SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®

400 COMMONWEALTH DRIVE, WARRENDALE, PA 15096

Submitted for recognition as an American National Standard

ENTIRE STANDARD REVISED

AEROSPACE STANDARD

AS 954

Issued 6-67
Revised 2-88

REV. D

WRENCHES, HAND
TWELVE POINT
HIGH STRENGTH, THIN WALL

1. SCOPE AND CLASSIFICATION:

1.1 Scope: This SAE Aerospace Standard (AS) covers high strength thin wall commercial sockets, flexible sockets, box wrenches and torque adaptors which possess the strength, clearances, and internal wrenching design so configured that, when mated with 12-point fasteners conforming to the requirement of AS 870, they shall transmit torque to the fastener without bearing on the outer 5% of the fastener's wrenching points.

1.2 Classification: This AS covers sizes and combinations of sizes of the aforementioned items for which an aerospace need has been demonstrated and for which the commercial item manufacturers can meet all requirements of this AS. Wrenches, sockets, and adaptors covered by this AS shall be of the following types, classes, and styles, as specified:

Type I Sockets
  Class 1 Sockets
    Style A - Regular
    Style B - Long

  Class 2 Flexible Sockets

Type II Wrenches, Box
  Class 1 Angled End

  Class 2 Modified Offset
    Style A Regular Length
    Style B Short Length

1.2 Classification (Cont'd):

Class 3 Deep Offset
Style A Regular Length
Style B Short Length

Class 4 Combination

Type III Torque Adaptors

2. APPLICABLE DOCUMENTS:

2.1 The following documents of the issue in effect on the date of invitations for bid or request for proposal form a part of this AS to the extent specified herein.

2.1.1 American Society for Testing and Materials (ASTM) Standard: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103

E18 - Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials, Standard Methods of Test For

2.1.2 American National Standards Institute (ANSI), Inc., Standards: Available from American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018

B46.1 - Surface Texture
B107.4 - Driving and Spindle Ends for Portable, Hand, Air and Electric Tools
B107.6 - Wrenches, Box, Open End, Combination and Flare Nut
B107.17M - Gages, Wrench Openings, Reference

2.1.3 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096

AS 478 - Identification - Marking Methods
AS 870 - Wrenching Configuration, Double Hexagon (12-point) for Threaded Fasteners

3. REQUIREMENTS:

3.1 Illustrations: The illustrations shown herein are descriptive, not restrictive, and are not intended to preclude sockets, flexible sockets, box wrenches, and torque adaptors which are otherwise in accordance with this standard.

3.2 Materials: Unless otherwise specified hereinafter, the materials used in the manufacture of the sockets, flexible sockets, box wrenches and torque adaptors shall be steel, the chemical composition and heat treatment of which shall be such as to produce tools conforming to the physical requirements specified herein. Powdered metal or cast steel shall not be used.

3.3 Marking: The sockets, flexible sockets, box wrenches and torque adaptors shall be marked in a permanent manner with the manufacturer's name, or with a trademark of such known character that the source of manufacture may be readily determined. In addition, the tools shall be marked in a permanent manner with the nominal wrench opening. Marking requirement shall be in accordance with AS 478.

3.4 Manufacture and Design:

3.4.1 Drive End Dimensions: Female drive end dimensions shall conform to ANSI B 107.4. Male drive tangs in accordance with ANSI B 107.4 shall be used to judge the following requirements:

3.4.1.1 Female Drive Opening: All female drive openings shall be broached or formed in a smooth and well defined manner. Tools having female drive openings shall be firmly attachable to corresponding size male drive tangs by one of the following methods.

3.4.1.1.1 Detent: All four faces of the female drive opening shall be recessed so that one of the recesses engages the spring-loaded steel ball on the corresponding male drive.

3.4.1.1.2 Cross-hole: One or more of the faces of the female drive opening shall be drilled with a cross-hole to engage the spring-loaded steel ball on the corresponding male drive.

3.4.2 Tang Engagement and Disengagement: The detachable sockets, flexible sockets and torque adaptors shall be so designed that male tangs can be inserted into the corresponding female openings without undue force and shall be manually detachable without the use of any tools or keys, and meet the minimum force requirements to remove tang as specified in applicable tables of ANSI B 107.4. Binding between surfaces and corners shall not be evident.

3.4.3 Edges and Corners: All edges and corners, capable of causing injury, not otherwise covered herein, shall have sharp edges removed by rounding, chamfering, or other means. The inside edges of the wrench shall be chamfered.

3.5 Hardness: Unless otherwise specified herein, sockets, flexible sockets, box wrenches and torque adaptors shall be hardened throughout to a Rockwell hardness of not less than 40 nor more than 54 on the "C" scale. Hardness definitions, nomenclature and procedures used herein can be found in ASTM E 18. When grinding is necessary to prepare the test surface, the amount removed must not exceed 0.007 inch on the surface contacted by the indenter.

3.6 Finish: Two types of protective finish are covered. Chromium plate will be furnished unless otherwise specified.

3.6.1 Chromium Plate: The plating shall be electrodeposited metals consisting of nickel, followed by chromium, the minimum thickness of which shall be of 0.0002 inch for nickel or iron-nickel, and 0.00001 inch for chromium. The plating shall be adherent, smooth, continuous and free from pits, blisters, nodules, and any other defects which would interfere with their protective value and serviceability. The minimum thickness of the plating shall be as specified on all external visible surfaces which can be touched by a ball 0.750 inch in diameter.

