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MILITARY SPECIFICATION

SCREWS; SELF-TAPPING STEEL, AIRCRAFT

This specification was approved by the Departments of the Army, the Navy, and the Air Force for use of procurement services of the respective Departments.

1. SCOPE AND CLASSIFICATION

1.1 This specification establishes the requirements for all types of self-tapping screws used for aircraft.

2. APPLICABLE SPECIFICATIONS, OTHER PUBLICATIONS, AND DRAWINGS

2.1 The following specifications, other publications, and drawings, of the issue in effect on date of invitation for bids, shall form a part of this specification to the extent specified herein:

2.1.1 Specifications.-

Federal

QQ-M-151	Metals; General Specification For Inspection of
QQ-P-416	Plating; Cadmium (Electrodeposited)

Military

JAN-P-105	Packaging and Packing for Overseas Shipment - Boxes; Wood, Cleated, Plywood
JAN-P-106	Packaging and Packing for Overseas Shipment - Boxes; Wood, Nailed
JAN-P-108	Packaging and Packing for Overseas Shipment - Boxes; Fiberboard (V-Board and W-Board), Exterior and Interior
JAN-P-120	Packaging and Packing for Overseas Shipment - Cartons; Folding, Paperboard
JAN-P-125	Packaging and Packing for Overseas Shipment - Barrier-Materials; Waterproof, Flexible
JAN-P-133	Packaging and Packing for Overseas Shipment - Boxes, Set-Up, Paper-Board
JAN-P-139	Packaging and Packing for Overseas Shipment - Plywood, Container Grade

Air Force-Navy Aeronautical

AN-P-13	Preservation and Packaging; Parts and Equipment (General Specification For)
AN-P-32	Plating; Zinc
AN-QQ-S-685	Steel; Chrome-Molybdenum, (4130), Plate, Sheet, and Strip

U. S. Army

94-40645 Marking; Exterior, Domestic, and Export Shipment, by Contractors 1/

2.1.2 Other Publications.-

Bureau of Supplies and Accounts

Navy Shipment Marking Handbook 2/

2.1.3 Drawings.-

Air Force-Navy Aeronautical Standard Drawings.-

AN530	Screw - Sheet Metal Round Head
AN531	Screw - Sheet Metal Flat Head
AND10325	Self Tapping Screws - Coarse Thread (Hole Sizes For)
AND10326	Self Tapping Screws - Machine Screw Thread (Hole Sizes For)

(Copies of this publication and copies of other publications referenced herein or required for Government procurement, and the Index of Military Aeronautical (AN or MIL) Standards, may be obtained upon application to the Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio; or the Commanding Officer, U. S. Naval Air Station, Johnsville, Pennsylvania.)

3. REQUIREMENTS

3.1 Materials.- Materials used in the manufacture of self-tapping screws shall be of high quality, suitable for the purpose, and shall conform to applicable Government specifications.

3.2 Design.-

3.2.1 Head.- The head shall be at right angles to the body of the screw within two degrees, and concentric with the body within a tolerance of 3 percent of the diameter of the head.

3.2.2 Threads.- Self-tapping screws shall be right hand, of the size specified in the applicable Air Force-Navy drawing. Threads for sheet metal screws of the type specified on Drawings AN530 and AN531 shall conform to figure 1.

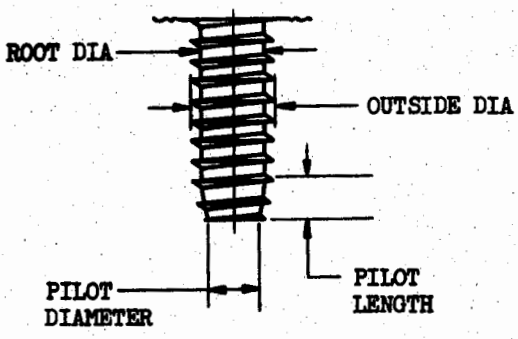
3.2.3 Grip.- The grip shall be the length from the portion of the head indicated on the applicable AN drawing to the intersection of the parallel threaded portion and the tapered or bevelled threaded portion of the screw.

