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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

SURFACE VEHICLE STANDARD

SAE J1053

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Submitted for recognition as an American National Standard

STEEL STAMPED NUTS OF ONE PITCH THREAD DESIGN—INCH SERIES

1. ***Scope—***Included herein are general, dimensional, and performance specifications for those types, styles, and sizes of stamped nuts of one pitch thread design recognized as SAE standard. These nuts are intended for general use where the engagement of a single thread on the mating screw or unthreaded stud is considered adequate for the application. For the metric equivalent of this document, see SAE J1053M.

2. ***References***

2.1 **Applicable Publications—**The following publication forms 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 PUBLICATION—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J1053M —Steel Stamped Nuts of One Pitch Thread Design—Metric Series

3. ***General Specifications***

3.1 **Dimensional Tolerance—**Tolerance on dimensions are shown in Tables 1 to 12.

3.2 **Miscellaneous Dimensions—**Taper on the sides of hexagon portions of nuts (angle between one side and the axis of nut) shall not exceed 1 degree, the maximum limit specified being the largest dimension.

3.3 **Thread Embossments**

3.3.1 FORMED THREAD EMBOSSMENT—Detail of the thread engaging portion of formed thread type nuts shall be such as to permit nut to assemble readily with the specified screw and not strip or deform at the minimum torques shown in Table 2. The edges around the opening shall be spirally formed to conform to the helix of the mating thread and, as indicated on illustrations, the top or top and bottom corners on edges of holes shall be swaged to provide flats for bearing on flanks of the mating thread.

3.3.2 SELF-THREADING EMBOSSMENT—The configuration of self-threading embossment may vary with manufacturer; however, the detail and formation of embossment shall be such as to enable the nuts to cut and/or form threads on cast or wire studs, conforming to the recommended stud designs contained in 5.2, at or below the maximum driving torques shown in Table 3.

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3.4 Material—Nuts shall be fabricated from carbon spring steel suitably processed to meet the performance requirements of this document.

3.5 Finish—Stamped nuts are normally supplied with finishes as specified by the purchaser. Nuts processed with supplemental finishes shall be suitably treated to obviate hydrogen embrittlement.

3.6 Workmanship—Stamped nuts shall be free from cracks, burrs, splits, loose scale, or any defects that might affect their serviceability.

4. Test Procedures and Performance Requirements

4.1 Formed Thread Embossment

4.1.1 ULTIMATE TORQUE TEST—Insert hardened steel (53 HRC min) unplated or uncoated test socket head cap screws of the respective size and 1.00 in length, Class 3A thread, as-received with light coating of oil, into holes in the test fixture. The test fixture is to consist of a hardened steel (58-62 HRC) bar, 1.00 x 0.25 x 18.00 in or equivalent, having 12 equally spaced test holes of the diameter given in Table 1 for respective size.

TABLE 1—TEST BAR HOLE SIZES, IN

Nominal Screw and Nut Size	Hole Diameter Max	Hole Diameter Min	Nominal Screw and Nut Size	Hole Diameter Max	Hole Diameter Min
6-32	0.149	0.144	1/4-20	0.262	0.257
8-32	0.178	0.173	5/16-18	0.328	0.323
10-24	0.204	0.199	3/8-16	0.391	0.386

Hand assemble the test nuts to the test screws. In turn, hold each nut and tighten the test screw to the torque value shown in Table 2 for the respective size. The test shall be performed with a device capable of measuring the clamp load developed, and the load attained shall not be less than the minimum tension values specified in Table 2. After initial breakaway, the nuts must disassemble, by hand, from the test screws.

TABLE 2—ULTIMATE TORQUE SPECIFICATIONS

Nominal Nut Size, in	Torque, lb-in Min	Tension, lb Min	Nominal Nut Size, in	Torque, lb-in Min	Tension, lb Min
6-32	8	120	1/4-20	27	340
8-32	12	150	5/16-18	32	450
10-24	17	220	3/8-16	40	480

4.1.2 EMBRITTLEMENT TEST—Insert hardened steel (53 HRC min) unplated or uncoated test socket head cap screws of the respective size and 1.00 in length, Class 3A thread, as-received with light coating of oil, into holes in the test fixture described in 4.1.1.