3.6.2 Black Oxide or Phosphate Treatment: The tools shall be coated with a chemically produced oxide or phosphate coating followed with a coating of rust preventive oil. All external surfaces shall have a maximum roughness height value of 150 μ inch.

3.6.3 Surface Roughness: All external surfaces shall be free from pits, nodules, forge flash, burrs, cracks, and other detrimental defects. The external forge flash shall blend smoothly with adjacent surfaces except that the forge flash shall be completely removed from the periphery of the heads of box wrenches and torque adaptors and from that portion of the handle which shall be essentially straight and uniform in section dimensions. Determinations of μ inch values shall be taken on a representative surface using a 0.030 inch width cut-off on the surface measuring instrument. Definitions and nomenclature used herein can be found in ANSI B 46.1.

3.6.3.1 Surface Finish Requirements for Chromium Plate: On all Type I sockets and flexible sockets, the outer longitudinal surface or major diameter thereof shall be bright with 30 μ inch maximum, except where knurled or grooved. The remaining exterior longitudinal socket surface shall be 150 μ inch maximum. On all Type II box wrenches and Type III torque adaptors, a minimum of 180 deg of the outer periphery of the box ends (90 deg on each side of the longitudinal axis of the wrench) shall be 30 μ inch maximum.

3.7 Test Loads: The items covered herein shall withstand the test load specified in the applicable tables without injury or permanent deformation (set) which might affect the durability or serviceability of the tools. Adequate safeguards for personnel and property shall be employed in conducting all tests. Approved eye protection shall be worn at all times and equipment safety shields in place when tests are in progress.

3.7.1 Mandrels for Wrench Openings: Wrench openings shall be tested on hexagonal mandrels. The size of all mandrels shall conform to the dimensions and tolerances specified in Table I. The hexagonal mandrel shall be reduced by 0.05 H at each corner as shown on Fig. 1 to ensure that wrench lobes do not transmit torque on mandrel points. Mandrels shall be hardened to a Rockwell hardness of not less than 55 on the "C" scale and shall have smoothly finished wrench engagement surfaces.

3.7.2 Test Plug:

3.7.2.1 Type I, Class 1 Sockets: A square test plug of suitable strength and complying with the minimum dimensional requirements of the male drive tang specified in ANSI B 107.4 shall be employed. The test plug may be driven by any suitable manual or mechanical means. The socket shall then be engaged on the end of a mandrel to a maximum depth in accordance with Table 1. A stop may be set at the outer end of the test plug to prevent slippage of the socket end-wise from the mandrel.

3.7.2.2 Type I, Class 2 Flexible Sockets: A test plug as in 3.7.2.1 shall be used except that a means shall be provided to keep flexible socket parts in the axis about which the load is applied.

3.7.3 Qualification Test:

3.7.3.1 All Type I Sockets, Type II Wrenches, Type III Torque Adaptors: Each sample tool tested shall be capable of withstanding 2000 applications of the minimum torque cyclic fatigue load specified in Tables II, III, IV or IX, as applicable, and then the associated proof load when engaged per 3.7.1. After each 250 applications on the mandrel, the tool shall be indexed 30 deg.

3.8 Wrench Opening:

3.8.1 Wrench Design: The internal wrench design of all Type I Sockets, Type II Wrenches, and Type III Torque Adaptors shall be so configured that, when mated with 12-point fasteners conforming to the requirements of AS 870, they shall transmit torque to the fastener without bearing on the outer 5% of the fastener's wrenching points (see Fig. 1).

