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**Mechanical and Material
Requirements for Steel
Nuts — SAE J995c**

SAE STANDARD

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Report of Iron and Steel Technical Committee approved August 1967
 and last revised September 1974.

1. SCOPE - This SAE Standard covers the mechanical and material requirements for three grades of steel nuts suitable for use in automotive and related engineering applications, in sizes $\frac{1}{4}$ to $1\frac{1}{2}$ in., inclusive, and with dimensions conforming with the requirements of the latest issue of SAE J104.

1.1 This standard does not include limits for surface discontinuities. Where usage requires such control, limits may be specified separately. For sizes $\frac{1}{4}$ through 1 in., this may be done by the statement: "Surface discontinuities shall not exceed the limits specified in SAE J122."

2. DESIGNATION - The three grades of nuts are designated Grades 2, 5; and 8.

3. MATERIAL - Nuts shall be made of steel conforming to the chemical composition limits specified in Table 1.

4. MECHANICAL REQUIREMENTS

4.1 PROOF LOAD - Nuts described in this standard shall withstand the proof load stress specified for the applicable nut grade, size, and thread series shown in Table 2.

4.2 HARDNESS - Nuts shall have a hardness not in excess of that specified in Table 2.

5. TEST METHODS

5.1 PROOF LOAD TEST - The nut shall be assembled on a test bolt or on a hardened and threaded mandrel, as described below and illustrated in Fig. 1. The specified proof load for the nut shall be applied against the nut in an axial direction. (See footnote b of Table 2 for method for computing the proof load in pounds for a nut.) The nut shall resist this load without failure by stripping or rupture, and shall be removable from the test bolt or mandrel by the fingers after the load is released. (NOTE: Occasionally it may be necessary to use a manual wrench or other means to start the nut in motion. Use of such means is permissible, providing the nut is removable by the fingers following an initial loosening of not more than one-half turn of the nut.) If

the threads of the test bolt or mandrel are damaged during the test, the test shall be discarded. (See Fig. 1.)

Test bolts shall have threads conforming to Class 2A tolerances and shall have a yield strength in excess of the specified proof load of the nut being tested.

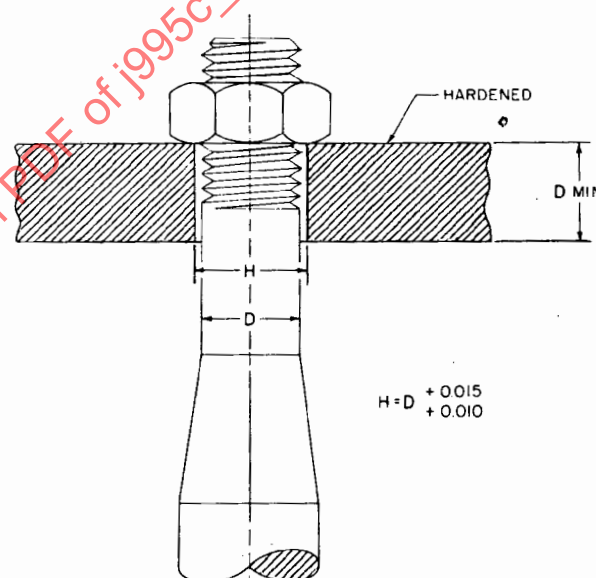


FIG. 1

Mandrels shall have a hardness of Rockwell C45 minimum; and shall be threaded to Class 3A tolerance, except that the major diameter shall be the minimum major diameter with a tolerance of +0.002 in.

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

5.2 HARDNESS TEST - Rockwell hardness shall be determined on the top or bottom of the nut.

Hardness determinations shall be made on a polished surface located on the nut face halfway between the major diameter of the thread and the one corner, or, if applicable, on a wrench face one-third of the dis-

tance from a corner to the center of the wrench face. In preparing the surface, sufficient material shall be removed to assure elimination of any decarburization or other surface irregularities.

Hardness tests shall be conducted in accordance with SAE J417.

6. MARKING

6.1 Grade 2 nuts are not required to be marked for grade identification. All grades of hex jam, heavy hex jam, hex slotted, heavy hex slotted, hex thick and heavy hex nuts are not required to be marked for grade identification, unless specified by the purchaser.

