

Fastener Part Standard—Machine Screws

- 1. Scope**—This SAE Part Standard covers selected machine screws manufactured in accordance with American Society for Mechanical Engineers dimensional standards. This SAE standard covers material most often used in ship systems and equipment but its use may be applied wherever fasteners of the covered materials are used. This document permits the fasteners to be identified and ordered by a part or identifying number (PIN) as defined in this document.
- 1.1 Purpose**—The purpose of this document is to assist the designer and other personnel in providing requirements and part identifying numbers for the most commonly used machine screws for ship systems and equipment. A part or identification number is normally required for all military applications and provides a useful means of communicating fastener requirements to suppliers and manufacturers in a very succinct manner.
- 1.2 Machine Screw Part Numbers**—This document provides part or identifying numbers that can be used to identify machine screws covered by this document. The parts covered by this document are manufactured in accordance with materials and processes identified in standards issued by ASTM. The part identification number (PIN) identifies the thread form, type of head, type of drive, nominal diameter, special features (plating, locking elements), nominal length and fastener material.
- 2. References**
- 2.1 Applicable Publications**—The following documents form a part of this document to the extent specified herein. The latest issue of the documents shall be used except in those cases where an invitation for bid or procurement contract specifically identifies the issues in effect on a particular date.
- 2.1.1 SAE PUBLICATIONS**—Available from SAE, 400 Commonwealth Drive, Warrendale, Pa 15096-0001. Web site: www.sae.org Tel: (724) 776-4970
- SAE AMS 2412—Silver Plating, Copper Strike, Low Brake
SAE AMS 2485—Black Oxide Coating
SAE AMS 2487—Anodic Treatment of Titanium and Titanium Alloys—Solution pH 12.4 maximum
SAE AMS 2488—Anodic Treatment, Titanium and Titanium Alloy
SAE AMS-C-26074—Coatings, Electroless Nickel, Requirements for
SAE AS1701—Lubricant, Solid Dry Film
SAE J121—Decarburization In Hardened and Tempered Unified Threaded Fasteners
SAE J121M—Decarburization in Hardened and Tempered Metric Threaded Fasteners
SAEJ2270—Ship Systems and Equipment—Fasteners—Test, Inspection and Installation Requirements

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SAE WEB ADDRESS:

SAE J2485 (DRAFT)—Fastener Part Standard—Machine Screw Nuts
SAEJ2280—Ship Systems and Equipment—Fasteners—Selection and Identification Requirements
SAE J2295—Fasteners—Part Standard—Cap Screws, Hex Bolts, and Hex Nuts

- 2.1.2 AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC. PUBLICATIONS—Available from the Aerospace Industries Association of America, Inc., Suite 1200, 1250 Eye Street NW, Washington, DC 20005-3924. Web site: www.aia-aerospace.org ; Tel: (202) 371-8400.

NAS 1283—Fasteners, Male Threaded, Self-locking

- 2.1.3 ASME PUBLICATIONS—Available from the American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017. web site: www.asme.org Tel. (800) 843-2763.

ASME B1.1—Unified Inch Screw Threads (UN and UNR Thread Form)
ASME B1.13M—Metric Screw Threads - M Profile
ASME B18.6.3—Machine Screws and Machine Screw Nuts
ASME B18.6.7M—Metric Machine Screws
ASME B18.18.2M—Inspection and Quality Assurance for High Volume Machine Assembly Fasteners

- 2.1.4 ASTM PUBLICATIONS—Available from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959. Web site: www.astm.org Tel. (610) 832-4585

