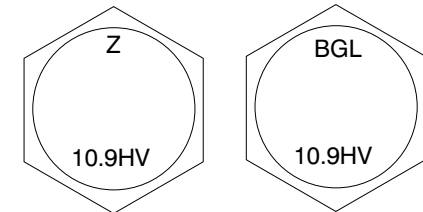
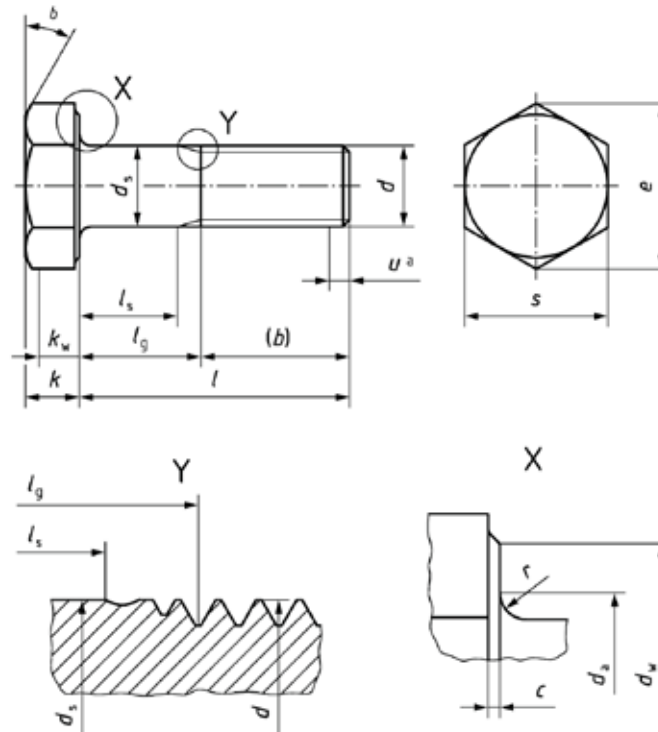
^a *P* is the pitch of the thread
^b $d_{w \max} = s_{\text{actual}}$

Bolt/Nut/Washer Assembly System HV	
General Requirements	BS EN 14399-1
Materials & Manufacture	BS EN 14399-4
Marking	HV
Property Classes	10.9/10
Washer(s)	BS EN 14399-5 or BS EN 14399-6
Marking	H
Suitable Test for Preloading	BS EN 14399-2
"K" Class Designation	"K1 & K2" Class

BS EN 14399-4 HV Head Marking

Material	Steel	
General Requirements	BS EN 14399-1 and BS EN 14399-2	
Thread	Tolerance	6g ^a
	International Standards	ISO 261, ISO 965-2
Mechanical Properties	Property Class	10.9
	European Standard	BS EN ISO 898-1
Tolerances	Product Grade	C except for dimensions <i>c</i> and <i>r</i> + IT 17 Tolerance for lengths ≥ 155 mm: - 1/2 IT 17
	European Standard	BS EN ISO 4759-1
Surface - Coating ^b	Uncoated	as processed ^c
	Hot Dip Galvanized	BS EN ISO 10684
	Others	to be agreed ^d
Surface Integrity	Limits for surface discontinuities as specified in BS EN 26157-1.	
Acceptability	For acceptance procedure, see BS EN ISO 3269.	

^a The tolerance class specified applies to bolts without or before any coating. Hot-dip galvanized bolts are intended for assembly with nuts tapped oversize to 6AZ.
^b Attention is drawn to the need to consider the risk of hydrogen embrittlement in the case of bolts of property class 10.9, when selecting an appropriate surface treatment process (e.g. cleaning and coating), see the relevant coating standards.
^c "As processed" means the normal finish resulting from manufacture with a light coating of oil.
^d Other coatings may be negotiated between the purchaser and the manufacturer provided they do not impair the mechanical properties or the functional characteristics. Coatings of cadmium or cadmium alloys are not permitted.



Key
a incomplete thread $u \leq 2P$
b 15° to 30°

IMPORTANT NOTE

It is a requirement of BS EN 14399 that the bolt, nut and washer assembly is supplied by one manufacturer who is responsible for the function of the assembly. All the components are identified with the manufacturer's mark. The coating of the assembly is under the control of the manufacturer.



BS EN 14399-4 HV Nut Dimensions. Class 10

Thread <i>d</i>	<i>P</i> ^a	<i>d_a</i>		<i>d_w</i>		<i>e</i>	<i>m</i>		<i>m_w</i>	<i>s</i>	
		max.	min.	max.	min.		min.	max.		min.	max.
M12	1.75	13.0	12	b	20.1	23.91	10	9.64	7.71	22	21.16
M16	2.00	17.3	16		24.9	29.56	13	12.30	9.84	27	26.16
M20	2.50	21.6	20		29.5	35.03	16	14.90	11.92	32	31.00
M22	2.50	23.7	22		33.3	39.55	18	16.90	13.52	36	35.00
M24	3.00	25.9	24		38.0	45.20	20	18.70	14.96	41	40.00
M27	3.00	29.1	27		42.8	50.85	22	20.70	16.56	46	45.00
M30	3.50	32.4	30		46.6	55.37	24	22.70	18.16	50	49.00
M36	4.00	38.9	36		55.9	66.44	29	27.70	22.16	60	58.80

^a *P* is the pitch of the thread

^b $d_{w\max} = s_{\text{actual}}$

Material		Steel		
General Requirements		BS EN 14399-1 and BS EN 14399-2		
Thread	Coating of Bolt	Uncoated	Hot dip galvanized	Others
	Tolerance Class of the Nut	6H	6AZ	6H ^a
	International Standards	ISO 261, ISO 965-2	ISO 261, ISO 965-5	ISO 261, ISO 965-2, ISO 965-5
Mechanical Properties	Property Class	10		
	European Standard	BS EN ISO 898-2		
Tolerances	Product Grade	B		
	European Standard	BS EN ISO 4759-1		
Surface - Coating	Uncoated	as processed ^b		
	Hot Dip Galvanized	BS EN ISO 10684		
	Others	to be agreed ^c		
Surface Integrity		Limits for surface discontinuities as specified in BS EN ISO 6157-2.		
Acceptability		For acceptance procedure, see BS EN ISO 3269.		

^a For other coatings that need an increased fundamental deviation and according to the relevant standard, oversize tapped nuts with a thread tolerance class up to 6AZ may be used.
^b "As processed" means the normal finish resulting from manufacture with a light coating of oil.
^c Other coatings may be negotiated between the purchaser and the manufacturer provided they do not impair the mechanical properties or the functional characteristics. Coatings of cadmium or cadmium alloys are not permitted.

Functional characteristics of the bolt/nut/washers assembly

The functional characteristics of the bolt/nut/washers assemblies according to 1.1 and 1.3 shall be achieved for all *k*-classes when tested in accordance with BS EN 14399-2.

Minimum clamp lengths are specified in BS EN 14399-4.

NOTE For further background information as to these functional characteristics, see BS EN 14399-2.

The bolting assembly shall be suitably lubricated in the as delivered condition, to ensure that seizure will not take place during tightening of the assembly and that the required preload is obtained.

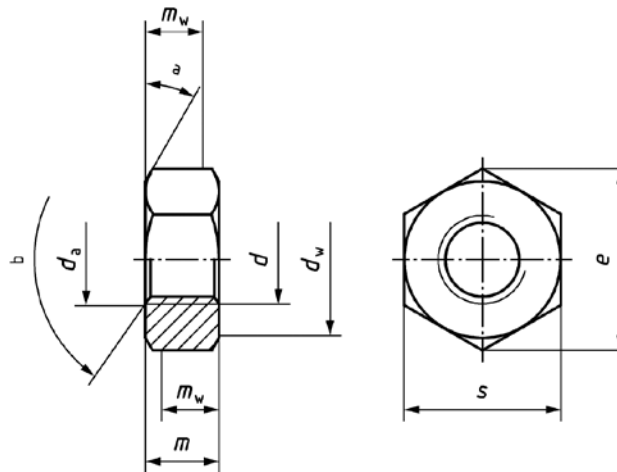
1.1 Maximum individual value of the bolt force during fitness for purpose test ($F_{bi\max}$)

The following applies:

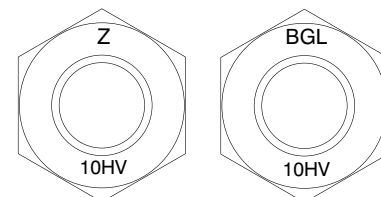
$$F_{bi\max} \geq 0,9 f_{ub} \times A_s$$

where

f_{ub} is the nominal tensile strength (R_m)
 A_s is the nominal stress area of the bolt.



BS EN 14399-4 HV Nut Marking



1.2 Values of angle $\Delta\Theta_1$

$\Delta\Theta_1$ is the angle by which the nut shall be turned starting from a preload of $0,7 f_{ub} \times A_s$ until $F_{bi\max}$ is reached.