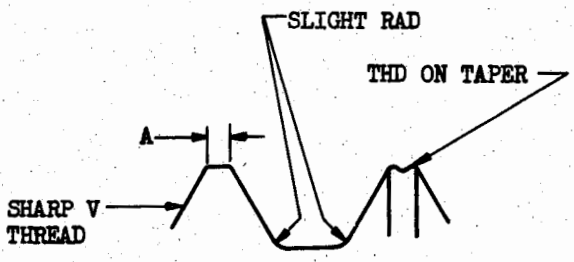
3.2.4 Special Features.- The entering end of the screw may incorporate a bevel, a slot or slots, or similar arrangements, to assist in entering and tapping the hole. Any bevel or taper shall not extend into the grip portion of the screw.

3.2.5 Dimensions.- Dimensions shall be as specified on the applicable AN drawing.

3.3 Finish.- Self-tapping screws of other than corrosion-resisting steel shall be cadmium-plated in accordance with Specification QQ-P-416 or zinc-plated in accordance with Specification AN-P-32. The plating shall be such as to withstand a 150-hour salt spray test without showing signs of corrosion.

1/ Applicable only to Air Force purchases.
2/ Applicable only to Navy purchases.





A = MAX .004 UP TO & INCL #8
A = MAX .006 OVER #8

SIZE OF SCREW	THDS PER INCH	OUTSIDE DIA		ROOT DIA		PILOT DIA		PILOT LENGTH	
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
0	48	.057	.060	.033	.036	.031	.033	.042	.052
1	42	.072	.075	.046	.049	.044	.046	.048	.060
2	32	.084	.088	.060	.064	.052	.055	.062	.078
3	28	.097	.101	.071	.075	.066	.069	.071	.089
4	24	.110	.114	.082	.086	.075	.078	.083	.104
5	20	.126	.130	.090	.094	.081	.084	.100	.125
6	20	.135	.139	.099	.104	.090	.093	.100	.125
7	19	.149	.154	.109	.115	.098	.101	.106	.132
8	18	.161	.166	.116	.121	.104	.107	.111	.139
10	16	.183	.189	.135	.141	.127	.130	.125	.156
12	14	.209	.215	.157	.164	.143	.146	.143	.179
14	14	.240	.246	.185	.192	.170	.174	.143	.179
5/16	12	.308	.315	.236	.244	.231	.235	.166	.208
3/8	12	.371	.380	.299	.309	.294	.298	.166	.208
7/16	10	.431	.440	.349	.359	.344	.348	.200	.250
1/2	10	.495	.504	.413	.423	.407	.411	.200	.250

NOTE: THE STANDARD ANGLE OF THREAD IS 60° ON ALL SIZES.

FIGURE 1. Thread Dimensions for Sheet Metal (AN530 and AN531) Type Self-Tapping Screws.

3.4 Performance.-

3.4.1 Single Shear with Bending.- Self-tapping screws shall withstand the minimum test loading specified in table I when tested in single shear with bending.

TABLE I
Single Shear with Bending

Screw Size	Minimum Allowable Test Loading (Pounds)	Size of Hole for Test 1/	
		Drill Size No.	Diameter (Inches)
4-40	300	40	.098
4-24	300	38	.101
6-32	450	31	.120
6-20	450	30	.128
8-32	720	27	.144
8-18	720	27	.144
10-24	870	20	.161
10-16	870	18	.169
14-14	1,050	4	.209
1/4-20	1,050	7/32	.218

1/ See Drawing AND10325, or AND10326, as applicable, for recommended hole sizes applicable to various materials and thicknesses.

