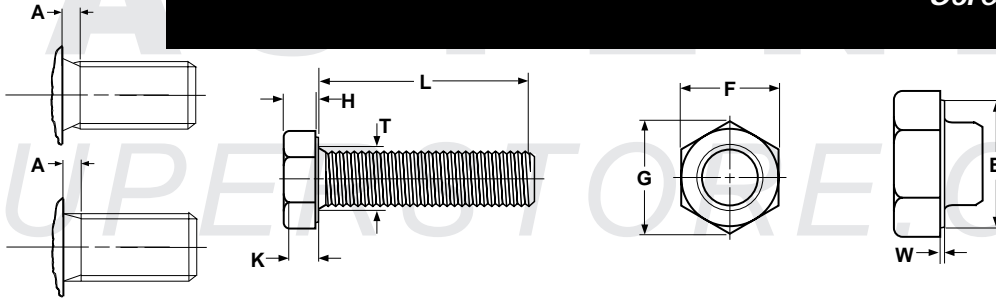


# Cap Screws & Bolts

## METRIC

### Full Thread Hex Cap Screws Grade-A & B



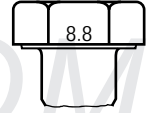
METRIC - HEX HEAD CAP SCREWS, FULL THREAD, PRODUCT GRADE A													ISO 4017	
Nominal Size	Thread Pitch	A		W		T	E		H		F		G	K
		Thread Run-Out		Washer Face Thickness		Fillet Transition Diameter	Washer Face Diameter		Head Height		Width Across Flats		Width Across Corners	Wrenching Height
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Min	Min	
M1.6	0.35	1.05	0.35	0.25	0.1	2	2.27	1.225	0.975	3.2	3.02	3.41	0.68	
M2	0.4	1.2	0.4	0.25	0.1	2.6	3.07	1.525	1.275	4	3.82	4.32	0.89	
M2.5	0.45	1.35	0.45	0.25	0.1	3.1	4.07	1.825	1.575	5	4.82	5.45	1.1	
M3	0.5	1.5	0.5	0.4	0.15	3.6	4.57	2.125	1.875	5.5	5.32	6.01	1.31	
M4	0.7	2.1	0.7	0.4	0.15	4.7	6.03	2.925	2.675	7	6.78	7.66	1.87	
M5	0.8	2.4	0.8	0.5	0.15	5.7	6.88	3.65	3.35	8	7.78	8.79	2.35	
M6	1	3	1	0.5	0.15	6.8	8.88	4.15	3.85	10	9.78	11.05	2.7	
M8	1.25	4	1.25	0.6	0.15	9.2	11.63	5.45	5.15	13	12.73	14.38	3.61	
M10	1.5	4.5	1.5	0.6	0.15	11.2	14.63	6.58	6.22	16*	15.73	17.77	4.35	
M12	1.75	5.3	1.75	0.6	0.15	13.7	16.63	7.68	7.32	18*	17.73	20.03	5.12	
M14	2	6	2	0.6	0.15	15.7	19.37	8.98	8.62	21*	20.67	23.36	6.03	
M16	2	6	2	0.8	0.2	17.7	22.49	10.18	9.82	24	23.67	26.75	6.87	
M20	2.5	7.5	2.5	0.8	0.2	22.4	28.19	12.715	12.285	30	29.67	33.53	8.6	
M24	3	9	3	0.8	0.2	26.4	33.61	15.215	14.785	36	35.38	39.98	10.35	
Tolerance on Length		2-3mm: ±0.2				4-6mm: ±0.24				8-10mm: ±0.29				
		12-16mm: ±0.35				20-30mm: ±0.42				35-50mm: ±0.5				
		55-80mm: ±0.6				90-120: ±0.7				130-150mm: ±0.8				

\*DIN 933 spec for maximum width across flats on these three diameters are 17, 19 & 22 mm, respectively.

METRIC - HEX HEAD CAP SCREWS, PRODUCT GRADE B													ISO 4017		
Nominal Size	Thread Pitch	A		W		T	E		H		F		G	K	
		Thread Run-Out		Washer Face Thickness		Fillet Transition Diameter	Washer Face Diameter		Head Height		Width Across Flats		Width Across Corners	Wrenching Height	
		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Min	Min		
M16	2	6	2	0.8	0.2	17.7	22	10.29	9.71	24	23.16	26.17	6.8		
M20	2.5	7.5	2.5	0.8	0.2	22.4	27.7	12.85	12.15	30	29.16	32.95	8.51		
M24	3	9	3	0.8	0.2	26.4	33.25	15.35	14.65	36	35	39.55	10.26		
M30	3.5	10.5	3.5	0.8	0.2	33.4	42.75	19.12	18.28	46	45	50.85	12.8		
M36	4	12	4	0.8	0.2	39.4	51.11	22.92	22.08	55	53.8	60.79	15.46		
M42	4.5	13.5	4.5	1	0.3	45.6	59.95	26.42	25.58	65	63.1	71.3	17.91		
M48	5	15	5	1	0.3	52.6	69.45	30.42	29.58	75	73.1	82.6	20.71		
M56	5.5	16.5	5.5	1	0.3	63	78.66	35.5	34.5	85	82.8	93.56	24.15		
M64	6	18	6	1	0.3	71	88.16	40.5	39.5	95	92.8	104.86	27.65		
Tolerance on Length		60-80mm: ±1.5				90-120mm: ±1.75				130-180mm: ±2.0				200mm: ±2.3	



