

METALLURGICAL AND MECHANICAL PROPERTIES OF WHEEL BOLTS - INCH & METRIC

GM6109M GM6177M

1 SCOPE. This standard covers the metallurgical, processing, and mechanical requirements for passenger car and truck wheel bolts and studs.

2 REQUIREMENTS.

2.1 MATERIAL.

2.1.1 SAE 1541 Steel, fine grain, shall be used for metric sizes through 14 mm diameter and inch sizes through 9/16 inch diameter.

2.1.2 Medium carbon alloy steel, fine grain, with hardenability that will produce a minimum hardness of HRC47 at center of threaded section one diameter from end of bolt after oil quenching shall be used for metric sizes over 14 mm and inch sizes over 9/16 inch diameter.

2.2 MANUFACTURING PROCESSES.

2.2.1 Forming. Bolts and studs shall be cold formed and roll threaded.

2.2.2 Heat Treatment.

2.2.2.1 Serrated Shank Bolts shall be carburized in a non-nitriding atmosphere to the following case depth, and shall be oil quenched and tempered at a minimum temperature of 450°C.

	Total Case Depth
Metric Sizes, mm	0.10-0.30
Inch Sizes, in	.004-.012

2.2.2.2 Non-serrated shank bolts and studs shall be through hardened, oil quenched and tempered at a minimum tempering temperature of 425°C.

2.2.3 Decarburization. Non-carburized bolts and studs shall conform to GM6104M (class 9.8 for metric series and class C for inch series).

2.2.4 Surface Discontinuities. Bolts and studs shall conform to GM6102M. For sizes and lengths not covered by GM6102M, surface discontinuities shall be within limits specified by purchaser.

2.3 MECHANICAL.

2.3.1 Surface hardness of carburized bolts shall be HR15N 81.5 maximum.

2.3.2 Base metal hardness shall be HRC28-34.

2.3.3 Axial Tensile Strength. Bolt shall withstand the Minimum Tensile Test Load (shown in Table 1) without breaking into separate parts.

TABLE 1 - TENSILE STRENGTH VALUES

Table 1A - Metric Sizes				
Tensile Stress Minimum	Thread Size	Stress Area	Tensile Test Load Minimum	
MPa		mm ²	kN (lb)	
910	M12x1.5	88.1	80.2	(18 030)
910	M14x1.5	125	114	(25 630)
910	M18x1.5	216	197	(44 290)
910	M20x1.5	272	248	(55 760)
910	M22x1.5	333	303	(68 120)

Table 1B - Inch Sizes			
Tensile Stress Minimum	Thread Size	Stress Area	Tensile Test Load Minimum
ksi		in. ²	lb
133	7/16-20	.1187	15 800
133	1/2-20	.1599	21 300
133	9/16-18	.2030	27 000
133	5/8-18	.256	34 000
133	3/4-16	.373	49 600
133	1 1/8-16	.889	118 200

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2.3.4 Bend Test. Bolt shall withstand a 10° bend without breaking into separate parts.

2.3.5 Serration Test (applies only to serrated shank bolts). Bolt serrations shall not peel such that they accumulate under the bolt head is pressed into the specified test plate.

3 METHODS OF TEST.

3.1 CASE DEPTH. Shall be measured on a transverse section through the serrations according to SAE J423 using visual methods.

3.2 SURFACE HARDNESS. Surface hardness shall be measured according to SAE J417.

3.3 Base metal hardness shall be measured at mid radius of the transverse section cut for case depth or through the threaded portion and at a distance of one diameter from the end of the bolt according to SAE J417.

3.4 AXIAL TENSILE TEST. The bolt shall be assembled as shown in Figure 1 and tensile tested to fracture.

3.5 BEND TEST. Bolt shall be supported in a steel V-block and loaded by a press as shown in Figure 2, until the bolt bottoms on the fixture.

3.6 SERRATION TEST. Bolt shall be pressed until seated into a round hole (diameter specified on bolt drawing) drilled into a steel plate, no less than 12 mm thick and hardness BHN269-285 (equivalent HRC28-30). Bolt shall then be pressed out and serrations inspected. Portion of hole engaged by serrations shall be new for each test.

3.7 Speed of loading in Axial, Bend and Serration Test as determined by a free running crosshead, shall not exceed 25 mm/min.

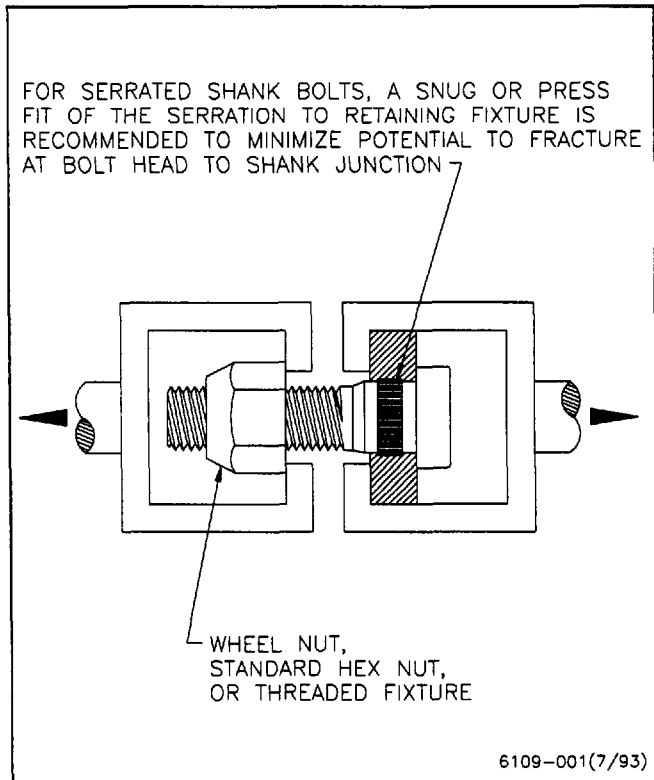


FIGURE 1 - AXIAL TEST SETUP

4 MARKING.

4.1 Metric bolts shall be marked permanently and clearly with the numerals 6177 on top of the head.

4.2 All bolts shall have manufacturers I.D. marked on head.