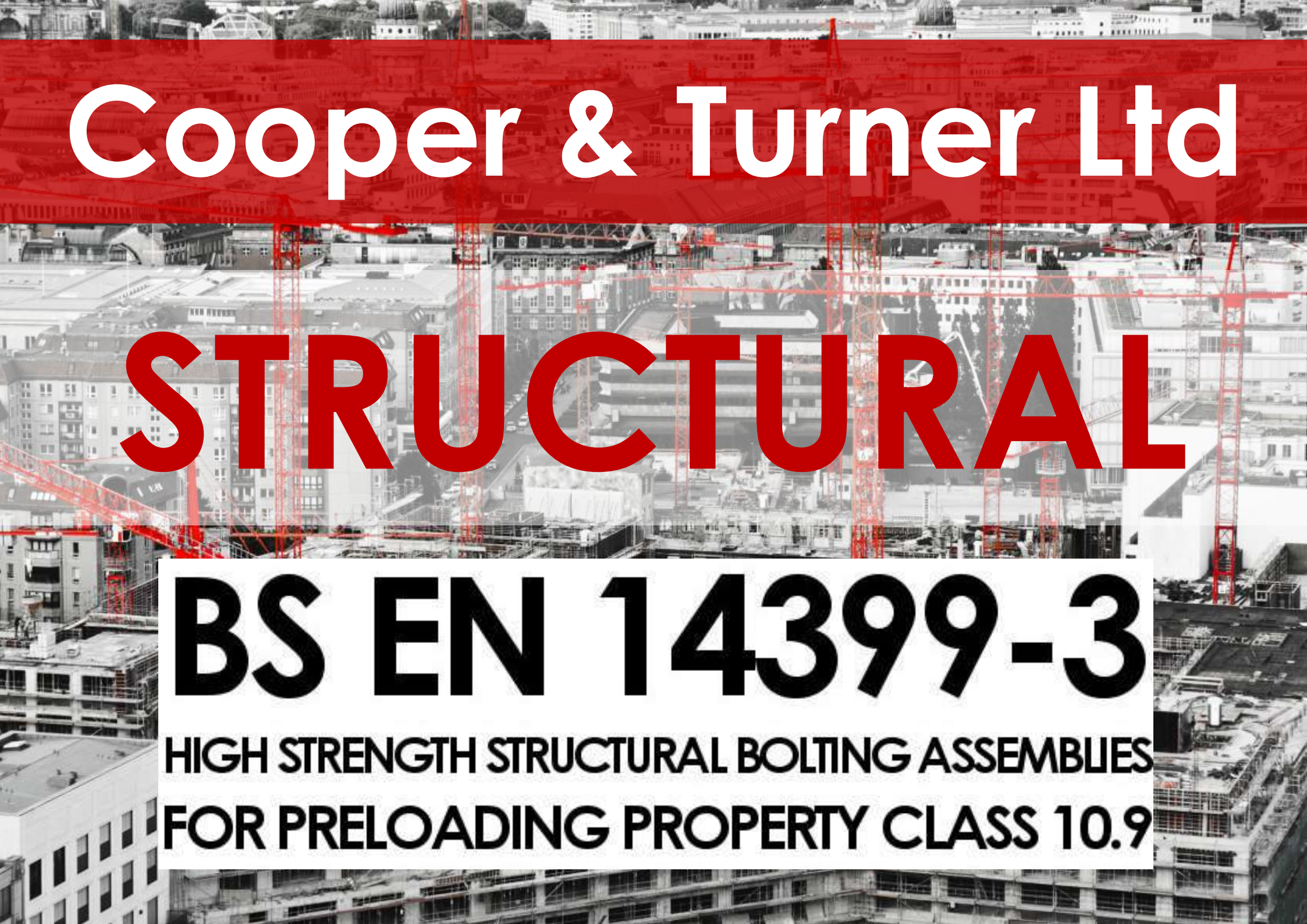

Cooper & Turner Ltd
STRUCTURAL
BS EN 14399-3
HIGH STRENGTH STRUCTURAL BOLTING ASSEMBLIES
FOR PRELOADING PROPERTY CLASS 10.9