Hand assemble new test nuts, from the same lot, to test screws. In turn, hold each nut and tighten test screw to the minimum torque value shown in Table 2 for respective size. After 48 h in this state, the test nuts shall be examined. No cracks are permitted.

4.1.3 SCREW THREAD DAMAGE APPRAISAL TEST—Insert 12 nonheat-treated, unplated or uncoated, steel screws of respective size and 25 mm length, into holes in the test fixture described in 4.1.1.

Hand assemble new test nuts, from the same lot, to test screws. In turn, hold each nut and tighten test screw to the torque value shown in Table 2 for the respective size. Remove nuts from screws and screws from test bar and examine threads on screws for visible damage. Continue test by assembling, with the fingers, untested nuts from same lot onto tested screws. The new nuts must pass over the area on the screw where the previously tested nut engaged the threads.

4.2 Self-Threading Embossment

4.2.1 STARTING EASE TEST—The test nut must start onto the chamfered end (0.003 x 45 degrees) of an unplated or uncoated cold-rolled steel (78-81 HR30T) rod of the diameter specified in Table 3, within one revolution of nut when applied with an appropriate socket affixed to a screwdriver handle.

TABLE 3—TORQUE AND RELATED TENSION SPECIFICATIONS

Nominal Stud or Test Rod Dia, in	Test Rod Dia, in Max	Test Rod Dia, in Min	Driving Torque, lb-in Max	Nut Flange Dia, in Basic	Test Torque, lb-in	Tension, lb Min
1/8	0.126	0.123	8	0.437	34	150
3/16	0.189	0.186	26	0.562	68	250
1/4	0.251	0.248	35	0.687	90	300

4.2.2 ULTIMATE TORQUE TEST—Insert a test rod (see 4.2.1) into a suitable holding device exposing the chamfered end to a height equivalent to the nut height plus 0.125 in or, for closed end nuts, equivalent to the wrenching height. Place an unplated or uncoated soft steel (78-82 HR30T) flat test plate on the exposed test rod. The test plate shall have a minimum thickness of 0.030 in, an inside diameter 0.031 in larger than the diameter of test rod, and shall be at least 1.00 in^2. A new test plate shall be used for each torque test. The test rod and assembled plate must be retained in a suitable clamping device to prevent rotation of the rod and plate and tilting of the plate. The test shall be performed with a device capable of measuring the clamp load developed.

Assemble test nut on the test rod with a suitable torque indicating device. The maximum driving torque shall be recorded and this shall not exceed the maximum driving torque values shown in Table 3 for the respective size. At the torque test values specified in Table 3, the minimum tension values indicated shall be achieved.

4.2.3 EMBRITTLEMENT TEST—Assemble new test nut from the same lot to test rod using test torques shown in Table 3 for respective size. After 48 h, inspect the assembled nut for cracks. No cracks are permitted.

5. Design Criteria

5.1 Formed Thread Embossment—To insure proper starting of formed thread type stamped nuts, the length of the mating externally threaded component shall be such that it will protrude beyond the embossment in nut a minimum distance equivalent to two pitches (threads), exclusive of the length of any chamfer or point provision, under limit stack conditions. Recommended minimum protrusion lengths beyond panels with no allowance for pointing are presented in Figure 1 and Table 4 for respective nut types.

