PRE-LOAD

BOLT ASSEMBLIES HV
BS EN 14399-4:2015

CE

EN14399-1

Cert No:
0038/CPR/4006773/B

BAPP

Group of Companies

Pre-Load Bolt Assemblies HV

BS EN 14399-4:2015

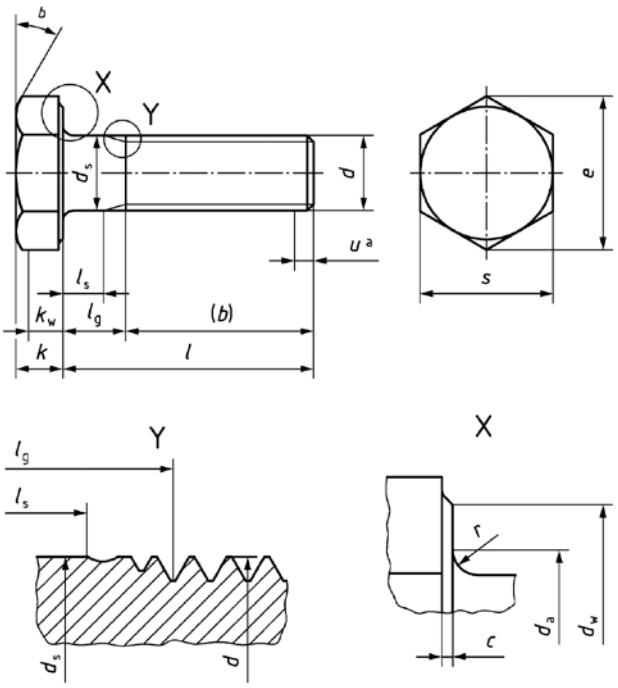
BS EN 14399-4 HV Bolt Dimensions. Class 10.9

Thread *d*	*P*[a]	*b* (ref).	*c*		d_a	d_s			d_w		*e*	*k*			k_w	*r*	*s*	
			min.	max.	max.	nom.	min.	max.	min.	max.	min.	nom.	min.	max.	min.	min.	max.	min.
M12	1.75	23	0.4	0.6	15.2	12	11.30	12.70	20.1		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	[b]	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] $d_{w\,max} = s_{actual}$

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* + 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.

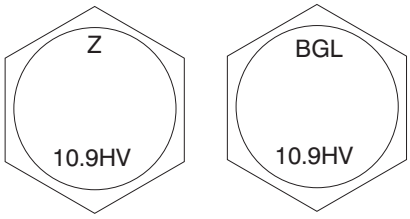
[a] The tolerance class specified applies to bolts without or before any coating. Hot-dip galvanized bolts are intended for assembly with nuts tapped oversize to 6AZ.
[b] Attention is drawn to the need to consider the risk of hydrogen embrittlement in the case of bolts of property class 10.9, when selecting 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.



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

Key
a incomplete thread u ≤ 2P
b 15° to 30°

BS EN 14399-4 HV Head Marking



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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 d	P[a]	d_a		d_w		e	m		m_w	s	
		max.	min.	max.	min.	min.	max.	min.	min.	max.	min.
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] $d_{w\,max} = s_{actual}$

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 ≥ 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.

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 $\sum t$ [a]	$\Delta\Theta_1$ min.
$\sum t < 2\,d$	90°
$2\,d \le \sum t < 6\,d$	120°
$6\,d \le \sum t \le 10\,d$	150°
[a] $\sum t$ 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 $f_{ub} \times$ As 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 $\sum t$ [a]	$\Delta\Theta_2$ min.
$\sum t < 2\,d$	180°
$2\,d \le \sum t < 6\,d$	210°
$6\,d \le \sum t \le 10\,d$	240°
[a] $\sum t$ 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 ≤ k_i ≤ 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:

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

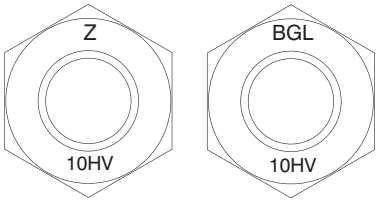
where
M_i is the individual value of the applied torque;
$F_{p,C}$ is the required preload;
d is the nominal bolt diameter.
The coefficient of variation of the *k*-factor (V_k) shall be calculated as follows:

$$V_k = \frac{S_k}{k_m}$$

where S_k is the standard deviation $\left(S_k = \sqrt{\frac{\sum (K_i - K_m)^2}{n - 1}} \right)$

When k_m and V_k the following values apply:
0,10 ≤ k_m ≤ 0,23
V_k ≤ 0,06

BS EN 14399-4 HV Nut Marking



Pre-Load Bolt Washers

BS EN 14399-5:2015 / BS EN 14399-6:2015

BS EN 14399-5 Washer Dimensions (Hardened)						
Nominal Size of Bolt or Screw	Inside Diameter d_1		Outside Diameter d_2		Thickness h	
	max.	min.	max.	min.	max.	min.
M12	13.27	13.00	24.00	23.48	3.3	2.7
M16	17.27	17.00	30.00	29.48	4.3	3.7
M20	21.33	21.00	37.00	36.38	4.3	3.7
M22	23.33	23.00	39.00	38.38	4.3	3.7
M24	25.33	25.00	44.00	43.38	4.3	3.7
M27	28.52	28.00	50.00	49.00	5.6	4.4
M30	31.62	31.00	56.00	54.80	5.6	4.4
M36	37.62	37.00	66.00	64.80	6.6	5.4

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

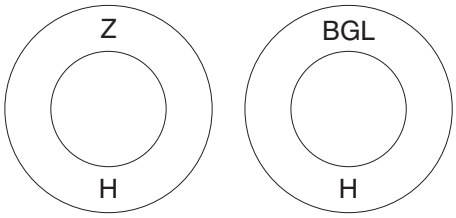
Material		**Steel**
General requirements		BS EN 14399-1 and BS EN 14399-2
Mechanical properties	Hardness range	300 HV to 370 HV
Tolerances	Product grade	A
	European Standard	BS EN ISO 4759-3
Finish - Coating[a]	Uncoated	as processed[b]
	Hot dip galvanized	BS EN ISO 10684
	Others	to be agreed[c]
Workmanship		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.

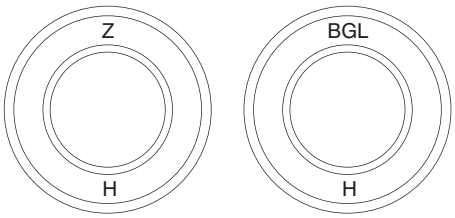
[b] "As processed" means the normal finish resulting from heat treatment with a light coating of oil.

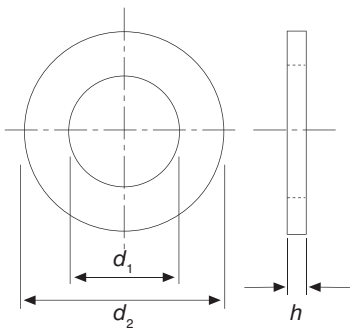
[c] Other coatings may be negotiated between the purchaser and the manufacturer provided they do not impair the mechanical properties or the functional characteristics. Coatings of cadmium or cadmium alloys are not permitted.

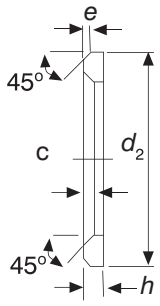
BS EN 14399-5 Washer Marking

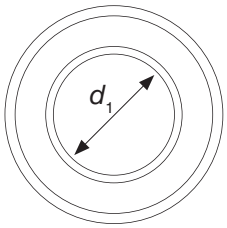


BS EN 14399-6 Washer Marking









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