BOLT PROPERTY CLASS 10.9

Issue: 2
Date: 30/01/2015
Approved: M.R.Tiddy
Page 1 of 9

BS EN 14399-3 BOLT DIMENSIONS

Thread *d*		M16	M20	M22[2]	M24	M27[2]	M30	M36
P pitch of thread		2	2.5	2.5	3	3	3.5	4
b	Bolt ≤125	38	46	50	54	60	66	78
	Bolt >125 ≤200	44	52	56	60	66	72	84
	Bolt › 200	-	65	69	73	79	85	97
c	max.	0.8	0.8	0.8	0.8	0.8	0.8	0.8
	min.	0.4	0.4	0.4	0.4	0.4	0.4	0.4
da	max.	19.2	24.4	26.4	28.4	32.4	35.4	42.4
ds	max.	16.70	20.84	22.84	24.84	27.84	30.84	37.00
	min.	15.30	19.16	21.16	23.16	26.16	29.16	35.00
dw[1]	min.	24.9	29.5	33.3	38.0	42.8	46.6	55.9
e	min.	29.56	35.03	39.55	45.20	50.85	55.37	66.44
k	max.	10.75	13.40	14.90	15.90	17.90	19.75	23.55
	min.	9.25	11.60	13.10	14.10	16.10	17.65	21.45
r	min.	1.2	1.5	1.5	1.5	2.0	2.0	2.0
s	max.	27	32	36	41	46	50	60
	min.	26.16	31	35	40	45	49	58.8

[1] The maximum value of ***dw*** shall not exceed the actual width across flats

[2] Non-preferred sizes. Can only be supplied if the quantity required is sufficient to warrant manufacture.

Dimensions are in millimetres and apply prior to any coating.

CHARACTERISTIC		STANDARD
General Requirements		BS EN 14399-1
Materials & Manufacture		BS EN ISO 898-1 Property Class 10.9
Finish / Coatings	Self Colour/Black	BS EN 14399-3 - as processed
	Hot Dip Galvanized	BS EN ISO 10684
Mechanical Properties		BS EN 14399-3, BS EN ISO 898-1 10.9
Dimensions & Tolerances		BS EN 14399-3
Threads		ISO 261, ISO 965-2 tolerance 6g
Product Marking		BS EN 14399-3

