SAE International

SURFACE VEHICLE STANDARD

SAE J995 FEB2012

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Superseding J995 JUL1999

Mechanical and Material Requirements for Steel Nuts

RATIONALE

There are many nut products for industrial applications that are furnished as Grades 2, 5, and 8, but are not specifically covered by the previous revision of SAE J995. This standard has been expanded by the following changes:

1. Added Grade 2 to all nut types because they are being specified.
2. Added nut types that are being specified, but are not currently covered. Added Appendix Tables A2 and A3 to provide easier use of the standard when determining specific proof load values.
3. Changed the quality requirements to those maintained by ASTM so that testing laboratories will have fewer standards and procedures to refer to in the future. This will not add testing requirements to these products. It will simply make the evaluation procedures for nut made to ASTM and SAE the same.
4. Added illustration to better explain the grade markings for various SAE nuts.

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 1/4 to 1-1/2 in, inclusive, and with dimensions conforming with the requirements of the latest issue of SAE J482 or ASME B18.2.2, except for machine screw nuts which are not covered in this standard.

This document does not include limits for surface discontinuities. Where usage requires such control, limits may be specified separately. For sizes 1/4 through 1 in, this may be done by the statement: “Surface discontinuities shall not exceed the limits specified in ASTM F812/F812M.”

2. REFERENCES

2.1 Applicable Documents

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

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: http://www.sae.org

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/J995_201202

2.1.1 SAE Publications

Available from SAE International, 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 J409 Product Analysis – Permissible Variations from Specified Chemical Analysis of a Heat or Cast of Steel

SAE J417 Hardness Tests and Hardness Number Conversions

SAE J482 Hexagon High Nuts

2.1.2 ASME Publications

Available from ASME, 22 Law Drive, Box 2300, Fairfield, NJ 07007-2300, www.asme.org

ASME B18.2.2 NUTS FOR GENERAL APPLICATIONS - MACHINE SCREW NUTS, HEX, SQUARE, HEX FLANGE, AND COUPLING NUTS (INCH SERIES)

ASME B18.18 Quality Assurance for Fasteners

2.1.3 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org

ASTM F812/F812M Surface Discontinuities of Nuts, Inch and Metric.

ASTM F606 Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, and Rivets

ASTM F1470 Fastener Sampling for Specified Mechanical Properties and Performance Inspection

3. DESIGNATION

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

4. MATERIAL

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

TABLE 1 - CHEMICAL COMPOSITION REQUIREMENTS(1)

Nut Grade	C Max	Mn Min	P Max	S Max
2	0.55	-	0.12(2)	0.15(3)
5	0.55	0.30	0.05(4)(5)	0.15(3)(5)
8	0.55	0.30	0.04	0.05(6)

1. All values are for ladle analysis (percent by weight) and are subject to standard variations for check analysis as given in SAE J409.
2. Resulfurized and rephosphorized material is not subject to rejection based on check analysis for sulfur.
3. If agreed between purchaser and producer, sulfur content may be 0.23 max.
4. Phosphorus content may be 0.13 max for acid bessemer steel only.
5. If 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.
6. If agreed between purchaser and producer, sulfur content may be 0.33 max provided that manganese content is 1.35 min.

5. MECHANICAL REQUIREMENTS

5.1 Proof Load

Nuts described in this document shall withstand the proof load stress specified in Table 2 for the nut grade, size, and thread series.

TABLE 2 - PROOF LOAD REQUIREMENTS FOR NUTS(1)