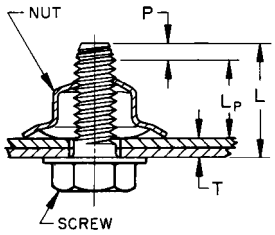

FIGURE 1A—FACETED FLANGE TYPE NUTS

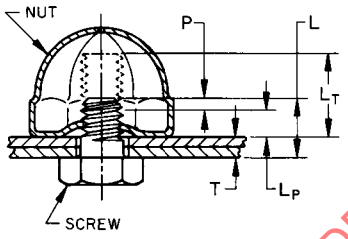

FIGURE 1B—ACORN OR REGULAR TYPE NUTS

$$L = L_P + T + P \quad \text{(Eq. 1)}$$

where:

L = Minimum length of screw or stud
L_p =Minimum protrusion of full form thread length beyond panel (see Table 4 for respective nut types)
L_T = Maximum protrusion of mating part beyond panel allowable for acorn type nuts (see Table 4)
P =Length of point on screw or stud
T = Maximum thickness of panel or panels to be assembled, including allowance, if necessary, to accommodate mismatch of surfaces, etc.

TABLE 4—PROTRUSION LENGTHS FOR FORMED THREAD TYPE STAMPED NUTS, IN

Nominal Thread Size	L_P Protrusion of Threaded Length on Mating Part Beyond Panel Faceted Flange Type Min[1]	L_P Protrusion of Threaded Length on Mating Part Beyond Panel Acorn or Regular Types Min[2]	L_T Total Protrusion of Mating Part Beyond Panel Acorn Types Max[3]
6-32	0.29	0.13	0.21
8-32	0.29	0.13	0.24
10-24	0.33	0.16	0.25
1/4-20	0.40	0.19	0.28
5/16-18	0.44	0.22	0.36
3/8-16	—	0.23	0.34

[1]Values shown are applicable to nuts shown in Table 7. For sealer styles, add height of uncompressed sealer.
[2]Values shown are applicable to nuts shown in Tables 8 and 9, respectively.V
[3]Values shown apply to nuts shown in Table 8.
[4] There are no 3/8-16 washer faceted flange parts available at this time.

5.2 Self-Threading Embossment—To assure proper function and performance of self-threading types of stamped nuts and to provide flexibility for changing nut designs, it is essential that studs and clearance holes in mating panels be designed in conformance with the recommendations set forth in the following.

5.2.1 STUD DESIGN—Studs which are integral features of die-cast components should comply as closely as possible with the recommendations presented in Figures 2 and 3 and Table 5. Studs fabricated from wire or rod shall be in accord with recommendations shown in Figures 4 and 5 and Table 5. Consideration should also be given to the recommendations for fillets, plating, and alignment which follow:

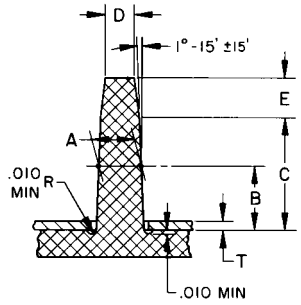

FIGURE 2—DIE CAST AND PLASTIC STUD

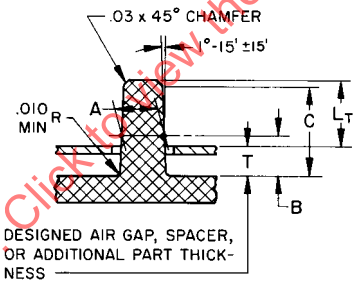

FIGURE 3—SHORT DIE CAST AND PLASTIC STUD

TABLE 5—RECOMMENDED DIMENSIONS OF STUDS FOR USE WITH SELF-THREADING TYPES OF SAMPLED NUTS, in

Nominal Stud Size	A[1] Stud Dia Max	A[1] Stud Dia Min	B[2,3] Length Faceted Flange Type	B[2,3] Length Acorn and Regular Types	C[3] Length Faceted Flange Type Min	C[3] Length Acorn and Regular Types Min	D[1] Point Dia ±0.005	E[4] Point Length Max	E[4] Point Length Min	L_T Stud Protrusion Acorn Type Max
1/8[5]	0.128	0.122	T+0.24	T+0.8	T+0.45	T+0.12	0.073	0.175	0.145	0.26
5/32	0.160	0.154	T+0.24	T+0.11	T+0.45	T+0.16	0.100	0.180	0.150	0.30
3/16	0.191	0.185	T+0.24	T+0.11	T+0.45	T+0.16	0.130	0.190	0.150	0.36
1/4	0.253	0.247	T+0.27	T+0.14	T+0.45	T+0.16	0.180	0.260	0.220	0.38
5/16	0.315	0.309	T+0.31	—6	T+0.45	—6	0.220	0.300	0.260	—6

[1] For plastic studs minimum and maximum diameters 0.05 in larger. Maximum plate per side 0.03 in0. Nickel, chromium plate, or other hard finishes are not recommended on steel studs

[2] Point on shank of die cast studs where A diameter must be within the specified limits.