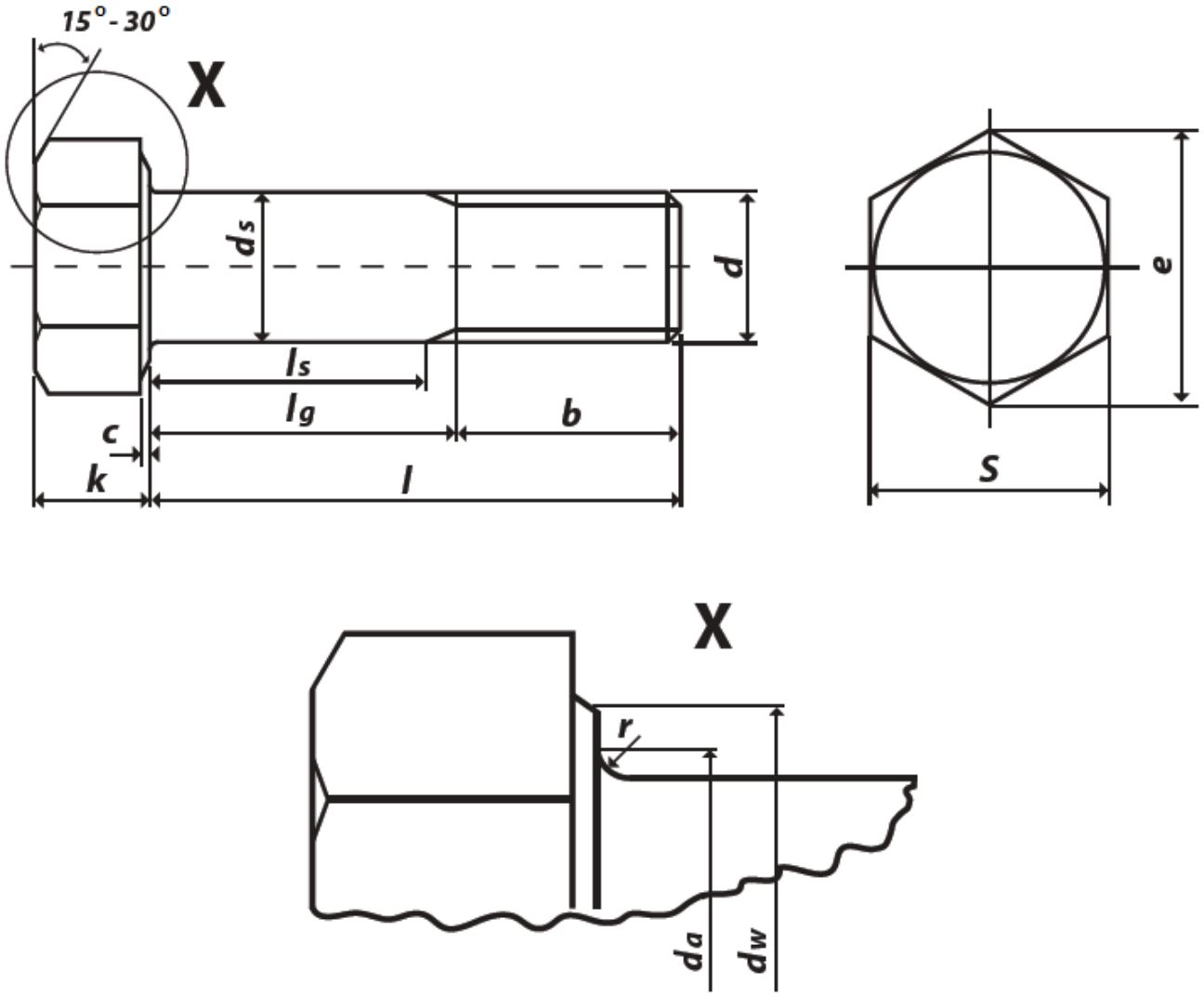
IMPORTANT NOTE

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.**

Cooper & Turner BS EN 14399-3 HR preload assemblies are supplied in accordance with *k* class K0 this means that C&T EN 14399-3 preload assemblies should only be installed using Direct Tension Indicators (DTI's). "CE" marking can only be supplied if the whole assembly (bolt, nut, washer(s) and DTI) is purchased.

BOLT PROPERTY CLASS 10.9



BS EN 14399-3 HEAD MARKING

BS EN 14399-3 MECHANICAL PROPERTIES OF PROPERTY CLASS 10.9 BOLTS

Bolt Thread Diameter	Stress Area	Proof Load min.	Ultimate Load min.	Hardness Rockwell HRC	
	mm²	kN	kN	min.	max.
M16	157	130	163	32	39
M20	245	203	255	32	39
M22	303	252	315	32	39
M24	353	293	367	32	39
M27	459	381	477	32	39
M30	561	466	583	32	39
M36	817	678	850	32	39

This drawing shows part threaded bolts and represents all those that appear below the stepped line in the Table on Page 3, however, some of the shorter bolts are fully threaded – See footnote [2] in the Table on Page 3

