



Designation: F 879 – 01

Standard Specification for Stainless Steel Socket Button and Flat Countersunk Head Cap Screws¹

This standard is issued under the fixed designation F 879; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers the chemical and mechanical requirements for stainless steel inch hexagon socket button (SBHCS) and flat countersunk (SFHCS) head cap screws with nominal thread 0.060 through 0.625 in. intended for use in applications requiring general corrosion resistance.

1.2 The following two conditions are covered:

1.2.1 Austenitic alloy condition AF in an annealed condition at 85 ksi maximum and

1.2.2 Austenitic alloy condition CW in a cold-worked condition at 95 ksi minimum.

1.3 The following precautionary caveat pertains only to the test method portion, Section 12, of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

A 262 Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels²

A 342 Test Methods for Permeability of Feebly Magnetic Materials³

A 380 Practice for Cleaning and Descaling Stainless Steel Parts, Equipment, and Systems²

A 555/A555M Specification for General Requirements for Stainless and Heat-Resisting Steel Wire and Wire Rods²

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products²

A 967 Specification for Chemical Passivation Treatments for Stainless Steel Parts²

D 3951 Practice for Commercial Packaging⁴

E 353 Test Methods for Chemical Analysis of Stainless, Heat-Resisting, Maraging, and Other Similar Chromium-Nickel-Iron Alloys⁵

F 593 Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs⁶

F 606 Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, and Rivets⁶

F 788/F788M Specification for Surface Discontinuities of Bolts, Screws and Studs, Inch and Metric Series⁶

F 1470 Guide for Fastener Sampling for Specified Mechanical Properties and Performance Inspection⁶

2.2 ASME Standard:

B 18.3 Socket Cap, Shoulder and Set Screws (Inch Series)⁷

3. Classification

3.1 The designation of the alloy group and condition of this specification shall be consistent with the stainless steel designations in Specification F 593.

3.2 The austenitic stainless steel socket screw shall be designated F 879 Group 1 Condition AF or F 879 Group 1 Condition CW.

4. Ordering Information

4.1 Orders for material under this specification shall include the following information:

4.1.1 Quantity (number of pieces of each item).

4.1.2 Name of the screw, SBHCS or SFHCS.

4.1.3 Dimensions, including nominal thread designation, thread pitch, and nominal screw length (inches). A standard part number may be used for this definition.

4.1.4 Alloy group, and condition (Group 1 AF or Group 1 CW).

4.1.5 Certification, if required (see Section 15).

4.1.6 ASTM specification and year of issue.

¹ This specification is under the jurisdiction of ASTM Committee F16 on Fasteners and is the direct responsibility of Subcommittee F16.04 on Nonferrous Fasteners.

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² Annual Book of ASTM Standards, Vol 01.03.

³ Annual Book of ASTM Standards, Vol 03.04.

⁴ Annual Book of ASTM Standards, Vol 15.09.

⁵ Annual Book of ASTM Standards, Vol 03.05.

⁶ Annual Book of ASTM Standards, Vol 01.08.

⁷ Available from Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112.

4.1.7 Any special or supplemental requirements (see Supplementary Requirements S1 through S6).

5. Materials and Manufacture

5.1 Screws shall be formed by upsetting or extruding, or both.

5.2 Screws shall be roll threaded.

5.3 *Heat Treatment*—Austenitic alloys Condition AF screws, following manufacture, shall be annealed by heating to $1900 \pm 50^\circ\text{F}$ to obtain maximum corrosion resistance and minimum permeability. The screws shall be held for a sufficient time at temperature, then cooled at a rate sufficient to prevent precipitation of the carbide and provide the properties specified in Table 1.

5.4 When Condition CW is specified, the austenitic alloys shall be annealed as specified in 5.3, generally by the raw material manufacturer, then cold worked to develop specific properties.

6. Chemical Composition

6.1 It is the intent of this specification that screws shall be ordered by alloy condition. The chemical composition of the screws shall conform to the requirements of Table 2.

6.2 Unless otherwise specified in the inquiry and purchase order (see Supplementary Requirement S2) when CW or AF condition property class is specified, the choice of stainless steel used shall be that of the fastener manufacturer as determined by his fabrication methods and material availability. The specific stainless steel used by the manufacturer shall be clearly identified on all certification required in the purchase order and shall have a chemical composition conforming to the limits specified in Table 2.

6.3 When chemical analysis is performed by the purchaser using finished fasteners, the chemical composition obtained shall conform to the limits specified in Table 2 for the specific alloy. Chemical composition shall conform to the tolerances specified in Specification A 555.