Values for $\Delta\Theta_1$	
Clamp length Σt^a	$\Delta\Theta_1$ min.
$\Sigma t < 2d$	90°
$2d \leq \Sigma t < 6d$	120°
$6d \leq \Sigma t \leq 10d$	150°

^a Σt is the total thickness of the clamped parts including washer(s).

1.3 Values of angle $\Delta\Theta_2$

$\Delta\Theta_2$ is the angle by which the nut shall be turned, starting from a preload of $0,7 f_{ub} \times A_s$ through $F_{bi\max}$ and until F_{bi} has dropped to $0,7 f_{ub} \times A_s$.

Values for $\Delta\Theta_2$	
Clamp length Σt^a	$\Delta\Theta_2$ min.
$\Sigma t < 2d$	180°
$2d \leq \Sigma t < 6d$	210°
$6d \leq \Sigma t \leq 10d$	240°

^a Σt is the total thickness of the clamped parts including washer(s).

1.4 Individual values of the *k*-factor (k_i), mean value of the *k*-factor (k_m) and coefficient of variation of the *k*-factor (V_k)

1.4.1 Individual values of the *k*-factor (k_i) for *k*-class K1

For *k*-class K1, the k_i values shall be within the range of $0,10 \leq k_i \leq 0,16$.

1.4.2 Mean value of the *k*-factor (k_m) and coefficient of variation of the *k*-factor (V_k) for *k*-class K2

The mean value (k_m) of the *k*-factor shall be calculated as follows:

$$k_m = \frac{\sum_{i=1}^n k_i}{n} \quad \text{with} \quad k_i = \frac{M_i}{F_{p,C} \times d}$$

where

M_i is the individual value of the applied torque;

$F_{p,C}$ is the required preload;

d is the nominal bolt diameter.

The coefficient of variation of the *k*-factor (V_k) shall be calculated as follows:

$$V_k = \frac{S_k}{k_m} \quad \left(S_k = \sqrt{\frac{\sum (K_i - K_m)^2}{n - 1}} \right)$$

where S_k is the standard deviation

When k_m and V_k the following values apply:

$$0,10 \leq k_m \leq 0,23$$

$$V_k \leq 0,06$$

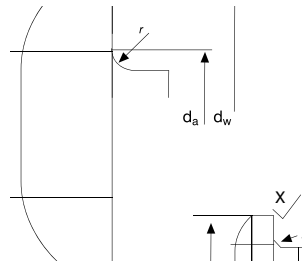
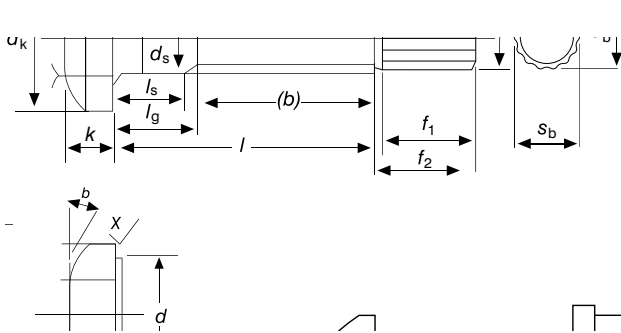
Pre-Load Bolt Assemblies HRC

BS EN 14399-10:2018

BS EN 14399-10 HRC Cup Head Bolt Dimensions. Class 10.9

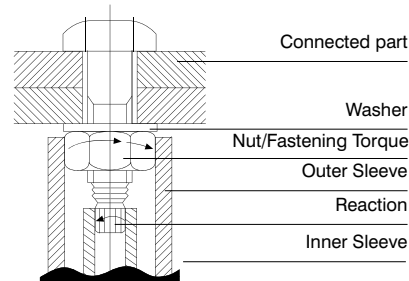
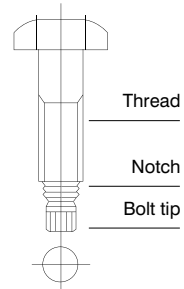
Thread d	p^a	b (ref)			d_k min.	d_a max.	d_s		d_w min.	k		r min.
		b	c	d			max.	min.		max.	min.	
M12	1.75	30			21.0	15.2	12.70	11.30	20	8.8	7.2	1.2
M16	2.00	38	44		27.0	19.2	16.70	15.30	26	10.8	9.2	1.2
M20	2.50	46	52	65	34.0	24.4	20.84	19.16	33	13.9	12.1	1.5
M22	2.50	50	56	69	38.5	26.4	22.84	21.16	37	14.9	13.1	1.5
M24	3.00	54	60	73	43.0	28.4	24.84	23.16	41	15.9	14.1	1.5
M27	3.00	60	66	79	48.0	32.4	27.84	26.16	46	17.9	16.1	2.0
M30	3.50	66	72	85	52.0	35.4	30.84	29.16	50	20.0	18.0	2.0
M36	4.00	78	84	97	66.0	42.4	37.00	35.00	61	24.0	22.0	2.0

^a P is the pitch of the thread
^b For lengths $l_{nom} \leq 125$ mm.
^c For lengths 125 mm $< l_{nom} \leq 200$ mm.
^d For lengths $l_{nom} > 200$ mm.



Before Clamping

After Clamping



Features of High Strength 10.9 HRC Bolting Assemblies

Developed for more simplified bolt fastening and more accurate performance. HRC (Tension Control) Bolts offer excellent characteristics as shown below.

1. Controlled clamping force can be ensured.
2. Completion of bolt fastening can be confirmed by the shear-off of the notched end of the bolt.
3. Removes the possibility of operator error.
4. Fastening can easily be done by electric wrench.
5. Noiseless installation and no need of wrench adjustment.
6. The bolt does not rotate when fastening.

The bolt reacts to the fastening torque and the notched end of the bolt shears off. The required clamping force is thus given.

Material		Steel
General Requirements		BS EN 14399-1 and BS EN 14399-2
Thread	Tolerance	6g ^a
	International Standards	ISO 261, ISO 965-2
Mechanical Properties	Property Class	10.9
	European Standard	BS EN ISO 898-1
Tolerances	Product Grade	C except for dimensions c and r Tolerance for lengths ≥ 160 mm: $\pm 4,0$ mm
	European Standard	BS EN ISO 4759-1
Surface - Coating ^b	Uncoated	as processed ^c
	Hot Dip Galvanized	BS EN ISO 10684
	Others	to be agreed ^d
Additional protection against corrosion		After tightening, the non-coated area appearing at the end of the bolt resulting from the fracture of the spline-end may be protected against corrosion by applying an efficient protective treatment (e.g. by a complementary zinc-rich paint).
Surface Integrity		Limits for surface discontinuities as specified in BS EN 26157-1.
Acceptability		For acceptance procedure, see BS EN ISO 3269.

^a The tolerance class specified applies to bolts without or before any coating. Hot-dip galvanized bolts are intended for assembly with nuts tapped oversize to 6AZ.
^b Attention is drawn to the need to consider the risk of hydrogen embrittlement in the case of bolts of property class 10.9, when selecting an appropriate surface treatment process (e.g. cleaning and coating), see the relevant coating standards.
^c "As processed" means the normal finish resulting from manufacture with a light coating of oil.
^d Other coatings may be negotiated between the purchaser and the manufacturer provided they do not impair the mechanical properties or the functional characteristics. Coatings of cadmium or cadmium alloys are not permitted.

BS EN 14399-10 HRC Spline End Dimensions

Thread d	Width Across Flats of Spline-end s_b^a		Width Across Corners of Spline-end e_b^b	Length of Spline-end f_1	Break off Length f_2
	max.	min.	min.	min.	max.
M12	8.0	7.4	8.36	11.0	16.0
M16	11.6	11.0	12.43	13.0	18.0
M20	14.4	13.8	15.60	15.0	20.0
M22	15.7	15.1	17.06	15.5	21.0
M24	17.1	16.5	18.65	16.0	21.5
M27	19.3	18.7	21.13	19.0	24.0
M30	21.4	20.8	23.50	21.0	26.0
M36	25.7	25.1	28.50	25.0	31.0

^a For hot dip galvanized bolts, the dimensions apply before galvanizing except for s_b max. which applies after galvanizing.
^b e_b min. = $1,13 s_b$ min.



