



Pre-Load Assemblies Comparison Guide

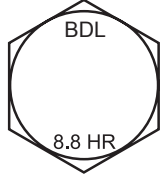



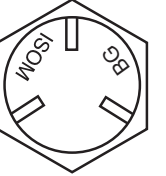






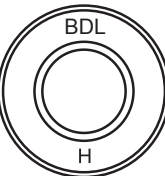
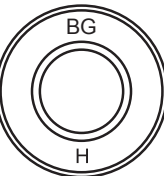


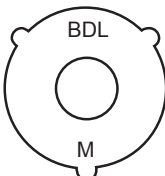
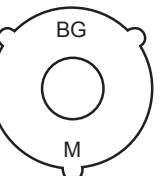






BS EN 14399 | BS 4395



BAPP
Group of Companies

Introduction

BS 4395 (Specification for high strength friction grip bolts and associated nuts and washers for structural engineering) has been replaced by BS EN 14399 (High strength structural bolting assemblies for preloading). BS 4395 has three parts and BS EN 14399 has ten parts.

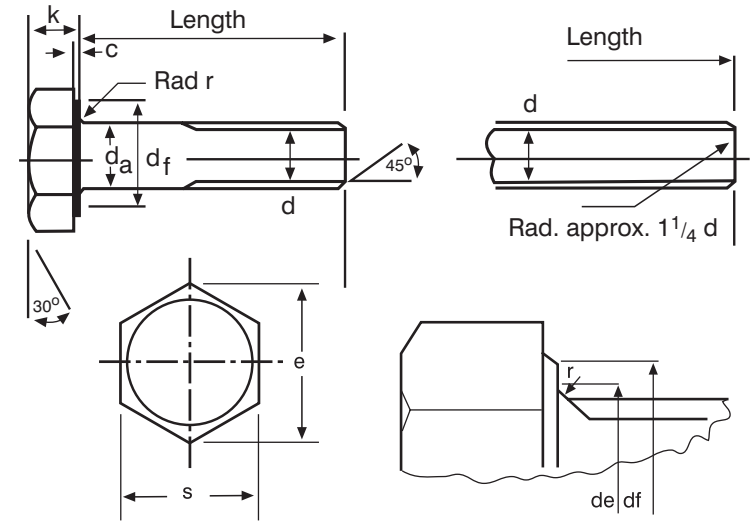
Standard	Description Markings	BS EN 14399 8.8 HR			Standard	Description Markings	BS 4395 PT1	
BS EN 14399 PT 1	General requirements				BS 4395 PT 1	General Grade		
BS EN 14399 PT 2	Suitability test for preloading				BS 4395 PT 2	Higher grade bolts and nuts and general grade washers		
BS EN 14399 PT 3	System HR. Hexagon bolt and nut assemblies				BS 4395 PT 3	Higher grade bolts (waisted shank), nuts and general grade washers		
BS EN 14399 PT 4	System HV. Hexagon bolt and nut assemblies							
BS EN 14399 PT 5	Plain washers							
BS EN 14399 PT 6	Plain chamfered washers							
BS EN 14399 PT 7	System HR. Countersunk head bolt and nut assemblies							
BS EN 14399 PT 8	System HV. Hexagon fit bolt and nut assemblies							
BS EN 14399 PT 9	Direct Tension Indicators							
BS EN 14399 PT 10	Tension Control Bolts and Nut Assemblies HRC 10.9							

BS EN 14399 require an impact test at -20°C and a suitability test as per BS EN 14399-2