6.3.1 In the event of a discrepancy, a referee analysis of the samples for each lot as specified in 12.1 shall be made in accordance with 11.3.1.

7. Mechanical Properties

7.1 The finished screws shall conform to the mechanical requirements specified in Table 1.

7.2 Screws having a nominal length equal to or greater than three diameters shall be tensile tested full size and shall meet the full size breaking strength requirements specified in Table 3. Tensile failures through the head are acceptable providing the load requirements are satisfied.

7.3 Screws that are too short (lengths less than specified in 7.2 or that have insufficient threads for tension testing) shall

not be subject to tension tests, but shall conform to the maximum and minimum hardness requirements of Table 1.

8. Corrosion Resistance Requirements

8.1 Carbide Precipitation:

8.1.1 Rod, bar, and wire in the austenitic alloy group 1 used to make fasteners in accordance with this specification shall be capable of passing the test for susceptibility to intergranular corrosion as specified in Practice E of Practices A 262.

8.1.2 As stated in Practices A 262, samples may be subjected to the faster and more severe screening test in accordance with Practice A. Failing Practice A, specimens shall be tested to Practice E and be considered satisfactory if passing Practice E.

9. Dimensions

9.1 Unless otherwise specified, the dimensions shall conform to the requirements of ASME B18.3.

10. Workmanship and Finish

10.1 *Surface Treatment*—Unless otherwise specified, screws shall be cleaned, descaled, and passivated in accordance with Practice A 380 or Specification A 967 at the option of the manufacturer.

10.2 Surface Discontinuities:

10.2.1 The surface discontinuities for these products shall conform to Specification F 788/F 788M and the additional limitations specified herein.

10.2.1.1 Forging defects that connect the socket to the periphery of the head are not permissible. Defects originating on the periphery and with a traverse indicating a potential to intersect are not permissible. Other forging defects are permissible provided those located in the bearing area, fillet, and top surfaces shall not have a depth exceeding $0.03 D$ or 0.005 in, whichever is greater. For peripheral discontinuities, the maximum depth may be $0.06 D$ (see Fig. 1).

10.2.1.2 Forging defects located in the socket wall within 0.1 times the actual key engagement, T , from the bottom of the socket are not permissible. Discontinuities located elsewhere in the socket shall not have a length exceeding $0.25 T$, or a maximum depth of $0.03 D$ not to exceed 0.005 in. (see Fig. 2).

10.2.1.3 Seams in the shank shall not exceed a depth of $0.03 D$ or 0.008 in, whichever is greater.

10.2.1.4 No transverse discontinuities shall be permitted in the head-to-shank fillet area.

10.2.1.5 Threads shall have no laps at the root or on the flanks, as shown in Fig. 3. Laps are permitted at the crests (Fig. 3(C)) that do not exceed 25 % of the basic thread depth, and on the flanks outside the pitch cylinder. Longitudinal seams rolled beneath the root of the thread and across the crests of the threads are acceptable within the limits of 10.2.1.3.

TABLE 1 Mechanical Property Requirements

Alloy Condition	Full Size Product Tests		Machined Specimen Tests			Hardness			
	Tensile Strength ksi	Extension min	Tensile Strength ksi	Yield Strength ksi	Elongation % min	Vickers		Rockwell	
						min	max	min	max
AF	85 max	0.6D	80 max	50 max	40	...	170	...	B85
CW	90 min	0.4D	85 min	58 min	20	220	330	B80	C33

TABLE 2 Alloy Group 1 Chemical Requirements

UNS Designation	Alloy	Composition, % maximum except as shown							
		Carbon	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickel	Copper
Austenitic Alloys									
S30400	304	0.08	2.00	0.045	0.030	1.00	18.0 to 20.0	8.0 to 10.5	1.00
S30403	304L	0.030	2.00	0.045	0.030	1.00	18.0 to 20.0	8.0 to 12.0	1.00
S30500	305	0.12	2.00	0.045	0.030	1.00	17.0 to 19.0	10.5 to 13.0	1.00
S38400	384	0.08	2.00	0.045	0.030	1.00	15.0 to 17.0	17.0 to 19.0	...
S30430	XM7	0.03	2.00	0.045	0.030	1.00	17.0 to 19.0	8.0 to 10.0	3.0 to 4.0
S31600	316	0.08	2.00	0.045	0.030	1.00	16.0 to 18.0	10.0 to 14.0	...
S31603	316L	0.03	2.00	0.045	0.030	1.00	16.0 to 18.0	10.0 to 14.0	...

