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SURFACE VEHICLE STANDARD

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Mechanical and Material Requirements for One Piece Wheel Nuts

RATIONALE

No changes required.

STABILIZED NOTICE

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1. Scope

This SAE Standard covers the chemical, metallurgical, and mechanical requirements for one piece passenger car and truck ferrous wheel nuts with conical or spherical nut seats for the following sizes:

a.	M10 x 1.25	M14 x 1.5	M14 x 2.0	9/16-18
b.	M12 x 1.25	M12 x 1.5	1/2-20	

This test is for typical wheel nuts. Special applications (nut material and/or configurations) may require special conditions which must meet load values in 3.4.

2. References

2.1 Applicable Publications

The following publications form a part of this specification to the extent specified herein. Unless otherwise specified, the latest issue of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J122—Surface Discontinuities on Nuts
SAE J995—Mechanical and Material Requirements for Steel Nuts
SAE J1102—Mechanical and Material Requirements for Wheel Bolts

2.1.2 ANSI PUBLICATIONS:

Available from ANSI, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ANSI B1.1—Unified Inch Screw Threads (UN and UNR Thread Form)
ANSI B1.13M—Metric Screw Thread—M Profile

3. Test Procedures

3.1 Nut Proof Load Test Procedures

Use only fully processed nuts which are representative of production parts intended for the vehicle. The nut shall be assembled on a wheel bolt or on a hardened threaded mandrel at the specified thread length engagement (L) specified in Table 1. The proof load (F) for the nut as specified in Table 1 shall be applied against the nut in an axial direction in tension as shown in Figure 1. The load shall be maintained for 15 s. The nut shall resist the load without failure by stripping or rupture and shall be removed by finger turning after the load is released. It may be necessary to start the nut rotating by using a manual wrench. Such wrenching is permissible provided it is restricted to one-half turn and that the nut is then removable by finger turning. Special materials and configurations may require different test methods to meet these load values.

TABLE 1—PROOF LOAD VALUES, THREAD ENGAGEMENT, AND FIXTURE HOLE REQUIREMENTS

Thread Size	Proof Load (F)[1] kN	Proof Load (F)[1] lb	85% Thread Engagement (L)[2] mm	85% Thread Engagement (L)[2] Turns[3]	Bolt Hole Dia (D_1) mm	Bolt Hole Dia (D_1) in	Nominal Thread Dia (D) mm	Nominal Thread Dia (D) in
M10 x 1.25	50.8	11,420	8.8/8.1	7 to 6-1/2	10.22/10.38	0.409/0.402	10	0.394
M12 x 1.25	76.4	17,180	10.6/10.0	8-1/2 to 8	12.22/12.38	0.488/0.481	12	0.472
M12 x 1.5	73.1	16,450	10.5/9.8	7 to 6-1/2	12.22/12.38	0.488/0.481	12	0.472
M14 x 1.5	103.4	23,240	12.4/11.6	8-1/4 to 7-3/4	14.22/14.38	0.566/0.560	14	0.551
M14 x 2.0	95.8	21,540	12.5/11.5	6-1/4 to 5-3/4	14.22/14.38	0.566/0.560	14	0.551
1/2 - 20	85.4	19,200	11.1/10.5	8-3/4 to 8-1/4	12.92/13.08	0.515/0.508	12.7	0.500
9/16 - 18	108.3	24,360	12.7/12.0	9 to 8-1/2	14.52/14.68	0.578/0.571	14.3	0.563

1. For sizes not included in Table 1:
   Inch series based on 120 ksi material tensile strength. Metric series based on 830 MPa material tensile strength from SAE J1102.
   Metric Stress Areas = $0.7854 (D-0.9382P)^{(2)}$
   Inch Stress Areas = $0.7854 (D-0.9743/n)^{(2)}$
   where:
   D = Nominal thread diameter
   P = Thread pitch
   n = Number of threads per inch
2. Length of thread engagement does not include nut and bolt thread chamfer. For nuts shorter than 85% thread engagement, use full thread engagement of nut.
3. One turn equals 360 degrees rotation of the nut on the test bolt. Nut and bolt thread chamfer can be eliminated by counting turns from the point of initial engagement of bolt and nut threads.

3.1.1 If the threads on the bolt or mandrel are damaged during the test, the test should be discarded. For referee test purposes, the hardened mandrel shall be used.

3.1.2 The test bolts shall have threads conforming to 6g tolerances for metric and 2A tolerances for unified inch series. The test bolt shall have a yield strength in excess of specified proof load of nut being tested.

3.1.3 The mandrels shall have a hardness of Rockwell C45 minimum. The hardened mandrel shall have threads conforming to Class 3A tolerances as specified in ANSI B1.1, except that the major diameter shall be the minimum major diameter with a plus tolerance of 0.002 in. The metric mandrels shall have threads conforming to the threads as specified in ANSI B1.13M except minimum major diameter shall be the minimum major diameter plus 0.25 times major diameter tolerance.

3.1.4 For referee purposes, the proof load test shall be conducted using a hardened mandrel.

3.2 Nut Cone Seat Concentricity

3.2.1 The nut shall be assembled on a threaded mandrel and rotated using a dial indicator gage to measure the runout of the cone (nut seat) to the threads as shown in Figure 2. Special configurations may require a different measurement method to test nut seat concentricity

3.2.2 The total runout shall not exceed 2% of the nominal thread diameter (D).

3.3 Surface Discontinuities

The nut shall meet SAE J122 for surface discontinuities.

3.4 Mechanical and Material Requirements

The nut shall meet SAE J995 for mechanical and material requirements not specified in this document.