Bolt Dimensions BS EN 14399 Part 3

BS EN 14399 Bolt Dimensions

Nominal size and thread diameter d	Pitch of thread p (coarse pitch series)	Diameter of unthreaded shank d_a		Width across flats s		Width across corners e	Diameter of washer face d_f	Depth of washer face c		Radius under head r	Transition diameter d_e	Thickness of head k	
		max.	min.	max.	min.	min.	min.	max.	min.	min.	max.	max.	min.
M12	1.75	12.70	11.30	22.00	21.16	23.91	20.10	0.8	0.4	1.2	15.20	7.95	7.05
M16	2.00	16.70	15.30	27.00	26.16	29.56	24.90	0.8	0.4	1.2	19.20	10.75	9.25
M20	2.50	20.84	19.16	32.00	31.00	35.03	29.50	0.8	0.4	1.5	24.40	13.40	11.60
M22	2.50	22.84	21.16	36.00	35.00	39.55	33.30	0.8	0.4	1.5	26.40	14.90	13.10
M24	3.00	24.84	23.16	41.00	40.00	45.20	38.00	0.8	0.4	1.5	28.40	15.90	14.10
M27	3.00	27.84	26.16	46.00	45.00	50.85	42.80	0.8	0.4	2.0	32.40	17.90	16.10
M30	3.50	30.84	29.16	50.00	49.00	55.37	46.60	0.8	0.4	2.0	35.40	19.75	17.65
M36	4.00	37.00	35.00	60.00	58.80	66.44	55.90	0.8	0.4	2.0	42.40	23.55	21.45



Bolt Mechanical Properties of BS EN 14399

Bolt thread Dia	Stress Area A_s mm ²	Proof Load min. kN	Ultimate Load min. kN	Hardness Rockwell HRC	
				min.	max.
M12	84.30	50.70	70.00	23	34
M16	157.0	94.50	130.0	23	34
M20	245.0	147.0	203.0	23	34
M22	303.0	182.0	252.0	23	34
M24	353.0	212.0	293.0	23	34
M27	459.0	275.0	381.0	23	34
M30	561.0	337.0	466.0	23	34
M36	817.0	490.0	678.0	23	34

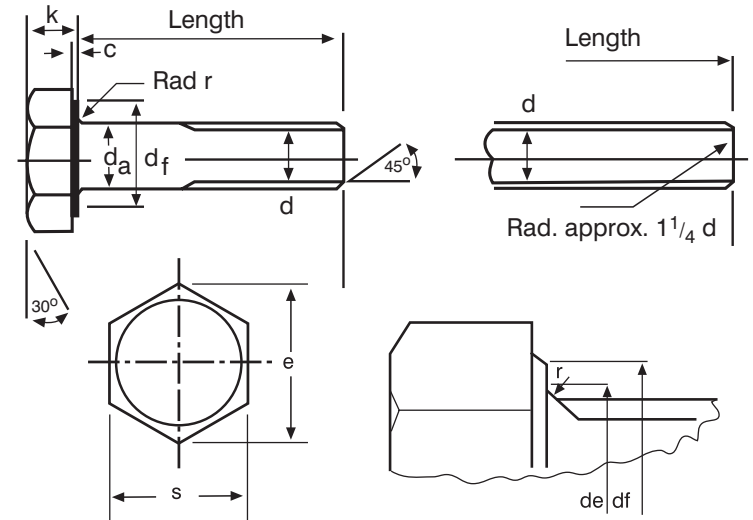
BS EN 14399 Head Marking



Bolt Dimensions BS 4395:1969

BS 4395 Bolt Dimensions

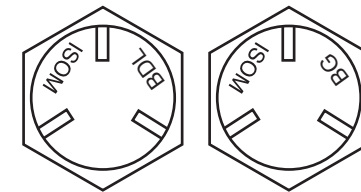
Nominal size and thread diameter d	Pitch of thread p (coarse pitch series)	Diameter of unthreaded shank d_a		Width across flats s		Width across corners e	Diameter of washer face d_f	Depth of washer face c	Radius under head r	Transition diameter d_e	Thickness of head k	
		max.	min.	max.	min.	min.	min.	max.	min.	max.	max.	min.
M12	1.75	12.70	11.30	22	21.16	23.70	19.91	0.4	0.6	14.7	8.45	7.55
M16	2.0	16.70	15.30	27	26.16	29.30	24.91	0.4	0.6	18.7	10.45	9.55
M20	2.5	20.84	19.16	32	31.00	35.03	29.75	0.4	0.8	23.24	13.90	12.10
M22	2.5	22.84	21.16	36	35.00	39.55	33.75	0.4	0.8	25.24	14.90	13.10
M24	3.0	24.84	23.16	41	40.00	45.20	38.75	0.5	0.8	27.24	15.90	14.10
M27	3.0	27.84	26.16	46	45.00	50.85	43.75	0.5	1.0	30.84	17.90	16.10
M30	3.5	30.84	29.16	50	49.00	55.37	47.75	0.5	1.0	33.84	20.05	17.95
M36	4.0	37.0	35.00	60	58.80	66.44	57.75	0.5	1.0	40.00	24.05	21.95