BOLT PROPERTY CLASS 10.9

BS EN 14399-3 BOLT LENGTH AND THREAD TOLERANCES

Thread d			M16		M20		M22[1]		M24		M27[1]		M30		M36	
l			ls min.	lg max.	ls min.	lg max.	ls min.	lg max.	ls min.	lg max.	ls min.	lg max.	ls min.	lg max.	ls min.	lg max.
nom.	min.	max.														
40	38.75	41.25	FT [2]	FT [2]												
45	43.75	46.25	FT [2]	FT [2]												
50	48.75	51.25	8 [2]	11 [2]	FT [2]	FT [2]	FT [2]	FT [2]								
55	53.5	56.5	8 [2]	11 [2]	FT [2]	FT [2]	FT [2]	FT [2]								
60	58.5	61.5	12	22	10 [2]	14 [2]	FT [2]	FT [2]	FT [2]	FT [2]	FT [2]	FT [2]				
65	63.5	66.5	17	27	10 [2]	14 [2]	11 [2]	15 [2]	FT [2]	FT [2]	FT [2]	FT [2]				
70	68.5	71.5	22	32	11.5	24	11 [2]	15 [2]	12 [2]	17 [2]	FT [2]	FT [2]	FT [2]	FT [2]		
75	73.5	76.5	27	37	16.5	29	12.5	25	12 [2]	17 [2]	FT [2]	FT [2]	FT [2]	FT [2]		
80	78.5	81.5	32	42	21.5	34	17.5	30	12 [2]	17 [2]	13.5 [2]	19.5 [2]	FT [2]	FT [2]		
85	83.25	86.75	37	47	26.5	39	22.5	35	16	31	13.5 [2]	19.5 [2]	15 [2]	24 [2]	FT [2]	FT [2]
90	88.25	91.75	42	52	31.5	44	27.5	40	21	36	15	30	15 [2]	24 [2]	FT [2]	FT [2]
95	93.25	96.75	47	57	36.5	49	32.5	45	26	41	20	35	15 [2]	24 [2]	18 [2]	26 [2]
100	98.25	101.75	52	62	41.5	54	37.5	50	31	46	25	40	16.5	34	18 [2]	26 [2]
110	108.25	111.75	62	72	51.5	64	47.5	60	41	56	35	50	26.5	44	18 [2]	26 [2]
120	118.25	121.75	72	82	61.5	74	57.5	70	51	66	45	60	36.5	54	22	42
130	128	132	76	86	65.5	78	61.5	74	55	70	49	64	40.5	58	26	46
140	138	142	86	96	75.5	88	71.5	84	65	80	59	74	50.5	68	36	56
150	148	152	96	106	85.5	98	81.5	94	75	90	69	84	60.5	78	46	66
160	156	164	106	116	95.5	108	91.5	104	85	100	79	94	70.5	88	56	76
170	166	174							95	110	89	104	80.5	98	66	86
180	176	184							105	120	99	114	90.5	108	76	96
190	186	194							115	130	109	124	100.5	118	86	106
200	196	204							125	140	119	134	110.5	128	96	116

[1] Non-preferred sizes. Can only be supplied if the quantity required is sufficient to warrant manufacture.

[2] Bolts shown above the stepped line have sufficient thread to meet the requirements of EN 1090-2. FT indicates fully threaded and in the near future all bolts above the stepped line will be manufactured fully threaded

Dimensions are in millimetres and apply prior to any coating

NUT PROPERTY CLASS 10

BS EN 14399-3 NUT DIMENSIONS

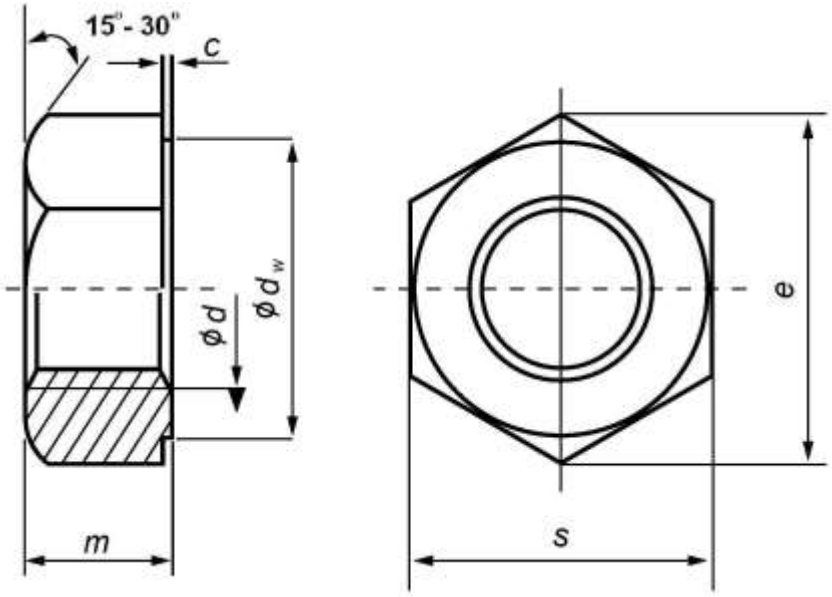
Thread size ***d***		**M16**	**M20**	**M22**[2)]	**M24**	**M27**[2)]	**M30**	**M36**
P pitch of thread		2	2.5	2.5	3	3	3.5	4
c	max.	0.8	0.8	0.8	0.8	0.8	0.8	0.8
	min.	0.4	0.4	0.4	0.4	0.4	0.4	0.4
dw[1)]	min.	24.9	29.5	33.3	38.0	42.8	46.6	55.9
e	min.	29.56	35.03	39.55	45.20	50.85	55.37	66.44
m	max.	14.8	18	19.4	21.5	23.8	25.6	31
	min.	14.1	16.9	18.1	20.2	22.5	24.3	29.4
s	max	27	32	36	41	46	50	60
	min.	26.16	31	35	40	45	49	58.8

[1)] The maximum value of ***dw*** shall not exceed the actual width across flats

[2)] Non-preferred sizes.