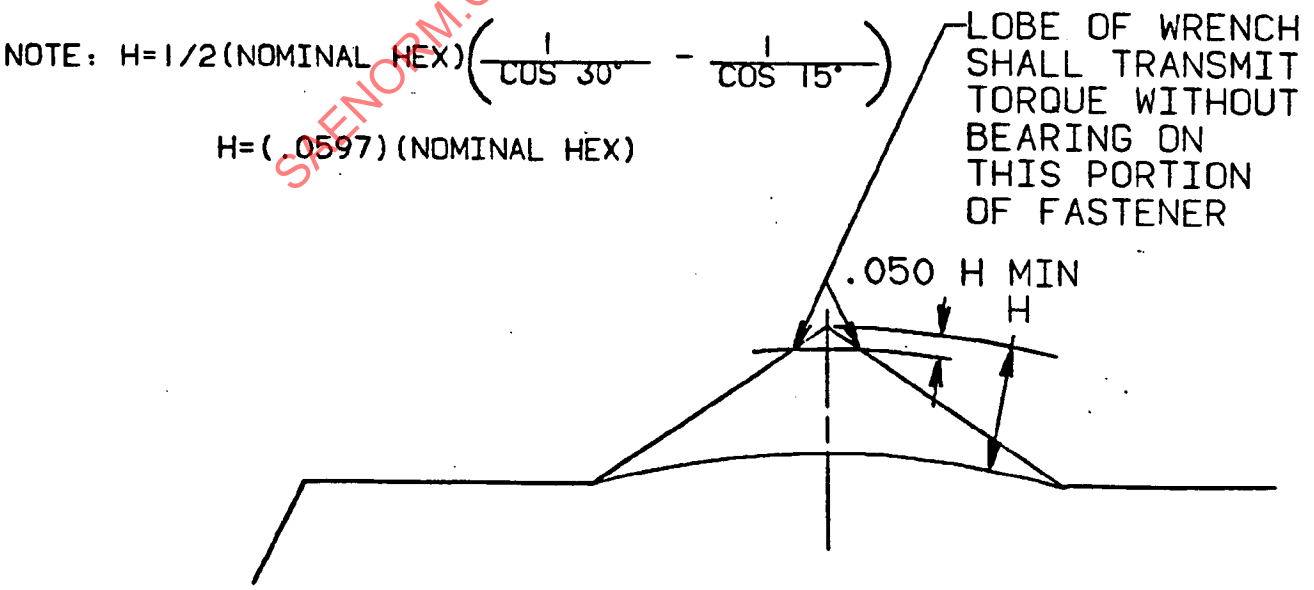

FIGURE 1 - Internal Wrench Engagement

3.8.2 Bolt and Nut End Opening Tolerance: Wrench opening tolerance shall be as specified in ANSI B 107.17M.

3.9 Type I, Class 1 Sockets: In addition to the requirements of 3.4, a bolt clearance hole shall be provided. The clearance hole length shall be from the base of the 12-point opening to the base of the square drive. The diameter of the bolt clearance hole and other socket dimensions shall conform to Table II. The bolt clearance hole shall be concentric with the 12-point opening within 0.015 Total Indicator Reading.

3.10 Type I, Class 2 Flexible Sockets: In addition to the requirements of 3.4, flexible sockets shall be provided with a friction type device which will hold the drive end and the socket end in any set position with a force adequate to hold the universal joint against gravity. The hinge pin shall be solid and not extend beyond the periphery of the universal joint. The universal joint shall be capable of rotation in a complete arc when the angular deviation of either end member from the common center line is 40 deg. A bolt clearance hole and other flexible socket dimensions shall conform to Table III.

3.11 Type II Wrenches, Type III Torque Adaptors:

3.11.1 Type II, Class 1 Box Wrench, Angled End: The angled end box wrenches shall be 12-point, double hexagon double-head design, shall possess the wrenching desion of 3.8.1 and shall conform to Tables IV and V.

3.11.2 Type II, Class 2, Style A & B Box Wrench, Modified Offset: The modified offset box wrenches shall be 12-point, double hexagon double-head design, shall possess the wrenching design of 3.8.1 and shall conform to Tables IV and VI.

3.11.3 Type II, Class 3, Style A & B Box Wrench, Deep Offset: The deep offset box wrenches shall be 12-point, double hexagon double-head design, shall possess the wrenching design of 3.8.1 and shall conform to Tables IV and VII.

3.11.4 Type II, Class 4 Box Wrench, Combination: The combination box and open end wrenches shall have a box wrench head on one end and an open end wrench head on the other end. The box wrench head shall be 12-point, double hexagon with the wrenching design of 3.8.1 and shall conform to Table IV. The open end wrench head shall conform to ANSI B 107.6 Type III. The combination wrench shall conform to Table VIII.

3.11.5 Type III Torque Adaptor: Torque adaptors shall have a square drive at one end and a 12-point double hexagon box wrench at the other end. The wrenching design shall conform to 3.8.1, Table IV and Table IX. One side of the square drive shall be within 3 deg of parallel to a line drawn from the center of the drive through the center of the wrench opening. Dimensions shall conform to Table IX.

3.12 Workmanship: All details of workmanship shall be in accordance with high grade commercial practices. All items covered herein shall be free from rust, fins, burrs, external sharp or rough edges, corners or surfaces and other defects which may impair their serviceability or durability.

Prepared by Subcommittee EG-1B, Hand Tools of the SAE Committee EG-1
Aerospace Propulsion Systems Support Equipment

TABLE I - Hexagon Mandrel Dimensions & Engagement Data
(Dimensions in Inches)

For Wrench Sizes	Nominal Wrench Opening	Hexagonal Mandrel Across Flats Tolerances	Mandrel Engagement Maximum Depth of Insertion
3/16	0.1875	+0.001 -0.002	0.094
7/32	0.2188	+0.001 -0.002	0.109
1/4	0.2500	+0.001 -0.002	0.125
9/32	0.2812	+0.001 -0.002	0.141
5/16	0.3125	+0.001 -0.002	0.141
11/32	0.3438	+0.001 -0.002	0.156
3/8	0.3750	+0.001 -0.002	0.156
7/16	0.4375	+0.001 -0.002	0.218
1/2	0.5000	+0.001 -0.003	0.265
9/16	0.5625	+0.001 -0.003	0.328
5/8	0.6250	+0.001 -0.003	0.375
11/16	0.6875	+0.001 -0.003	0.375
3/4	0.7500	+0.001 -0.003	0.437
25/32	0.7812	+0.001 -0.003	0.453
13/16	0.8125	+0.001 -0.003	0.453
7/8	0.8750	+0.001 -0.003	0.500
15/16	0.9375	+0.001 -0.003	0.546
1	1.0000	+0.001 -0.003	0.546
1 1/16	1.0625	+0.001 -0.003	0.625
1 1/8	1.1250	+0.001 -0.003	0.656
1 3/16	1.1875	+0.001 -0.003	0.656
1 1/4	1.2500	+0.001 -0.003	0.750
1 5/16	1.3125	+0.001 -0.003	0.765
1 3/8	1.3750	+0.001 -0.003	0.781
1 7/16	1.4375	+0.001 -0.003	0.875
1 1/2	1.5000	+0.001 -0.003	0.875
1 3/4	1.7500	+0.001 -0.007	1.093
1 13/16	1.8125	+0.001 -0.007	1.125
1 7/8	1.8750	+0.001 -0.007	1.125
1 15/16	1.9375	+0.001 -0.007	1.125

