

SUBJECT: HEX CAP SCREWS – UNF SERIES, GRADE 5, PLATED

1.0 SCOPE AND PURPOSE. This Material and Process Specification encompasses dimensional data and material specifications for hexagon cap screws, UNF series, grade 5, plated.

2.0 USE OF THIS SPECIFICATION. Hex cap screws shall conform to this M&PS when this M&PS is referenced on the drawing or on the purchase order.

3.0 SOURCE REFERENCE. AGCO's Hesston Operations standards committee is responsible for the content of this specification. The following

documents are referenced either directly or indirectly in this specification:

ASME B1.1 – 2003 (R2008) Unified Inch Screw Threads
ASME B18.2.1 – 2010 Hex Cap Screws (Inch Series)
SAE J429 – 1999-01 Mechanical and Material Requirements for Externally Threaded Fasteners

4.0 DIMENSIONS OF HEX CAP SCREWS. All dimensions are inches. See Table 1.

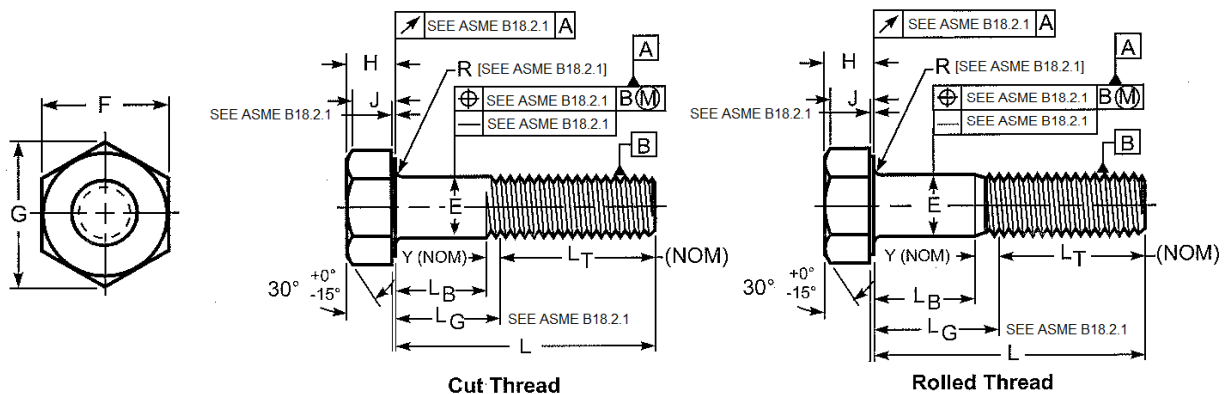


Table 1 Dimensions of Hex Cap Screws

Nominal Size or Basic Ø	E		F		G		H		J	L _T		Y
	Body Ø		Width Across Flats		Width Across Corners		Head Height		Wrenching Height	Thread Length for Screw Lengths		Transition Thread Length
	Max	Min	Max	Min	Max	Min	Max	Min	Min	≤6	>6	Ref
1/4	0.2500	0.2450	0.438	0.428	0.505	0.488	0.163	0.150	0.106	0.750	1.000	0.250
5/16	0.3125	0.3065	0.500	0.489	0.577	0.557	0.211	0.195	0.140	0.875	1.125	0.278
3/8	0.3750	0.3690	0.562	0.551	0.650	0.628	0.243	0.226	0.160	1.000	1.250	0.312
7/16	0.4375	0.4305	0.625	0.612	0.722	0.698	0.291	0.272	0.195	1.125	1.375	0.357
1/2	0.5000	0.4930	0.750	0.736	0.866	0.840	0.323	0.302	0.215	1.250	1.500	0.385
9/16	0.5625	0.5545	0.812	0.798	0.938	0.910	0.371	0.348	0.250	1.375	1.625	0.417
5/8	0.625	0.617	0.938	0.922	1.083	1.051	0.403	0.378	0.269	1.500	1.750	0.455
3/4	0.750	0.741	1.125	1.100	1.299	1.254	0.483	0.455	0.324	1.750	2.000	0.500
7/8	0.875	0.866	1.312	1.285	1.516	1.465	0.563	0.531	0.378	2.000	2.250	0.556
1	1.000	0.990	1.500	1.469	1.732	1.675	0.627	0.591	0.416	2.250	2.500	0.625
1-1/8	1.125	1.114	1.688	1.631	1.949	1.859	0.718	0.658	0.461	2.500	2.750	0.714
1-1/4	1.250	1.239	1.875	1.812	2.165	2.066	0.813	0.749	0.530	2.750	3.000	0.714
1-3/8	1.375	1.363	2.062	1.994	2.382	2.273	0.878	0.810	0.569	3.000	3.250	0.833
1-1/2	1.500	1.488	2.250	2.175	2.598	2.480	0.974	0.902	0.640	3.250	3.500	0.833