[3] The T dimension in illustrations represents the distance from base of part to the bearing face of nut in the installed position. The factors to be added represent the minimum length required for normal installation of sealer styles of nuts. Where the factors specified would create an interference condition or otherwise be objectionable, it may be necessary to reduce the factor to that which is required for the respective nut size, type, and style.

[4] On studs for acorn type nuts, it may be necessary to shorten point or apply the chamfer specified for short studs in order to keep protrusion of stud beyond panel within maximum permissible.

[5] Due to susceptibility to breakage in handling and processing, it is recommended use of 1/8 and 5/32 in size die cast and plastic studs be avoided wherever possible.

[6] There are no 5/16 acorn self-threading nuts available at this time.

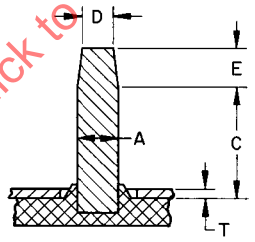

FIGURE 4A—WIRE OR ROD STUD

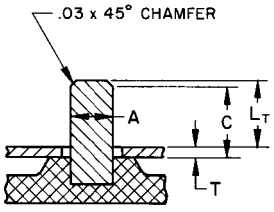

FIGURE 4B—SHORT WIRE OR ROD STUD

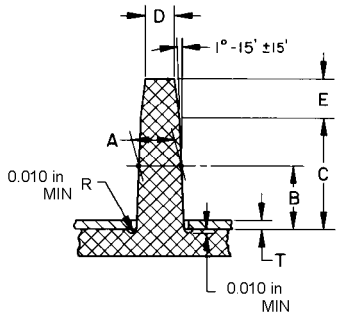

FIGURE 5—DIE CAST STEEL AND PLASTIC STUD

5.2.1.1 *Fillets*—The fillet at the junction of stud with die-casting base shall have as generous a radius as the design will permit, but not less than 0.010 in. Where the panel is to fit tight against the die casting, an annular relief groove should be provided in the die casting at base of stud to accommodate the fillet (see Figure 2) and the fillet radius should be made larger wherever the design will permit.

5.2.1.2 *Angularity*—It is preferable that the axis of the stud be kept perpendicular to the base of the part or as nearly so as possible. However, where design conditions or parting lines on die castings dictate the axis of stud must deviate from square with base, the departure from perpendicular shall not exceed 20 degrees. Similarly, where sufficient driver clearance cannot be provided in line with the stud axis, the angular deviation from axis should in no case exceed 15 degrees in order to insure the socket will have adequate engagement with the nut for assembly.

5.2.1.3 *Stud Location*—On drawings for parts entailing multiple studs, the studs should be located in accordance with the dimensioning and tolerancing practices set forth in the SAE Drawing Standards.

5.3 Panel Clearance Holes—The clearance holes in mating panels for stamped nuts should be designed in conformance with Figure 6 and Table 6. A selection of three hole sizes for each stud size is provided to best satisfy varying design conditions as explained in the following:

a. Preferred hole sizes listed under “X” are recommended and should be used for all attachments requiring normal provisions for clearance and adjustment.
b. Maximum clearance holes tabulated under “X_1” should be used only in applications where maximum adjustment capability is a requirement. These holes provide maximum clearance while assuring that the hole can effectively be sealed with sealer styles of the faceted flange type nuts contained herein.
c. Minimum clearance holes shown under “X_2” may necessarily have to be used where the width of the part being fastened is at or approaches the minimum “Z” dimension. These holes provide adequate clearance for studs under limit stack conditions while insuring that the fastened part will cover the hole. It follows, therefore, that the “Z” dimension shall be the design criterion for the width of portions of parts adjacent to studs.