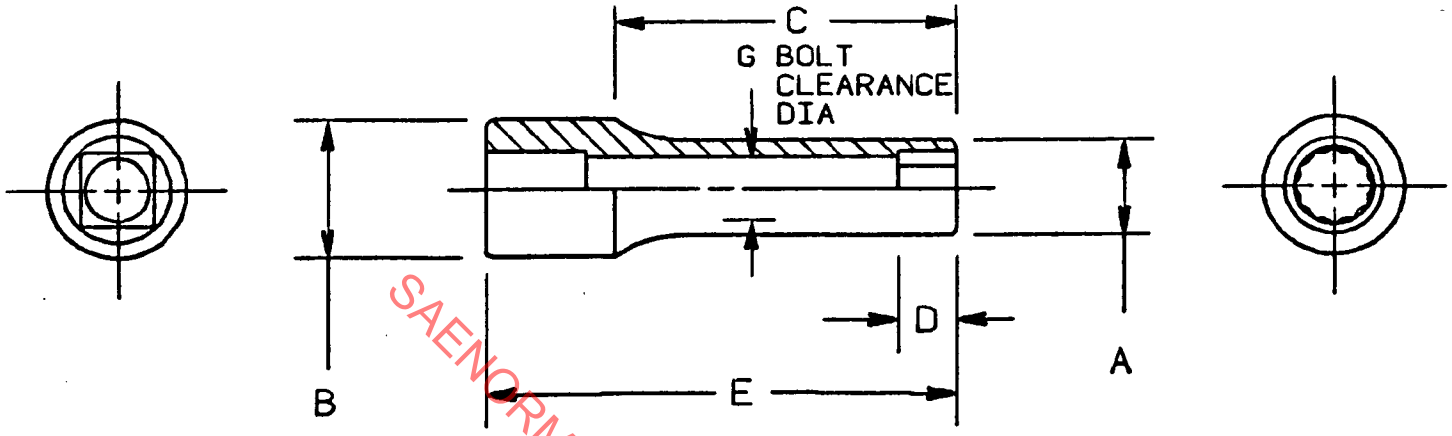

TABLE IIA - Type I, Class 1 Socket Dimensions (Dimensions in Inches)
1/4 Square Drive

Nominal Wrench Opening	A Dia. Max	B Dia. Max	D Depth Min	G Dia. Min	Style A Regular Length C Min	Style A Regular Length E Max	Style B Long Length C Min	Style B Long Length E Min	Torque Requirements Cyclic Load (in lb)	Torque Requirements Proof Load (in lb)
3/16	0.315	0.440	0.175	0.156	0.390	1.270	0.420	1.930	65	200
7/32	0.343	0.440	0.190	0.195	0.390	1.270	0.420	1.930	75	225
1/4	0.380	0.440	0.205	0.203	0.390	1.270	0.420	1.930	100	300
9/32	0.430	0.440	0.215	0.260	0.390	1.270	0.420	1.930	125	375
5/16	0.478	0.478	0.250	0.265	-	1.270	-	1.930	150	450
11/32	0.500	0.500	0.265	0.320	-	1.270	-	1.930	175	525
3/8	0.550	0.550	0.265	0.328	-	1.270	-	1.930	200	600
7/16	0.625	0.625	0.345	0.390	-	1.270	-	1.930	200	600
1/2	0.687	0.687	0.350	0.453	-	1.270	-	1.930	200	600
9/16	0.750	0.750	0.355	0.516	-	1.270	-	1.930	200	600