AGCO Non-preferred Sizes

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5.0 MATERIAL. Hex cap screws shall be manufactured from steel conforming to SAE J429 Grades 5. Grade 5.2 may be substituted when grade 5 is specified. See Table 2.

Table 2 Chemical Composition Requirements

Grade	Material	Treatment	Element, %						
			C		Mn	P	S	B	
			Min	Max				Min	Max
5	Medium carbon steel	Quenched and tempered	0.28	0.55	--	0.025	0.025	--	--
	Carbon steel with additives		0.15	0.40				0.0005	0.003
5.2*	Low carbon boron steel			0.25	0.74				

*Applicable to sizes 1/4 thru 1

6.0 MECHANICAL PROPERTIES. Hex cap screws shall meet the mechanical requirements specified by SAE J429. See Table 3.

Table 3 Mechanical Requirements

Grade	Nominal Size	Proof Load (Stress), psi	Tensile Strength (Stress), Min, psi	Core Hardness	
				Min	Max
5	1/4 thru 1	85,000	120,000	25HRC	34HRC
	>1 thru 1-1/2	74,000	105,000	19HRC	30HRC
5.2	1/4 thru 1	85,000	120,000	26HRC	36HRC

7.0 HEAD. Top of head shall be full form and chamfered, with the diameter of chamfer circle being equal to the maximum width across flats within a tolerance of minus 15%.

8.0 WASHER FACE. Thickness of washer face shall be not less than 0.015 in. or greater than 0.025 in. for screw sizes 3/4 in. and smaller, and not less than 0.015 in. or greater than 0.035 in. for screws larger than 3/4 in. The washer face

diameter shall be equal to the maximum width across flats with a tolerance of minus 10%. Measurement of the washer face diameter shall be taken 0.004 in. below the bearing surface plane toward the head of the screw. Die seams are not allowed on the washer faces of screws. The runout of the washer face with respect to the axis of the body shall conform to ASME B18.2.1.

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9.0 Fillet. The fillet at the junction of the head and shank shall conform to ASME B18.2.1.

10.0 THREADS. Threads shall conform to ASME B1.1, UNF-2A as specified. Threads shall be right hand unless otherwise specified. For plated screws, the maximum diameter of class 2A may be exceeded by the amount of the allowance.

11.0 THREAD LENGTH. The length of thread on screws shall be controlled by the grip gaging length, L_G , max, and the body length, L_B , min. as set forth in ASME B18.2.1. Two measurements that can be used for criteria for inspection are:

$$L_G, \text{ max} = L_{\text{NOM}} - L_T$$

$$L_B, \text{ min} = L_G, \text{ max} - Y$$

See Table 4 for values for preferred lengths.

