FINISHED HEX BOLTS (Hex Cap Screws)

GENERAL SPECIFICATIONS

GENERAL: The Hex Head Bolts in this standard are the same as Finished Hex Head Bolts (Hex Cap Screws) described in ANSI B18.2.1 (latest issue) with Style 1 max/min radius fillet.

Refer to CNH Standard, STPA020, Abbreviations for Fastener Finishes and Material Specifications.

PREFERRED PARTS POLICY: Preferred parts are so designated to reduce variety of parts and assure maximum availability, interchangeability and cost savings in volume buying.

Material and Finish:	Grade 5 Zinc Dichromate (ZND) Grade 8 Phosphate Coated (PHC)
Thread:	Coarse
Diameters:	1/4, 5/16, 3/8, 1/2, 5/8, 3/4, 1, 1-1/4 and 1-1/2
Lengths:	All diameters - 1/4 inch increments thru 4 inches
1/4 and 5/16 dia.	{1/2 inch increments-4 thru 7 inches {1 inch increments - over 7 inches
3/8 thru 1-1/2 dia.	{1/2 inch increments-4 thru 9 inches {1 inch increments - over 9 inches

All preferred lengths beyond the 7 and 9 inch ranges indicated above will be carried in the non-preferred section because of limited usage.

SERVICE PARTS SUBSTITUTION POLICY: In the event that engineering does not indicate a "Do not substitute" in engineering specifications, the following substitutions may be implemented in service.

Hex Head Bolts	
To be replaced	Service Replacement
Grade 2 Phosphate Coating (PHC)	Grade 5 Zinc Dichromate (ZND)
Grade 2 Plain (PLN)	Grade 5 Zinc Dichromate (ZND)
Grade 2 Zinc Dichromate (ZND)	Grade 5 Zinc Dichromate (ZND)
Grade 5 Plain (PLN)	Grade 5 Zinc Dichromate (ZND)
Grade 5 Phosphate Coating (PHC)	Grade 8 Phosphate Coating (PHC)
Grade 8 Plain (PLN)	Grade 8 Phosphate Coating (PHC)

DIMENSIONS: All dimensions in this standard are in inches.

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LENGTH TOLERANCE: Bolts shall be as tabulated in Table 1.

TABLE 1
LENGTH TOLERANCES

Length	Nominal Sizes				
	1/4 - 3/8	7/16 & 1/2	9/16 - 3/4	7/8 & 1-1/8	1-1/8 - 1-1/2
Up to 1 in, incl	-0.03	-0.03	-0.03		
Over 1 in to 2-1/2 in, incl	-0.04	-0.06	-0.08	-0.10	-0.12
Over 2-1/2 in to 4 in, incl	-0.06	-0.08	-0.10	-0.14	-0.16
Over 4 in to 6 in, incl	-0.10	-0.10	-0.10	-0.16	-0.18
Longer than 6 in	-0.18	-0.18	-0.18	-0.20	-0.22

THREADS: Threads shall be Unified Series, Class 2A in accordance with American National Standard B-1.1. Acceptability of screw threads shall be determined based on System 21, ANSI B1.3 Screw Thread Gaging Systems for Dimensional Acceptability. For threads with additive finish, the maximum diameter of Class 2A may be exceeded by the amount of the allowance; that is, the Class 2A maximum diameters apply to an unplated or uncoated part or to a part before plating or coating, whereas the basic diameters (Class 2A maximum diameters plus the allowance) apply to a part after plating or coating.

THREAD LENGTH: The length of thread on bolts shall be controlled by the grip gaging length, L_G max, which is the distance measured parallel to the axis of bolt from the underhead bearing surface to the face of a non-counterbored or non-countersunk standard GO thread ring gage assembled by hand as far as the thread will permit. It shall be used as the criterion for inspection. The maximum grip gaging length, as calculated and rounded to two decimal places for any bolt not threaded full length, shall be equal to the nominal bolt length minus the basic thread length (L_G max = L nom - L_T). For bolts which are threaded full length, L_G max defines the unthreaded length under the head and shall conform to the values listed in Table 2. For the respective nominal bolt lengths, L_G max represents the minimum design grip length of the bolt and shall be used for determining thread availability when selecting bolt lengths even though usable threads may extend beyond this point. Basic thread length L_T is a reference dimension, intended for calculation purposes only, which represents the distance from the extreme end of the bolt to the last complete (full form) thread. Basic thread length equals twice the basic thread diameter plus 0.25 inch for nominal bolt length up to and including 6 inches, and twice the basic thread diameter plus 0.50 inch for nominal lengths over 6 inches.

