



Designation: F879 – 23

# Standard Specification for Stainless Steel Socket Button, Low and Flat Countersunk Head Cap Screws<sup>1</sup>

This standard is issued under the fixed designation F879; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

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

## 1. Scope\*

1.1 This specification covers the chemical and mechanical requirements for stainless steel inch hexagon socket button (SBHCS), flat countersunk (SFHCS) head cap screws with nominal thread 0.060 through 0.625 in. and low head (SLHCS) cap screws with nominal thread 0.112 through 0.625 in. intended for use in applications requiring general corrosion resistance.

1.2 Two groups of austenitic stainless steel alloys and three conditions are covered. See [Table 1](#) and [Table 2](#).

1.3 *Units*—The values stated in inch-pound units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

2.1 *ASTM Standards*:<sup>2</sup>

[A262 Practices for Detecting Susceptibility to Intergranular](#)

[Attack in Austenitic Stainless Steels](#)  
[A342/A342M Test Methods for Permeability of Weakly Magnetic Materials](#)

[A380/A380M Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems](#)

[A555/A555M Specification for General Requirements for Stainless Steel Wire and Wire Rods](#)

[A751 Test Methods and Practices for Chemical Analysis of Steel Products](#)

[A967/A967M Specification for Chemical Passivation Treatments for Stainless Steel Parts](#)

[D3951 Practice for Commercial Packaging](#)

[E18 Test Methods for Rockwell Hardness of Metallic Materials](#)

[E92 Test Methods for Vickers Hardness and Knoop Hardness of Metallic Materials](#)

[E384 Test Method for Microindentation Hardness of Materials](#)

[F593 Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs](#)

[F606/F606M Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators, and Rivets](#)

[F788 Specification for Surface Discontinuities of Bolts, Screws, Studs, and Rivets, Inch and Metric Series](#)

[F1470 Practice for Fastener Sampling for Specified Mechanical Properties and Performance Inspection](#)

2.2 *ASME Standard*:

[B 18.3 Socket Cap, Shoulder and Set Screws \(Inch Series\)](#)<sup>3</sup>

2.3 *JIS Standard*:<sup>4</sup>

[JIS G 4309 Stainless Steel Wires](#)

## 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 [F593](#).

<sup>3</sup> Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

<sup>4</sup> Available from Japanese Industrial Standards Committee (JIS) 1-3-1 Kasumigaseki, Chiyoda-ku, Tokyo 100-8901, JAPAN. <http://www.jisc.go.jp>

\*A Summary of Changes section appears at the end of this standard

**TABLE 1 Mechanical Property Requirements**

Alloy Group	Alloy Condition	Full Size Product Tests <sup>A</sup>		Machined Specimen Tests			Core Hardness <sup>B</sup>	
		Tensile Strength ksi	Extension min <sup>C</sup>	Tensile Strength ksi	Yield Strength ksi	Elongation % min	Vickers	Rockwell
All	AF	85 max	0.6D	85 max	55 max	40	210 max	95 HRB max
All	CW	80 min	0.4D	80 min	40 min	25	150 min	50 HRA min
All	CW1	102 min	0.4D	87 min	65 min	20	220 min	59 HRA min

<sup>A</sup> Actual full-size testing of condition CW and CW1 may result in decreased tensile strength because of the head configuration (see Table 3). For fasteners with nominal thread diameters larger than 0.625 in., the mechanical properties shall be agreed upon between the user and manufacturer.

<sup>B</sup> Core hardness is only required when full-size product testing cannot be accomplished.

<sup>C</sup> D denotes nominal thread size.

**TABLE 2 Chemical Requirements**

Alloy Group	UNS Designation	Alloy	Composition, % maximum except as shown								
			Carbon	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickel	Copper	Molybdenum
Austenitic Alloys											
1	S30400	304	0.08	2.00	0.045	0.030	1.00	18.0 to 20.0	8.0 to 10.5	1.00	...
1	S30403	304L	0.030	2.00	0.045	0.030	1.00	18.0 to 20.0	8.0 to 12.0	1.00	...
1	S30500	305	0.12	2.00	0.045	0.030	1.00	17.0 to 19.0	10.5 to 13.0	1.00	...
1	S38400	384	0.08	2.00	0.045	0.030	1.00	15.0 to 17.0	17.0 to 19.0	...	...
1	S30430	18–9LW	0.10	2.00	0.045	0.030	1.00	17.0 to 19.0	8.0 to 10.0	3.0 to 4.0	...
1	S30433	302HQ	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	...
1	...	304J3 <sup>A</sup>	0.08	2.00	0.045	0.030	1.00	17.0 to 19.0	8.0 to 10.5	1.00 to 3.00	...
2	S31600	316	0.08	2.00	0.045	0.030	1.00	16.0 to 18.0	10.0 to 14.0	...	2.00 to 3.0
2	S31603	316L	0.03	2.00	0.045	0.030	1.00	16.0 to 18.0	10.0 to 14.0	...	2.00 to 3.0

<sup>A</sup> 304J3 from JIS G 4309.

3.2 Screws shall be designated by group and condition (for example, F879 Group 1 Condition AF).

#### 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, SLHCS 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.
- 4.1.5 Certification, if required (see Section 15).
- 4.1.6 ASTM specification and year of issue.
- 4.1.7 Any special or supplemental requirements (see Supplementary Requirements S1 through S7).

#### 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 ± 50 °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 or CW1 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 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), the choice of an alloy from within a group shall be that of the fastener manufacturer as determined by his fabrication methods and material availability. The specific alloy from within a group used by the manufacturer shall be clearly identified on all certification required in the purchase order.

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 A555/A555M.

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 hardness requirements of Table 1.

## 8. Corrosion Resistance Requirements

### 8.1 Carbide Precipitation:

8.1.1 Rod, bar, and wire 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 A262.

8.1.2 As stated in Practices A262, 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 A380/A380M or Specification A967/A967M at the option of the manufacturer.

### 10.2 Surface Discontinuities:

10.2.1 The surface discontinuities for these products shall conform to Specification F788 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.

## 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:

**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), 64 ksi min (CW), and 82 ksi for CW1. The minimum loads for the CW and CW1 conditions are based on the tensile properties of 80 ksi minimum material strength and 102 ksi minimum material strength, respectively, reduced by 20 % to allow for the head critical nature of these configurations. See Note A in Table 1. Actual strength of the threaded section, if size permits, may be determined by removing the head and testing the threaded section as a stud.

Nominal Size	Tensile Stress Area, in. <sup>2</sup>	Alloy Condition, lb. min			
		AF	CW	CW1	
0	0.060–80	0.00180	153	115	147
1	0.073–64	0.00263	223	168	215
2	0.086–56	0.00370	314	237	303
3	0.099–48	0.00487	414	312	399
4	0.112–40	0.00604	513	386	495
5	0.125–40	0.00796	676	509	652
6	0.138–32	0.00909	772	581	745
8	0.164–32	0.0140	1191	897	1149
10	0.190–24	0.0175	1490	1122	1438
¼	0.250–20	0.0318	2705	2037	2609
⅜	0.312–18	0.0524	4457	3356	4299
½	0.375–16	0.0775	6587	4959	6354
⅝	0.500–13	0.1419	12 061	9082	11 636
¾	0.625–11	0.226	19 210	14 464	18 532