BS EN 14399-10 HRD Nut Dimensions											M = 1d (HRD)			
Thread d	P ^a	d _a		d _w		e	c		s		t	m		m _w
		max.	min.	max.	min.	min.	max.	min.	max.	min.		max.	min.	min.
M12	1.75	13.0	12	b	20.1	23.91	0.8	0.4	22	21.16	0.38	12.35	11.65	9.32
M16	2.00	17.3	16		24.9	29.56	0.8	0.4	27	26.16	0.47	16.35	15.65	12.52
M20	2.50	21.6	20		29.5	35.03	0.8	0.4	32	31.00	0.58	20.65	19.35	15.48
M22	2.50	23.7	22		33.3	39.55	0.8	0.4	36	35.00	0.63	22.65	21.35	17.08
M24	3.00	25.9	24		38.0	45.20	0.8	0.4	41	40.00	0.72	24.65	23.35	18.68
M27	3.00	29.1	27		42.8	50.85	0.8	0.4	46	45.00	0.80	27.65	26.35	21.08
M30	3.50	32.4	30		46.6	55.37	0.8	0.4	50	49.00	0.87	30.65	29.35	23.48
M36	4.00	38.9	36		55.9	66.44	0.8	0.4	60	58.80	1.05	36.80	35.20	28.16

^a P is the pitch of the thread
^b d_w max = s actual

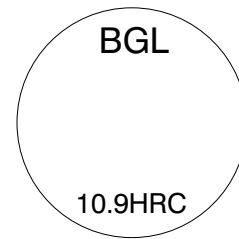
BS EN 14399-10 10 HRD Proof Load Requirements		
Nut thread d	Nominal Stress Area of Standard Test Mandrel A _S mm ²	Nuts with Height m = d HRD ^b
	mm ²	Proof Load kN
M12	84.3	104 900
M16	157.0	195 500
M20	245.0	305 000
M22	303.0	377 200
M24	353.0	439 500
M27	459.0	571 500
M30	561.0	698 400
M36	817.0	1017 100

^b The proof load values are based on the stress under proof load of 1 245 N/mm²

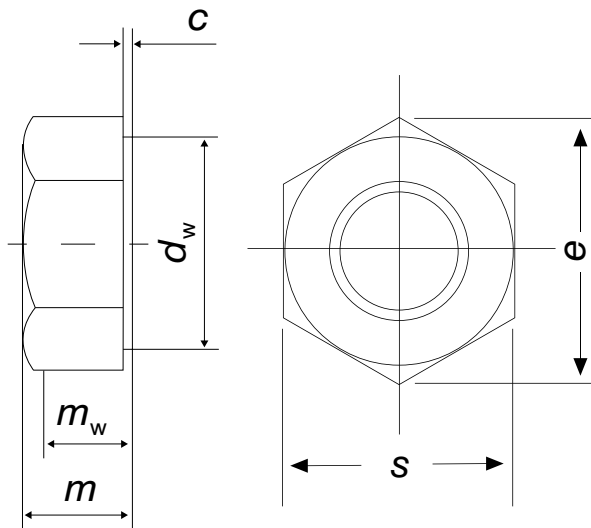
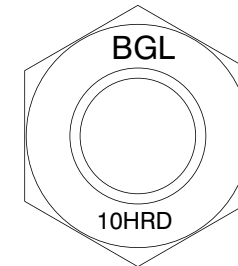
Material	Steel			
General Requirements	BS EN 14399-1 and BS EN 14399-2			
Thread	Coating of the Bolt	Uncoated	Hot dip galvanized	Others
	Tolerance Class of the Nut	6H	6AZ	6H ^a
	International Standards	ISO 261, ISO 965-2	ISO 261, ISO 965-5	ISO 261, ISO 965-2, ISO 965-5
Mechanical properties	Property Class	10 ^b		
	European Standard	BS EN ISO 898-2		
Tolerances	Product Grade	B		
	European Standard	BS EN ISO 4759-1 ^c		
Finish - Coating^b	Uncoated	as processed ^d		
	Hot Dip Galvanized	BS EN ISO 10684		
	Others	to be agreed ^e		
Surface Integrity	Limits for surface discontinuities are specified in BS EN ISO 6517-2.			
Acceptability	For acceptance procedure, see BS EN ISO 3269.			

^a For other coatings that need an increased fundamental deviation and according to the relevant standard, oversize tapped nuts with a thread tolerance class up to 6AZ may be used.
^b For mechanical properties and proof load values other than those specified see BS EN ISO 898-2.
^c Except tolerance on perpendicularity of bearing face, see BS EN 14399-3.
^d "As processed" means the normal finish resulting from manufacture with a light coating of oil.
^e Other coatings may be negotiated between the purchaser and the manufacturer provided they do not impair the mechanical properties or the functional characteristics. Coatings of cadmium or cadmium alloys are not permitted.

BS EN 14399-10 HRC Head Marking



BS EN 14399-10 HRD Nut Marking



Quality Assurance

Galvanised HRC Assemblies, (bolts, nuts and washers) are supplied in a fully assembled condition ready for use. No treatments such as T-Washing or Etching can be applied before installation as this will change the tightening characteristics and prevent the correct preload being achieved.

The components of the assembly, as supplied, have been tested as a batch and must not be mixed with components from any other batch of HRC assemblies.

Care must always be taken to avoid any contamination of the assemblies with anything that may change the lubrication of the nut, bolt thread or washer.

SUCH CONTAMINATION WILL EFFECT THE ASSEMBLY PRELOAD THAT IS ACHIEVED DURING TIGHTENING.

We would advise that tightening of HRC assemblies is avoided in the rain

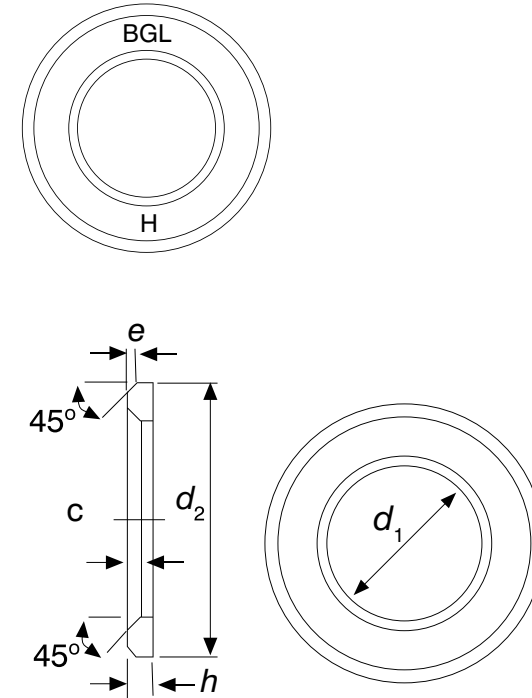
Pre-Load Bolt Washer

BS EN 14399-6:2015

BS EN 14399-6 Chamfered Washer Dimensions (Hardened)

Nominal Size of Bolt or Screw	Inside Diameter d_1		Outside Diameter d_2		Thickness h		External Chamfer e		Internal Chamfer c	
	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.
M12	13.27	13.00	24.00	23.48	3.3	2.7	1.00	0.50	1.9	1.6
M16	17.27	17.00	30.00	29.48	4.3	3.7	1.50	0.75	1.9	1.6
M20	21.33	21.00	37.00	36.38	4.3	3.7	1.50	0.75	2.5	2.0
M22	23.33	23.00	39.00	38.38	4.3	3.7	1.50	0.75	2.5	2.0
M24	25.33	25.00	44.00	43.38	4.3	3.7	1.50	0.75	2.5	2.0
M27	28.52	28.00	50.00	49.00	5.6	4.4	2.00	1.00	3.0	2.5
M30	31.62	31.00	56.00	54.80	5.6	4.4	2.00	1.00	3.0	2.5
M36	37.62	37.00	66.00	64.80	6.6	5.4	2.50	1.25	3.0	2.5

BS EN 14399-6 Washer Marking



Material		Steel
General requirements		BS EN 14399-1 and BS EN 14399-2
Mechanical properties	Hardness range	300 HV to 370 HV
Tolerances	Product grade	A
	European Standard	BS EN ISO 4759-3
Finish - Coating ^a	Uncoated	as processed ^b
	Hot dip galvanized	BS EN ISO 10684
	Others	to be agreed ^c
Workmanship		Parts shall be uniform and free of irregularities or detrimental defects. No protruding burrs shall appear on the washer.
Acceptability		For acceptance procedure, see BS EN ISO 3269.
^a Attention is drawn to the need to consider the risk of hydrogen embrittlement when selecting an appropriate surface treatment process (e.g. cleaning and coating), see relevant coating standards.		
^b "As processed" means the normal finish resulting from heat treatment with a light coating of oil.		
^c Other coatings may be negotiated between the purchaser and the manufacturer provided they do not impair the mechanical properties or the functional characteristics. Coatings of cadmium or cadmium alloys are not permitted.		