Table 4. Values for L_G and L_B for Preferred Sizes

Nominal Length, L	Nominal ϕ and Threads per Inch													
	1/4-28		5/16-24		3/8-24		1/2-20		5/8-18		3/4-16		1-12	
	L_G Max	L_B Min	L_G Max	L_B Min	L_G Max	L_B Min	L_G Max	L_B Min	L_G Max	L_B Min	L_G Max	L_B Min	L_G Max	L_B Min
1/2														
3/4														
1	0.089	0.043												
1-1/4	0.50	0.25												
1-1/2	0.75	0.50	0.62	0.35	0.50	0.19								
1-3/4	1.00	0.75	0.88	0.60	0.75	0.44								
2	1.25	1.00	1.12	0.85	1.00	0.69	0.75	0.38						
2-1/4	1.50	1.25	1.38	1.10	1.25	0.94	1.00	0.62	0.75	0.30				
2-1/2	1.75	1.50	1.62	1.35	1.50	1.19	1.25	0.86	1.00	0.55				
2-3/4	2.00	1.75	1.88	1.60	1.75	1.44	1.50	1.12	1.25	0.80	1.00	0.50		
3	2.25	2.00	2.12	1.85	2.00	1.69	1.75	1.36	1.50	1.05	1.25	0.75		
3-1/4	2.50	2.25	2.38	2.10	2.25	1.94	2.00	1.62	1.75	1.30	1.50	1.00	1.00	0.38
3-1/2	2.75	2.50	2.63	2.21	2.50	2.19	2.25	1.86	2.00	1.55	1.75	1.25	1.25	0.62
3-3/4	3.00	2.75	2.88	2.60	2.75	2.44	2.50	2.12	2.25	1.80	2.00	1.50	1.50	0.88
4	3.25	3.00	3.12	2.85	3.00	2.69	2.75	2.36	2.50	2.05	2.25	1.75	1.75	1.12
Threaded full length. See M&PS 705100617.														

12.0 SCREW LENGTH TOLERANCE. Screw length tolerances shall be as given in Table 5.

Table 5. Screw Length Tolerances

Nominal Length, L, in	Nominal Size				
	1/4 to 3/8	7/16 & 1/2	9/16 to 3/4	7/8 & 1	1-1/8 to 1-1/2
1 ≤ L	+0.00				
	-0.03				
1 < L ≤ 2-1/2	+0.00				
	-0.04	-0.06	-0.08	-0.10	-0.12
2-1/2 < L ≤ 4	+0.00				
	-0.06	-0.08	-0.10	-0.14	-0.16
4 < L ≤ 6	+0.00				
	-0.10			-0.16	-0.18
L > 6	+0.00				
	-0.18			-0.20	-0.22

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13.0 POINTS. Hex cap screws are required to have a chamfered point. The chamfer angle may vary depending on the manufacturing process. The presence of a point is to reduce the possibility of damage to the leading threads and promote the assemble ability with a tapped hole or nut.

14.0 IDENTIFICATION MARKINGS. Screws, shall have grade identification markings on the head in conformance to SAE J429.



15.0 FINISH. Items furnished to this specification shall be as specified on the drawing, the most common being a dip spin zinc rich inorganic coating as specified in Material & Process Specification 705100300.

16.0 DEFECTS. Screws shall be free from burrs, seams, laps, loose scale, irregular surfaces and any defects affecting their serviceability.

17.0 PROOF LOAD AND TENSILE STRENGTH. See Table 6.

Table 6 Proof Load and Tensile Strength

Nominal Ø and Threads per Inch	Stress Area, in ²	Grade 5 and 5.2	
		Proof Load, lb	Tensile Strength Min, lb
Fine Thread Series - UNF			
1/4-28	0.0364	3 100	4 350
5/16-24	0.0580	4 900	6 950
3/8-24	0.0878	7 450	10 500
7/16-20	0.1187	10 100	14 200
1/2-20	0.1599	13 600	19 200
9/16-18	0.203	17 300	24 400
5/8-18	0.256	21 800	30 700
3/4-16	0.373	31 700	44 800
7/8-14	0.509	43 300	61 100
1-12	0.663	56 400	79 600
1-1/8-12	0.856	63 300	89 900
1-1/4-12	1.073	79 400	112 700
1-3/8-12	1.315	97 300	138 100
1-1/2-12	1.581	117 000	166 000
AGCO non-preferred sizes.			

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18.0 AGCO PART NUMBERS. This list was current/complete at the time this specification was written or revised and may not be current/complete on another date.

HEX CAP SCREWS GRADE 5 UNF-2A PLATED

SCREW LENGTH	NOMINAL Ø and THREADS PER INCH							
	1/4-28	5/16-24	3/8-24	7/16-20	1/2-20	5/8-18	3/4-16	1-12
1	70916401							
1 1/4								
1 1/2	70927929		702571					
1 3/4								
2				7701162	7772874			
2 1/2				7771074	7773047			
2 3/4			8701989					
3								
3 1/4					W908513-4			
3 1/2					8701559			
4								
4 1/2			771402					
5			700722824		773051			
5 1/2								

Threaded full length. See M&PS 7051006??.

AGCO non-preferred

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