

Material Qualities and Torques for Standard Hardware

1. SCOPE

This standard specifies the minimum torque values for both metric and inch hardware. In addition, material properties are provided for different grades of metric and inch hardware to allow the designer to calculate the torque/clamping force relationship for hardware not shown in the tables.

IFI-101 - Torque-Tension Requirements for Prevailing Torque Type Steel Hex and Hex Flange Locknuts.

86508305(FNHA-2-H-500.00) - Zinc Electroplating on Ferrous Materials

2.2 This standard replaces the following company standard:

2. RELATED SPECIFICATIONS

New Holland

WS48.04

2.1 REFERENCED STANDARDS

ISO 898/I, 898/II, 898/V - Mechanical Properties of Fasteners:

SAE J429 - Mechanical and Material Requirements for Externally Threaded Fasteners.

SAE J995 - Mechanical and Material Requirements for Steel Nuts.

3. MATERIAL QUALITIES (EXTERNAL)

Proof load and tensile strengths, with hardness values, for different hardware material qualities are shown below. The proof load strength is the highest tensile stress that a fastener can withstand without having permanent deformation. Proof load strength is always lower than yield strength, which produces a 0.02% permanent deformation.

3.1 METRIC HARDWARE (External) - NOTE 1

Property Class Bolt or Screw	Proof Str'th Minimum N/mm ² (psi)	Tensile Str'th Minimum N/mm ² (psi)	Hardness		Nut Class Note (2)
			Min. HB	Max. HB	
4.6	225 (32,600)	400 (58,000)	114	209	4
4.8	310 (45,000)	420 (60,900)	124	209	4
5.6	280 (40,600)	500 (72,500)	147	209	5
5.8	380 (55,100)	520 (75,400)	152	209	5
6.8	440 (63,800)	600 (87,000)	181	238	6
8.8 for ≤ M16	580 (84,100)	800 (116,000)	219	285	8
8.8 > M16	600 (87,000)	830 (120,400)	242	319	8
10.9	830 (120,400)	1040 (150,800)	295	363	10
12.9	970 (140,700)	1220 (176,900)	353	412	12

					NAME	STD TORQUE SPEC		
ALL	F	BJF	114706	4/00				
ALL	E	BJF	112159	6/98	 NEW HOLLAND		ENGINEERING SPECIFICATION	
ALL	D	EF	110646	10/97				
ALL	C	RLF	110244	8/97	THE INFORMATION HEREON IS THE CONFIDENTIAL AND PROPRIETARY PROPERTY OF NEW HOLLAND N. V. AND/OR ITS SUBSIDIARIES. ANY USE, EXCEPT THAT FOR WHICH IT MAY BE LOANED, IS PROHIBITED.		FRAME	OF
ALL	B	BJF	108573	9/96			1	7
ALL	A	RE	107244	12/95				
FRAME NO.	REV	BY	ECN NO.	DATE			PART NUMBER	
APP.	DRAWN		BJFJR	12/95				
KHH 1/96	CHECKED						36529681	

3.2 INCH HARDWARE (EXTERNAL)

Bolt SAE Grade	Nominal Dia. Inch (mm)	Proof Str'th Minimum psi (N/mm ²)	Tensile Str'th Minimum psi (N/mm ²)	Hardware HB Max	Nut SAE Grade Note (2)
2	≤ 0.75 (19.1) ≤ 1.50 (38.1)	55,000 (380) 33,000 (230)	74,000 (510) 60,000 (415)	-- --	2 2
5	≤ 1.00 (25.4) ≤ 1.50 (38.1)	85,000 (585) 74,000 (510)	120,000 (830) 105,000 (725)	313 280	5 5
8	≤ 1.50 (38.1)	120,000 (830)	150,000 (1035)	363	8

NOTE (1): The preferred classes of hardware, Class 8.8 (Metric) and Grade 5 (Inch), are shown in "bold" in the Torque Tables (Sections 5.1 - 5.4).

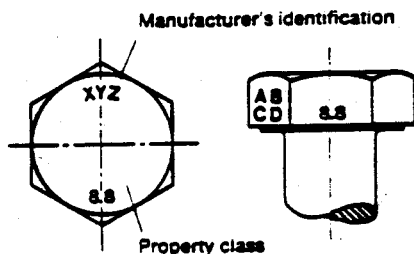
NOTE (2): These recommended nuts have a proof load strength corresponding to the minimum tensile strength of the bolt (shown), so as to ensure the loading capacity of the bolted connection up to the minimum tensile strength of the bolt.