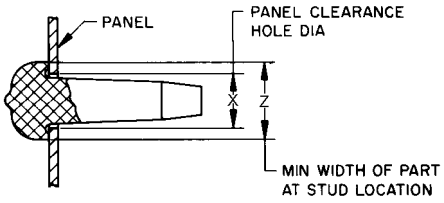

FIGURE 6—PANEL CLEARANCE HOLES

TABLE 6—PANEL CLEARANCE HOLES, IN

Nominal Stud Dia	X Clearance Hole Diameter[1] Preferred Max	X Clearance Hole Diameter[1] Preferred Min	X_1 Clearance Hole Diameter[1] Maximum Clearance Max	X_1 Clearance Hole Diameter[1] Maximum Clearance Min	X_2 Clearance Hole Diameter[1] Minimum Clearance Max	X_2 Clearance Hole Diameter[1] Minimum Clearance Min	Z Part Width Min
1/8[2]	0.188	0.172	0.219	0.203	0.171	0.155	0.24
5/32	0.220	0.205	0.252	0.236	0.205	0.188	0.29
3/16	0.250	0.234	0.281	0.265	0.234	0.219	0.32
1/4	0.344	0.328	0.406	0.390	0.312	0.296	0.41

[1] For recommendations on application of the three choices offered, refer to 5.3.
[2] Due to susceptibility to breakage in handling and processing, it is recommended use of 1/8 and 5/32 mm size die cast and plastic studs be avoided wherever possible.

5.3.1 PANEL HOLE LOCATION—On drawings for panels, multiple holes shall be located in a manner which is compatible with that used to position studs on the mating part.

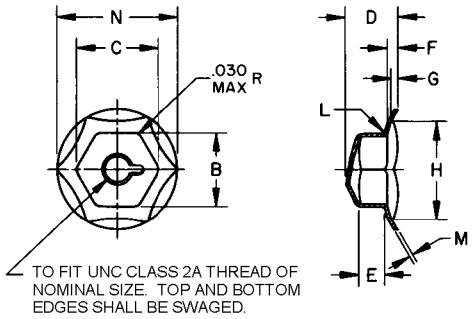

FIGURE 7—FORMED THREAD FACETED FLANGE TYPE STAMPED NUTS, in[1]

TABLE 7A—DIMENSIONS OF FORMED THREAD FACETED FLANGE TYPE STAMPED NUTS, in[1] (SEE FIGURE 7)

Nominal Size[2] or Basic Thread Dia	Threads Per In	B Hexagon Across Flats Max	B Hexagon Across Corners Min	C Hexagon Across Corners Max	C Hexagon Across Corners Max	D Overall Height Max	D Overall Height Min	E Height of Flat Min	F Depth to Radius Max	F Depth to Radius Min
6 0.1380	32	0.312	0.306	0.360	0.348	0.218	0.198	0.067	0.017	0.007
8 0.1640	32	0.343	0.337	0.396	0.382	0.225	0.205	0.072	0.018	0.008
10 0.1900	24	0.375	0.369	0.433	0.418	0.246	0.226	0.076	0.019	0.009
1/4 0.2500	20	0.437	0.430	0.505	0.488	0.302	0.282	0.090	0.047	0.035
5/16 0.3125	18	0.500	0.492	0.577	0.557	0.330	0.310	0.100	0.057	0.045

TABLE 7B—DIMENSIONS OF FORMED THREAD FACETED FLANGE TYPE STAMPED NUTS, in[1] (SEE FIGURE 7) (CONTINUED)

