SAE International™

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J1965

REAF. OCT2008

Issued 1993-02
Reaffirmed 2008-10

Superseding J1965 JUN2003

Road Vehicles—Wheels for Commercial Vehicles and Multipurpose Passenger Vehicles—Fixing Nuts—Test Methods

1. ***Scope***—This SAE Recommended Practice applies to nuts as specified in SAE J694 and J1835 used for wheel and demountable rim attachment.

Only the test methods necessary to assure proper wheel or rim assembly are specified. Fasteners for less common and special applications are not included.

1.1 Purpose—This document, to ensure proper assemblies, specifies test methods for Metric or English, one- or two-piece flange nuts, single ball seat nuts, inner and outer ball seat nuts, and rim clamp nuts.

2. ***References***

2.1 Applicable Publications—The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated, the latest revision of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J122—Surface Discontinuities on Nuts (Ref. ISO 6157/2)
SAE J694—Disc Wheel/Hub or Drum Interface Dimensions—Commercial Vehicles (Ref. ISO 4107)
SAE J1835—Fastener Hardware for Wheels for Demountable Rims

2.2 Related Publications—The following publications are provided for information purposes only and are not a required part of this document.

2.2.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J267—Wheels/Rims—Trucks—Test Procedures and Performance Requirements (Ref. ISO 3894)
SAE J393—Nomenclature—Wheels, Hubs, and Rims for Commercial Vehicles (Ref. ISO 3911)
SAE J1992—Wheels/Rims—Military Vehicles—Test Procedures and Performance Requirements

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3. *Test Methods for Nut Body and Ball Seat Nuts*

3.1 Proof Load/Compression Test Procedures—Use only fully processed nuts/nut assemblies, which are production parts intended for the vehicle. For inner dual ball seat nuts, and test method recommended can be seen in Figure 1. For two-piece nuts, the initial height of the nut (H) must be measured before beginning the proof load/compression test. The nut shall be loaded on a threaded fixture or bolt as shown in Figure 2. For outer ball seat nuts and rim clamp nuts, the recommended test method can be seen in Figure 3. The complete nut/nut assembly shall be loaded axially through the thread three times to a load of 0.6 x proof load value (F). After three loadings, a fourth loading of 1.0 x F shall be applied.