Body length L_B min is the distance measured parallel to the axis of bolt from the underhead bearing surface to the last scratch of thread or to the top of the extrusion angle. It shall be used as a criterion for inspection. The minimum body length as calculated and rounded to two decimal places shall be equal to the maximum grip gaging length minus the maximum transition thread length (L_B min = L_G max - Y max).

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THREAD LENGTH: (Continued)

Bolts of nominal length which have a calculated L_B min length equal to or shorter than the length of 2.5 times the coarse thread (UNC) pitch (see nominal lengths listed in the fifth column of Table 2) shall be threaded for full length. The length of the underhead fillet of these thread to head bolts shall not be less than L_B max. as defined in note 7 to Table 4 of ANSI B18.2.1.

Transition thread length Y is a reference dimension equal to five coarse (UNC) pitches intended for calculation purposes only, which includes the length of incomplete threads, the extrusion angle on rolled threads, and tolerances on grip length.

TABLE 2
LIMITATIONS FOR PRODUCTS
THREADED FULL LENGTH

Nominal Size	For Nominal Product Lengths (1)	L_G Max (2) Unthreaded Length Under Head	For Nominal Product Lengths		L_G Max (3) Unthreaded Length Under Head	
	Less Than or Equal To	All Thread Series	Greater Than	Less Than or Equal To	Coarse (UNC) Thd	Fine (UNF) Thd
1/4	1/2	0.075	1/2	1.125	0.125	0.089
5/16	5/8	0.083	5/8	1.375	0.139	0.104
3/8	3/4	0.094	3/4	1.500	0.156	0.104
7/16	7/8	0.107	7/8	1.750	0.179	0.125
1/2	1	0.115	1	1.875	0.192	0.125
5/8	1-1/4	0.136	1-1/4	2.250	0.227	0.139
3/4	1-1/2	0.150	1-1/2	2.250	0.250	0.156
7/8	--	--	--	2.875	0.278	0.179
1	--	--	--	3.250	0.312	0.208
1-1/8	--	--	--	3.625	0.357	0.208
1-1/4	--	--	--	3.875	0.357	0.208
1-3/8	--	--	--	4.250	0.417	0.208
1-1/2	--	--	--	4.500	0.417	0.208

NOTE - Tabulated values are equal to:
(1) 2 times the basic product diameter.
(2) 1.5 times the coarse thread (UNC) pitch.
(3) 2.5 times the thread pitch.

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INCOMPLETE THREAD DIAMETER: The major diameter of incomplete threads shall not exceed the actual major diameter of full form threads.

BODY DIAMETER: The diameter of body over the L_B minimum length shall conform to the limits for E given in the Bolt Dimensional table. On screws threaded for full length, the diameter of the unthreaded shank shall not exceed the tabulated E max body diameter nor be less than the specified minimum pitch diameter of the thread.

MATERIAL AND PHYSICAL PROPERTIES: Case Grade 2, 5 and 8 in accordance with Case Engineering Specification ES-B7002, ES-B7005 and ES-B7008 as specified on parts listing.

Grade 8R material shall be in accordance with Case Engineering Specification ES-B7008 providing it is quenched, tempered and roll threaded after heat treatment. Roll threading after heat treatment shall be accomplished in one pass, no rerolling is permitted. Normally, roll threaded after heat treatment bolts are specified for special applications requiring enhanced fatigue resistance. Usage of these bolts is allowed after approval of Materials Engineering. These fasteners are usually associated with severe cost penalties.