6.2 Grade 5 and Grade 8 hex nuts, sizes $\frac{1}{4}$ thru $1\frac{1}{2}$, shall be marked for grade identification. Three "styles" of grade marking are acceptable: Style A is applicable to all sizes of nuts. Style B may be used at the supplier's option for sizes 5/8 and larger; and may be used for smaller sizes only when authorized by the purchaser. Style C is applicable to nuts which are fabricated by cutting from hex bar.

Unless otherwise specified by the purchaser, marking for manufacturer identification shall be at supplier's option. No more than 10% of the nut top surface area may be used for grade and manufacturer markings. In the case of double chamfer nuts, one face only is considered a top surface.

Style A markings shall consist of a dot and a radial or circumferential line at 120 deg counterclockwise from the dot for Grade 5 nuts, and 60 deg counterclockwise from the dot for Grade 8 nuts. These marks shall be located on the top surface of the nut on a circular line or path approximately midway between hole diameter and hex flat diameter, and in a manner which precludes any metal projecting above the top surface. Radial and circumferential lines shall conform to the following dimensions (inch, nominal):

Nut Size	Width(W)	Length(L)	Deep(D)
1/4 and 5/16	0.015	0.05	0.010
3/8 thru 9/16	0.020	0.06	0.010
5/8 thru 7/8	0.030	0.08	0.010
1 and larger	0.030	0.12	0.010

Dot may be round (diameter = W) or rectangular (maximum length = L/2).

Style B markings shall consist of a dot at one corner of the nut and a radial line at the corner 120 deg counterclockwise

from the dot for Grade 5 nuts, and 60 deg counterclockwise from the dot for Grade 8 nuts. These marks shall be located on the chamfer surface of the top of the nut, and may be raised or depressed at the option of the supplier. Raised marks shall not project beyond the height or width of the nut.

Style C markings shall consist of notches at the hexagon corners, one notch at each corner for Grade 5, and two notches at each corner for Grade 8.

Note: While SAE J995 and SAE J104 do not cover flange nuts, it is appropriate to recommend that Grade 5 and Grade 8 products be marked as described above for hex nuts, with the following additional supplier op-

7.1 MANUFACTURER'S RESPONSIBILITY - During the manufacture of products to the tions: (1) raised or depressed Style A markings on top of flange or on top surface of nut, (2) lines up to 2 times the dimensions specified above.

7. TESTING REQUIREMENTS requirements of this specification, the manufacturer shall make periodic tests to ensure that the properties of the product are being maintained within specified limits. Such tests shall be conducted in accordance with a sampling plan, preferably the sampling plan given in paragraph 7.3, and the test results shall be recorded in a test report. When requested in writing by the purchaser, the manufacturer shall furnish a copy of the test report certified to be a report of the results of the last completed set of tests for the specific type, size, length, and grade of product.

Additional tests of products in individual shipments are not normally contemplated. Unless otherwise agreed at time of original inquiry and purchase order, individual heats of steel need not be identified in the finished product.

7.2 PURCHASER'S OPTIONS - If the purchaser requires that additional tests be performed by the manufacturer to determine that the properties of products in an individual shipment are within specified limits, or if the purchaser requires that a sampling plan different from that given in paragraph 7.3 shall be used when determining the acceptability of a lot, or shipment, of products, the purchaser shall specify the complete testing requirements, including sampling plan and basis of acceptance, in the original inquiry and purchase order.

7.3 GENERAL - An acceptable sampling plan is outlined below:

Number of Pieces in Lot	Minimum Number of Specimens To Be Tested
50 and under	2
51 to 500	3
501 to 35,000	5
35,001 and over	8

A lot, for purposes of selecting test specimens, shall consist of all products offered for inspection and testing at one time that are of the same type, grade, size, length, and thread series and are manufactured essentially at one time and under the same process conditions.

The same test specimens may be used for different tests wherever practical.

If the failure of a test specimen is due to improper preparation of the specimen or to incorrect testing technique, the specimen shall be discarded and another specimen substituted.