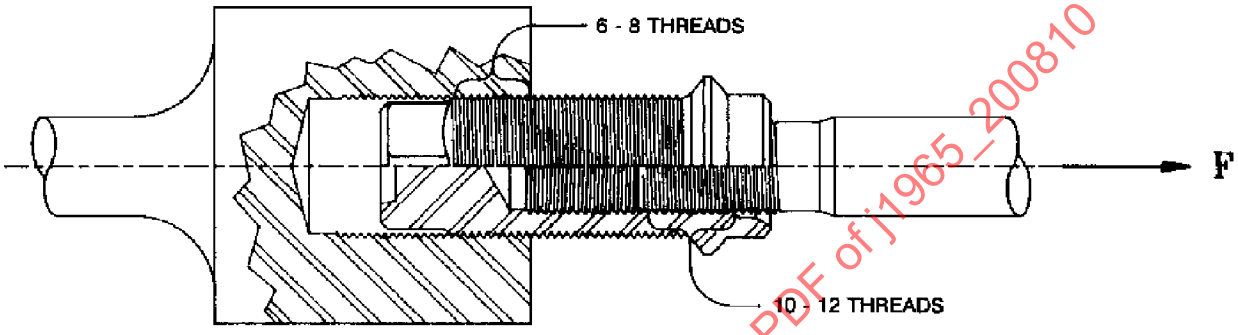

FIGURE 1—INNER DUAL BALL SEAT NUT PROOF LOAD TEST ARRANGEMENT

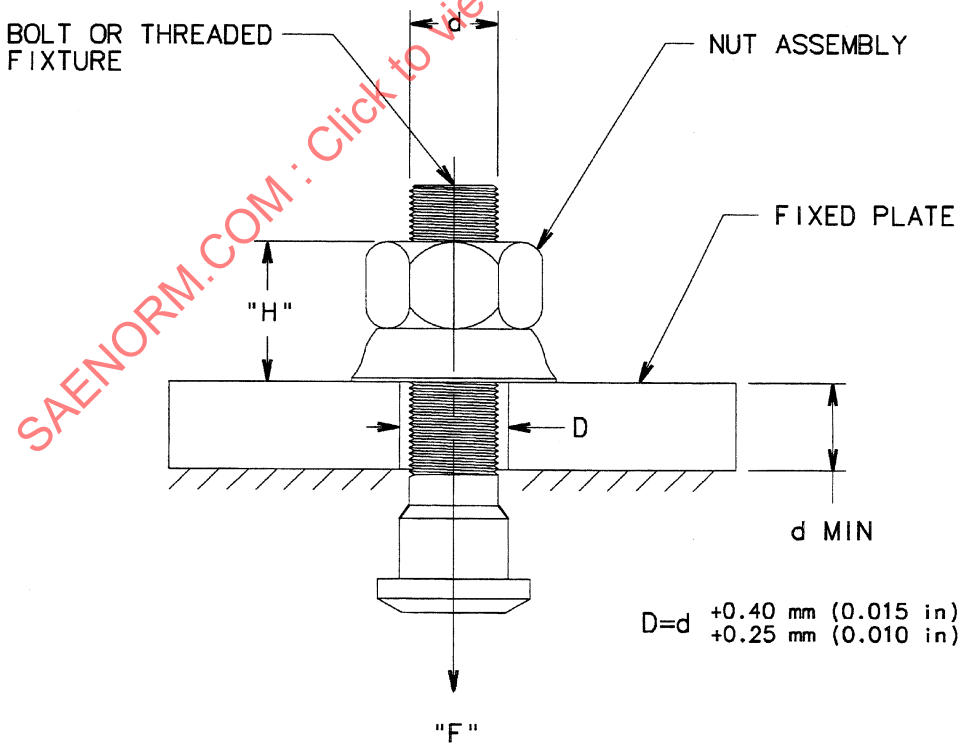

FIGURE 2—TWO-PIECE FLANGE NUT PROOF LOAD/COMPRESSON TEST ARRANGEMENT

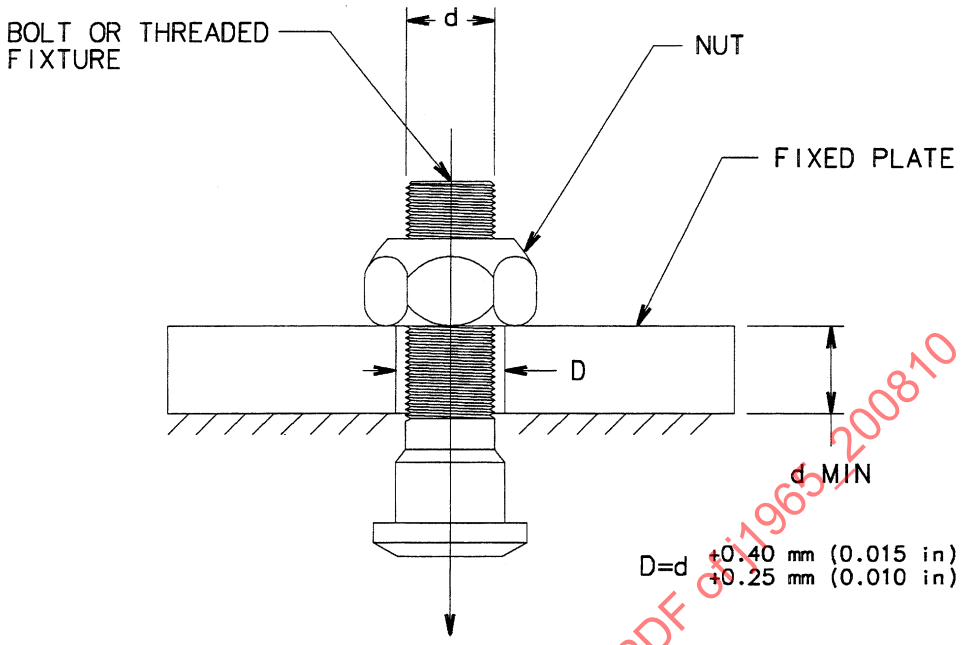

FIGURE 3—OUTER BALL SEAT NUT PROOF LOAD TEST ARRANGEMENT

The load shall be maintained for 15 s. The nut shall resist the load without failure by stripping or rupture and shall be removable by hand after the load is released. If the threads on the bolt or test fixture are damaged during the test, the test should be discarded. (It may be necessary to use a manual wrench to start the nut in motion. Such wrenching is permissible provided that it is restricted to one-half turn and that the nut is then removable by hand.) The test fixture or bolt used shall be threaded to a tolerance class that is representative of the parts to be used in production.