Nut Grade	2		5				8	
Nut Size	1/4 thru 1-1/2	1/4 thru 1-1/2	1/4 thru 1	1/4 thru 1	Over 1 thru 1-1/2	Over 1 thru 1-1/2	1/4 thru 1-1/2	1/4 thru 1-1/2
Thread Series	UNC and 8UN	UNF, 12 UN and Finer	UNC and 8UN	UNF, 12 UN and Finer	UNC and 8UN	UNF, 12UN and Finer	UNC and 8UN	UNF, 12UN and Finer
Nut Type	Proof Load Stress, psi (1)	Proof Load Stress, psi (1)	Proof Load Stress, psi (1)	Proof Load Stress, psi (1)	Proof Load Stress, psi (1)	Proof Load Stress, psi (1)	Proof Load Stress, psi (1)	Proof Load Stress, psi (1)
Hex	90 000	80 000	120 000	109 000	105 000	94 000	150 000	150 000
Hex Flange	90 000	80 000	120 000	109 000	105 000	94 000	150 000	150 000
Hex Jam(2)	54 000	48 000	72 000	65 000	63 000	57 000	90 000	90 000
Heavy Hex Jam(2)	54 000	48 000	72 000	65 000	63 000	57 000	90 000	90 000
Hex Slotted(2)	71 000	65 000	96 000	87 000	84 000	75 000	120 000	120 000
Heavy Hex(2)	100 000	90 000	133 000	120 000	116 000	105 000	165 000	150 000
Hex Thick(2)	100 000	90 000	133 000	120 000	116 000	105 000	165 000	150 000
Hex Thick Slotted(2)	79 000	71 000	105 000	96 000	92 000	84 000	132 000	120 000
Hex High(2)	100 000	90 000	133 000	120 000	116 000	105 000	165 000	150 000
Hex High Slotted(2)	79 000	71 000	105 000	96 000	92 000	84 000	132 000	120 000
Square	90 000	80 000	105 000	96 000	92 000	84 000	132 000	120 000
Heavy Square	100 000	90 000	133 000	120 000	116 000	105 000	165 000	150 000

NOTE:

(1) The proof load in pounds for nuts is computed by multiplying the proof load stress, in psi (lbf/in^2), for the nut grade, size, thread series, and type, as shown in Table 2, and tensile stress area in sq in (in^2), for the applicable size and thread series shown in Table 3. (For tabulated values see Appendix A.)

To convert the inch based pounds per square inch (psi) values above to metric Megapascal (MPa) units multiple the above values by .00689.

(2) Proof load stress values for hex jam, heavy hex jam, hex slotted, heavy hex, hex thick, heavy hex slotted, and hex thick slotted nuts are based on the requirement for hex nuts. Primarily, each value is derived from the ratio of the minimum thickness of the product involved to the minimum thickness of similar hex or square machine screw nuts and hex nuts (see B18.2.2) of the same size.

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

Coarse Thread Series UNC Nominal Size and Threads Per Inch	Coarse Thread Series UNC Tensile Stress Area, sq in.	Fine Thread Series UNF Nominal Size and Threads Per Inch	Fine Thread Series UNF Tensile Stress Area, sq in.	8-Thread Series 8 UN Nominal Size and Threads Per Inch	8-Thread Series 8 UN 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

5.2 Hardness

Nuts shall have hardness within the limits specified in Table 4.

TABLE 4 - HARDNESS REQUIREMENTS FOR NUTS

Nut Grade	Nominal Nut Size	Hardness
2	1/4 thru 1-1/2	32 HRC max
5	1/4 thru 1-1/2	32 HRC max
8	1/4 thru 5/8	24 - 32 HRC
8	Over 5/8 thru 1	26 - 34 HRC
8	Over 1 thru 1-1/2	26 - 36 HRC

6. TEST METHODS

For proof load and hardness testing procedures refer to ASTM F606.

7. MARKING

Three “styles” of grade marking are acceptable. Style A is applicable to all types and sizes of nuts. Style B is applicable to hex nuts of sizes 5/8 in. and larger; but may be used for smaller sizes or other types of nuts only when authorized by the purchaser. Style C is applicable to nuts that are fabricated by cutting from hex bar.

Marking for source (manufacturer or private label distributor) identification shall be by the manufacturer’s or private label distributor’s mark. The manufacturer’s mark is represented by “X” in the illustrations below.

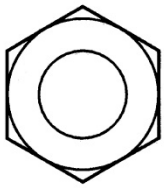
Markings shall not project beyond the height or width across flats of the nuts. No more than 10% of the nut top surface area may be used for grade and source markings. In the case of double chamfer nuts, one face only is considered a top surface.