Bolt Mechanical Properties of BS 4395

Bolt thread Dia	Stress Area	Proof Load min.	Ultimate Load min.	Hardness Rockwell HRC	
	mm ²	kN	kN	min.	max.
M12	84.30	49.40	69.60	25.00	34.00
M16	157.0	92.10	130.0	25.00	34.00
M20	245.0	144.0	203.0	25.00	34.00
M22	303.0	177.0	250.0	25.00	34.00
M24	353.0	207.0	292.0	25.00	34.00
M27	459.0	234.0	333.0	19.00	30.00
M30	561.0	286.0	406.0	19.00	30.00
M36	817.0	418.0	591.0	19.00	30.00

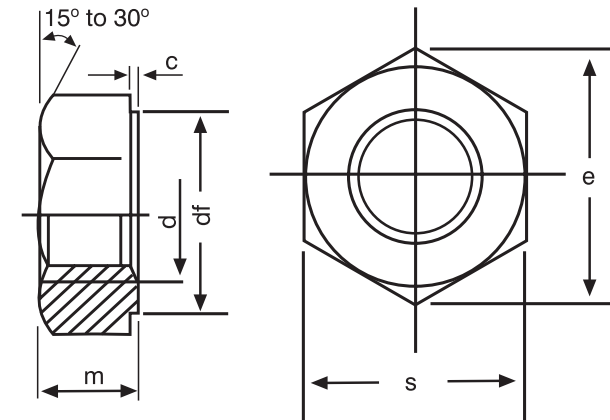
BS 4395 Head Marking



Nut Dimensions BS EN 14399 Part 3

Dimensions of BS EN 14399 Nuts

Nominal size and thread diameter <i>d</i>	Pitch of thread <i>p</i>	Width across flats <i>s</i>		Width across corners <i>e</i>	Diameter of washer <i>d_f</i>	Depth of washer face <i>c</i>	Thickness of nut <i>m</i>	
	(Coarse pitch series)	max.	min.	min.	min.	max.	max.	min.
M12	1.75	22.00	21.16	23.91	20.10	0.8	10.80	10.37
M16	2.00	27.00	26.16	29.56	24.90	0.8	14.80	14.10
M20	2.50	32.00	31.00	35.03	29.50	0.8	18.00	16.90
M22	2.50	36.00	35.00	39.55	33.30	0.8	19.40	18.10
M24	3.00	41.00	40.00	45.20	38.00	0.8	21.50	20.20
M27	3.00	46.00	45.00	50.85	42.80	0.8	23.80	22.50
M30	3.50	50.00	49.00	55.37	46.60	0.8	25.60	24.30
M36	4.00	60.00	58.80	66.44	55.90	0.8	31.00	29.40