ASTM A 29/A 29M—Steel Bars, Carbon and Alloy, Hot-Wrought and Cold-Finished, General Requirements for
ASTM A 342/A 342M—Standard Test Methods for Permeability of Feebly Magnetic Materials
ASTM A 380—Cleaning, Descaling and Passivation of Stainless Steel Parts, Equipment, and Systems
ASTM A 453/A 453M—Bolting Materials, High Temperature, 50 to 120 ksi [345 to 827 MPa] Yield Strength, With Expansion Coefficients Comparable to Austenitic Steels
ASTM B 580—Standard Specification for Anodic Oxide Coatings on Aluminum
ASTM F 468—Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
ASTM F 468M—Nonferrous Bolts, Hex Cap Screws, and Studs for General Use [Metric]
ASTM F 568M—Carbon and Alloy Steel Externally Threaded Metric Fasteners
ASTM F 593—Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F 738M—Stainless Steel Metric Bolts, Screws, and Studs
ASTM F 788/F 788M—Surface Discontinuities of Bolts, Screws, and Studs, Inch and Metric Series
ASTM F 1941—Electrodeposited Coatings on Threaded Fasteners (Unified Inch Screw Threads (UN/UNR))
ASTM F 1941M—Electrodeposited Coatings on Threaded Fasteners (Metric)

- 2.1.5 DEPARTMENT OF DEFENSE PUBLICATIONS—Available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Ave., Philadelphia, PA 19111-5094, web site: <http://assist.daps.mil> Tel. (215) 697-2179.

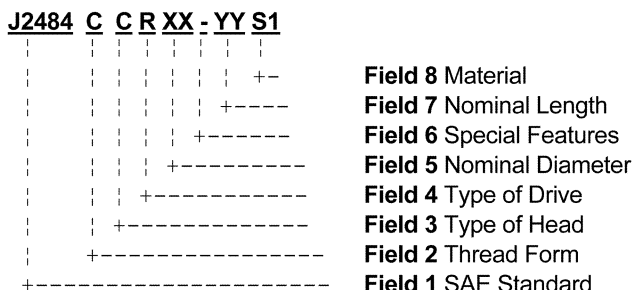
MIL-DTL-83488—Detail Specification, Coating, Aluminum, High Purity

3. **Fastener Part or Identifying Numbers**

- 3.1 **SAE Machine Screw Standards**—This machine screw part standard utilizes ASME dimensional standards for machine screws and primarily ASTM standards for materials,

- 3.2 **Part or Identifying Numbers (PINs) for Selected Machine Screws**—PINs are provided herein for selected machine screws for the purpose of common logistics parts identification between designers, fastener manufacturers, construction and repair activities and equipment operators. Part numbers are provided for only those fastener configurations and materials most likely to be needed for ship systems and equipment.

Figures 1A and 1B provides part or identifying numbers for selected machine screws. The part number consists of a number of fields in order as identified in Figures 1A and 1B. (There are no blank spaces in the PIN.) The last field in the PIN, field 8, designates the machine screw material. Table 1 lists the material designators for field 8 of the PIN along with the chemical and mechanical properties of the material.



Field 1 - SAE J2484 Machine Screw Part Standard

Field 2 Thread Form (See 3.3.3 for thread class)

C = UNC/UNRC (ASME B1.1) M = Metric (ASME B1.13M)
 F = UNF/UNRF (ASME B1.1)

Field 3 Type of Head As defined in ASME B18.6.3 (inch products) and ASME B18.6.7M (metric products)

C = Flat countersunk head, 82 degree (inches), 90 degree (metric) P = Pan Head
 D = Flat countersunk head, 100 degree (inches) T = Truss Head
 F = Fillister Head (inch only) W = Hex Washer Head (inch), Hex Flange Head (metric)
 G = Fillister Head (Drilled - inch only) V = Oval countersunk head
 H = Hex Head 82 degree (inches), 90 degree (metric)

Field 4 Type of Drive As defined in ASME B18.6.3 (inch products) and ASME B18.6.7M (metric products)

H = Hex Socket S = Slotted R = Type I Cross Recessed

Field 5 Nominal Diameter (See 3.3.2 for selection of diameters. The type thread in Field 2 determines whether diameter is in inch or metric units).

Inch - Indicate nominal size with one or two digits as required for sizes 0 through 12.