TABLE 1 - CHEMICAL COMPOSITION REQUIREMENTS

Nut Grade No.	C Max	Mn Min	P Max	S Max
2	0.47	—	0.12 ^a	0.15 ^{b, d}
5	0.55	0.30	0.05 c, d	0.15 ^{b, d}
8	0.55	0.30	0.04	0.05 ^e

NOTE: All values are for ladle analysis (per cent by weight) and are subject to standard variations for check analysis as given in SAE J409.

^aResulfurized and rephosphorized material is not subject to rejection based on check analysis for sulfur.

^bIf agreed between purchaser and producer, sulfur content may be 0.23 max.

^cPhosphorus content may be 0.13 max for acid bessemer steel only.

^dIf agreed between purchaser and producer, sulfur content may be 0.35 max and phosphorus content may be 0.12 max provided that manganese content is 0.70 min.

^eIf agreed between purchaser and producer, sulfur content may be 0.33 max provided that manganese content is 1.35 min.

TABLE 2 - PROOF LOAD AND HARDNESS REQUIREMENTS FOR NUTS^a

Nut Grade	Nut Size Die, in.	Proof Load Stress, psib		Rockwell Hardness, Max
		Thread Series		
		UNC 8 UN	UNF, 12 UN and Finer	
2c	1/4 thru 1-1/2	90,000	90,000	C32
	1/4 thru 1	120,000	109,000	C32
5	Over 1 thru 1-1/2	105,000	94,000	C32
	1/4 thru 5/8	150,000	150,000	C24-C32
Over 5/8 thru 1	C26-C34			
Over 1 thru 1-1/2	C26-C36			

^aValues listed are not normally applicable to jam, slotted, castle, heavy, or thick nuts (see Appendix).

^bThe proof load in pounds for a nut is computed by multiplying the proof load stress for the nut grade, size, and thread series, as shown in Table 2, and the stress area for the applicable size and thread series shown in Table 3. (See Appendix, Table 6, for computed values for same products.)

^cNormally applicable to square nuts only. Also, square nuts normally available in Grade 2 only.

TABLE 3 - TENSILE STRESS AREAS (TEST BOLT OR MANDREL)

Coarse Thread Series UNC		Fine Thread Series UNF		8-Thread Series 8 UN	
Nominal Size and Threads Per Inch	Tensile Stress Area, sq. in.	Nominal Size and Threads Per Inch	Tensile Stress Area, sq. in.	Nominal Size and Threads Per Inch	Tensile Stress Area, sq. in.
1/4 -20	0.0318	1/4 -28	0.0364	—	—
5/16 -18	0.0524	5/16 -24	0.0580	—	—
3/8 -16	0.0775	3/8 -24	0.0878	—	—
7/16 -14	0.1063	7/16 -20	0.1187	—	—
1/2 -13	0.1419	1/2 -20	0.1599	—	—
9/16 -12	0.182	9/16 -18	0.203	—	—
5/8 -11	0.226	5/8 -18	0.256	—	—
3/4 -10	0.334	3/4 -16	0.373	—	—
7/8 -9	0.462	7/8 -14	0.509	—	—
1 -8	0.606	1 -12	0.663	1 -8	0.606
1-1/8 -7	0.763	1-1/8 -12	0.856	1-1/8 -8	0.790
1-1/4 -7	0.969	1-1/4 -12	1.073	1-1/4 -8	1.000
1-3/8 -6	1.155	1-3/8 -12	1.315	1-3/8 -8	1.233
1-1/2 -6	1.405	1-1/2 -12	1.581	1-1/2 -8	1.492

TABLE 4 - PROOF LOAD AND HARDNESS REQUIREMENTS FOR MISCELLANEOUS NUTS 120,000 BASIC PROOF LOAD STRESS

Nut Size & Thread Series	Proof Load Stress, psi				Rockwell Hardness, Max
	1/4 thru 1 In. Dia		Over 1 thru 1-1/2 in. Dia		
	UNC and 8 UN	UNF and 12 UN and Finer	UNC and 8 UN	UNF and 12 UN and Finer	
Hex Jam	72,000	65,000	63,000	57,000	C32
Hex Slotted	96,000	87,000	84,000	75,000	C32
Heavy Hex	133,000	120,000	116,000	105,000	C32
Heavy Hex Jam	72,000	65,000	63,000	57,000	C32
Heavy Hex Slotted	105,000	96,000	92,000	84,000	C32
Hex Thick	133,000	120,000	116,000	105,000	C32
Hex Thick Slotted	105,000	96,000	92,000	84,000	C32

