



# AEROSPACE STANDARD

## AS 954

SOCIETY OF AUTOMOTIVE ENGINEERS, Inc.

485 Lexington Ave., New York, N. Y. 10017

Issued 6-15-67

Revised

### DESIGN DATA AND STANDARDIZATION of THIN WALL 12-POINT SOCKETS AND BOX WRENCHES for AEROSPACE ENGINE USE

1. PURPOSE - This Standard is intended to reduce the need for special or modified thin wall series sockets and box wrenches.
2. SCOPE - The thin wall series sockets and box wrenches covered herein are those designed for general usage on aerospace engine 12-point threaded fastener hardware. Standardized wrench clearance dimensions are given, as well as a stringent test procedure to ensure reliability.
3. GENERAL REQUIREMENTS
  - 3.1 Applicable Specifications and Standards - The following specifications and standards of the issue in effect on the date of invitations for bids form a part of this specification to the extent specified herein:

AS 291	Surface Texture, Roughness, Waviness and Lay
AS 478	Identification Marking Methods
AS 870	Wrenching Configuration, 12-Point Threaded Fasteners
  - 3.2 Material and Workmanship
    - 3.2.1 Material - The material used in the manufacture of the sockets and box wrenches 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.
    - 3.2.2 Workmanship - All details of workmanship shall be in accordance with high grade commercial practices. Sockets and box wrenches 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.
  - 3.3 Marking - The sockets and box wrenches 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 sockets shall be permanently marked with the appropriate nominal wrench opening. Marking requirement shall be in accordance with AS 478.
  - 3.4 Illustrations - The illustrations shown herein are descriptive and not restrictive and are not intended to preclude the manufacture of sockets or box wrenches which are otherwise in accordance with this specification.
  - 3.5 Edges and Corners - All edges and corners capable of causing injury and not otherwise covered herein shall have sharp edges removed by rounding, chamfering, or other means. The inside edges of the wrenching opening shall be chamfered.
  - 3.6 Nut, Bolt and Screw Engaging Surfaces - Nut, bolt, and screw engaging surfaces of all sockets or box wrenches shall be broached, punched, or machined in a smooth and well defined manner, with the corners also well defined. The engaging surfaces shall be suitable for use on bolt heads conforming to AS 870.

SAE Technical Board rules provide that: "All technical reports, including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no agreement to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report, in formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against liability for infringement of patents."

- 3.7 Internal Wrenching Design - The internal wrench design of the box wrench or socket wrenching profile 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.