EN14399-1

Cert No:
0038/CPR/4006773/B

Direct Tension Indicator Washers

BS EN 14399-9:2018

BS EN 14399-9 Direct Tension Indicator Washer Dimensions									
Nominal Size d	Internal Diameter d_1		External Diameter d_2		Material Thickness h_1	Height Over Protrusions h_2	Height of Protrusions h_3	Protrusion Tangential Diameter d_3	Protrusion Internal Diameter d_4
	min.	max.	min.	max.	min.	max.	min.	max.	min.
M12	12.75	12.85	26.0	32.5	2.50	5.50	0.80	20	13.85
M16	16.75	16.85	35.0	36.8	3.00	6.00	0.80	25	17.85
M20	20.95	21.05	41.0	46.0	3.50	6.50	0.80	29	22.05
M22	23.05	23.15	46.5	50.6	4.00	7.00	0.80	33	24.15
M24	25.15	25.25	50.0	55.2	4.00	7.00	0.80	38	26.25
M27	28.30	28.40	54.0	62.1	4.00	7.00	0.80	43	29.40
M30	31.45	31.55	59.0	69.0	4.00	7.00	0.80	46.5	32.55
M36	37.75	37.85	78.0	83.0	4.00	7.50	0.80	56	38.85

Test compression loads at 0,40 mm gap				
Nominal size d (nominal thread diameter of associated bolt)	Compression Load (KN)			
	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

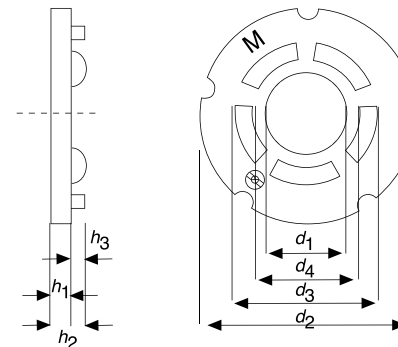
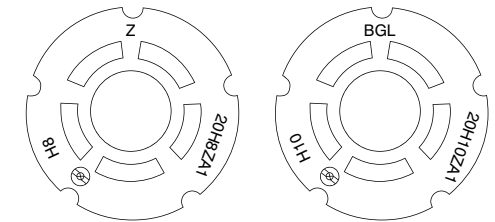
NOTE These minimum values are equal to $0,7 f_{ub} \times A_s$ in accordance with BS EN 1993-1-8.

Product Characteristic	Standard	
Material	Steel	
General Requirements	BS EN 14399-1 & BS EN 14399-2	
Heat Treatment	Hardened and tempered or controlled rolled and tempered	
Maximum Hardness	380 HV	
Surface Finish ^a	Normal	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 ^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.

BS EN 14399-9 DTI Washer Feeler gauge Requirements	
Direct tension indicator positions	Designation H8 and H10 Thickness of feeler gauge
Under bolt head, when nut is turned	0.40
Under nut, when bolt is turned	
Under nut, when nut is turned	0.25
Under bolt head, when bolt is turned	

BS EN 14399-9 DTI Washer Marking



The DTI is a specially hardened washer used totally independently of the bolts torque resistance.

DTI are one of four methods allowed to ensure that structural bolting is correctly installed.



Pre-Load Bolt Assemblies

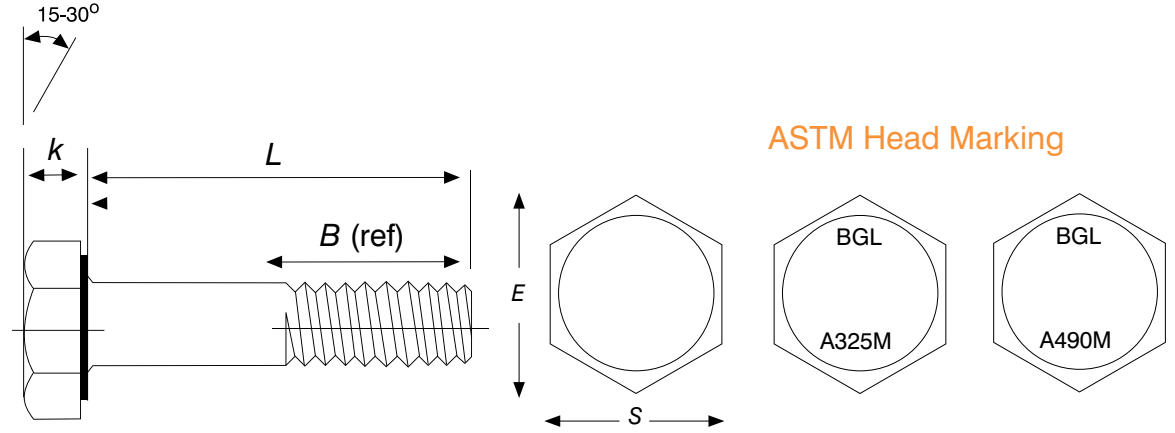
ASTM A325M / A490M

ASTM A325M Bolt

Standard Specification	ASTM A325M
Material	Medium Carbon Steel
Strength Grade	8.8
Screw Thread	ASME B1.13 6G
Surface Finish	Plain as processed
	Hot Dipped Galvanised ASTM A153C

ASTM A490M Bolt

Standard Specification	ASTM A490M
Material	Alloy Steel
Strength Grade	10.9
Screw Thread	ASME B1.13 6G
Surface Finish	Plain as processed



ASTM A325M / A490M Heavy Hex Structural Bolt Dimensions

Nominal Bolt Diameter and Thread Pitch <i>D</i>	Width Across Flats <i>S</i>		Width Across Corners <i>E</i>		Head Height <i>K</i>		Thread Length <i>B</i> (ref)	
	max.	min.	max.	min.	max.	min.	Bolt Lengths ≤ 100	Bolt Lengths > 100
							Basic	
M16 x 2	27.00	26.16	31.18	29.56	10.75	9.25	31	38
M20 x 2.5	34.00	33.00	39.26	37.29	13.40	11.60	36	43
M22 x 2.5	36.00	35.00	41.57	39.55	14.90	13.10	38	45
M24 x 3	41.00	40.00	47.34	45.20	15.90	14.10	41	48
M27 x 3	46.00	45.00	53.12	50.85	17.90	16.10	44	51
M30 x 3.5	50.00	49.00	57.74	55.37	19.75	17.65	49	56
M36 x 4	60.00	58.80	69.28	66.44	23.55	21.45	56	63

ASTM A325M Bolt Characteristics

Nominal Bolt Dia & Thread Pitch	Stress Area, mm ²	Proof Load Length Measurement Method, kN	Proof Load Yield Strength Method, kN	Tensile Strength min, kN	Hardness			
					Rockwell		Vickers	
					min.	max.	min.	max.
M16 x 2	157	94.2	104	130	C23	C34	255	336
M20 x 2.5	245	147	162	203				
M22 x 2.5	303	182	200	251				
M24 x 3	353	212	233	293				
M27 x 3	459	275	303	381				
M30 x 3.5	561	337	370	466				
M36 x 4	817	490	539	678				

ASTM A490M Bolt Characteristics

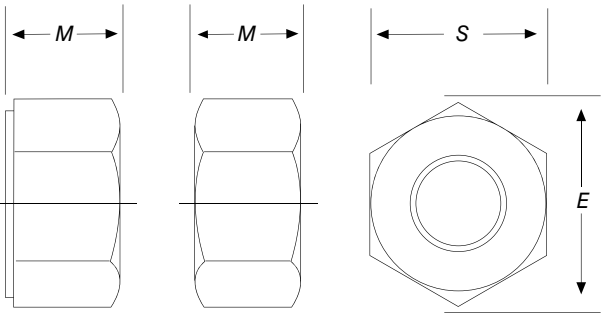
Nominal Bolt Dia & Thread Pitch	Stress Area, mm ²	Proof Load, kN		Tensile Strength, kN		Product Hardness				Surface Hardness
		Length Measurement Method	Yield Strength Method	min.	max.	HRC (Rockwell C)		HV (Vickers)		HR 30N (Rockwell 30N)
						min.	max.	min.	max.	max.
M16 x 2	157	130	148	163	190	33	39	327	382	59
M20 x 2.5	245	203	230	255	296					
M22 x 2.5	303	251	285	315	366					
M24 x 3	353	293	332	367	427					
M27 x 3	459	381	431	477	555					
M30 x 3.5	561	466	527	583	679					
M36 x 4	817	678	768	850	989					

ASTM A563M Heavy Hex Nut Dimensions						
Nominal Nut Diameter and Thread Pitch	Width Across Flats <i>S</i>		Width Across Corners <i>E</i>		Thickness <i>M</i>	
	max.	min.	max.	min.	max.	min.
M16 x 2	27.00	26.16	31.18	29.56	17.1	16.4
M20 x 2.5	34.00	33.00	39.26	37.29	20.7	19.4
M22 x 2.5	36.00	35.00	41.57	39.55	23.6	22.3
M24 x 3	41.00	40.00	47.34	45.20	24.2	22.9
M27 x 3	46.00	45.00	53.12	50.85	27.6	26.3
M30 x 3.5	50.00	49.00	57.74	55.37	30.7	29.1
M36 x 4	60.00	58.80	69.28	66.44	36.6	35.0

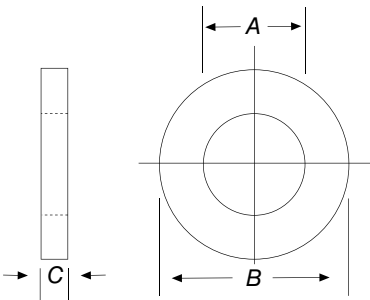
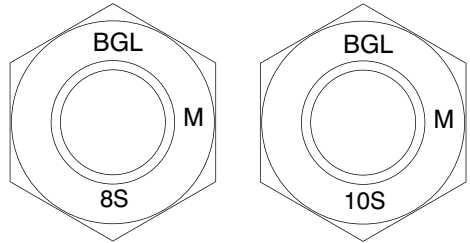
ASTM F436M Circular Washer Dimensions						
Nominal Washer Size (Bolt Diameter)	Inside <i>A</i>		Outside <i>B</i>		Thickness <i>C</i>	
	max.	min.	max.	min.	max.	min.
16	18.4	18.0	34.0	32.4	4.6	3.1
20	22.5	22.0	42.0	40.4	4.6	3.1
22	24.5	24.0	44.0	42.4	4.6	3.4
24	26.5	26.0	50.0	48.4	4.6	3.4
27	30.5	30.0	56.0	54.1	4.6	3.4
30	33.6	33.0	60.0	58.1	4.6	3.4
36	39.6	39.0	72.0	70.1	4.6	3.4