Size PIN	UNC	UNF	Diameter	Size PIN	UNC	UNF	Diameter
0 ⁽¹⁾	0-80	---	0.0600	F4	1/4-20	1/4-28	0.2500 0 ⁽¹⁾
1 ⁽¹⁾	1-64	1-72	0.0730	F5	5/16-18	5/16-24	0.3125
2	2-56	2-64	0.0860	F6	3/8-16	3/8-24	0.3750
3 ⁽¹⁾	3-48	3-56	0.0990	F7 ⁽¹⁾	7/16-14	7/16-20	0.4375
4	4-40	4-48	0.1120	F8	1/2-13	1/2-20	0.5000
5 ⁽¹⁾	5-40	5-44	0.1250	F9 ⁽¹⁾	9/16-12	9/16-18	0.5625
6	6-32	6-40	0.1380	G5	5/8-11	5/8-18	0.6250
8	8-32	8-36	0.1640	G6	3/4-10	3/4-16	0.7500
10	10-24	10-32	0.1900				
12 ⁽¹⁾	12-24	12-28	0.2160				

⁽¹⁾ These diameters are often not available and should not be used for new design: 0, 1, 3, 5, 12, F7, F9
 In addition, diameters shall be limited to those in ASME B18.6.3 for applicable screw configurations

FIGURE 1A—PART IDENTIFICATION NUMBERS (PIN'S) FOR MACHINE SCREWS

Metric - Multiply nominal screw size in mm by 10 (Diameters limited to those in ASME B18.6.7M for applicable configurations)

Size PIN	Diameter & Pitch	Nom. Size	Size PIN	Diameter & Pitch	Nom. Size
20	M2 X 0.4	2 mm	50	M5 X 0.8	5 mm
25	M2.5 x 0.45	2.5 mm	60	M6 x 1	6 mm
30	M3 x 0.5	3 mm	80	M8 x 1.25	8 mm
35	M3.5 x 0.6	3.5 mm	100	M10 x 1.5	10 mm
40	M4 x 0.7	4 mm	120	M12 x 1.75	12 mm

Field 6 Special Features and Coatings

- = No special features (including coatings)
- L = Locking element - (See 3.5)
- A = Aluminum plate (see 3.4.5)
- B = Black oxide (see 3.4.2)
- C = Cadmium electroplate (see 3.4.1)
- D = Dry Film Lubricant (see 3.4.7)
- N = Zinc Nickel Coating (See 3.4.1)
- S = Silver Coating (See 3.4.1 and 3.4.6)
- Z = Zinc Electroplate (See 3.4.1)

NOTE 1—When a locking element and a coating are needed, the locking element designator shall be identified first, Example "LZ".

NOTE 2—If a dry film lubricant is used over another coating, list the other coating first, then the dry film lubricant.

EXAMPLE—ZD for dry film lubricant over zinc plating.

Field 7 Nominal Length (See 3.3.1 for selection of length increments)

Inch - In 16ths of an inch (Use one digit for 9/16ths and less)

Metric - In mm (Use two digits below 100 mm, three digits for 100 mm and greater)

NOTE—The type thread in Field 2 determines whether length is in inch or metric units.

Field 8 Material (See Table 1 for designator and mechanical property requirements)

FIGURE 1B—PART NUMBERS FOR MACHINE SCREWS (CONTINUED)