Nominal Size[2] or Basic Thread Dia	Thread Per in	G Dish Depth Max	G Dish Depth Min	H Dish Diameter Max	H Dish Diameter Min	L Fillet Radius Max	L Fillet Radius Min	M Stock Thickness Basic ±0.0015	N Flange Diameter Max	N Flange Diameter Min
6 0.1380	32	Equal to H	Equal to H	0.401	0.387	0.033	0.027	0.013	0.442	0.432
8 0.1640	32	Equal to H	Equal to H	0.429	0.415	0.035	0.029	0.014	0.474	0.464
10 0.1900	24	Equal to H	Equal to H	0.457	0.443	0.037	0.031	0.018	0.505	0.495
1/4 0.2500	20	0.043	0.033	0.572	0.552	0.039	0.033	0.021	0.692	0.682
5/16 0.3125	18	0.050	0.040	0.674	0.650	0.041	0.035	0.023	0.817	0.807

[1] Sealer styles are also available, consult nut manufacturers.

[2] Where specifying nominal size in decimals, zeros preceding decimal and in fourth decimal place shall be omitted.

For recommended assembly data refer to Design Criteria in Section 5. Additional requirements given in General Specifications in Section 3 shall apply.

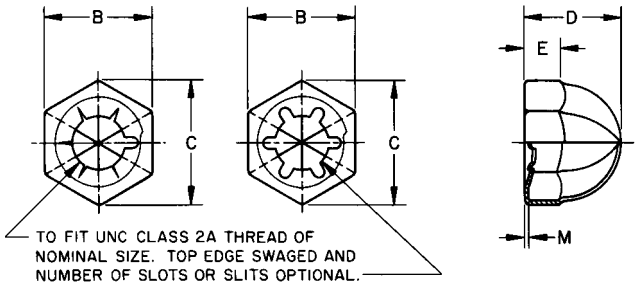

FIGURE 8—FORMED THREAD ACORN TYPE STAMPED NUTS

TABLE 8—DIMENSIONS OF FORMED THREAD ACORN TYPE STAMPED NUTS, in

Nominal Size[1] or Basic Thread Dia	Threads Per in	B Hexagon Across Flats Max	B Hexagon Across Flats Min	C Hexagon Across Comers Max	C Hexagon Across Corners Min	D Overall Height ±0.010	E Height at Corner of Hexagon Min	M Stock Thickness Basic ±0.0015
6 0.1380	32	0.312	0.306	0.306	0.348	0.261	0.080	0.013
8 0.1640	32	0.343	0.337	0.397	0.383	0.297	0.094	0.013
10 0.1900	24	0.375	0.368	0.433	0.418	0.324	0.108	0.017
1/4 0.2500	20	0.437	0.429	0.505	0.488	0.380	0.122	0.021
5/16 0.3125	18	0.562	0.553	0.650	0.627	0.484	0.157	0.024
3/8 0.3750	16	0.562	0.553	0.650	0.627	0.474	0.157	0.020

[1]Where specifying nominal size in decimals, zeros preceding decimal and in fourth decimal place shall be omitted.

For recommended assembly data, refer to Design Criteria in Section 5. Additional requirements given in General Specifications in Section 3 shall apply.