Standard Specification	ASTM F436M
Material	Hardened Steel
Material Properties	38 to 45 HRC
Surface Finish	Plain as processed
	Hot Dipped Galvanised ASTM A153C

Standard Specification	ASTM A563M
Material	Carbon & Alloy Steel
Strength Grade	8S, 10S
Screw Thread	ANSI B18.2.4.1M
Surface Finish	Plain as processed
	Hot Dipped Galvanised ASTM A153C



ASTM Nut Marking



Sq. Sq. Holding Down Bolts

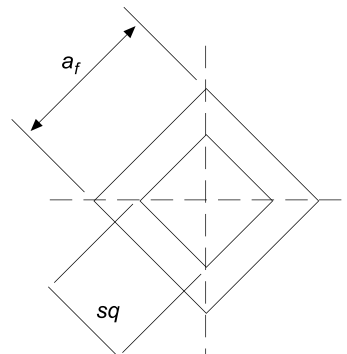
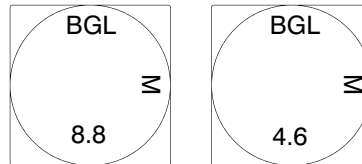
BS 7419

BS 7419 Sq Sq Bolt Dimensions. Classes 4.6 & 8.8															
Thread Size d	Pitch of Thread p	Thread Length t		Diameter of Unthreaded Shank d_s		Thickness of Head h		Radius Under Head r		Width Across Flats a_f		Depth of Washer Face s		Width Across Square sq	
		min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
M16	2.0	116	16.70	15.30	10.75	9.25	0.6	24.00	23.16	8.75	7.25	16.70	15.30		
M20	2.5	120	20.84	19.16	13.40	11.60	0.8	30.00	29.16	10.75	9.25	20.84	19.16		
M24	3.0	124	24.84	23.16	15.90	14.10	0.8	36.00	35.00	12.90	11.10	24.84	23.16		
M30	3.5	130	30.84	29.16	19.75	17.65	1.0	46.00	45.00	15.90	14.10	30.84	29.16		
M36	4.0	136	37.00	35.00	23.55	21.45	1.0	55.00	53.80	18.90	17.10	37.00	35.00		
M42	4.5	142	43.00	41.00	27.05	24.95	1.2	65.00	63.10	22.05	19.95	43.00	41.00		
M48	5.0	148	49.00	47.00	31.05	28.95	1.6	75.00	73.10	25.05	22.95	49.00	47.00		
M56	5.5	156	57.20	54.80	36.25	33.75	2.0	85.00	82.00	29.05	26.95	57.20	54.80		
M64	6.0	164	65.20	62.80	41.25	38.75	2.0	95.00	92.80	33.25	30.75	65.20	62.80		

BS 7419 Ultimate Tensile Load & Hardness							
Nominal Dia d	Stress Area mm^2	Property Class 4.6			Property Class 8.8		
		Tensile Load min kN	Hardness Rockwell HRB		Tensile Load min kN	Hardness Rockwell HRC	
			min	max		min	max
M16	157	62.80	67	95	130	23	34
M20	245	98.00	67	95	203	23	34
M24	353	141.0	67	95	293	23	34
M30	561	224.0	67	95	466	23	34
M36	817	327.0	67	95	678	23	34

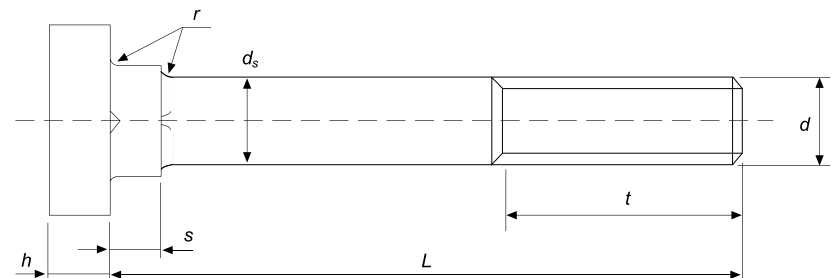
BS7419 Machined Test Requirements			
Property Class	Tensile Strength (N/mm ²)	Elongation (%)	Reduction of area (%)
	min.	min.	min.
4.6	400	22	
8.8	830	12	52

BS 7419 Head Markings



Material	Steel	
General Requirements	BS ISO 8992	
Thread	Tolerance	8g ^a
	International Standards	BS 3643-1 and BS 3643-2
Mechanical Properties	Property Classes	$d \leq 39mm$: 4.6, 8.8 $d > 39mm$: as agreed ^b
	European Standard	BS EN ISO 898-1
Tolerances	Product Grade	C
	European Standard	BS EN ISO 4759-1
Finish - Coating	Normal	As processed ^c
	Hot dip galvanized	BS EN ISO 10684
	Sherardized	BS 7371-8
	Zinc electroplated	BS EN ISO 4042
	Others	To be agreed ^d
Associated nuts	Standards	BS EN ISO 4032 & BS EN ISO 4034
	Property classes	5, 8, 10 ^e
	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 or BS 4320 Form G
	Others	to be agreed ^f
Acceptability	Standard	BS EN ISO 3269
Suitability test	Standard	BS EN 15048-2

^a The tolerance class specified applies before hot dip galvanizing or coating with any thick protective coating.
^b The designation symbol for the property classes according to BS EN ISO 898-1 may also be used for thread sizes above M39, provided that the finished product has all the properties assigned to the designation symbols in BS EN ISO 898-1.
^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 provided they do not impair the mechanical properties or the functional characteristics. Coatings of cadmium or cadmium alloy are not permitted.
^e Recommended bolt and nut combinations are shown in BS 7419.
^f Other washers may be supplied by agreement between the purchaser and the manufacturer.

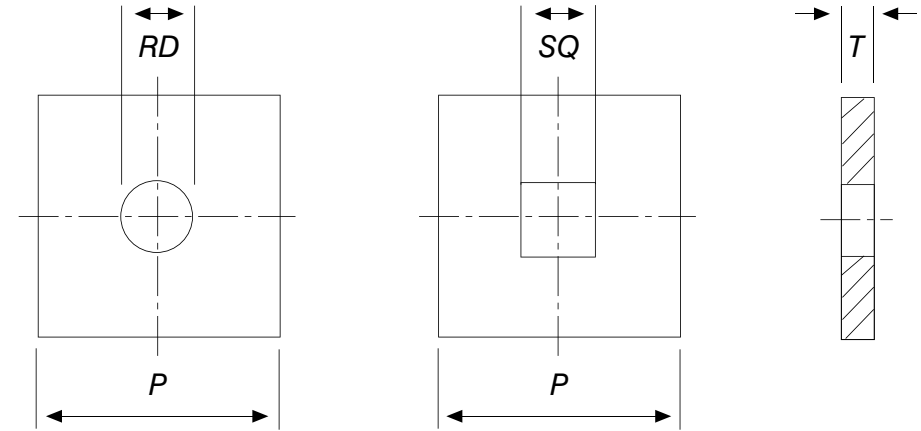
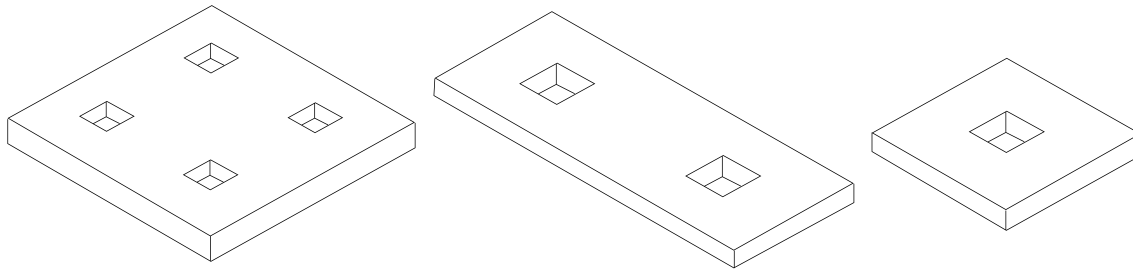


Washer Plates

Washer plates are produced from mild steel plate (S275).