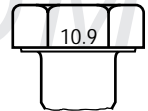
**CLASS 8.8 FULL-THREAD CAP SCREWS**



<b>Description</b>	A cap screw with metric thread pitch, threaded to the head, made from medium carbon steel and heat-treated. Grade-A bolts are the preferred style for most applications. Grade-B bolts have looser tolerances and can be manufactured in a cold or hot-forging process.
<b>Applications/ Advantages</b>	Has greater tensile strength than Class 4.6, 4.8 and 5.8 cap screws. Being threaded to the head makes the part useful for mounting motors to machinery. They are also used in automotive and truck repair.
<b>Material</b>	Class 8.8 cap screws can be made from a carbon steel with additives (such as Boron, Manganese or Chromium) which conforms to the following chemical composition-- <i>Carbon</i> : 0.15-0.40%; <i>Phosphorus</i> : 0.035% maximum; <i>Sulfur</i> : 0.035% maximum. In case of plain carbon boron alloyed steel with a carbon content of less than 0.25% (ladle analysis), the minimum <i>Manganese</i> content shall be 0.6%
	Class 8.8 cap screws can be made from a carbon steel which conforms to the following chemical composition-- <i>Carbon</i> : 0.25-0.55%; <i>Phosphorus</i> : 0.035% maximum; <i>Sulfur</i> : 0.035% maximum.
<b>Heat Treatment</b>	Class 8.8 cap screws shall be heat treated by quenching in a liquid medium from above the transformation temperature and reheating to a tempering temperature of 425°C.
<b>Core Hardness</b>	<b>For diameters less than or equal to 16mm:</b> Rockwell C22 - 32 (Vickers HV 250 - 320) <b>For diameters greater than 16mm:</b> Rockwell C23 - 34 (Vickers HV 255 - 335)
<b>Surface Hardness</b>	Shall not be more than 30 Vickers points above the measured core hardness on the product
<b>Proof Load</b>	<b>For diameters less than or equal to 16mm:</b> 640 N/mm <sup>2</sup> minimum <b>For diameters greater than 16mm:</b> 660 N/mm <sup>2</sup> minimum
<b>Tensile Strength</b>	<b>For diameters less than or equal to 16mm:</b> 800 N/mm <sup>2</sup> minimum <b>For diameters greater than 16mm:</b> 830 N/mm <sup>2</sup> minimum
<b>Elongation</b>	12% minimum
<b>Plating</b>	See Appendix-A for plating information



**CLASS 10.9 FULL-THREAD CAP SCREWS**



<b>Description</b>	A cap screw with metric thread pitch, threaded to the head, made from medium carbon alloy steel and heat-treated. Grade-A bolts are the preferred style for most applications. Grade-B bolts have looser tolerances and can be manufactured in a cold or hot-forging process.
<b>Applications/ Advantages</b>	Has greater tensile strength than Class 8.8 full-thread cap screws. Is most comparable but not exactly equivalent to U.S. Grade 8 cap screws.
<b>Material</b>	Class 10.9 cap screws can be made from a carbon steel which conforms to the following chemical composition-- <i>Carbon</i> : 0.25-0.55%; <i>Phosphorus</i> : 0.035% maximum; <i>Sulfur</i> : 0.035% maximum.
	Class 10.9 cap screws can be made from a low carbon martensite steel with additives (such as Boron, Manganese or Chromium) which conforms to the following chemical composition-- <i>Carbon</i> : 0.20-0.55%; <i>Phosphorus</i> : 0.035% maximum; <i>Sulfur</i> : 0.035% maximum. In case of plain carbon boron alloyed steel with a carbon content of less than 0.25% (ladle analysis), the minimum <i>Manganese</i> content shall be 0.7%
	Class 10.9 cap screws can be made from an alloy steel which conforms to the following chemical composition-- <i>Carbon</i> : 0.20-0.55%; <i>Phosphorus</i> : 0.035% maximum; <i>Sulfur</i> : 0.035% maximum; and shall contain one or more of the following elements: <i>Chromium</i> , <i>Nickel</i> , <i>Molybdenum</i> or <i>Vanadium</i>
<b>Heat Treatment</b>	Class 10.9 cap screws shall be heat treated by quenching in oil from above the transformation temperature and reheating to a tempering temperature of 425°C.
<b>Core Hardness</b>	Rockwell C32 - 39 (Vickers HV 320 - 380)
<b>Surface Hardness</b>	Shall not be more than 30 Vickers points above the measured core hardness on the product
<b>Proof Load</b>	940 N/mm <sup>2</sup> minimum
<b>Tensile Strength</b>	1040 N/mm <sup>2</sup> minimum
<b>Elongation</b>	9% minimum
<b>Plating</b>	See Appendix-A for plating information