Dimensions are in millimetres and apply prior to any coating

CHARACTERISTIC		STANDARD
General Requirements		BS EN 14399-1
Materials & Manufacture		BS EN ISO 898-2 Property Class 10
Finish / Coatings	Self Colour / Black	BS EN 14399-3 as processed
	Hot Dip Galvanized	BS EN ISO 10684
Mechanical Properties		BS EN 14399-3 BS EN ISO 898-2 Property Class 10
Dimensions & Tolerances		BS EN 14399-3
Threads		ISO 261 ISO 965-2 tolerance class 6H or 6AZ
Product Marking		BS EN 14399-3



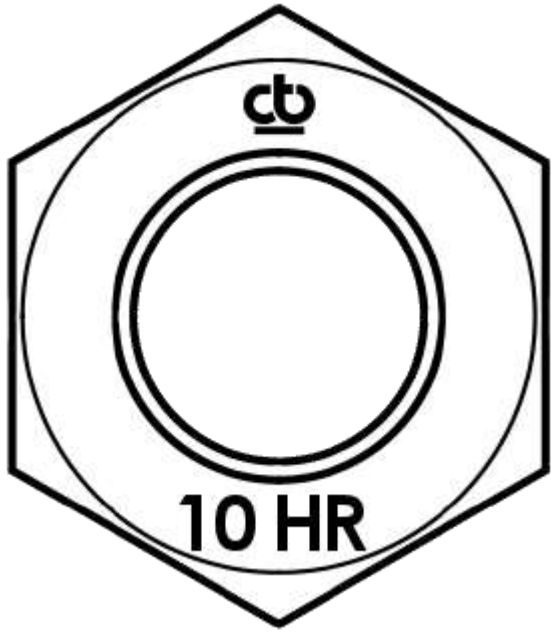
NUT PROPERTY CLASS 10

BS EN 14399-3 PROOF LOAD VALUES OF PROPERTY CLASS 10 NUTS

Nut thread diameter	Stress Area Test Mandrel	Tolerance Class 6H[1] or 6AZ[1]
	mm²	Proof Load kN
M16	157	182.1
M20	245	284.2
M22	303	351.2
M24	353	409.5
M27	459	532.4
M30	561	650.8
M36	817	947.7

[1] 6H is the tolerance class for self colour nuts and 6AZ is the tolerance class for hot dipped galvanized nuts.

BS EN 14399-3 NUT MARKING



WASHER CHAMFERED

BS EN 14399-6 CHAMFERED WASHER DIMENSIONS

Nominal size *d*[1]		M16	M20	M22[2]	M24	M27[2]	M30	M36
d1	min.	17	21	23	25	28	31	37
	max.	17.27	21.33	23.33	25.33	28.52	31.62	37.62
d2	min.	29.48	36.38	38.38	43.38	49	54.80	64.80
	max.	30	37	39	44	50	56	66
h	nom.	4	4	4	4	5	5	6
	min.	3.7	3.7	3.7	3.7	4.4	4.4	5.4
	max.	4.3	4.3	4.3	4.3	5.6	5.6	6.6
e	nom.=min.	0.75	0.75	0.75	0.75	1	1	1.25
	max.	1.50	1.50	1.50	1.50	2	2	2.50
c	min.	1.6	2.0	2.0	2.0	2.5	2.5	2.5
	max.	1.9	2.5	2.5	2.5	3.0	3.0	3.0

[1] Nominal thread diameter of associated bolts

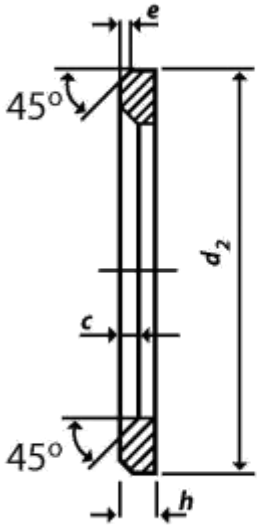
[2] Non-preferred sizes.