3.4.2 Driveability.- Self-tapping screws shall be capable of being driven (turned) without failure of the screw into a hole of the diameter specified in table II in sheet steel of the specified thickness. The sheet steel shall have a hardness equivalent to a steel having a tensile strength of 90,000 to 100,000 psi and a machineability approximately equivalent to that of steel conforming to Specification AN-QQ-S-685. The driving torque required shall not exceed the maximum allowable specified in table II.

TABLE II
Driveability

Screw Size	Size of Hole for Test		Maximum Allowable Driving Torque (Pound Inches)	Thickness of Sheet Steel (Inches)
	Drill No.	Diameter (Inches)		
4-40	43	.090	13	1/16
4-24	39	.099	12	1/16
6-32	34	.111	20	1/16
6-20	32	.116	19	1/16
8-32	27	.144	26	1/8
8-18	25	.149	26	1/8
10-24	20	.161	31	1/8
10-16	18	.169	35	1/8
14-14	1	.228	58	1/8
1/4-20	7/32	.218	65	1/8

3.5 Workmanship.- All screws shall be free from tool marks, flaws, burrs, and other defects. Workmanship shall conform to the best commercial practice covering this class of material.

4. SAMPLING, INSPECTION, AND TEST PROCEDURES

4.1 General.- All the tests required for the testing of screws are classified as Inspection tests, for which necessary sampling techniques and methods of testing are specified in this section. The contractor shall furnish all samples and shall be responsible for accomplishing the required tests. When inspection is conducted at the contractor's plant, all inspection and testing shall be under the supervision of the Government Inspector. The Procuring Service reserves the right, exercisable at any time, to conduct inspections and tests in whole or in part, for final determination of compliance with this specification. Contractors not having laboratory testing facilities satisfactory to the Government shall engage the services of a commercial testing laboratory acceptable to the Inspector. The contractor shall furnish test reports, in duplicate, showing quantitative results for all tests required by this specification, and signed by an authorized representative of the contractor or laboratory, as applicable. Acceptance or approval of material during course of manufacture shall in no case be construed as a guaranty of the acceptance of the finished product.

4.2 Sampling.- Sufficient self-tapping screws to insure uniformity and conformance with the Finish, Single Shear with Bending, and Driveability tests shall be selected at random from each lot to be subjected to the tests described under paragraph headed "Tests," with the exception of Examination of Product.

4.2.1 Lot.- A lot shall consist of all screws of the same AN part number produced at the same time from raw materials of uniform quality and composition.

4.3 Tests.-

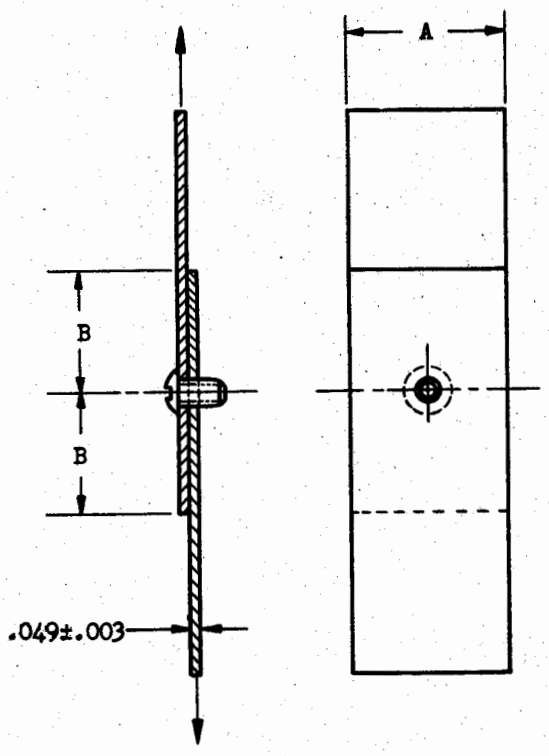
4.3.1 Examination of Product.- Self-tapping screws shall be examined for conformance with the requirements of this specification for materials, workmanship and design.