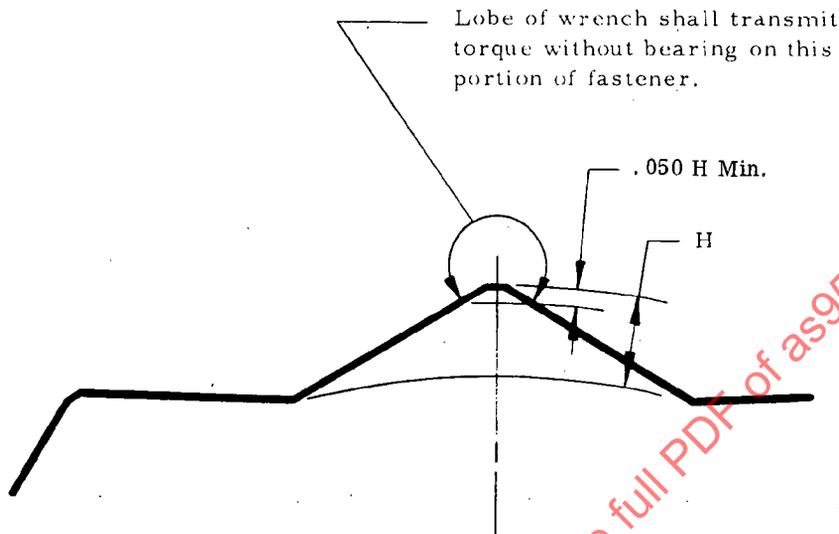


FIGURE 1 - INTERNAL WRENCH ENGAGEMENT

- 3.8 Hardness - Unless otherwise specified herein, sockets and box wrenches shall be hardened to a Rockwell hardness of not less than 38 nor more than 54 on the C scale.
- 3.9 Test Loads - When tested as specified in paragraph 7, tools 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.
- 3.10 Finish
- 3.10.1 Surface Roughness - All external surfaces shall be free from pits, nodules, forge flash, burrs, cracks, and other detrimental defects. The external forge flash shall be completely removed to blend smoothly with adjacent surfaces.
- 3.10.1.1 Maximum Surface Roughness - Areas that are ground and buffed or otherwise finished by an equivalent method and provided with a coating finish of chromium and nickel plate shall have a uniform bright finish with a maximum surface roughness of 15 microinches (Arithmetical Average) over a 0.030 inch cutoff distance on the surface roughness measuring instrument. Areas ground, buffed, or otherwise finished shall have a finish equivalent to chromium or nickel plate and shall conform to good commercial practice.
- 3.10.2 Coatings - The coatings 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 chromium or nickel plate coating shall be as specified in paragraphs 3.10.2.1 and 3.10.2.2, if applicable.
- 3.10.2.1 Chromium Plate - The coating shall be electrodeposited metals consisting of nickel, followed by chromium. The minimum thickness shall be 0.0002 inch for nickel and 0.00001 inch for chromium.
- 3.10.2.2 Nickel Plate - The coating shall be electrodeposited nickel not less than 0.0002 inch thick.

4. SOCKET WRENCHES

4.1 Socket Wrench Dimensions - The design configuration of the thin wall socket wrench with a .250, .375, or .500 inch square drive in the regular and deep length series shall conform to Fig. 2 and Table I.

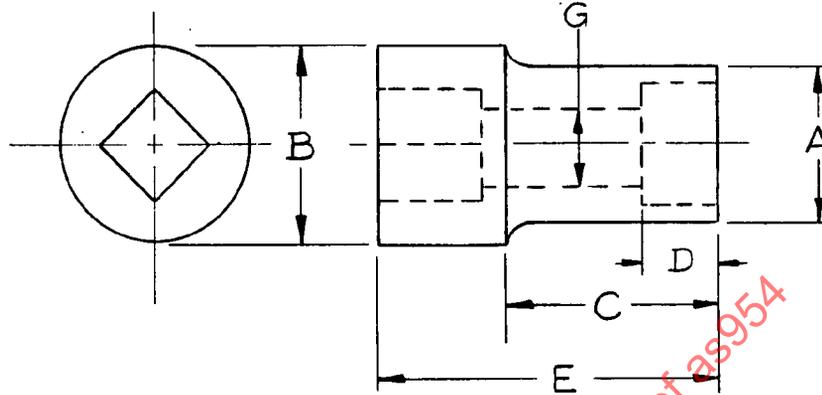


FIGURE 2 - THIN WALL SOCKET WRENCHES

4.2 The internal wrenching configuration shall restrict cocking to the limit of Table VI. This test shall be made with maximum wrench openings on minimum test mandrels engaged to depths shown on Table VI.

4.3 Female Drive Opening - All female drive openings shall be broached, punched, or machined in a smooth and well defined manner. Tools having female drive openings shall be firmly attachable to corresponding male drive tangs as follows:

4.3.1 On .375 Inch and Larger Drive Openings - One or more faces of the female drive openings shall be drilled or recessed in accordance with Fig. 3 and Table II so that any recess or drilled hole shall engage the spring loaded steel ball or steel plunger on the corresponding male drive. If only one or two faces of the female opening are recessed, the socket shall be marked indicating the face of the opening which is recessed.

4.3.2 On .250 Inch Drive Openings - The minimum force required to remove tang shall be as specified in Table II. Drilled or recessed holes in the face of the female drive opening are not required; however, such holes, if provided, shall be in accordance with Fig. 3, Table II.

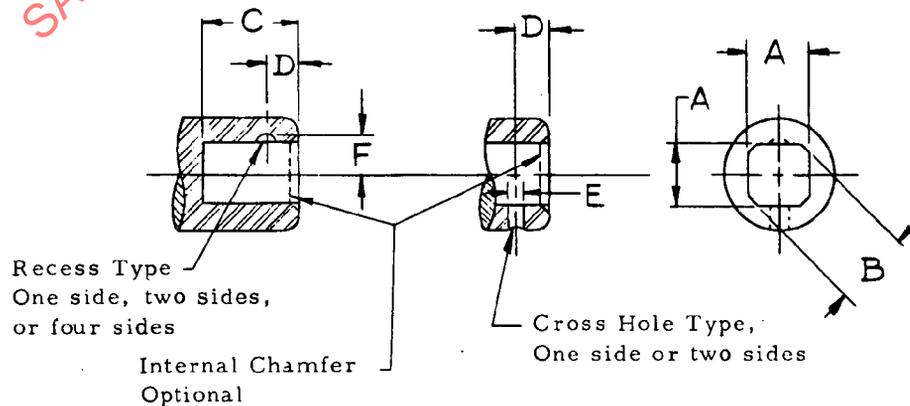


FIGURE 3 - FEMALE DRIVE OPENING

TABLE I - REGULAR AND DEEP LENGTH SOCKET DIMENSIONS (INCHES)