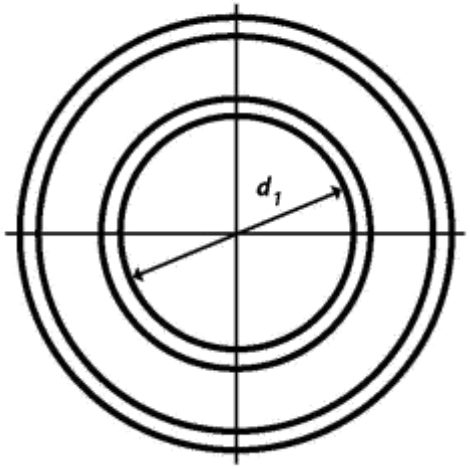
Dimensions are in millimetres and apply prior to any coating

CHARACTERISTIC		STANDARD
General Requirements		BS EN 14399-1
Finish / Coatings	Self Colour / Black	BS EN 14399-6 – as processed
	Hot Dip Galvanized	BS EN ISO 10684
Mechanical Properties		BS EN 14399-6
Dimensions & Tolerances		BS EN 14399-6
Product Marking		BS EN 14399-6

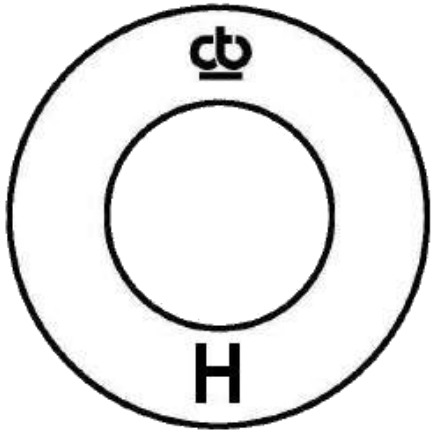
BS EN 14399-6 MECHANICAL PROPERTIES OF CHAMFERED WASHERS

Nominal Size	Vickers Hardness (HV)	
	min.	max.
M16 to **M36** inclusive	300	370





BS EN 14399-6 WASHER MARKING



DIRECT TENSION INDICATORS (DTI's) DESIGNATION H10

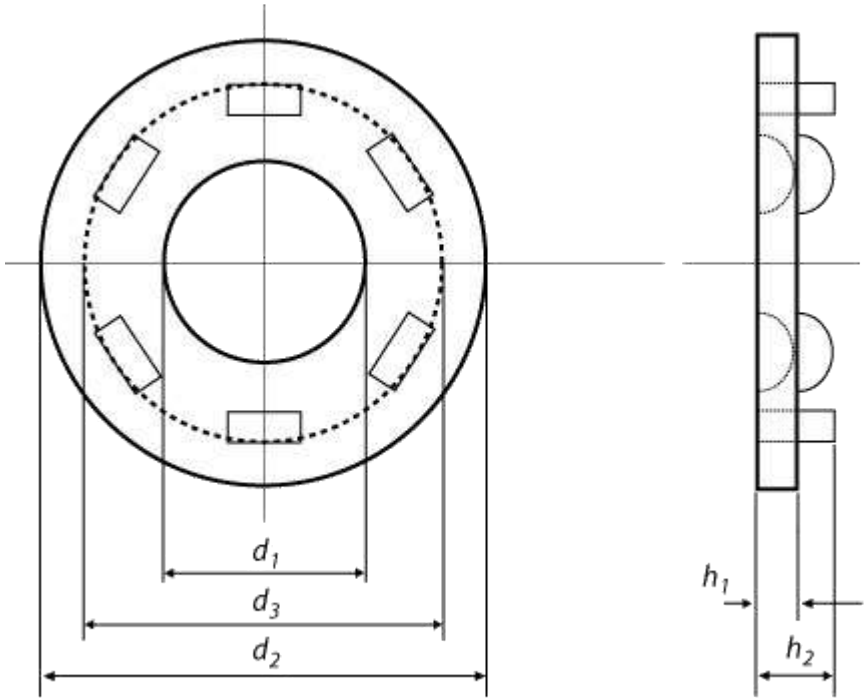
BS EN 14399-9 DIRECT TENSION INDICATOR DIMENSIONS

Nominal size d[1]		M16	M20	M22[2]	M24	M27[2]	M30	M36
d_1	max.	16.85	21.05	23.15	25.25	28.40	31.55	37.85
d_2	max.	36.8	46.0	50.6	55.2	62.1	69.0	83.0
d_3	max.	25	29	33	38	43	46.5	56
h_1	min.	3.0	3.5	4.0	4.0	4.0	4.0	4.0
h_2	max.	6.0	6.5	7.0	7.0	7.0	7.0	7.5