3.2 Proof Load Values—See Table 1.

TABLE 1—PROOF LOAD VALUES

	F (kN)	F (lb)
Inner Dual Ball Seat Nuts		
3/4-16 Class 10.9 (Grade 8) mechanical properties	249.1	56 000
3/4-16 Class 8.8 (Grade 5) mechanical properties	164.6	37 000
15/16-12	278.9	62 700
One-Piece Flange Nuts		
9/16-18	98.3	22 100
5/8-18	124.1	27 900
11/16-16	149.0	33 500
Two-Piece Flange Nuts		
9/16-18	108.5	24 400
5/8-18	136.6	30 700
7/8-14	271.3	61 000
M14x1.5	103.2	23 200
M18x1.5	179.3	40 300
M20x1.5	225.1	50 600
M22x1.5	276.2	62 100
Single or Outer Ball Seat Nuts		
3/4-16	164.6	37 000
1 1/8-16	222.4	50 000
15/16-12	278.9	62 700
1 5/16-12	378.1	85 000
Rim Clamp Nut		
3/4-10	197.5	44 400

3.3 Failure Criteria and Surface Discontinuities

a. The criteria for rejection due to cracks or other surface discontinuities is shown in Section 5.
b. For two-piece flange nuts, the permanent deformation in nut height (H) after unloading must not exceed 0.13 mm (0.005 in).

4. Nut Assembly Test Methods (Two-Piece Flange Nut Only)

4.1 Torque/Tension—Clamping Force—The purpose of this test is to assure the ability of the nut assembly to provide proper clamping force. The coefficient of friction should be representative of the production parts. Two test methods are acceptable: static torque using a load cell and torque wrench, and dynamic torque using load cell and torque transducer.

4.1.1 SELECTION—Use only fully processed nut assemblies and studs which are representative of production parts intended for the vehicle. New nuts and studs should be used for each test.

4.1.2 TEST PROCEDURE—STATIC TORQUE—The nut shall be tested on a load cell of sufficient capacity for the size of nut to be tested. A torque wrench of sufficient capacity shall be used for tightening the nut. The following shall be recorded:

a. Tightening torque, Initial
b. Stud tension, Initial
c. Tightening torque, Final
d. Stud tension, Final

TABLE 2—TEST TORQUES AND TENSIONS

Thread	A Initial Torque (N·m)	A Initial Torque (ft-lb)	B Initial Tension (Min) (kN)	B Initial Tension (Min) (lb)	C Final Torque (N·m)	C Final Torque (ft-lb)	D Final Tension (Max) (kN)	D Final Tension (Max) (lb)
M14x1.5	149	110	44.5	10 000	190	140	103.2	23 200
M18x1.5	249	184	80.1	18 000	430	317	179.3	40 300
M20x1.5	339	250	100.1	22 500	610	450	225.1	50 600
M22x1.5	502	370	133.4	30 000	678	500	276.2	62 100
9/16-18	169	125	52.5	11 800	190	140	108.5	24 400
5/8-18	176	130	54.3	12 200	244	180	136.5	30 700
7/8-14	475	350	89.0	20 000	678	500	271.3	61 000

The torque is applied to the nut with a torque wrench using a smooth, steady pull as each torque level (initial and final) is approached and attained. Test studs may be lubricated with a SAE 10W30 oil. Nuts shall be tested as supplied with no additional lubricant added. All other surfaces are to be kept dry.

The test method is to tighten to the initial value shown in Table 2 and record the bolt tension attained, then resume tightening to the final torque value as shown in Table 2 and record the bolt tension attained at this level.

4.1.3 TEST PROCEDURE DYNAMIC TORQUE—The nut shall be tested on a bolt test machine capable of displaying all necessary data. The following are to be recorded:

a. Tightening torque, Initial
b. Stud tension, Initial
c. Head friction torque/thread friction torque (optional)
d. Tightening torque, Final
e. Stud Tension, Final
f. Head friction torque/thread friction torque (optional)

The force is to be applied to the nut continuously from start through final torque using a rotational speed of approximately 10 rpm. Test studs must be representative of those used in production. To reduce variation, the test studs may be lubricated with a SAE 10W30 oil. Nuts shall be tested as supplied with no additional oil added.

The test method is to tighten the nut continuously from initial seating through final torque then retrieve data on tension at the torque levels in Table 2.