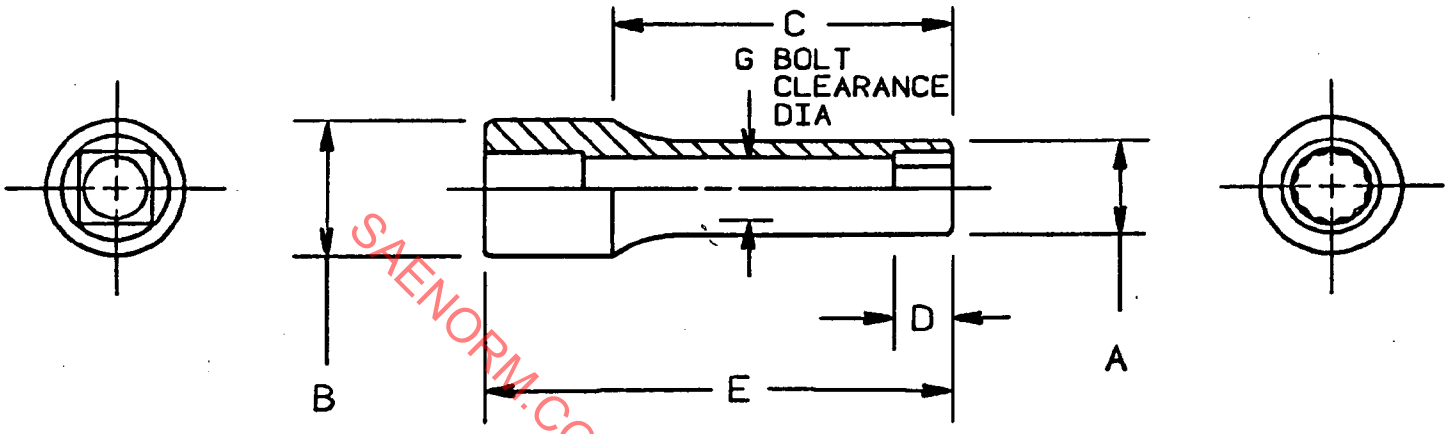

TABLE IIB - Type I, Class 1 Socket Dimensions (Dimensions in Inches)
3/8 Square Drive

Nominal Wrench Opening	A Dia. Max	B Dia. Max	D Depth Min	G Dia. Min	Style A Regular Length C Min	Style A Regular Length E Max	Style B Long Length C Min	Style B Long Length E Min	Torque Requirements Cyclic Load (in lb)	Torque Requirements Proof Load (in lb)
1/4	0.400	0.697	0.205	0.203	0.420	1.270	0.625	1.930	100	300
9/32	0.440	0.697	0.215	0.260	0.420	1.270	0.625	1.930	125	375
5/16	0.478	0.697	0.265	0.265	0.420	1.270	0.625	1.930	150	450
11/32	0.500	0.697	0.265	0.320	0.420	1.270	0.625	1.930	175	525
3/8	0.550	0.697	0.265	0.328	0.420	1.520	0.625	1.930	300	900
7/16	0.660	0.697	0.345	0.390	0.420	1.520	0.625	1.930	400	1200
1/2	0.730	0.730	0.350	0.453	-	1.780	-	1.930	800	2400
9/16	0.812	0.812	0.355	0.515	-	1.780	-	1.930	840	2500
5/8	0.880	0.880	0.460	0.578	-	1.780	-	2.000	840	2500
11/16	0.960	0.960	0.500	0.640	-	1.780	-	2.125	840	2500
3/4	1.055	1.055	0.590	0.703	-	1.780	-	2.125	840	2500
25/32	1.070	1.070	0.620	0.734	-	1.780	-	2.125	840	2500
13/16	1.130	1.130	0.650	0.765	-	1.780	-	2.180	840	2500
7/8	1.195	1.195	0.700	0.828	-	1.780	-	2.180	840	2500
15/16	1.250	1.250	0.750	0.891	-	1.780	-	2.250	840	2500
1	1.312	1.312	0.800	0.954	-	1.780	-	2.250	840	2500

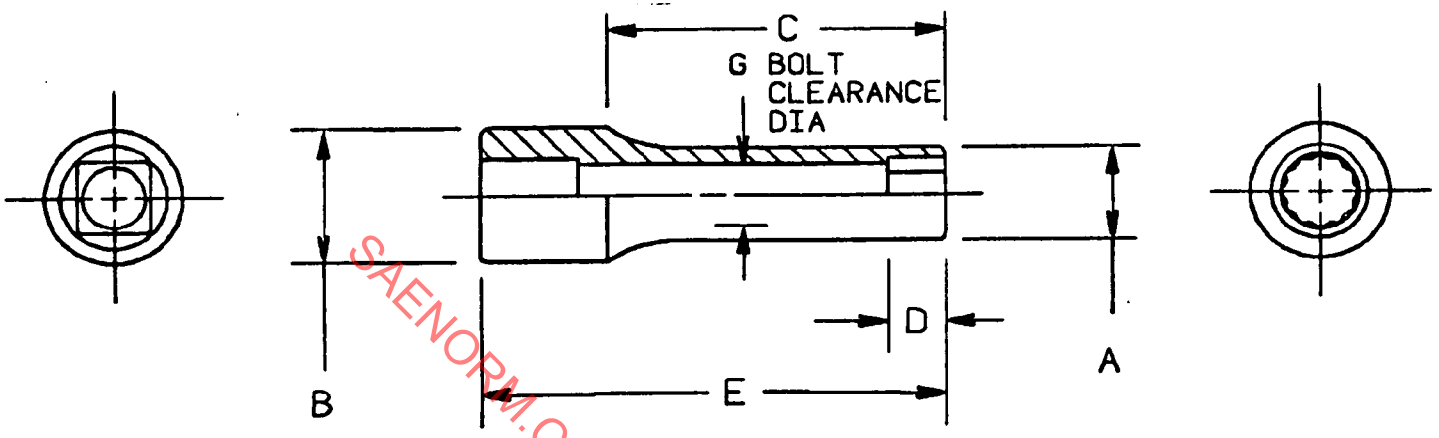

TABLE IIC - Type I, Class 1 Socket Dimensions (Dimensions in Inches)
1/2 Square Drive