TABLE 1—MECHANICAL PROPERTY REQUIREMENTS FOR MACHINE SCREW MATERIALS

Field 8 ⁽¹⁾ Designator	UNS Designation	Name/ Material Specification ⁽²⁾	Axial Tensile Strength ⁽³⁾	Minimum Yield Strength ⁽³⁾	Hardness
G	UNS G10150- UNS G10300 or UNS G11160- UNS G11320	Medium Carbon Steel- ASTM A 29/A 29M	60 - 100 ksi 420-690 MPa	49 ksi 340 MPa	69-100 HRB
S (See 4.4 and 4.5.1)	UNS S30300 UNS S30323 UNS S30400 UNS S30403 UNS S30500 UNS S38400 UNS S30430 UNS S31600 UNS S31603 UNS S32100 UNS S34700	Austenitic Stainless Steel Alloy 303 Alloy 303 Se Alloy 304 Alloy 304L Alloy 305 Alloy 384 Alloy XM7 Alloy 316 Alloy 316L Alloy 321 Alloy 347	80 - 140 ksi 700-970 MPa	65 ksi 450 MPa	95 HRB - 33 HRC
S1 (See 4.4 and 4.5.1)	See numbers Above	Alloys 304, 304L, 305, 384 & XM7	See above	See above	See above
S2 (See 4.4 and 4.5.1)	See above	Alloys 316 & 316L	See above	See above	See above
C	UNS C27000 or UNS C27400	Brass – Cu 270 or Brass – Cu 274	60-90 ksi 410-620 MPa	50 ksi 345 MPa	55 - 80 HRF
N	UNS N04400	Ni-Cu Alloy 400	80-130 ksi 550-900 MPa	40 ksi 275 MPa	75HRB - 25 HRC
BN (see 4.5)	UNS N06686	Ni-Cr-Mo-W Alloy	120-210 ksi 825-1450 MPa	85 ksi 585 MPa	23 - 41 HRC
H	UNS N10276	Ni-Mo-Cr Ni276	110-140 ksi 760-970 MPa	45 ksi 310 MPa	20 - 32 HRC
A1	UNS A96061	Aluminum 6061	37-52 ksi 260-360 MPa	31 ksi 215 MPa	40 - 50 HRB
A2	UNS A97075	Aluminum 7075-T73	68 ksi 470 MPa	50 ksi 345 MPa	80 - 90 HRB
T1	UNS R55111	Titanium Alloy 5111	105-150 ksi 725-1035 MPa	90 ksi 620 MPa	24 - 38 HRC
HR (See 4.5)	UNS S66286	Alloy A 286 ASTM A 453/ A453M	130 ksi (min) 895 MPa (min)	85 ksi, 585 MPa	99 HRB - 37 HRC

- For a specific designator, the supplier may furnish any of the alloys listed.
- Unless otherwise indicated the chemical requirements of the following specifications apply:
Inch - (austenitic steel) - ASTM F 593, (non ferrous materials) - ASTM F 468
Metric - (austenitic steel) - ASTM F 738M, (non ferrous materials) - ASTM F 468M
(carbon steel) - ASTM F 568M
- ksi units apply to inch size fasteners and MPa units apply to metric size fasteners.

3.3 Dimensional Requirements for Machine Screws—The dimensional requirements for a particular configuration of machine screw are to be as shown in ASME B18.6.3 for inch dimensioned machine screws and ASME B18.6.7M for metric machine screws.

3.3.1 LENGTHS OF FASTENERS—Lengths for metric machine screws shall be in accordance with the standard lengths identified in ASME B18.6.7M. (NOTE—When longer lengths are required they may be identified and ordered using the part numbering system identified. Length increments for longer fasteners shall be in accordance with Table 2.) Length increments for inch dimensioned machine screw shall be limited to the increments in Table 2. Length tolerance for metric and inch machine screws shall be in accordance with ASME B18.6.7M and B18.6.3 respectively.

TABLE 2—INCREMENTS

Units	Screw Length	Length Increments
Metric	<20 mm	See ASME B18.6.7M
	20 to 70 mm	5 mm
	80 to 200 mm	10 mm
	220 mm and longer	20 mm
Inch	0 to 0.750 in	0.0625 in
	0.875 to 2.00 in	0.125 in
	2.25 to 5.0 in,	0.250 in
	5.50 in and longer	0.500 in

3.3.2 DIAMETERS OF FASTENERS—Diameters shall be restricted to those identified in the applicable dimensional standards. For new design, diameters should be restricted to the following sizes when possible:

- a. Metric—M2, M2.5, M3, M3.5, M4, M5, M6, M8, M10
- b. Inch—No. 2, No. 4, No. 6, No. 8, No. 10, 1/4, 5/16, 3/8

NOTE— To minimize configurations, it is recommended that standard screws as identified in SAE J2295 be used for diameters of M6 and 1/4 inch and larger when available. Unlike machine screws, screws to SAE J2295 carry material identification marking.