4.3.2 Finish.- Plating shall be inspected as specified by the applicable referenced specification and then tested for corrosion resistance in accordance with the requirements of Specification QQ-M-151.

4.3.3 Single Shear with Bending.- Two pieces of steel with a tensile strength between 90,000 and 100,000 psi and of the dimensions shown in figure 2 shall be drilled as specified in table I and fastened together by the specimen screw as shown in figure 2. The minimum test loading specified by table I shall be applied with the direction of pull parallel to each piece of steel. The loading shall be in accordance with the requirements of Specification QQ-M-151. This test need not be made on screws with a grip of less than 0.10 inch.

4.3.4 Driveability.- A sheet of the specified material, size, and hardness shall be drilled as specified. Sample screws shall be inserted by means of screw-driver or wrench which incorporates a torque-measuring device. A lubricant may be used to facilitate driving the screw if desired. The screw shall be driven until the head is in contact with the plate. The screw shall be removed from the tapped hole and the screw and hole examined for any evidence of thread failure.

4.4 Rejection and Retest.- Failure of 25 percent of the self-tapping screws of a given lot to conform to any one of the requirements of this specification shall be cause for the rejection of the entire lot. Screws which have been rejected may be reworked or replaced to correct defects and resubmitted for acceptance. Before resubmitting, full particulars concerning previous rejection and the action taken to correct the defects in the original shall be furnished the Inspector. Any lot of self-tapping screws rejected after retest shall not be resubmitted without the specific approval of the Procuring Service.



SINGLE SHEAR WITH BENDING

SCREW SIZE	A	B
#4 UP TO #8	1	3/4
#10 UP TO 1/4	1-1/2	1

DIMENSIONS IN INCHES. UNLESS OTHERWISE SPECIFIED, TOLERANCES: DIMENSIONS ±1/32.

FIGURE 2. Single Shear With Bending

4.4.1 If the failure of a sample screw is definitely ascribed to faulty material (which cannot be corrected by heat treatment), the entire lot of screws represented by the sample shall be rejected and that lot shall not be resubmitted for inspection.

5. PREPARATION FOR DELIVERY

5.1 Application.- The packaging, packing, and marking requirements specified herein apply only to direct purchases by or direct shipments to the Government.

5.2 Preservation and Packaging.- Unless otherwise specified, self-tapping screws shall be protected from corrosion in accordance with Specification AN-P-13, method 1A without the use of a preservative compound. Unless otherwise specified, multiples of 144 self-tapping screws of the same AN part number shall be securely packaged within an interior container in accordance with Specification JAN-P-120, JAN-P-133, or JAN-P-108.

5.3 Packing.- Unless otherwise specified, all items shall be packed for domestic shipment. Shipping containers, insofar as possible, shall contain the same number of articles, shall be uniform in size and snugly packed. The gross weight of the fully packed shipping container shall not exceed approximately 200 pounds.

5.3.1 Domestic Packing.- Unless otherwise specified, interior packages shall be packed in substantial commercial exterior shipping containers so constructed as to insure acceptance by common or other carrier for safe transportation, at the lowest rate, to the point of delivery. Except as specified herein, the container shall conform to the requirements of Consolidated Freight Classification Rules in effect at the time of shipment, except that fiberboard, when used, shall have a minimum Mullen test of 275 pounds. Containers shall be able to withstand storage, rehandling, and reshipment without the necessity of repacking.

5.3.2 Overseas Packing.- Unless otherwise specified, for overseas shipment, the interior packages shall be packed in shipping containers in accordance with Specification JAN-P-105 or JAN-P-106. Plywood, if used, shall conform to Specification JAN-P-139, type B, condition I. Each exterior shipping container shall be provided with a sealed waterproof liner in accordance with Specification JAN-P-125.