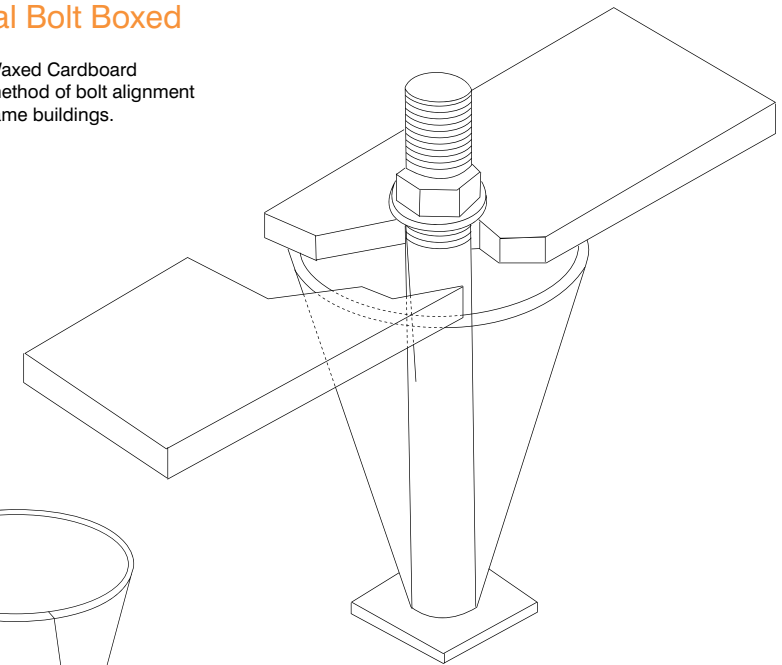
All holes are produced on a diameter + 2mm tolerance on both square and round hole.

As well as single holed plates, we can produce a range of multiple holed plates to customer specification.



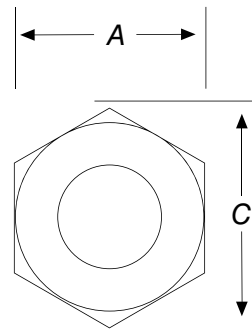
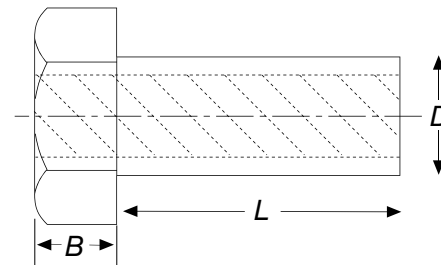
Conical Bolt Boxed

Material: Waxed Cardboard
A simple method of bolt alignment for steel frame buildings.

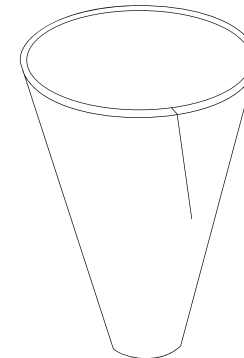


Bolt Extenders

BAPP produce bolt extenders specifically for the structural engineering industry. All bolt extenders are produced as Grade 8.8 (40cr mo4) as standard.



Internally threaded	Shank diameter max. (mm) <i>D</i>	Width across flats max (mm) <i>A</i>	Width across corners max. (mm) <i>C</i>	Head thickness (mm) <i>B</i>	Shank length (mm) <i>L</i>
M16	24	36	41.60	15.0	100
M20	30	46	53.10	18.7	100
M22	33	50	57.80	21.0	100
M24	36	55	63.50	22.5	100
M27	42	65	73.45	26.0	100
M30	45	70	80.80	28.0	100
M36	52	80	92.40	33.0	150



Fixings

Approved Throughbolt - Clear Zinc Plated - Min 5µm

Part Number	Anchor Hole Size mm	Anchor Length mm	Max. Fixture Thickness mm	Max. Hole Depth mm
AWA06060	6	60	1	55
AWA06080	6	80	22	55
AWA08075	8	75	4	65
AWA08090	8	90	19	65
AWA08115	8	115	44	65
AWA08130	8	130	59	65
AWA10090	10	90	10	70
AWA10120	10	120	40	70
AWA10150	10	150	70	70
AWA12110	12	110	18	85
AWA12140	12	140	48	85
AWA12160	12	160	68	85
AWA12180	12	180	88	85
AWA16125	16	125	4	110
AWA16145	16	145	22	110
AWA16170	16	170	47	110
AWA20170	20	170	23	135

Technical Information - Approved Throughbolt - C20/25 Concrete

Anchor/Hole Size mm	Thread Dia. mm	Embedment Depth mm	Fixture Clearance Hole mm	Centre Spacing mm	Edge Distance mm	Min. Structure Thickness mm	Approved Tensile Load KN	Approved Shear Load KN	Rec. Tightening Torque Nm
6	M6	50	7	120	60	100	3.9	2.9	7
8	M8	60	9	144	72	100	5.7	5.3	20
10	M10	67	12	165	83	100	6.4	8.4	35
12	M12	77	14	195	98	130	9.9	11.8	60
16	M16	104	18	252	126	168	13.9	21.9	120
20	M20	125	22	309	155	206	19.8	32.2	240

A throughbolt with a European Technical Approval, which is a torque controlled anchor suitable for use in concrete over C20/25



Shear loads are for loads away from a free edge



Heavy Duty Anchor - Countersunk Zinc Plated and Clear Passivated - Min 5µm

Part Number	Anchor Hole Size mm	Thread Diameter mm	Anchor Length mm	Max. Fixture Thickness mm	Max. Hole Depth mm	Head Diameter mm
SLSK10/10	10	6	70	10	65	16.5
SLSK10/25	10	6	85	25	65	16.5
SLSK10/50	10	6	105	45	65	16.5
SLSK12/10	12	8	80	10	80	20.5
SLSK12/25	12	8	95	25	80	20.5
SLSK12/50	12	8	120	50	80	20.5
SLSK15/10	15	10	95	10	95	24.5
SLSK15/25	15	10	110	25	95	24.5
SLSK15/50	15	10	135	50	95	24.5
SLSK18/15	18	12	115	20	105	29.5
SLSK18/40	18	12	135	40	105	29.5

Technical Information - Heavy Duty Anchor - C20/25 Concrete

Anchor/Hole Size mm	Thread Dia. mm	Embedment Depth mm	Fixture Clearance Hole mm	Centre Spacing mm	Edge Distance mm	Structure Thickness mm	Approved Tensile Load KN	Approved Shear Load KN	Rec. Tightening Torque Nm
10	M6	60	12	150	110	100	7.6	9.1	15
12	M8	70	14	180	125	120	9.5	14.0	30
15	M10	85	17	210	180	140	14.3	20.7	50
18	M12	95	20	240	200	160	17.2	34.3	80

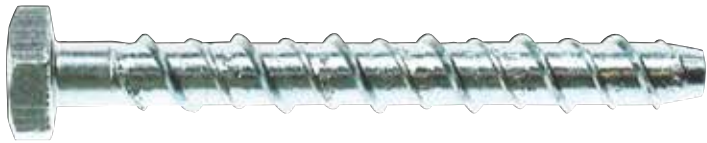


Shear loads are for loads away from a free edge



Technical Information - Vinylester - C20/25 Concrete

Thread Dia. mm	Hole Size mm	Embedment Depth mm	Fixture Clearance Hole mm	Centre Spacing mm	Edge Distance mm	Structure Thickness mm	Rec. Tensile Load KN	Rec. Shear Load KN	Rec. Tightening Torque Nm
M8	10	80	10	160	80	100	9.1	5.1	10
M10	12	90	12	180	90	120	14.3	8.0	20
M12	14	110	14	220	110	140	19.0	12.0	40
M16	18	125	18	250	125	160	28.6	22.3	80
M20	25	170	22	340	170	220	40.6	34.9	120
M24	28	210	26	420	210	260	60.1	50.3	150
M30	35	280	34	560	280	360	71.0	89.0	290



Pure Vinylester Resin is a high strength resin suitable for use in concrete, brickwork and most natural stone. Approved for use in contact with potable (drinking) water.

Hexagon Head - Zinc Plated and Clear Passivated - Min 5µm

New Part Number	Old Part Number	Drill Dia. mm	Anchor Length mm	Max. Fixture Thickness mm	Minimum Hole Depth mm	Driver Type
JAB08/10060	JAB10060	8.0	60	20	55	15mm A/F
JAB08/10075	JAB10075	8.0	75	35	55	15mm A/F
JAB08/10100	JAB10100	8.0	100	60	55	15mm A/F
JAB08/10130	JAB10130	8.0	130	90	55	15mm A/F
JAB08/10150	JAB10150	8.0	150	110	55	15mm A/F
JAB10/12060	JAB12060	10.0	60	10	70	17mm A/F
JAB10/12075	JAB12075	10.0	75	25	70	17mm A/F
JAB10/12100	JAB12100	10.0	100	50	70	17mm A/F
JAB10/12130	JAB12130	10.0	130	80	70	17mm A/F
JAB10/12150	JAB12150	10.0	150	100	70	17mm A/F
JAB12/14075	JAB14075	12.0	75	15	85	19mm A/F
JAB12/14100	JAB14100	12.0	100	40	85	19mm A/F
JAB12/14130	JAB14130	12.0	130	70	85	19mm A/F
JAB12/14150	JAB14150	12.0	150	90	85	19mm A/F
JAB12/14200	JAB14200	12.0	200	140	85	19mm A/F
JAB16/18100	JAB18100	16.0	100	20	112	27mm A/F
JAB16/18150	JAB18150	16.0	150	70	112	27mm A/F
JAB16/18200	JAB18200	16.0	200	120	112	27mm A/F