3.3.3 THREAD TYPES AND FITS—Thread types and fits shall be restricted to those identified herein and permitted in the applicable dimensional standard. Threads, tolerances, allowances for plating, and gauging shall be in accordance with ASME B18.6.3 for inch machine screws and ASME B18.6.7M for metric machine screws. The threads on inch size screws shall be Unified Standard Class 2A in accordance with ASME B1.1. For threads with additive finish, the maximum diameters of Class 2A may be exceeded by the amount of the allowance. Class 2A maximum diameters apply to an unplated, or uncoated part, or to a part before plating or coating, whereas the basic diameters (Class 3A GO) shall apply to a part after plating or coating. For metric screws, threads shall be metric coarse series conforming to ASME B1.13M. Thread size limits prior to plating or coating shall be class 6g (GO and NOT GO). After plating or coating, class 6g threads shall be accepted using the size limits of 6h GO (high limit) and 6g NOT GO (low limit).

3.4 Coating Requirements—Coatings shall be limited to those identified herein. Coatings are recommended for the medium carbon steels for corrosion protection. The applicable coating shall be designated in the part identification number as indicated in Figures 1A and 1B. All titanium fasteners shall be coated and the coating is not identified in the part identification number. While not normally recommended, the black oxide coating can be specified for materials other than carbon steels where a shiny natural appearance must be avoided.

- 3.4.1 **ELECTRO-DEPOSITED COATINGS**—Electro-deposited coatings shall be in accordance with ASTM F 1941 for inch dimensioned screws and ASTM F 1941M for metric screws as provided herein. The minimum coating thickness shall be one-sixth the pitch diameter allowance as identified in the applicable coating document or ASME B1.1 or B1.13M as applicable. Low coating thickness impairs chromate adhesion and performance. The use of coated screws is not recommended when the coating thickness will be less than 0.0015 in for inch screws and 4 mm for metric screws when measured in accordance with ASTM F 1941 and ASTM F 1941M as applicable. Unless designated by the purchaser, any of the chromate finishes identified in the referenced ASTM documents may be supplied. Designation A (Clear) for inch screws and Designation B (Blue-bright) for metric screws are recommended.
- 3.4.2 **BLACK OXIDE COATINGS**—Black oxide coatings shall be in accordance with SAE AMS 2485.
- 3.4.3 **ANODIZE COATINGS FOR ALUMINUM AND TITANIUM FASTENERS**—Fasteners of titanium alloy shall be anodized in accordance with SAE AMS 2487 or AMS 2488 Type 2 (except testing requirements may be negotiated between manufacturer and coating supplier). (See 3.4.7 for additional coatings for titanium.) Aluminum fasteners shall be anodized in accordance with ASTM B 580.
- 3.4.4 **PASSIVATION**—All corrosion-resistant steel fasteners shall be passivated in accordance with ASTM A 380. Additional coatings are not necessary for protection of corrosion resistant steel fasteners but solid dry film lubricants (see 3.4.7) may be added for lubricity.
- 3.4.5 **ALUMINUM COATINGS**—Aluminum plating of steel fasteners shall be in accordance with MIL-DTL-83488. For aluminum plated fasteners, a nickel strike undercoating in accordance with SAE AMS-C-26074 is recommended. Aluminum coatings shall be anodized in accordance with ASTM B 580.
- 3.4.6 **SILVER PLATING**—Silver plating shall be in accordance with SAE AMS 2412.
- 3.4.7 **SOLID DRY FILM COATINGS**—Dry or solid film lubricants are used on fasteners to prevent corrosion and to reduce installation friction. These coatings are particularly recommended for use on titanium and corrosion resisting steel fasteners to reduce friction and galling. Solid or dry film lubricants shall be in accordance with SAE AS1701 Class I except that the dry film lubricant for heat and corrosion resistant screws shall be of a class rated for 399 °C (750 °F) or higher.
- 3.5 **Locking Elements**—Locate locking element in accordance with NAS 1283. Performance and test for locking element performance shall be in accordance with SAE J2270. Identify 5 mm (3/16th in) and larger diameter fasteners with self-locking elements by six raised or depressed dots on the head, equally spaced in a circular pattern.
- 3.6 **Quality Assurance**—The ordering document must address quality assurance requirements. Many of the ASTM standards have supplementary requirements that apply only when specified by the purchaser in the contract or order. SAE J2280 Appendix A identifies additional test/inspection requirements that are to be applied when SAE J2280 Appendix A is contractually invoked, such as for most military procurements. If the ordering document does not address quality control requirements, the following inspections shall apply:
- 3.6.1 **SURFACE DISCONTINUITIES**—Non destructive inspection for surface discontinuities shall be in accordance with ASTM F 788/F 788M for externally threaded products using MT or PT inspection.