Nominal Wrench Opening	A Dia. Max	B Dia. Max	O Depth Min	G Dia. Min	Style A Regular Length C Min	Style A Regular Length E Max	Style B Long Length C Min	Style B Long Length E Min	Torque Requirements Cyclic Load (in lb)	Torque Requirements Proof Load (in lb)
3/8	0.580	0.940	0.265	0.328	0.420	1.780	0.700	2.930	300	900
7/16	0.680	0.940	0.345	0.390	0.420	1.780	0.700	2.930	400	1200
1/2	0.740	0.940	0.350	0.453	0.420	1.780	0.700	2.930	800	2400
9/16	0.818	0.940	0.355	0.515	0.420	1.780	0.700	2.930	1200	3600
5/8	0.892	0.940	0.460	0.578	0.500	1.780	0.700	2.930	1650	5000
11/16	0.960	0.960	0.500	0.650	-	1.780	-	2.930	1850	5500
3/4	1.055	1.055	0.590	0.703	-	1.780	-	2.930	2000	6000
25/32	1.070	1.070	0.620	0.734	-	1.780	-	2.930	2000	6000
13/16	1.130	1.130	0.650	0.765	-	1.780	-	2.930	2000	6000
7/8	1.200	1.200	0.700	0.828	-	1.780	-	2.930	2000	6000
15/16	1.300	1.300	0.720	0.890	-	1.780	-	2.930	2000	6000
1	1.370	1.370	0.730	0.953	-	1.780	-	2.930	2000	6000
1 1/16	1.440	1.440	0.750	1.015	-	1.780	-	2.930	2000	6000
1 1/8	1.510	1.510	0.780	1.077	-	1.780	-	2.930	2000	6000
1 1/4	1.580	1.580	0.810	1.202	-	1.780	-	2.930	2000	6000
1 5/16	1.650	1.650	0.840	1.264	-	1.780	-	2.930	2000	6000

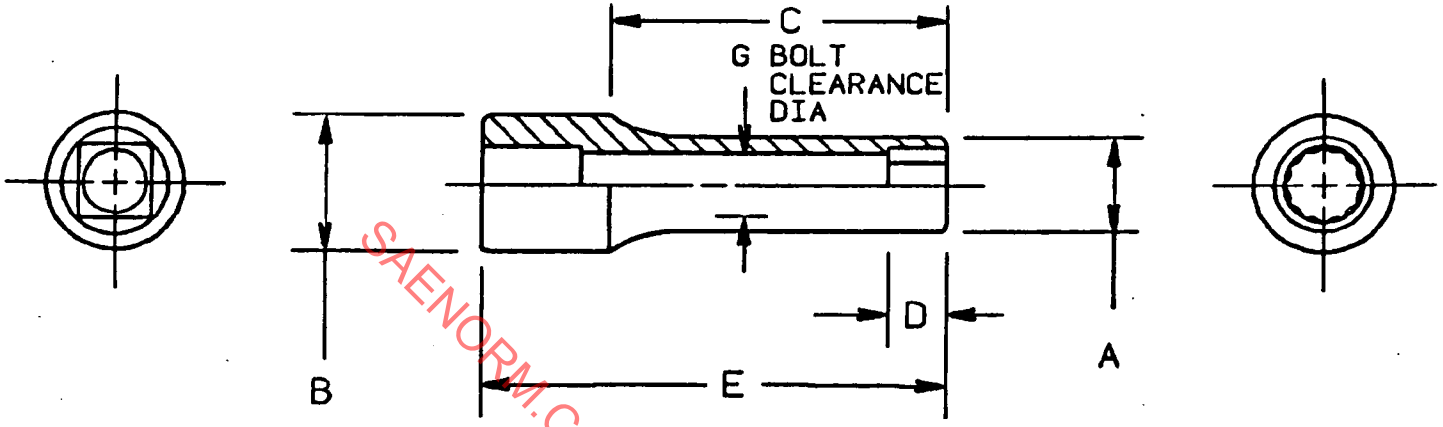

TABLE IID - Type I, Class 1 Socket Dimensions (Dimensions in Inches)
3/4 Square Drive

Nominal Wrench Opening	A Dia. Max	B Dia. Max	D Depth Min	G Dia. Min	Style A Regular Length C Min	Style A Regular Length E Max	Torque Requirements Cyclic Load (in lb)	Torque Requirements Proof Load (in lb)
3/4	1.200	1.500	0.590	0.734	0.600	2.300	3500	10500
3/16	1.295	1.500	0.650	0.765	0.600	2.300	3650	11000
7/8	1.340	1.500	0.700	0.828	0.600	2.300	5000	15000
15/16	1.420	1.500	0.720	0.890	0.600	2.300	5650	17000
1	1.510	1.575	0.750	0.953	0.600	2.300	6000	18000
1 1/16	1.575	1.575	0.750	1.015	-	2.300	6000	18000
1 1/8	1.635	1.635	0.780	1.077	-	2.300	6000	18000
1 3/16	1.700	1.700	0.790	1.139	-	2.300	6000	18000
1 1/4	1.825	1.825	0.810	1.202	-	2.300	6000	18000
1 5/16	1.920	1.920	0.840	1.264	-	2.700	6000	18000
1 3/8	1.980	1.980	0.900	1.326	-	2.700	6000	18000
1 7/16	2.075	2.075	0.950	1.388	-	2.700	6000	18000
1 1/2	2.135	2.135	1.000	1.450	-	2.700	6000	18000
1 9/16	2.200	2.260	1.050	1.512	-	2.700	6000	18000
1 5/8	2.270	2.325	1.100	1.574	-	2.700	6000	18000
1 11/16	2.400	2.400	1.150	1.636	-	3.200	6000	18000
1 3/4	2.510	2.510	1.200	1.698	-	3.200	6000	18000
1 13/16	2.575	2.575	1.250	1.762	-	3.200	6000	18000
1 7/8	2.695	2.695	1.300	1.824	-	3.200	6000	18000
1 15/16	2.780	2.780	1.350	1.887	-	3.200	6000	18000