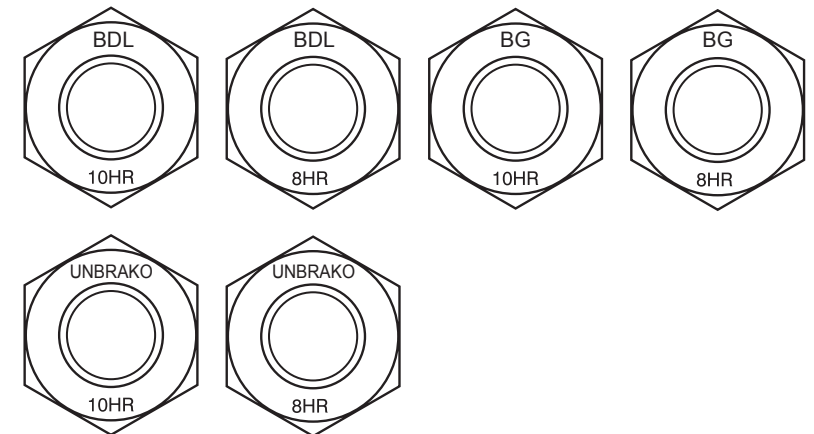


BS EN 14399 Proof load values of property classes 8 & 10 nuts

Nut thread Dia	Stress Area Test Mandrel mm ²	Property Class	
		8	10
		Tolerance class 1) 6H or 2) 6AZ	Tolerance class 1) 6H or 2) 6AZ
		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

1) 6H is the tolerance class for self colour & Zinc Plated nuts
 2) 6AZ is the tolerance class for hot dip galvanized nuts.

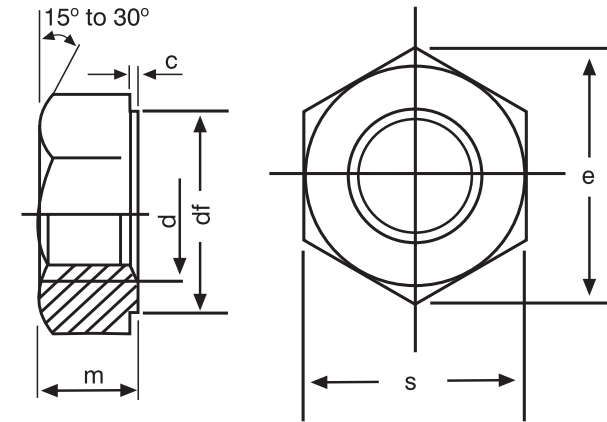
BS EN 14399 Nut Marking



Nut Dimensions BS 4395:1969

Dimensions of BS 4395 Nuts

Nominal size and thread diameter d	Pitch of thread p (Coarse pitch series)	Width across flats s		Width across corners e	Diameter of washer d_f	Depth of washer face c	Thickness of nut m	
		max.	min.				max.	min.
M12	1.75	22.00	21.16	25.40	19.91	0.4	11.55	10.45
M16	2.00	27.00	26.16	31.20	24.91	0.4	15.55	14.45
M20	2.50	32.00	31.00	36.90	29.75	0.4	18.55	17.45
M22	2.50	36.00	35.00	41.60	33.75	0.4	19.65	18.35
M24	3.00	41.00	40.00	47.30	38.75	0.5	22.65	21.35
M27	3.00	46.00	45.00	53.10	43.75	0.5	24.65	23.35
M30	3.50	50.00	49.00	57.70	47.75	0.5	26.65	25.35
M36	4.00	60.00	58.80	69.30	57.75	0.5	31.80	30.20

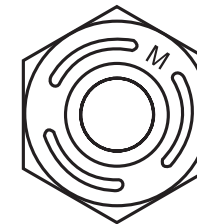


BS 4395 Part 1 Proof Load Values of Nuts

Nut thread Dia	Stress Area Test Mandrel mm ²	Part 1
		Tolerance class 1) 6H or 2) 6AZ Proof Load kN
M12	84.30	84.30
M16	157.0	157.0
M20	245.0	245.0
M22	303.0	303.0
M24	353.0	353.0
M27	459.0	459.0
M30	561.0	561.0
M36	817.0	817.0

1) 6H is the tolerance class for self colour & Zinc Plated nuts
2) 6AZ is the tolerance class for hot dip galvanized nuts.