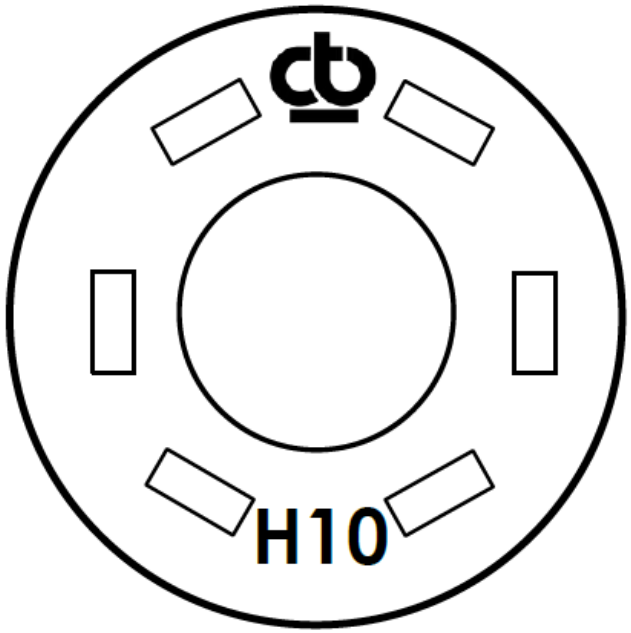
[1] Nominal thread diameter of associated bolt
[2] Non-preferred sizes.
Dimensions are in millimetres and apply prior to any coating

CHARACTERISTIC		STANDARD
General Requirements		BS EN 14399-1
Finish / Coatings[1]	Self Colour / Black	BS EN 14399-9 – as processed
	Mechanically Galvanized	BS 7371-7 / ASTM B695 Class 50
Mechanical Properties		BS EN 14399-9 Designation H10
Dimensions & Tolerances		BS EN 14399-9
Product Marking		BS EN 14399-9

[1] All stocks of DTI's are mechanically galvanized.



BS EN 14399-9 DTI MARKING



Note: This is a schematic representation of the protrusions and other forms including curved may be used

NUT FACE WASHERS

BS EN 14399-9 NUT FACE WASHERS

Nominal size *d*[1]		M16	M20	M22[2]	M24	M27[2]	M30	M36
d_1	min.	16.1	20.1	22.3	24.2	27.2	30.2	36.2
	max.	16.35	20.40	22.60	24.5	27.55	30.55	36.55
d_2	min.	27.7	34.4	37.4	41.4	46.4	50.1	60.1
	max.	29	36	39	43	48	52	62
h	min.	3.7	3.7	3.7	3.7	4.4	4.4	5.4
	max.	4.3	4.3	4.3	4.3	5.6	5.6	6.6

[1] Nominal thread diameter of associated bolt

[2] Non-preferred sizes.

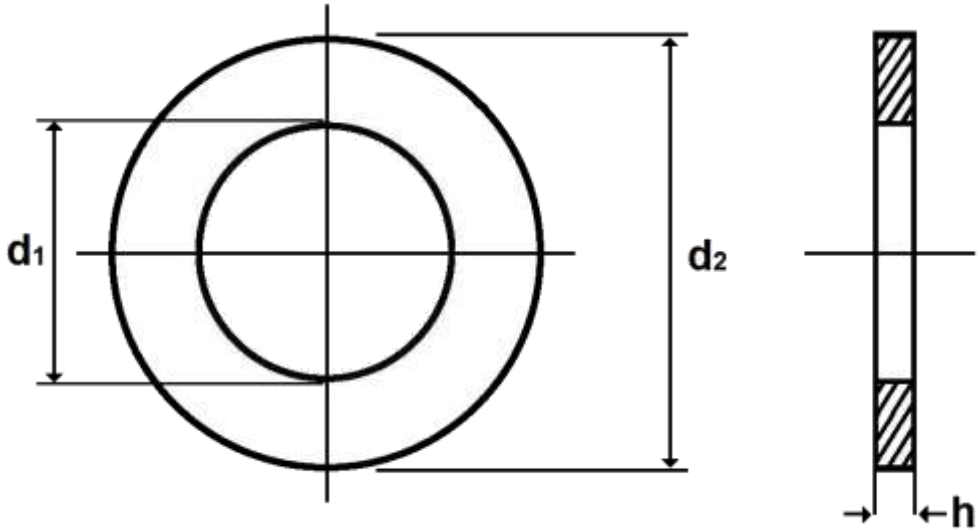
Dimensions are in millimetres and apply prior to any coating