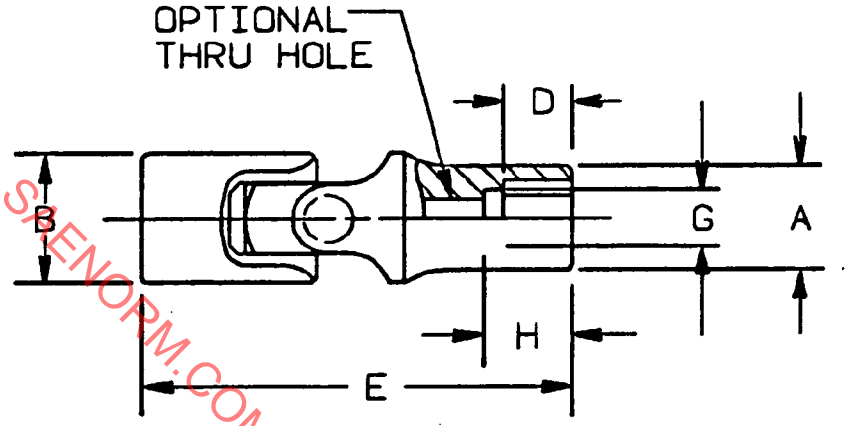

TABLE IIIA - Type I, Class 2 Flexible Socket Dimensions (Dimensions in Inches)
1/4 Square Drive

Nominal Wrench Opening	Outer Diameter Nut End Max A	Outer Diameter Drive End Max B	Depth Opening Nut End Min D	Bolt Clearance Dia. Min G	Bolt Clearance Length Min H	Overall Length Max E	Cyclic Torque Load (in lb) Min	Proof Torque Load (in lb) Min
1/4	0.385	0.515	0.205	0.203	0.330	1.312	100	300
5/16	0.470	0.515	0.250	0.265	0.408	1.437	150	450
3/8	0.540	0.540	0.265	0.328	0.437	1.500	165	500
7/16	0.625	0.540	0.345	0.390	0.545	1.625	165	500
1/2	0.687	0.540	0.350	0.453	0.560	1.688	165	500

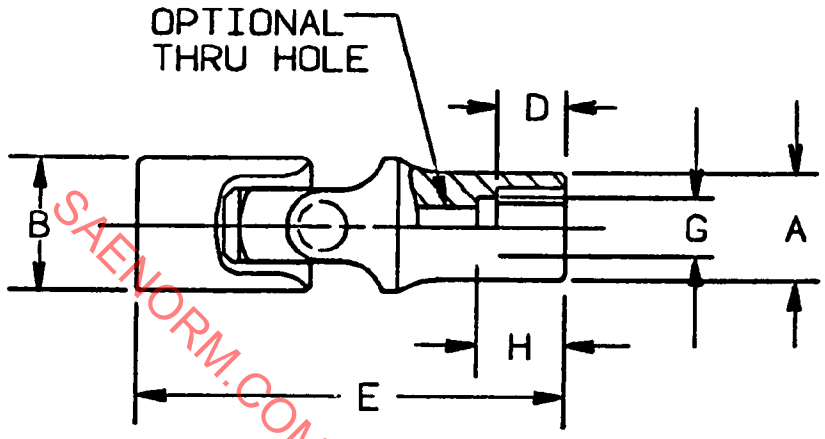

TABLE IIIB - Type I, Class 2 Flexible Socket Dimensions (Dimensions in Inches)
3/8 Square Drive

Nominal Wrench Opening	Outer Diameter Nut End Max A	Outer Diameter Drive End Max B	Depth Opening Nut End Min D	Bolt Clearance Dia. Min G	Bolt Clearance Length Min H	Overall Length Max E	Cyclic Torque Load (in lb) Min	Proof Torque Load (in lb) Min
3/8	0.550	0.750	0.265	0.328	0.465	2.000	300	900
7/16	0.660	0.750	0.345	0.390	0.545	2.125	350	1000
1/2	0.730	0.750	0.350	0.453	0.550	2.187	350	1000
9/16	0.812	0.785	0.355	0.515	0.555	2.250	350	1000
5/8	0.880	0.785	0.460	0.578	0.660	2.250	350	1000
11/16	0.960	0.785	0.500	0.640	0.720	2.250	350	1000
3/4	1.055	0.785	0.590	0.702	0.810	2.312	350	1000

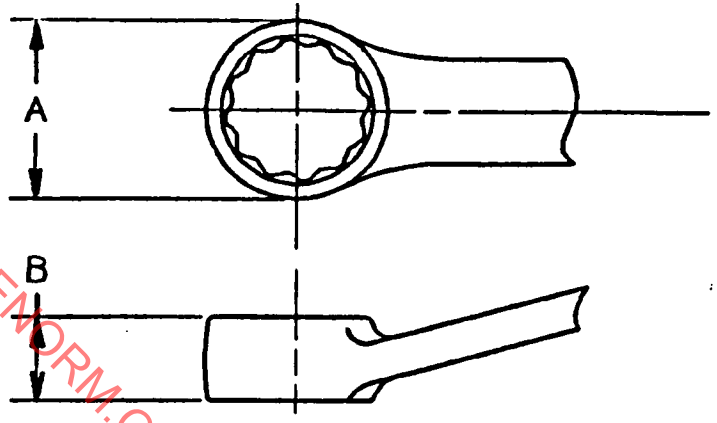

TABLE IV - Type II Box Wrench and Type III Torque Adaptor Data
(Dimensions in Inches)