Stainless steel (SST) Type 410. This is a magnetic general purpose stainless with good corrosion resistance and excellent strength properties. Stainless steel bolts shall be passivated to ensure a clean surface, free from iron bearing contaminants which cause rusting and adversely effect appearance.

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FINISHES: Bolts shall be furnished plain, plated or coated in accordance with Case Engineering Materials Specification:

Phosphate Coating	(PHC)	- MS 91
Zinc Dichromate	(ZND)	- MS 201
Cadmium	(CAD)	- MS 206 *Not Recommended
PTFE	(PTF)	- MS 61
Black Zinc	(BZN)	- MS 203
Black Cadmium	(BKC)	- MS 208 *Not Recommended
Zinc-Cobalt	(ZCA)	- MS202
Black Zinc-Cobalt	(ZCB)	- MS202

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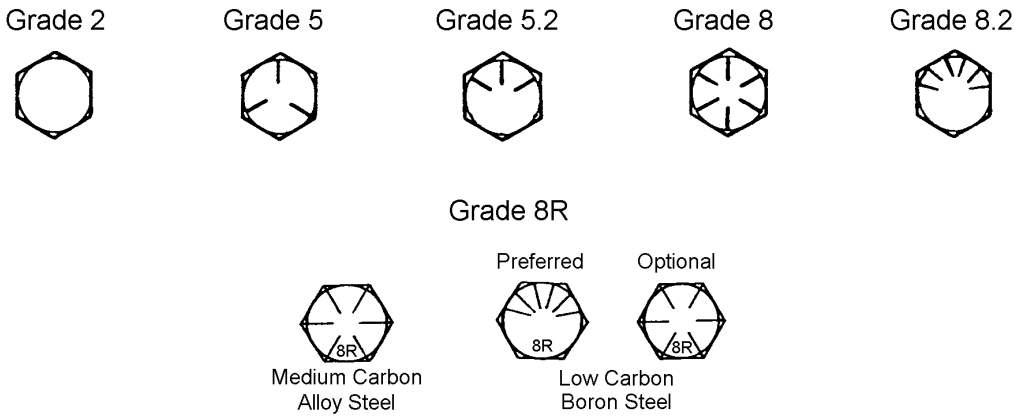
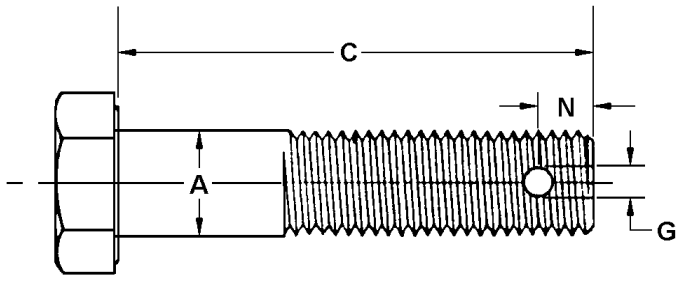
HEAD MARKING: Bolts shall have legible, raised radial head markings to indicate bolt type and a manufacturer's identification symbol recognizable in the trade to indicate source. Marking symbols on the heads for bolt sizes 5/8 inch and smaller shall project not less than .005 inch above surface nor more than .015 inch over the specified maximum head height; and for bolt sizes larger than 5/8 inch shall project not less than the equivalent in inches of .0075 times the basic bolt diameter above the surface nor more than .030 inch over the specified maximum head height.



REQUIREMENTS FOR DRILLED HOLES IN BODY:



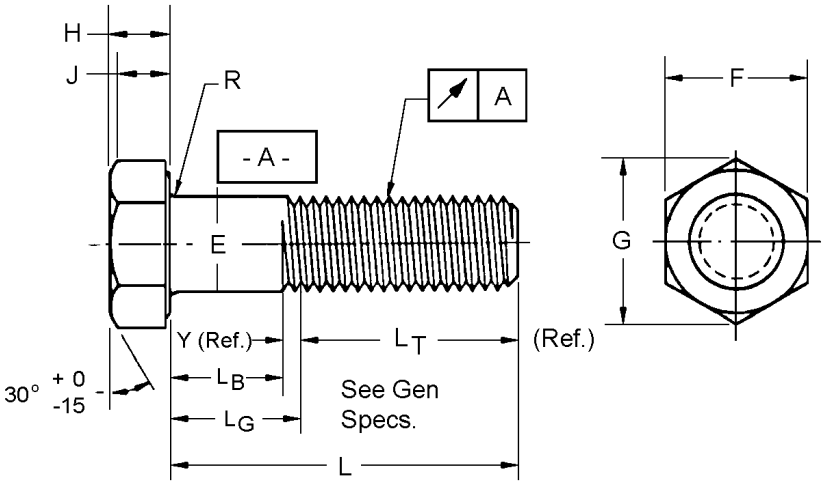
** Drilled holes are to be located from under the head a distance equal to nominal C minus N.

A	N**	G	Cotter Pin Size
1/4	.109	.078	1/16
5/16	.125	.078	1/16
3/8	.156	.125	3/32
7/16	.156	.125	3/32
1/2	.172	.125	3/32
5/8	.188	.156	1/8
3/4	.219	.156	1/8
7/8	.250	.156	1/8
1	.250	.156	1/8

THREAD RUBOUT AND SCREW STRAIGHTNESS: The rubout of the thread in relation to screw body and the shank straightness shall be such that screw will meet the requirements set forth in Appendix I, ANSI B18.2.1, Thread Rubout and Straightness Sleeve Gages and Gaging.

SURFACE DISCONTINUITIES: Allowable limit per SAE J123 and J1061.

FINISHED HEX BOLTS (Hex Cap Screws)



All dimensions are in inches.

Nominal Size	E		F			G		H		
	Body Diameter		Width Across Flats			Width Across Corners		Height		
	max.	min.	Basic	max.	min.	max.	min.	Basic	max.	min.
1/4	.250	.245	7/16	.438	.428	.505	.488	5/32	.163	.150
5/16	.312	.307	½	.500	.489	.577	.557	13/64	.211	.195
3/8	.375	.369	9/16	.562	.551	.650	.628	15/64	.243	.226
* 7/16	.438	.430	5/8	.625	.612	.722	.698	9/32	.291	.272
1/2	.500	.493	3/4	.750	.736	.866	.840	5/16	.323	.302
** 9/16	.562	.554	13/16	.812	.798	.938	.910	23/64	.371	.348
5/8	.625	.617	15/16	.938	.922	1.083	1.051	25/64	.403	.378
3/4	.750	.741	1-1/8	1.125	1.100	1.299	1.254	15/32	.483	.455
* 7/8	.875	.866	1-5/16	1.312	1.285	1.516	1.465	35/64	.563	.531
1	1.000	.990	1-1/2	1.500	1.469	1.732	1.675	39/64	.627	.591
* 1-1/8	1.125	1.114	1-11/16	1.688	1.631	1.949	1.859	11/16	.718	.658
1-1/4	1.250	1.239	1-7/8	1.875	1.812	2.165	2.066	25/32	.813	.749
* 1-3/8	1.375	1.363	2-1/6	2.062	1.994	2.382	2.273	27/32	.878	.810
1-1/2	1.500	1.488	2-1/4	2.250	2.175	2.598	2.480	15/16	.974	.902