TABLE 5 - MARKING DIMENSIONS

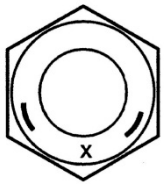
Nut Size	Marking Lines[1] Width	Marking Lines[1] Length	Marking Lines[1] Depth
1/4 and 5/16	0.015	0.05	0.010
3/8 thru 9/16	0.020	0.06	0.010
5/8 thru 7/8	0.030	0.08	0.010
1 and larger	0.030	0.12	0.010

1. For hex flange nuts, lines on the top of the flange may be up to two times the dimensions shown.

Style A marking shall be depressed on the top surface of the nut on a circular line or path approximately midway between hole diameter and hex flat diameter, or, for hex flange nuts at the supplier's option, raised or depressed on top of the flange, and shall consist of no marks for Grade 2 nuts; two circumferential lines 120 degrees apart for Grade 5 nuts; and two circumferential lines 60 degrees apart for Grade 8 nuts. The circumferential lines shall conform to the following dimensions (inch, nominal) (see Table 5):



Grade 2

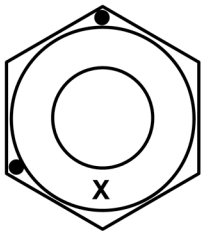


Grade 5

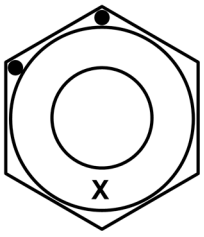
Grade 8

Style B marking shall be raised or depressed on the chamfer surface of the top of the nut corners, and shall consist of: no marks on Grade 2 nuts; one circumferential line on each of two corners 120 degrees apart for grade 5 nuts; and one circumferential line on each of two corners 60 degrees apart for Grade 8 nuts.

Grade 2

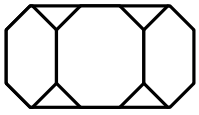


Grade 5

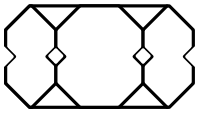


Grade 8

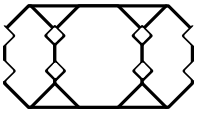
Style C marking shall consist of notches at the hexagon corners, one notch at each corner for Grade 5 nuts, and two notches at each corner for Grade 8 nuts.



Grade 2



Grade 5



Grade 8

7.1 Grade 2 nuts are not required to be marked for grade or source identification.

7.2 Grade 5 and Grade 8 hex and hex flange nuts, sizes 1/4 through 1-1/2, shall be marked for grade identification and for source identification. Grade 5 and Grade 8 hex jam, heavy hex jam, hex slotted, heavy hex slotted, hex thick slotted, hex thick, and heavy hex nuts are not required to be marked for grade or source identification, unless specified by the purchaser. If marked, Grade 5 and Grade 8 hex jam, heavy hex jam, hex slotted, heavy hex slotted, hex thick slotted, hex thick, and heavy hex nuts shall be marked with grade and source identification marks.

8. TESTING REQUIREMENTS

8.1 Manufacturer's Responsibility

During the manufacture of products to the requirements of this specification, the manufacturer shall make periodic tests to ensure that the properties of the product are being maintained within specified limits.

For all Grade 8 nuts, and for Grade 5 hex and hex flange nuts, each lot shall be tested for material properties conducted in accordance with the sampling plans in ASTM F1470 or B18.18 as applicable 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 lot for Grade 8 nuts or Grade 5 hex or hex flange nuts, or, for other nuts, of the last completed set of tests for the specific type, size, and grade of product.

8.2 General

A lot is a quantity of one part number that has been processed essentially under the same conditions from the same heat treatment lot and produced from one mill heat of material and submitted for inspection at one time.

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.