Nominal Wrench Opening	Type II Class 1, 2, 3 Type III A Max	Type II Class 1, 2, 3 Type III B Max	Type II Class 4 A Max	Type II Class 4 B Max	Torque Requirements Type II, Classes 1 and 4 Cyclic Load (in lb)	Torque Requirements Type II, Classes 1 and 4 Proof Load (in lb)	Torque Requirements Type II, Classes 2 and 3 Cyclic Load (in lb)	Torque Requirements Type II, Classes 2 and 3 Proof Load (in lb)
3/16	0.345	0.230	0.345	0.230	55	165	55	165
7/32	0.375	0.250	0.375	0.250	60	180	55	165
1/4	0.425	0.250	0.435	0.250	70	220	70	220
9/32	0.445	0.250	0.460	0.250	85	250	85	248
5/16	0.480	0.280	0.560	0.280	90	275	90	275
11/32	0.535	0.300	0.590	0.300	100	300	90	275
3/8	0.578	0.327	0.615	0.327	200	605	200	605
7/16	0.660	0.349	0.710	0.349	250	750	240	715
1/2	0.750	0.359	0.802	0.359	400	1200	340	1020
9/16	0.830	0.406	0.895	0.406	550	1650	500	1500
5/8	0.920	0.468	0.986	0.468	750	2200	730	2200
11/16	1.010	0.490	1.060	0.490	880	2640	880	2640
3/4	1.090	0.531	1.130	0.531	1000	3000	950	2860
13/16	1.180	0.562	1.230	0.562	1100	3300	1100	3300
7/8	1.270	0.594	1.340	0.594	1230	3700	1210	3630
15/16	1.360	0.615	1.420	0.615	1530	4600	1500	4510
1	1.450	0.630	1.530	0.640	1830	5500	1800	5390
1 1/16	1.530	0.660	1.640	0.720	2000	6000	1980	5940
1 1/8	1.610	0.690	1.720	0.780	2200	6600	2160	6490
1 3/16	1.690	0.720	1.790	0.780	2430	7300	2160	6490
1 1/4	1.780	0.750	1.900	0.780	2670	8000	--	--
1 5/16	1.860	0.780	1.970	0.780	3000	9000	--	--
1 3/8	1.940	0.810	2.060	0.900	3170	9500	--	--
1 7/16	2.020	0.840	2.160	0.940	3250	9750	--	--
1 1/2	2.100	0.870	2.210	0.960	4000	12000	--	--
1 3/4	2.690	1.000	2.800	1.100	4700	14300	--	--

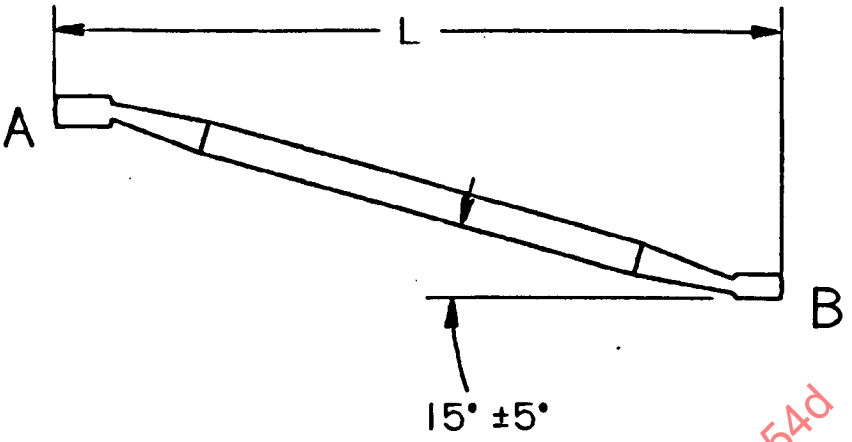

TABLE V - Type II, Class 1 Angled End Box Wrench
(Dimensions in Inches)

Wrench Opening Small End 'A'	Wrench Opening Large End 'B'	L Min	L Max
7/32	1/4	5.00	8.00
1/4	5/16	6.00	8.00
5/16	3/8	7.00	9.00
3/8	7/16	7.50	9.50
7/16	1/2	7.75	10.25
1/2	9/16	8.00	10.50
9/16	5/8	8.50	11.00
5/8	11/16	9.00	11.50
11/16	3/4	9.50	12.00
11/16	13/16	10.00	12.50
3/4	13/16	10.50	13.00
13/16	7/8	11.50	14.00
7/8	15/16	12.00	15.00
15/16	1	12.50	15.75
1 1/16	1 1/4	14.00	18.50
1 1/4	1 5/16	14.50	19.00
1 1/4	1 3/8	16.00	20.50
1 1/4	1 7/16	16.50	21.50
1 5/16	1 1/2	18.00	22.50
1 7/16	1 1/2	18.50	23.00