5.4 Marking and Labeling.-

5.4.1 Unit Packages.- Each unit package shall be durably and legibly marked with the following information in such a manner that the markings will not become damaged when the packages are opened:

SCREWS; SELF-TAPPING STEEL, AIRCRAFT
AN Part No._____
Quantity_____
Name of Manufacturer_____
Name of Contractor (if different from manufacturer)
Contract or Order No._____
Stock No._____(USAF or Navy as applicable)

5.4.2 Shipping Containers.- Each shipping container shall be marked as specified for unit packages; and marked to indicate preservation and method of packing. In addition, shipments for the Air Force shall be marked in accordance with the requirements of U. S. Army Specification 94-40645; and for the Navy, in accordance with the requirements of the Navy Shipment Marking Handbook.

6. NOTES

6.1 Intended Use.- Self-tapping screws are intended for use as fastenings on aircraft.

6.1.1 Restrictions.- Self-tapping screws shall not be used under the following conditions:

(a) As fastenings to primary or secondary structure.

(b) Where subject to stress reversals.

(c) As fastenings for superstructure or accessories where failure might result in danger or damage to the airplane or personnel.

(d) Where loss would permit the opening of a joint to air flow.

(e) Where the screw is subjected to a removal.

(f) Where subject to corrosive conditions.

6.1.2 Selection of Screws.-

6.1.2.1 Length of Screw.- The length of screw shall be such that at least two threads of the grip extend beyond the nut plate.

6.1.2.2 Diameter of Screw.- Whenever practicable the diameter shall be such that the recommended drill hole size will fall between the vertical heavy lines in Drawing AND10325, or AND10326, as applicable.

6.1.3 Holes for Screws.-

6.1.3.1 Sheet Material.-

6.1.3.1.1 Drilled Holes.- Drill each ply or plate of the assembly to the size recommended for its hardness and thickness. For assemblies already riveted together, the size of the hole shall depend on the hardest ply or plate employed as a nut plate or a tapped intermediate plate.

6.1.3.1.2 Punched Holes.- Punched holes may be used if the sheet is punched in the final joined position. Neither holes of a nominal diameter greater than 3/16 inch nor sheets with a nominal thickness greater than .065 inch shall be punched. If sheets are punched separately, clearance between punch and die shall be from 7 to 10 percent of the sheet thickness. If abrasion, denting, or deformation occurs in the vicinity of the holes due to the stripping plate of the punch press, the holes shall be drilled.

6.1.3.2 Holes in Castings.- If sheet material is to be fastened to castings by means of self-tapping screws, clearance holes should be drilled in the sheet to permit drawing the parts tightly together.

6.1.4 Self-Tapping Screws Used in Aluminum Alloy.- Self-tapping screws used in aluminum alloys shall be installed with a phenolic or aluminum washer. The washer and screw shall be coated with zinc-chromate paste before insertion so as to completely seal the connection.

6.1.5 Removal and Replacement.- If it is necessary to replace self-tapping screws, one of the following procedures shall be employed:

(1) The hole shall be redrilled and a screw at least one size larger used.

(2) If necessary to replace with a screw of the same size, a self-tapping screw or machine screw shall be installed with a lock washer.

6.2 Ordering Data.- Requisitions, contracts, and orders should state the AN part number of the screw desired and whether overseas packing shall be furnished. (See Section 5).

6.3 Definition of Plates.-

Name	Definition
Nut Plate	Any plate or part of a joint which grips the threaded portion of the screw so as to exert a tensile load on the screw when tightened.
Intermediate Plate	Any plate or part in the joint penetrated by the self-tapping screw between its head and a nut plate.
Tapped Intermediate Plate	An intermediate plate tapped by the action of the self-tapping screw.
Clearance Drilled Intermediate Plate	An intermediate plate drilled so as to clear the maximum allowable major diameter of the screw thread.

Custodian:
Navy - BuAer

Other interest:
Air Force