CHARACTERISTIC		STANDARD
General Requirements		BS EN 14399-1
Finish / Coatings[1]	Self Colour / Black	BS EN 14399-9 - as processed
	Sherardized	BS 7371 - 8
Mechanical Properties		BS EN 14399-9
Dimensions & Tolerances		BS EN 14399-9
Product Marking		BS EN 14399-9

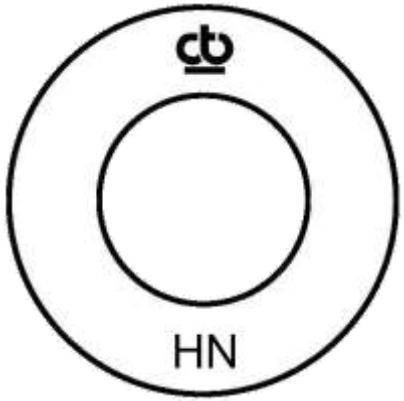
[1] All stocks of nut face washers are sherardized

BS EN 14399-9 MECHANICAL PROPERTIES OF NUT FACE WASHERS

Nominal Size	Vickers Hardness (HV30)		Rockwell Hardness (HRC)	
	min.	max.	min.	max.
M16 to **M30** inclusive	372	448	38	45

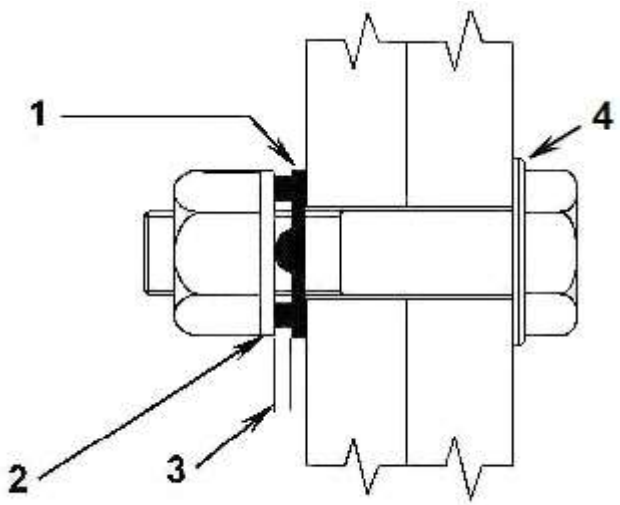


BS EN 14399-9 NUT FACE WASHER MARKING



BS EN 14399-3 PC 10.9 ASSEMBLIES WITH DIRECT TENSION INDICATORS H10

Assembly configuration for EN 14399-3 Property Class 10.9 with DTI fitted under the nut – Tightened by nut rotation



KEY

1. Direct Tension Indicator
2. Nut face washer according to EN 14399-9
3. Gap
4. Washer according to EN 14399-6

When the Direct Tension Indicators are installed in accordance with Cooper & Turner's instructions then the shank tension achieved will be in the range shown below.

Nominal bolt diameter	Shank Tension kN	
	H10 for 10.9	
	min	max
M16	110	132
M20	172	206
M22[1)]	212	254
M24	247	296
M27[1)]	321	385
M30	393	472
M36	572	688

[1)] Non – preferred sizes. Can only be supplied if the quantity required is sufficient to warrant manufacture.

Further information is contained in the sheet entitled 'Use of High Strength Structural Bolting Assemblies for Preloading BS EN 14399–3 PC 10.9 Hex with Direct Tension Indicators (DTI's)' which is available on our website.