Mechanical Specifications for Externally Threaded Fasteners with Grade Markings

Specification	Material	Size Range (Inches)	Min. Proof Strength (psi)	Min. Tensile Strength (psi)	Core Hardness Rockwell Min.	Core Hardness Rockwell Max.	Min. Yield Strength (psi)	Grade Identification Marking
SAE J429-Grade 1	Low or Medium Carbon Steel	1/4 - 1-1/2	33,000	60,000	B70	B100	36,000	
SAE J429-Grade 2		1/4 - 3/4 7/8 - 1-1/2	55,000 33,000	74,000 60,000	B80 B70	B100 B100	57,000 36,000	
ASTM A307-Grade A	Low or Medium Carbon Steel	1/4-4		60,000	B69 *(see note 1)*	B100		
ASTM A307-Grade B	Low or Medium Carbon Steel	1/4-4		60,000(min) 100,000(max)	B69 *(see note 1)*	B95		
SAE J429-Grade 5 ASTM A449-Type 1	Medium Carbon Steel: Quenched and Tempered	1/4-1 1-1/8 - 1-1/2	85,000 74,000	120,000 105,000	C25 C19	C34 C30	92,000 81,000	
ASTM A449-Type 1 See Note 2		1-3/4 - 3	55,000	90,000			58,000	
ASTM A325-Type 1	Medium Carbon Steel: Quenched & Tempered	1/2-1 1-1/8 - 1-1/2	85,000 74,000	120,000 105,000	C25 C19 *(see note 3)*	C34 C30	92,000 81,000	See Note 5
ASTM A354 Grade BC	Medium Carbon Alloy Steel: Quenched & Tempered	1/4 - 2-1/2 over 2-1/2 - 4	105,000 95,000	125,000 115,000 *(see note 2)*	C26 C22	C36 C33	109,000 99,000	
ASTM A354 Grade BD	Medium Carbon Alloy Steel: Quenched & Tempered	1/4 - 2-1/2 over 2-1/2 - 4	120,000 105,000	150,000 140,000	C33 C31 *(see note 2)*	C39 C39	130,000 115,000	See Note 4
SAE J429 Grade 8	Medium Carbon Alloy Steel: Quenched & Tempered	1/4 - 1-1/2	120,000	150,000	C33	C39	130,000	
SAE J429-Grade 8.2	Low Carbon Boron Steel: Quenched & Tempered	1/4 - 1	120,000	150,000	C33	C39	130,000	
ASTM A490-Type 1	Medium Carbon Alloy Steel: Quenched & Tempered	1/2 - 1-1/2	120,000	150,000(min) 170,000(max)	C33 *(see note 3)*	C38	130,000	
ASTM A574 Socket Head Cap Screw	Low Alloy Steel: Quenched & Tempered	#0 - 1/2 over 1/2 - 2	140,000 135,000	180,000 170,000	C39 C37	C45 C45		

Note 1: No minimum hardness is required on bolts and studs 3 times the diameter and longer.
Note 2: Bolts less than 3 times the diameter in length and studs less than 4 times diameter in length shall have hardness values not less than minimum and not more than maximum.
Note 3: Bolts 3 times the diameter in length and over are not required to meet minimum hardness requirements.
Note 4: ASTM A354-Grade BD shall be marked with the grade symbol "BD" and, in addition may be marked with six radial lines.
Note 5: Radial line markings 120 degrees apart are optional.

ASTM A36 Material Specification

Specification	Material	Tensile Strength (psi)	Miniumum Yield Strength (psi)
ASTM A36	Carbon Structural Steel	58,000 (min.) - 80,000 (max.)	36,000

Most designers and end users focus on the strength and other characteristics of the bolt or stud. Once having selected the bolt, they must choose the appropriate nut. There are two simple rules when it comes to selecting the nut:

Rule #1; choose a nut specification compatible with the bolt specification. The bolt specification will usually dictate which nut specification is applicable (ASTM A193 bolts require ASTM A194 nuts).

Rule #2; choose a nut whose minimum proof strength is greater than or equal to the minimum ultimate tensile strength of the bolt. This ensures us that the bolt will break in tension prior to the female and/or male threads stripping.

A broken bolt is an obvious failure. It's loose. However, when the threads strip prior to the bolt breaking, we may not notice the failure until after the fastener is put into service.

SAE J429 Bolt and Nut Compatibility

Bolt Grade	Recommended Nut Grade (1)	Suitable Substitution (2)
SAE J-429 Grade 2	Low Carbon Regular or Heavy Hex Nut	SAE J995 Grade 5 or Grade 8 Hex Nut
SAE J-429 Grade 5	SAE J995 Grade 5 Hex Nut	SAE J995 Grade 8 Hex Nut
SAE J-429 Grade 8	SAE J995 Grade 8 Hex Nut	

(1) "Recommended" denotes a commercially available nut having the most suitable mechanical properties that will make it possible to obtain the desired bolt load.
(2) "Suitable" denotes SAE J995 nuts having mechanical properties that will also make it possible to obtain the desired bolt load.