TABLE 5 - PROOF LOAD AND HARDNESS REQUIREMENTS FOR MISCELLANEOUS NUTS 150,000 BASIC PROOF LOAD STRESS

Nut Size & Thread Series Type of Nut	Proof Load Stress, psi		Rockwell Hardness, Max
	1/4 to 1-1/2 in. Dia		
	UNC 8 UN	UNF, 12 UN and Finer Pitch Series	
Hex Jam	90,000	90,000	C38
Hex Slotted	120,000	120,000	C38
Heavy Hex	165,000	150,000	C38
Heavy Hex Jam	90,000	90,000	C38
Heavy Hex Slotted	132,000	120,000	C38
Hex Thick	165,000	150,000	C38
Hex Thick Slotted	132,000	120,000	C38

TABLE 6 — PROOF LOAD FOR MISCELLANEOUS NUTS,^{a, b} LB (UNC Threads only)

Nut Size and Threads Per Inch	Square Nuts	Hexagon Nuts		Hex Jam and Heavy Hex Jam Nuts		Hex Slotted Nuts		Heavy Hex and Hex Thick Nuts		Heavy Hex Slotted and Hex Thick Slotted	
	Grade 2	Grade 5	Grade 8	X	Y	X	Y	X	Y	X	Y
1/4—20	2,850	3,800	4,750	2,300	2,850	3,050	3,800	4,250	5,250	3,350	4,200
5/16—18	4,700	6,300	7,850	3,750	4,700	5,050	6,300	6,950	8,650	5,500	6,900
3/8—16	7,000	9,300	11,600	5,600	7,000	7,450	9,300	10,300	12,800	8,150	10,200
7/16—14	9,550	12,800	15,900	7,650	9,550	10,200	12,800	14,100	17,500	11,200	14,000
1/2—13	12,800	17,000	21,300	10,200	12,800	13,600	17,000	18,900	23,400	14,900	18,700
9/16—12	16,400	21,800	27,300	13,100	16,400	17,500	21,800	24,200	30,000	19,100	24,000
5/8—11	20,300	27,100	33,900	16,300	20,300	21,700	27,100	30,100	37,300	23,700	29,800
3/4—10	30,100	40,100	50,100	24,000	30,100	32,100	40,100	44,400	55,100	35,100	44,100
7/8—9	41,600	55,400	69,300	33,300	41,600	44,400	55,400	61,400	76,200	48,500	61,000
1—8	54,500	72,700	90,900	43,600	54,500	58,200	72,700	80,600	100,000	63,600	80,000
1-1/8—7	68,700	80,100	114,000	48,100	68,700	64,100	91,600	88,500	126,000	70,200	101,000
1-1/4—7	87,200	102,000	145,000	61,000	87,200	81,400	116,000	112,000	160,000	89,100	128,000
1-3/8—6	104,000	121,000	173,000	72,800	104,000	97,000	139,000	134,000	191,000	106,000	152,000
1-1/2—6	126,000	148,000	211,000	88,500	126,000	118,000	169,000	163,000	232,000	129,000	185,000

^aProof load stress values in Table 4 and 5 are based on requirements shown in Table 2 for Grades 5 and 8 nuts. Primarily, each value is derived from the ratio of the minimum thickness of the product involved to the minimum thickness of square machine screw nuts and hex nuts (see SAE J107) of the same size—and "correction factors" added or subtracted to compensate for differences in width across flats, width and depth of slots, and depth of countersink.

^bComputed according to Table 2, Footnote b, using psi values shown in Tables 2, 4, and 5. Values in "X" columns are related to Table 4; those in "Y" columns to Table 5.

APPENDIX

Grade designations in this standard apply only to finished hexagon nuts and square nuts as indicated in Table 2. Tables 4 and 5 give proof load stress values for these types of nuts, but grade designations have not been established for these. Until these are established, products may be described by notes, such as the following: "SAE J995; Proof Load Stress: 96,000 psi; Hardness: Rockwell C32 max."

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