TABLE 3 Breaking Strength Values for Full Size Fasteners

NOTE 1—Breaking loads are based on tensile stress area and strengths of 85 ksi max (AF) and 76 ksi min (CW). The minimum loads for CW condition are based on the tensile properties of 95 ksi material strength, reduced by 20 % to allow for the head critical nature of these configurations.

Nominal Size	Tensile Stress Area, in. ²	Alloy Condition		
		AF, lb, max	CW, lb, min	
0	0.060–80	0.00180	153	137
1	0.073–64	0.00263	224	200
2	0.086–56	0.00370	255	280
3	0.099–48	0.00487	414	370
4	0.112–40	0.00604	513	460
5	0.125–44	0.00796	676	600
6	0.138–32	0.00909	772	690
8	0.164–32	0.0140	1190	1060
10	0.190–24	0.0175	1487	1330
1/4	0.250–20	0.0318	2703	2420
5/16	0.312–18	0.0524	4454	3980
3/8	0.375–16	0.0775	6588	5890
1/2	0.500–13	0.1419	12 061	10 800
5/8	0.625–11	0.226	19 210	17 200

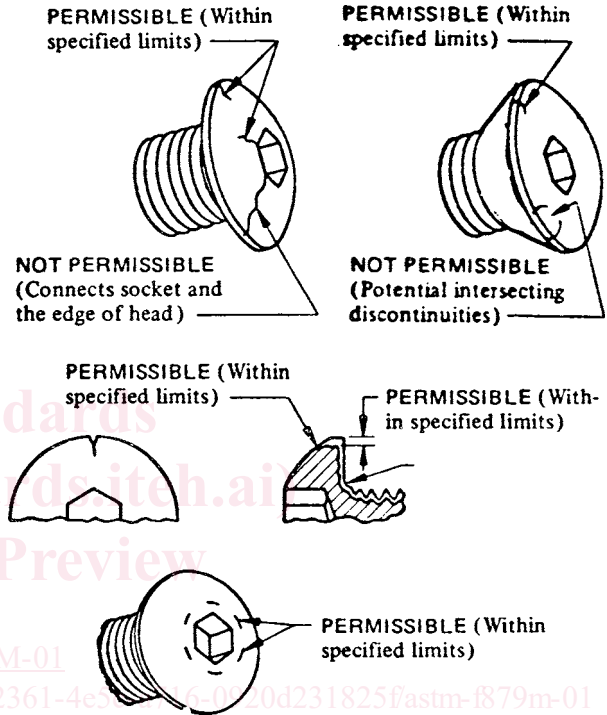


FIG. 1 Head Discontinuities (See 10.2.1)

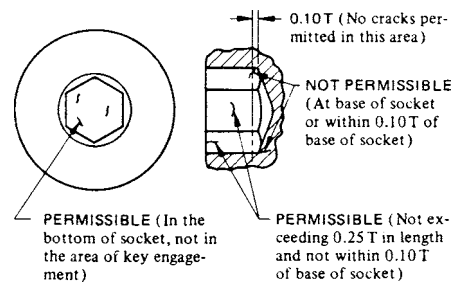


FIG. 2 Socket Discontinuities (See 10.2.1)

11. Number of Tests

11.1 The requirements of this specification shall be met in continuous mass production for stock and the manufacturer shall make sample inspections to ensure that the product conforms to the specified requirements. Additional tests of individual shipments of fasteners are not ordinarily necessary. A record of the individual heat of steel in each lot shall be maintained. The containers shall be coded to permit identification of the lot.

11.2 When specified in the purchase order, the manufacturer shall furnish a test report of the last complete set of chemical analysis and mechanical tests for each stock size in each shipment.

11.3 When tests of individual shipments are required, Supplementary Requirement S1 must be specified in the inquiry and order.

11.3.1 When the purchaser does not specify the sampling plan and basis of acceptance, the following shall apply:

11.3.1.1 The lot, for purposes of selecting samples, shall consist of all products offered for inspection and testing at one time that are of the same type, style, nominal diameter, thread pitch, nominal length, material, condition, and surface finish.

11.3.1.2 From each lot, samples shall be selected at random and tested for each requirement in accordance with the following:

Number of Pieces in Lot	Number of Samples
800 and less	1
Over 800 to 8000, incl	2
Over 8000 to 22 000, incl	3
Over 22 000	5

11.3.1.3 Should any sample fail to meet the requirements of a specified test, double the number of samples from the same lot shall be retested for the requirement(s) in which it failed. All of the additional samples shall conform to the specification, or the lot shall be rejected.