Nominal Wrench Opening	A Max	B Max	C Min Reg	C Min Deep	D Min Broach Depth	E Ref Reg	E Ref Deep	G Dia Min	Min Torque Endurance Load (In. - Lb)	Proof Torque Load (In. - Lb)	Nom Square Drive Size
0.1875	0.296	0.440	0.437	1.437	0.156	1.000	2.000	0.156	60	190	0.250
.2188	.343	.440	.437	1.437	.190	1.000	2.000	.188	75	225	.250
.2500	.375	.440	.437	1.437	.218	1.000	2.000	.203	100	300	.250
.2812	.421	.440	.437	1.437	.242	1.000	2.000	.250	125	375	.250
.3125	.453	.453	-	-	.265	1.000	2.000	.265	150	450	.250
.3438	.500	.500	-	-	.280	1.000	2.000	.281	175	525	.250
.3750	.540	.697	.600	1.250	.295	1.250	2.000	.328	300	900	.375
.4375	.625	.697	.600	1.500	.359	1.375	2.000	.390	500	1450	.375
.5000	.740	.885	.600	-	.375	1.500	3.000	.453	1000	3000	.500
.5625	.812	.947	.600	-	.390	1.500	3.000	.480	1400	4000	.500
.6250	.892	.892	-	-	.503	1.500	3.000	.578	1800	5500	.500
.7500	1.055	1.055	-	-	.588	1.500	3.000	.703	2500	7500	.500

TABLE II - FEMALE DRIVE OPENING DIMENSIONS (Inches)

Drive Size	A		B	C	D		E	F	Minimum Force Required to Remove Tang (Lb)
	Max	Min	Min	Min	Max	Min	Min	Min	
0.250	0.260	0.253	0.335	0.312	0.159	0.147	0.090	0.145	1.5
.375	.385	.378	.505	.438	.221	.209	.170	.210	4
.500	.511	.503	.670	.625	.315	.303	.201	.275	6

- 4.4 Bolt Clearance Hole - 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 for regular sockets and shall be 1.20 inch deep minimum from the 12-point drive end for deep sockets. The diameter of the bolt clearance hole shall conform to Fig. 2 and Table I.
- 4.5 Tang Attachability and Detachability - All detachable sockets shall be so designed that male drive tangs conforming to Fig. 4 and Table III can be inserted into the corresponding female drive openings without undue force. They shall be manually detachable without the use of tools or keys and shall meet the minimum force requirements for removing the male drive tang as specified in Table II. Binding between surfaces and corners shall not be evident.

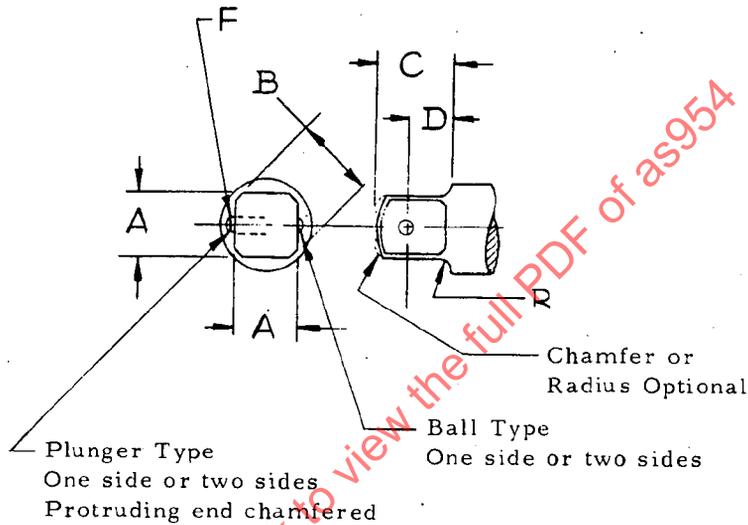


FIGURE 4 - MALE DRIVE TANG

TABLE III - MALE DRIVE TANG DIMENSIONS (Inches)

Drive Size	A		B	C		D		R	F
	Max	Min	Max	Max	Min	Max	Min	Max	Max
0.250	0.252	0.247	0.330	0.312	0.265	0.165	0.153	0.015	0.078
.375	.377	.372	.500	.438	.406	.227	.215	.031	.156
.500	.502	.497	.665	.625	.531	.321	.309	.031	.187

5. BOX WRENCHES

- 5.1 Box Wrench Dimensions - The design configuration of the thin wall box wrench shall conform to Fig. 5 and Table IV.
- 5.2 Design - Box wrenches shall be angled or offset so as to afford a compatible hand grip with the wrench style. The nut and bolt head engaging surface of the box end wrenches shall be finished in a smooth and well defined manner. The corners and serrations in the box wrench openings shall be relatively sharp.