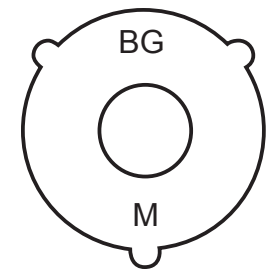
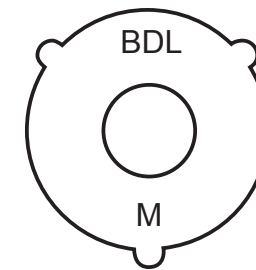
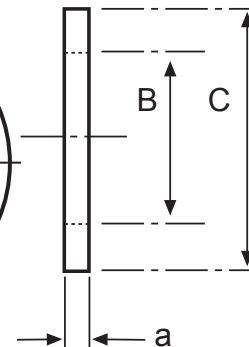
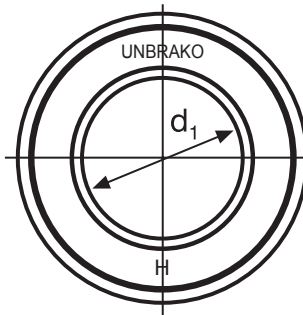
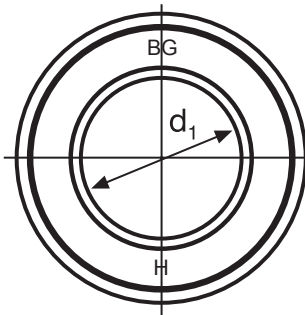
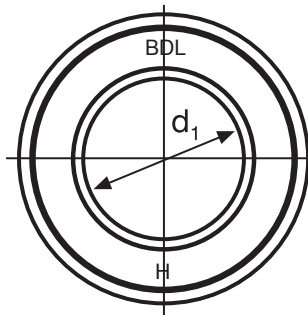
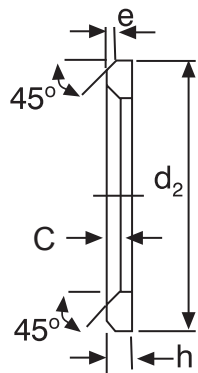
BS 4395 Nut Marking



Washer Dimensions BS EN 14399 Part 5 & 6

Nominal size of bolt or screw	BS EN 14399 Parts 5 & 6									
	Inside Diameter d1		Outside Diameter d2		Thickness h		External Chamfer e		Internal Chamfer c	
	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
M12	13.00	13.27	23.48	24.00	2.7	3.3	0.50	1.00	1.6	1.9
M16	17.00	17.27	29.48	30.00	3.7	4.3	0.75	1.50	1.6	1.9
M20	21.00	21.33	36.38	37.00	3.7	4.3	0.75	1.50	2.0	2.5
M22	23.00	23.33	38.38	39.00	3.7	4.3	0.75	1.50	2.0	2.5
M24	25.00	25.33	43.38	44.00	3.7	4.3	0.75	1.50	2.0	2.5
M27	28.00	28.52	49.00	50.00	4.4	5.6	1.00	2.00	2.5	3.0
M30	31.00	31.62	54.80	56.00	4.4	5.6	1.00	2.00	2.5	3.0
M36	37.00	37.62	64.80	66.00	5.4	6.6	1.25	2.50	2.5	3.0

Hardness Required 300 - 370 HV



Washer Dimensions BS 4395:1969

Nominal size of bolt or screw	BS 4395:1969					
	Inside Diameter B		Outside Diameter C		Thickness a	
	max.	min.	max.	min.	max.	min.
M12	13.8	13.4	30	29	2.8	2.4
M16	17.8	17.4	37	36	3.4	3.0
M20	21.5	21.1	44	43	3.7	3.3
M22	23.4	23.0	50	48.5	4.2	3.8
M24	26.4	26.0	56	54.5	4.2	3.8
M27	29.4	29.0	60	58.5	4.2	3.8
M30	32.8	32.4	66	64.5	4.2	3.8
M36	38.8	38.4	85	83.5	4.6	4.2

Hardness Required Rockwell C 38 to 45 HRC