* Non-Preferred

** Not Recommended for New Design

Preferred Parts

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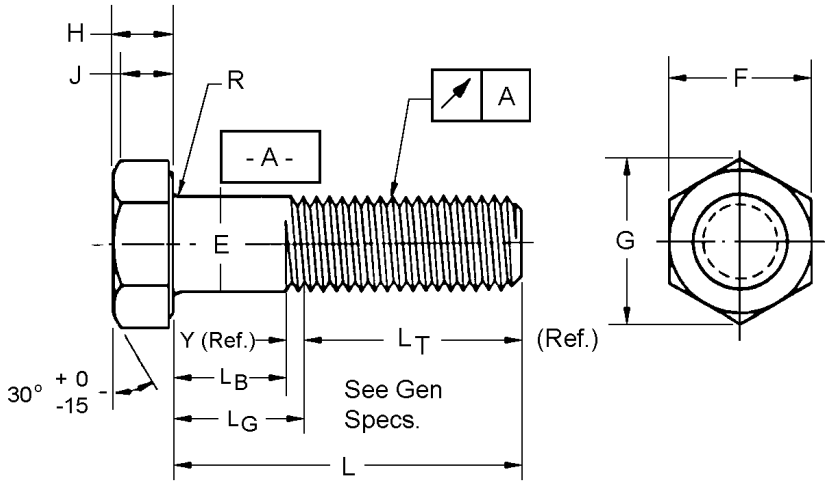


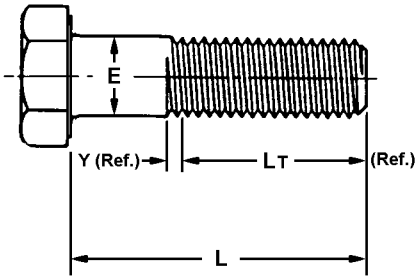
All dimensions are in inches.

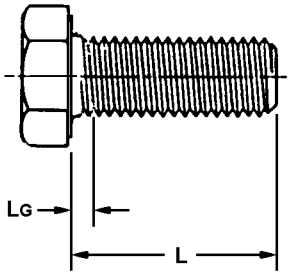
Nominal Size	J	L_T		Y	R	
	Wrenching Height	Thread Length for Screw Lengths		Transition Thread Length	Radius	
		6" & Shorter	Over 6"			
	min.	Basic	Basic	max.	max.	min.
1/4	.106	.750	1.000	.250	.025	.015
5/16	.140	.875	1.125	.278	.025	.015
3/8	.160	1.000	1.250	.312	.025	.015
* 7/16	.195	1.125	1.375	.357	.025	.015
1/2	.215	1.250	1.500	.385	.025	.015
** 9/16	.250	1.375	1.625	.417	.045	.020
5/8	.269	1.500	1.750	.455	.045	.020
3/4	.324	1.750	2.000	.500	.045	.020
* 7/8	.378	2.000	2.250	.556	.065	.040
1	.416	2.250	2.500	.625	.095	.060
*1- 1/8	.461	2.500	2.750	.714	.095	.060
1- 1/4	.530	2.750	3.000	.714	.095	.060
*1- 3/8	.569	3.000	3.250	.833	.095	.060
1- 1/2	.640	3.250	3.500	.833	.095	.060

* Non-Preferred
** Not Recommended for New Design.

FINISHED HEX BOLTS (Hex Cap Screws)

Thread Length of Standard Bolts
Maximum Bolt Length of Standard Thread to Head Bolts





Standard Thread Length				Standard Thread to Head Length		
E	LT		Y	L		LG
Nominal Size	Thread Length for Bolt Lengths		Transition Thread Length	For Nominal Product Lengths		Coarse (UNC)
	6" & Shorter	Over 6"		> Than	# Than	
	Basic	Basic	max.			max.
1/4	.750	1.000	.250	.500	1.125	0.125
5/16	.875	1.125	.278	.625	1.375	0.139
3/8	1.000	1.250	.312	.750	1.500	0.156
7/16 *	1.125	1.375	.357	.875	1.750	0.179
1/2	1.250	1.500	.385	1.000	1.875	0.192
9/16 **	1.375	1.625	.417	1.125	2.000	0.208
5/8	1.500	1.750	.455	1.250	2.250	0.227
3/4	1.750	2.000	.500	1.500	2.250	0.250
7/8 *	2.000	2.250	.556		2.875	0.278
1	2.250	2.500	.625		3.250	0.312
1-1/8 *	2.500	2.750	.714		3.625	0.357
1-1/4	2.750	3.000	.714		3.875	0.357
1-3/8 *	3.000	3.250	.833		4.250	0.417
1-1/2	3.250	3.500	.833		4.500	0.417

* Non-Preferred
** Not Recommended for New Design