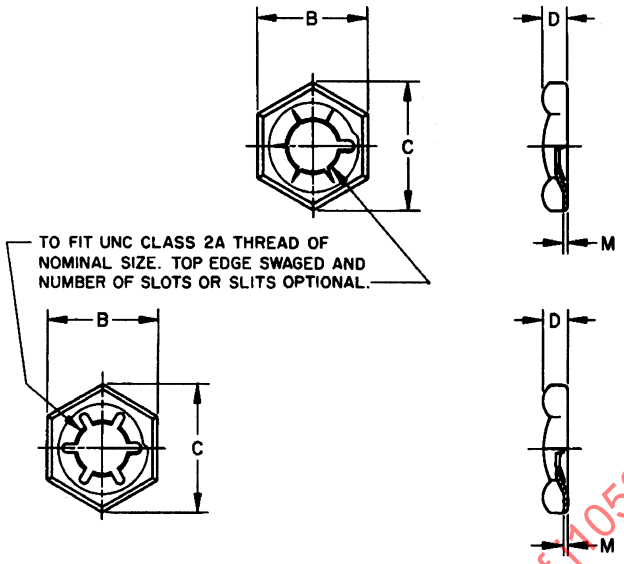

FIGURE 9—FORMED THREAD REGULAR TYPE STAMPED NUTS

TABLE 9—DIMENSIONS OF FORMED THREAD REGULAR TYPE STAMPED NUTS, in

Nominal Size[1] or Basic Thread Dia	Threads Per in	B Hexagon Across Flats Max	B Hexagon Across Flats Min	C Hexagon Across Corners Max	C Hexagon Across Corners Min	D Overall Height Max	D Overall Height Min	M Stock Thickness Basic ±0.0015
6 0.1380	32	0.312	0.305	0.341	0.348	0.102	0.082	0.013
8 0.1640	32	0.343	0.336	0.397	0.383	0.109	0.089	0.013
10 0.1900	24	0.375	0.348	0.433	0.418	0.113	0.095	0.017
1/4 0.2500	20	0.437	0.429	0.505	0.488	0.133	0.113	0.021
5/16 0.3125	18	0.500	0.492	0.578	0.558	0.144	0.124	0.021
3/8 0.3750	16	0.562	0.553	0.650	0.627	0.155	0.135	0.021

[1] Where specifying nominal size in decimals, zeros preceding decimal and in fourth decimal place shall be omitted.

For recommended assembly data, refer to Design Criteria in Section 5. Additional requirements given in General Specifications in Section 3 shall apply.

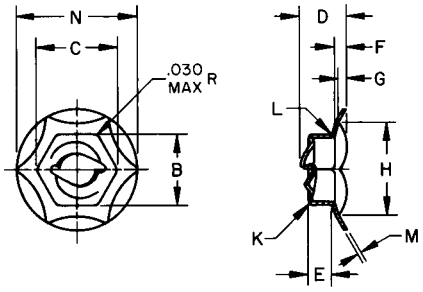

FIGURE 10—SELF-THREADING FACETED FLANGE TYPE STAMPED NUTS

TABLE 10A—DIMENSIONS OF SELF-THREADING FACETED FLANGE TYPE STAMPED NUTS, in[1] (SEE FIGURE 10)

Nominal Size[1] or Basic Stud Dia	B Hexagon Across Flats Max	B Hexagon Across Flats Min	C Hexagon Across Corners Max	C Hexagon Across Corners Min	D Overall Height Max	D Overall Height Min	E Height of Flat Min	E Depth to Radius Max	F Depth to Radius Min
1/8 0.125	0.312	0.034	0.360	0.348	0.199	0.179	0.067	0.017	0.007
3/16 0.188	0.375	0.366	0.433	0.418	0.239	0.219	0.078	0.037	0.025
1/4 0.250	0.437	0.428	0.505	0.488	0.273	0.253	0.090	0.047	0.035

TABLE 10B—DIMENSIONS OF SELF-THREADING FACETED FLANGE TYPE STAMPED NUTS, in[1] (SEE FIGURE 10) (CONTINUED)

Nominal Size[1] or Basic Stud Dia	G Dish Depth Max	G Dish Depth Min	H Dish Diameter Max	H Dish Diameter Min	K Corner Radius Max	L Fillet Radius Max	L Fillet Radius Min	M Stock Thickness Basic ±0.0015	N Flange Diameter Max	N Flange Diameter Min
1/8 0.125	Equal to H	Equal to H	0.401	0.387	0.035	0.033	0.027	0.020	0.442	0.432
3/16 0.188	0.036	0.026	0.468	0.448	0.037	0.037	0.031	0.020	0.567	0.557
1/4 0.250	0.043	0.033	0.572	0.552	0.043	0.039	0.033	0.021	0.692	0.682

[1] Sealer styles are also available, consult manufacturers.

[2] Where specifying nominal size in decimals, zeros preceding decimal shall be omitted.

For recommended assembly data refer to Design Criteria in Section 5. Additional requirements given in General Specifications in Section 3 shall apply.