Metal Anchors

- Throughbolts
- Wirehangers
- Ankerbolts
- Sleeve Anchors
- Scaffold Ring Bolts
- Forged Hooks and Eyes
- Drop in Anchors
- Setting Punches
- Shield Anchors
- Heavy Duty Anchors
- Concrete Screws



Chemical Anchors

- Chemical Capsules
- Chemical Anchor Studs
- Injection Resin
- Injection Resin Accessories
- Internal Threaded Sockets
- J-Bond
- Rockite
- Kwixset
- Expanding Foam
- Silicone
- Adhesive
- Fire Stop Expanding Foam
- Fire Stop Sealant

Nylon Fixings

- Hammer Screws
- Flange Head Hammer Screws
- Nylon Nail Plugs
- Push Plugs
- Coach Screws and Plugs
- Frame Fixings
- Cavity Fixings



Established 1934

The original, the expert

- Inventor of steelwork clamping systems
- Over 80 years experience
- Case studies available on virtually any application on high profile projects from across the globe (visit www.lindapter.com)
- Technical support includes free design from qualified Lindapter engineers
- R&D department for bespoke product development only Lindapter offers
- Hollo-Bolt®, the only cavity fixing to be recognised for primary structural use by both SCI and BCSA
- Extreme strength fixings, e.g. Type AF Girder Clamp (250kN)
- Huge range of unique products, includes: Type CF (High Friction), Type AF (High Tension & Friction), Type LS (Stainless Steel), Hollo-Bolt (for structural hollow section)

Benefits

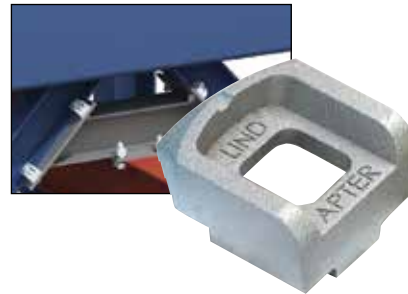
- For primary & secondary steelwork
- No on-site drilling or welding
- Fast, cost-effective installation
- On site adjustability
- No weakening/damage to steel work
- Hot working permits not required
- Only hand tools needed
- Less work at height
- Potential to dismantle for reconstruction or multi cycling
- Industry leading quality approvals

Technical Innovation in Steelwork Connections



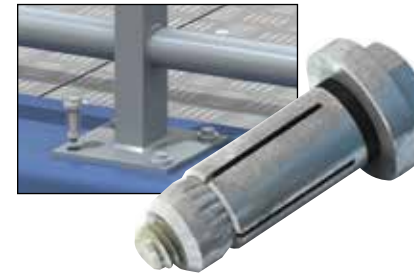
STEELWORK FIXINGS

For over 80 years Lindapter has pioneered the design and manufacture of quality steel work connection solutions, providing a unique and proven concept: innovative clamping systems that eliminate the need to drill or weld steelwork, reducing installation time and labour costs. Lindapter steelwork fixings and Girder Clamps are ideally suited for both new construction and the refurbishment of existing structures.



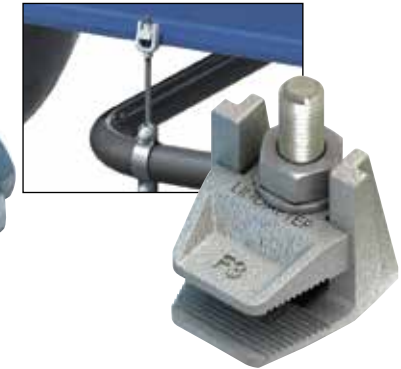
CAVITY FIXINGS

The range consists of the legendary Hollo-Bolt® and Lindibolt®, creating simple, cost-effective connections of SHS and other hollow sections, or conventional steelwork where access is available from one side only. The Hollo-Bolt can be used as a primary structural connection as detailed in the SCI/BCSA publication 'Joints in Steel Construction – Simple Connections'.



SUPPORT FIXINGS

Lindapter provides solutions for supporting all building services, including the suspension of HVAC equipment, pipe work, fire protection/sprinkler systems, suspended ceilings and electrical equipment from structural or secondary beams.



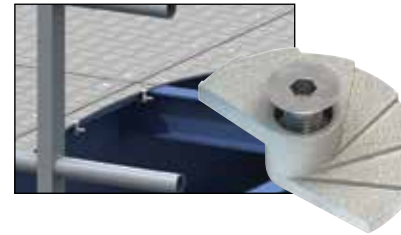
DECKING FIXINGS

Lindapter produce a range of high quality, cost effective building services connections designed to fit inside the dovetail shaped re-entrant channel of decking profiles, compatible with all major manufacturers including CMF, Corus, Kingspan, SMD and Richard Lees.



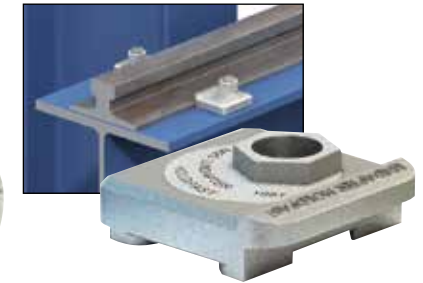
FLOOR FIXINGS

Lindapter's concept extends to their innovative fixings that connect steel flooring to supporting steelwork without the need of on-site drilling or welding. Access to the underside of the flooring is not required, eliminating the need for costly scaffolding or elevated floors. Installation can be carried out quickly and safely from above, often by one person, significantly reducing costs.



RAIL FIXINGS

Fast and convenient fixings are available for over head equipment, track work cable troughs, electrification bracketry, station monitors and the holding down of low speed rail lines. Lindapter also design and manufacture bespoke products for individual customer requirements.



Protective Coatings

Most fasteners used in the structural fabrication market are supplied with some form of corrosion resistant coating, this is to give the product more durability in the connection enhancing lasting strength, visual appearance and ease of installation and dismantling.

Corrosion is caused directly by the particular environment it is exposed to, during both storage and service, so dependant on the levels of corrosive elements within the atmosphere BAPP Group would suggest that one of the following three coatings be applied to the assembly.

ELECTRO ZINC PLATING

ISO 4042 CR3

This is a bright zinc finish and generally would be a maximum of 8/10 microns of zinc coating, this should be used only for short term protection or in non aggressive environments such as Europe.

HOT DIP GALVANISING

ISO 10684 & BS 7371-6

This is a deep grey finish and would always be a minimum of 45 microns, this coating has a very thick layer of zinc and would be recommended for highly aggressive environments such as those in the Middle East.

SHERARDISING

BS 4921 Class 1

This is a matt grey finish (almost black) and would always be a minimum of 30 microns, this is a zinc dust diffusion process at high temperatures (320-500 degrees C). This coating again is recommended for highly aggressive environments such as those in the Middle East, and also has a very high salt spray resistance suitable for coastal use.

HYDROGEN EMBRITTLEMENT

During any zinc application by electroplating the supplier must ensure that hydrogen embrittlement does not occur during the process, this is the diffusion of hydrogen ions into the metal which causes high stresses in the structure of the steel and can give rise to delayed or spontaneous brittle fracture.

Embrittlement is caused by pre-treatments like pickling prior to electroplating, this is avoided by either very stringent cleaning procedures or by reheating the product after the zinc process for a period of time and at a set temperature based on ISO 4042

OTHER AVAILABLE COATINGS:

MECHANICAL GALVANISING

GREENKOTE®

DACROMET 320 or 500

SHERAPLEX

DELTA COAT

DELTA SEAL

GEOMET

JS 500

XYLAN 1070

CE Marking

Regulation 305/211/EEC

Each bag/box of CE assembled product is supplied with a BAPP colour coded label and a BAPP CE label affixed. These labels contain unique assembly batch and BAPP CE ID numbers.

Each CE label also provides the following information.

1. CE Marking Symbol
2. Identification number of the FPC Certification body.
3. Name or identifying mark and registered address of the producer.
4. Last two digits of the year in which the marking was affixed.
5. FPC Certificate number.
6. No. of European Standard.
7. Description of product.
8. BAPP Declaration of Performance Number.

The CE marking symbol shall be in accordance with the general principles set out in article 30 of regulation (EC) No. 765/2008 and shall be affixed visibly, legibly and indelibly on the label.