9. NOTES

9.1 Marginal Indicia

A change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

APPENDIX A

TABLE A1 - PROOF LOAD FOR MISCELLANEOUS NUTS, (1) LBF (UNC THREADS ONLY)

Nominal Nut Size and Threads Per Inch	Hex and Hex Flange Nuts			Hex Jam and Heavy Hex Jam Nuts			Hex Slotted Nuts		
	Grade 2	Grade 5	Grade 8	Grade 2	Grade 5	Grade 8	Grade 2	Grade 5	Grade 8
1/4 - 20	2850	3800	4750	1750	2300	2850	2250	3050	3800
5/16 - 18	4700	6300	7850	2800	3750	4700	3700	5050	6300
3/8 - 16	7000	9300	11 600	4200	5600	7000	5500	7450	9300
7/16 - 14	9550	12 800	15 900	5750	7650	9550	7550	10 200	12 800
1/2 - 13	12 800	17 000	21 300	7650	10 200	12 800	10 100	13 600	17 000
9/16 - 12	16 400	21 800	27 300	9850	13 100	16 400	12 900	17 500	21 800
5/8 - 11	20 300	27 100	33 900	12 250	16 300	20 300	16 050	21 700	27 100
3/4 - 10	30 100	40 100	50 100	18 000	24 000	30 100	23 700	32 100	40 100
7/8 - 9	41 600	55 400	69 300	25 000	33 300	41 600	32 800	44 400	55 400
1 - 8	54 500	72 700	90 900	32 700	43 600	54 500	43 050	58 200	72 700
1-1/8 - 7	68 700	80 100	114 000	41 200	48 100	68 700	54 200	64 100	91 600
1-1/4 - 7	87 200	102 000	145 000	52 350	61 000	87 200	68 800	81 400	116 000
1-3/8 - 6	104 000	121 000	173 000	62 350	72 800	104 000	82 000	97 000	139 000
1-1/2 - 6	126 000	148 000	211 000	75 850	88 500	126 000	99 750	118 000	169 000

Nominal Nut Size and Threads Per Inch	Heavy Hex, Hex Thick, Hex High and Heavy Square Nuts			Hex High Slotted and Hex Thick Slotted Nuts			Square Nuts		
	Grade 2	Grade 5	Grade 8	Grade 2	Grade 5	Grade 8	Grade 2	Grade 5	Grade 8
1/4 - 20	3200	4250	5250	2500	3350	4200	2850	3350	4200
5/16 - 18	5200	6950	8650	4150	5500	6900	4700	5500	6900
3/8 - 16	7750	10 300	12 800	8100	8150	10 200	7000	8150	10 200
7/16 - 14	10 600	14 100	17 500	8400	11 200	14 000	9550	11 200	14 000
1/2 - 13	14 200	18 900	23 400	11 200	14 900	18 700	12 800	14 900	18 700
9/16 - 12	18 150	24 200	30 000	14 350	19 100	24 000	16 400	19 100	24 000
5/8 - 11	22 600	30 100	37 300	17 800	23 700	29 800	20 300	23 700	29 800
3/4 - 10	33 300	44 400	55 100	26 350	35 100	44 100	30 100	35 100	44 100
7/8 - 9	46 050	61 400	76 200	36 400	48 500	61 000	41 600	48 500	61 000
1 - 8	60 450	80 600	100 000	47 700	63 600	80 000	54 500	63 600	80 000
1-1/8 - 7	76 300	88 500	126 000	60 300	70 200	101 000	68 700	70 200	101 000
1-1/4 - 7	96 900	112 000	160 000	76 550	89 100	128 000	87 200	89 100	128 000
1-3/8 - 6	115 500	134 000	191 000	91 250	106 000	152 000	104 000	106 000	152 000
1-1/2 - 6	140 500	163 000	232 000	111 000	129 000	185 000	126 000	129 000	185 000

NOTE 1: Values computed by multiplying the strength values (psi) in Table 2 by the tensile stress area (in^2). The values are rounded to the closest 50 pound increment.

2: To convert the inch based pounds values above to metric based Newtons (N) multiple the values above by 4.448.