3.3 MARKINGS FOR METRIC/INCH FASTENERS

3.3.1 Metric Fasteners

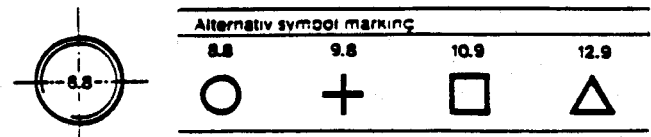
3.3.1.1 Hex cap screw

Classes 4.6, 5.6 and 8.8 and up.
Dia. ≥ 5 mm



3.3.1.3 Studs

Classes 8.8 and up
Dia. ≥ 5 mm



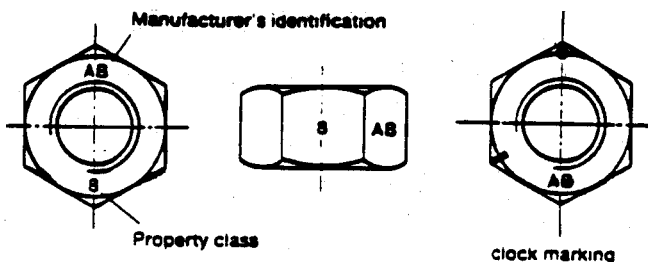
3.3.2 Inch Fasteners

3.3.2.1 Hex and Hex Flanged Cap Screws -

Manufacturer's identification and SAE Grade markings shall appear on all bolt heads Grade 5 and above. SAE Grade 5 screws shall be marked using three radial lines, 120° apart. SAE Grade 8 screws will be marked using six radial lines, 60° apart.

3.3.1.2 Hex nuts and locknuts.

Classes 05, 8 and up.
Dia. ≥ 5 mm



SAE Grade 5

SAE Grade 8



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3.3.2.2 Hex and Hex Flange Nuts - Grade 2 nuts are not required to be marked for grade identification. Grade 5 and Grade 8 hex nuts shall be marked for grade identification using Style A/B or Style C markings. Style A/B markings shall consist of a dot for Grade 5 nuts, and 60° counterclockwise from the dot for Grade 8 nuts. Style C markings are applicable to nuts which are fabricated by cutting from hex bar and consist of notches at the hexagon corners, one notch at each corner for Grade 5, and two notches at each corner for Grade 8.

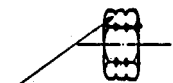


SAE Gr 5
hex nuts.



SAE Gr 8
hex nuts.

3.3.2.3 Hex and Hex Flange Locknuts - There are three grades of prevailing-torque type steel locknuts designated respectively as Grade A, B, and C and one grade for hex flange locknuts, Grade F. Grade A locknuts are not required to be marked for grade identification. Grade B and Grade F locknuts shall be marked with three equally spaced identical symbols (dot, line, letter, or other character) 120° apart on the chamfered surface of the top of the locknut. Grade C locknuts shall be marked with six symmetrically spaced identical symbols. Alternately, at manufacturer's option, Grades B, F, and C locknuts may be marked respectively with the letters B, F, and C located on one or more of the side flats of the locknut. As a second alternative, Grade B, F, and C locknuts may be marked respectively with one, one, or two small notches cut circumferentially into each of the six corners of the locknut.



GRADE IDENTIFICATION
GRADE A NO NOTCHES
GRADE B ONE CIRCUMFERENTIAL NOTCH
GRADE C TWO CIRCUMFERENTIAL NOTCHES



GRADE IDENTIFICATION
GRADE A NO MARKS
GRADE B THREE MARKS
GRADE C SIX MARKS
MARKS NEED NOT BE
LOCATED AT CORNERS



GRADE IDENTIFICATION
GRADE A NO MARK
GRADE B LETTER B
GRADE C LETTER C

3.3.2.4 Studs - Studs need not be marked.

4. TORQUE FORMULAS

A bolt's tightening torque to tension (also known as clamp load or preload) relationship can be calculated using the following formula:

$$P = f \times S^p \times A$$

and

$$T = (K \times D \times P) / C$$

where:

- T = Torque in 'N-m' (metric) or 'Ft-Lb' (Inch).
- P = Bolt clamp load in 'N' (Metric) or 'Lb' (Inch).
- f = Percentage (%) of bolt proof load. For normal Bolt assemblies, use 75% (the value selected for the Torque Tables, Section 5).
- S^p = Bolt proof strength in 'N/mm²' (Metric) or psi (Inch). **Note:** Proof is approximately equal to 90% of yield strength.
- D = Nominal bolt diameter in 'mm' (Metric) or 'in' (Inch).
- A = Stress area of bolt in 'mm²' (Metric) or 'in²' (Inch). For coarse threads, these are shown in the tables, (Section 5). Stress areas not listed can be calculated using the following formulas:

$$\text{For Metric Bolt: } A_{s1} = 0.7854 [D - (0.9382 \cdot p)]^2$$

$$\text{For Inch Bolt: } A_{s1} = 0.7854 [D - (0.9743/n)]^2$$

D = Nominal bolt diameter (mm or inch).
p = pitch (mm per thread).
n = number of threads per inch.

C = Conversion coefficient to get torque in proper units.

c_m = 1000 in Metric units to convert millimeters into meters.

c₁ = 12 in Inch units to convert inches into feet.

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