BAPP Colour Codes



EN15048-1
Cert No:
0038/CPR/4006773/C





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

Colour Coding CE Label


Plain Finish = White
BZP Finish = Blue
HDG Finish = Orange


BS EN 14399-1:2015 Example CE Marking Information

 0038	
BAPP Group Ltd Unit 5, Darton Business Park, Darton, Barnsley South Yorkshire, S75 5QX, UK 11 0038/CPR/4006773/B	
EN 14399-1:2015 High strength structural bolting assemblies for preloading intended to be used in structural metallic works in accordance with a defined k-class	
Bolt	EN 14399-3 M16 x 80 - 8.8 - HR - HDG
Nut	EN 14399-3 M16 - 10 - HR - HDG
Washer	EN 14399-6 M16 - - H - HDG
Assembly Batch No. BG0123456789 BAPP CE ID No. CE01234567 BAPP DOP No. BAPP0062 k-class: K2: $k_m = 123456$ $V_k = 123456$	

 0038	
BAPP Group Ltd Unit 5, Darton Business Park, Darton, Barnsley South Yorkshire, S75 5QX, UK 11 0038/CPR/4006773/B	
EN 14399-1:2015 High strength structural bolting assemblies for preloading intended to be used in structural metallic works in accordance with a defined k-class	
Bolt	EN 14399-3 M16 x 80 - 8.8 - HR - PLAIN
Nut	EN 14399-3 M16 - 8 - HR - PLAIN
Washer	EN 14399-6 M16 - - H - PLAIN
Assembly Batch No. BG0123456789 BAPP CE ID No. CE01234567 BAPP DOP No. BAPP0038 k-class: K0: NPD	

BS EN 15048-1:2007 Example CE Marking Information

 0038	
BAPP Group Ltd Unit 5, Darton Business Park, Darton, Barnsley South Yorkshire, S75 5QX, UK 11 0038/CPR/4006773/C	
BS EN 15048-1 Non-preloaded structural bolting assembly Tolerances EN/ISO 4014/4032/7091	
Bolt	EN ISO 4014 M16 x 80 - 8.8 - HDG
Nut	EN ISO 4032 M16 - 10 - HDG
Washer	EN ISO 7091 M16 - - HDG
Assembly Batch No. BG0123456789 BAPP CE ID No. CE01234567 BAPP DOP No. BAPP0011	

 0038	
BAPP Group Ltd Unit 5, Darton Business Park, Darton, Barnsley South Yorkshire, S75 5QX, UK 11 0038/CPR/4006773/C	
BS EN 15048-1 Non Pre-load Structural Bolting Assembly Tolerances EN/ISO 4017/4032/7091	
Setscrew	EN ISO 4017 M12 x 30 - 8.8 - BZP CR3
Nut	EN ISO 4032 M12 - 8 - BZP CR3
Washer	EN ISO 7091 M12 - - BZP CR3
Assembly Batch No. BG0123456789 BAPP CE ID No. CE01234567 BAPP DOP No. BAPP0001	

Certification

BAPP Group of Companies		BAPP Group Ltd, Darton Business Park, Barnsley, South Yorkshire, UK S75 5QX Tel: +44 (0)1226 383824 Fax: +44 (0)1226 390004		Assembled Test Certificate BS EN 15048 PARTS 1 & 2: 2007					
BAPP Customer Name		BAPP Customer Order No.		BAPP Order No.					
BAPP Order No.		Assembly Batch/Lot No.		Product Description					
Product Description		Product Standard		Batch/Lot No.					
Batch/Lot No.		Raw Material Grade							
CE Number	Stamped	Finish	Quantity						
BOLT CHEMICAL ANALYSIS									
Element	C	Mn	P	S	Si	Cr	Ni	Cu	Mo
%									
BOLT MECHANICAL PROPERTIES									
Test Item	Test Method	Standard	Actual Results	Remarks					
Hardness (HRC)	ISO 898-1:2013								
Ultimate Tensile Strength (N/mm ²)	ISO 898-1:2013								
Suitability Test (Tension)	EN ISO 15048-2:2007								
Proof Load (KN)	ISO 898-1:2013								
Wedge Load (KN)	ISO 898-1:2013								
Elongation (%)	ISO 898-1:2013								
Reduction of Area (%)	ISO 898-1:2013								
Charpy Impact V Notch	ISO 898-1:2013								
BOLT DIMENSIONAL									
Method	Standard	Actual Results	Sampling	Reject	Remarks				
Width A/F									
Head Height									
Major Diameter									
Radius Under Head									
Visual									
NUT DETAIL									
Product Description		Product Standard		Batch/Lot No.					
Batch/Lot No.		Finish							
NUT CHEMICAL ANALYSIS									
Element	C	Mn	P	S	Si	Cr	Ni	Cu	Mo
%									
NUT MECHANICAL PROPERTIES									
Test Item	Test Method	Standard	Actual Results	Remarks					
Hardness (HV)	BS EN ISO 20898-2:2012								
Proof Load (KN)	BS EN ISO 20898-2:2012								
NUT DIMENSIONAL									
Method	Standard	Actual Results	Sampling	Reject	Remarks				
Width A/F									
Nut Height									
Visual									
Go-Gauge									
No Go-Gauge									
WASHER DETAIL									
Product Description		Product Standard		Batch/Lot No.					
Batch/Lot No.		Finish							
WASHER CHEMICAL ANALYSIS									
Element	C	Mn	P	S	Si	Cr	Ni	Cu	Mo
%									
WASHER MECHANICAL PROPERTIES									
Test Item	Test Method	Standard	Actual Results	Remarks					
Hardness (HV)	EN ISO 6507-1:2005								
WASHER DIMENSIONAL									
Method	Standard	Actual Results	Sampling	Reject	Remarks				
OD									
ID									
Thickness									
ADDITIONAL COMMENTS									

ALL PRODUCTS HAVE BEEN TESTED AND COMPLY IN ALL ASPECTS TO BS EN 15048 PART 1 & 2.
We hereby certify that all the above results are original from our factories actual testing and the products have proved to comply with the relevant standard.

Wayne Grealey - Quality Manager
Bapp Group Limited

CE
CERTIFICATION IN ACCORDANCE WITH EN 10204-3.1

BAPP Group of Companies		BAPP Group Ltd, Darton Business Park, Barnsley, South Yorkshire, UK S75 5QX Tel: +44 (0)1226 383824 Fax: +44 (0)1226 390004		Assembled Test Certificate BS EN 14399 PARTS 1,2,3 & 6:2015 (HR Assembly)						
BAPP Customer Name		BAPP Customer Order No.		BAPP Order No.						
BAPP Order No.		Assembly Batch/Lot No.		Product Description						
Product Description		Product Standard		Batch/Lot No.						
Batch/Lot No.		Raw Material Grade								
CE Number	Stamped	Finish	Quantity							
BOLT CHEMICAL ANALYSIS										
Element	C	Mn	P	S	Si	Cr	B	Ni	Cu	Mo
%										
BOLT MECHANICAL PROPERTIES										
Test Item	Test Method	Standard	Actual Results	Remarks						
Hardness (HRC)	ISO 898-1:2013									
Ultimate Tensile Strength (N/mm ²)	ISO 898-1:2013									
Suitability Test	BS EN 14399-2:2015 (Fbi Max)									
Suitability Test	BS EN 14399-2:2015 (Fp)									
Proof Load (KN)	ISO 898-1:2013									
Wedge Load (KN)	ISO 898-1:2013									
Elongation (%)	ISO 898-1:2013									
Reduction of Area (%)	ISO 898-1:2013									
Charpy Impact V Notch	ISO 898-1:2013									
BOLT DIMENSIONAL										
Method	Standard	Actual Results	Sampling	Reject	Remarks					
Width A/F										
Head Height										
Major Diameter										
Radius Under Head										
Visual										
NUT DETAIL										
Product Description		Product Standard		Batch/Lot No.						
Batch/Lot No.		Finish								
NUT CHEMICAL ANALYSIS										
Element	C	Mn	P	S	Si	Cr	B	Ni	Cu	Mo
%										
NUT MECHANICAL PROPERTIES										
Test Item	Test Method	Standard	Actual Results	Remarks						
Hardness (HV)	ISO 898-2:2012									
Proof Load (KN)	BS EN 14399-3:2015 (Table 6)									
NUT DIMENSIONAL										
Method	Standard	Actual Results	Sampling	Reject	Remarks					
Width A/F										
Nut Height										
Visual										
Go-Gauge										
No Go-Gauge										
WASHER DETAIL										
Product Description		Product Standard		Batch/Lot No.						
Batch/Lot No.		Finish								
WASHER CHEMICAL ANALYSIS										
Element	C	Mn	P	S	Si	Cr	B	Ni	Cu	Mo
%										
WASHER MECHANICAL PROPERTIES										
Test Item	Test Method	Standard	Actual Results	Remarks						
Hardness (HV)	BS EN 14399-6:2015									
WASHER DIMENSIONAL										
Method	Standard	Actual Results	Sampling	Reject	Remarks					
OD										
ID										
Thickness										
ADDITIONAL COMMENTS										
Material conforms to standard BS EN 14399-2:2015 k Class: K2 $k_m =$ $V_k =$										
ADDITIONAL COMMENTS										

ALL PRODUCTS HAVE BEEN TESTED AND COMPLY IN ALL ASPECTS TO BS EN 14399 PART 1,2,3 & 6:2015.
We hereby certify that all the above results are original from our factories actual testing and the products have proved to comply with the relevant standard.

Wayne Grealey - Quality Manager
Bapp Group Limited

CE
CERTIFICATION IN ACCORDANCE WITH EN 10204-3.1

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