- 3.6.2 **DECARBURIZATION**—Decarburization inspection of externally threaded and heat treated carbon or alloy steels shall be in accordance with SAE J121 Class B or SAE J121M Class 2/3 H as applicable. Unless otherwise specified, only one sample per lot is required unless the lot exceeds 250 000 pieces. In such cases, one sample is required for each 250 000 pieces or fraction thereof. A lot is a quantity of product of the same material heat and configuration (except different lengths may be included) made by the same production process and subsequently submitted for final inspection at the same time. All fasteners in the lot shall be coated and heat treated in the same batch or by a continuous process under the same conditions as to time and temperature. Note: If certification of in-process inspections is provided, the inspection of a finished fastener is not required.
- 3.6.3 **DIMENSIONS**—Dimensional inspections shall be in accordance with the referenced ASME dimensional standard. Unless otherwise specified, the number of samples shall be in accordance with the ASME dimensional standard. If the number of samples is not addressed in the dimensional standard, the requirements of ASME B18.18.2M shall apply.
- 3.6.4 **STRENGTH AND MATERIAL TESTS AND DIMENSIONAL INSPECTIONS**—These tests and inspections shall be in accordance with the applicable referenced ASTM fastener material standard except the number of samples shall be in accordance with ASME B18.18.2M unless the manufacturer utilizes a quality assurance process that provides equivalent or better assurance.
- 3.6.5 **COATING THICKNESS**—For coated fasteners, the coating thickness shall be verified by one of the methods identified in ASTM F 1941 or F 1941M as applicable. The number of samples shall be as specified in ASTM F 1941 or F 1941M, as applicable.
- 4. Notes**—This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.
- 4.1 Intended Use**—This document establishes requirements and part or identifying numbers for selected materials. While this standard was developed specifically for ship systems and equipment, its use is not restricted to these applications.
- 4.2 Identification of Part Numbering System on Drawings**—On drawings where a column exists for identifying the manufacturer or his Commercial and Government Entity (CAGE) Code, indicate the CAGE Code “81343/J2484” or “SAE J2484” as required by the drawing standard. If no column exists or there is space only for the 5-digit CAGE Code, then a note must indicate that the part numbers are defined in SAE J2484.
- 4.3 Machine Screw Nuts**—Part Numbers and requirements for machine screw nuts are covered in SAE J2485.
- 4.4 Magnetic Permeability**—For certain applications, low magnetic permeability may be required. Most non-ferrous fasteners have a relative magnetic permeability in air of 2.0 maximum when determined in accordance with ASTM A 342/A 342M on the finished fastener. However Nickel-Copper Alloy 400 and 405 fasteners should not be used when a magnetic permeability of 2.0 maximum is required as the magnetic permeability changes significantly at a transition temperature which is within the temperature range of normal usage. For CRES fasteners, alloy 316/316L should be specified when low magnetic permeability is required. The relative magnetic permeability should not exceed 2.0 maximum for 316/316L alloy fasteners while similar CRES fasteners of other 300 series alloy may exceed this value. If compliance with magnetic permeability requirements is necessary, the requirements must be identified in addition to the part number for the screw.