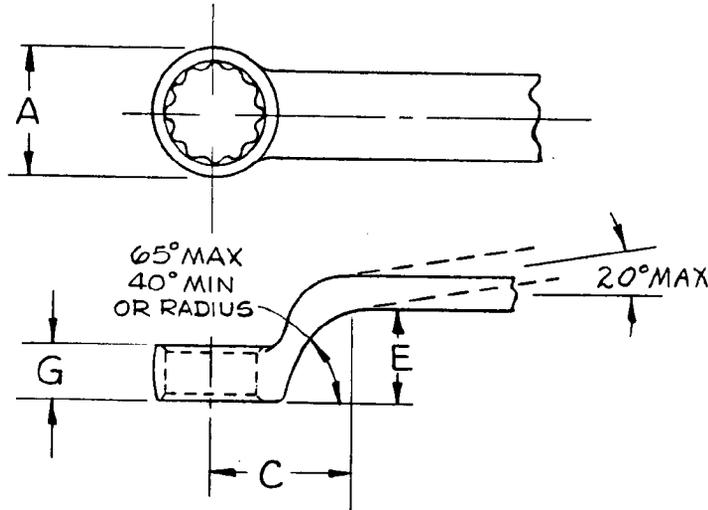


FIGURE 5 - THIN WALL BOX WRENCHES

TABLE IV - BOX WRENCH DIMENSIONS (INCHES)

Nominal Wrench Opening	A Max	C Max Deep Offset	C Max Reg Offset	E Min Deep Offset	E Min Reg Offset	G Max	Min Torque Endurance Load (In. - Lb)	Proof Torque Load (In. - Lb)
0.1875	0.296	0.625	-	0.188	0.030	0.188	50	150
.2188	.343	.750	-	.218	.030	.203	60	180
.2500	.375	.812	-	.218	.030	.219	70	210
.2812	.421	.812	-	.281	.030	.234	75	225
.3125	.453	.875	-	.296	.030	.250	85	250
.3438	.500	.875	-	.344	.030	.281	105	315
.3750	.531	1.000	-	.500	.030	.312	125	400
.4375	.625	1.000	-	.562	.030	.340	250	750
.5000	.740	1.060	-	.562	.030	.359	400	1200
.5625	.812	1.125	-	.625	.030	.406	550	1650
.6250	.892	1.125	-	.717	.030	.468	750	2200
.7500	1.035	1.125	-	.812	.030	.531	1000	3000

6. INSPECTION

6.1 Quality Assurance Provisions - Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Inspection records of the examination and tests shall be kept complete and available. The purchaser reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that suppliers conform to prescribed requirements.

7. TEST PROCEDURES

7.1 Test Loads - Sample thin wall sockets and/or box wrenches shall be tested in accordance with the following paragraphs. Tools tested shall withstand the test loads specified in the applicable table without injury or permanent deformation (set).

7.2 Mandrels for Wrench Openings - Wrench openings shall be tested on hexagonal mandrels. The size of all mandrels on the socket engagement surface shall not exceed the nominal size of the socket specified in Table V by more than plus 0.000/minus 0.002 inch. The OD of the hexagonal mandrel shall be reduced by 0.05 H as shown on Fig. 1 to ensure the wrench lobe does not transmit torque on mandrel points. Mandrel shall be hardened to show a Rockwell number of not less than 55 on C scale and shall have smoothly finished wrench engagement surface.

TABLE V - SOCKET WRENCH OPENINGS AND SQUARE DRIVE SIZE (INCHES)

Nominal Size of Wrench Opening-Distance Across Flats	Nominal Square Drive Size	Minimum Size of Square Drive
0.1875	.250	.247
.2188		
.2500		
.2812		
.3125		
.3438	.375	.372
.3750		
.4375		
.5000	.500	.497
.5625		
.6250		
.7500		