

MIL-B-7874B
3 December 1982
SUPERSEDING
MIL-B-7874A
17 November 1967

MILITARY SPECIFICATION

BOLT, MACHINE, 1200°F

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

* 1.1 Scope. This specification establishes the requirements for the manufacture and inspection of one type and class of bolt that shall be furnished in one grade only for use where temperatures will not exceed 1200°F.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

* 2.1.1 Specifications, standards and handbooks. Unless otherwise specified, the following specifications, standards and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

PPP-H-1581	Hardware (Fasteners and Related Items), Packaging of.
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Beneficial comments, (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to the Naval Air Engineering Center, Engineering Specifications and Standards Department (Code 93), Lakehurst, NJ 08733, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC 5306

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SPECIFICATIONS - Continued.

MILITARY

MIL-N-7873	Nut, Self-Locking, 1200°F.
MIL-S-8879	Screw Threads, Controlled Radius Root with Increased Minor Diameter, General Specification for.

STANDARDS

MILITARY

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-1312	Fasteners, Test Methods.

(See supplement for list of applicable military standards.)

(Copies of specifications, standards, handbooks, drawings, and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

- * 2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

American National Standards Institute

ANSI B46.1	Surface Texture (Surface Roughness, Waviness and Lay).
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(Applications for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, New York 10018.)

Society of Automotive Engineers, Inc.

AMS 5731, AMS 5732, AMS 5734, and AMS 5737	Steel Bars, Forgings, Tubing, and Rings, Corrosion and Heat Resistant.
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(Applications for copies of AMS publications should be addressed to the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096.)

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

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- * 2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

- * 3.1 Qualification. The bolts furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.3 and 6.3).
- * 3.2 Material. The bolts shall be fabricated from heat and corrosion-resisting material. Unless otherwise specified, this material shall have a minimum tensile strength of 140,000 pounds per square inch (psi), a minimum 0.2 percent yield strength of 95,000 psi and a minimum stress rupture strength of 65,000 psi in 23 hours at 1200° F. Material shall be A286 per AMS 5731, AMS 5732, AMS 5734 or AMS 5737.
- 3.3 Design and construction.
- 3.3.1 Dimensions. Dimensions shall be in accordance with applicable standards.
- 3.3.2 Threads.
- 3.3.2.1 Form and dimensions. Thread dimensions shall be in accordance with MIL-S-8879 and shall be fully formed by any single rolling process after heat treatment.
- 3.3.2.2 Incomplete thread pitches. The threads shall be faired into the shank with a thread runout of a maximum of two and a minimum of one imperfect threads, to eliminate an abrupt change in cross-sectional area. The bottom and sides of runout thread pitches may deviate from true thread form but shall be smooth and free of tool marks.
- 3.3.2.3 Grain flow. The grain flow in the threads shall be continuous and shall follow the general thread contour with the maximum density at the bottom of the root radius as shown in figure 1.
- 3.3.3 Heads. The bolt heads shall be forged.
- 3.3.3.1 Bearing surface. The bearing surface of bolt heads shall be at right angles to the shank within limits shown in figure 2. The angular variation of the underside of the head shall be uniform around the shank within a tolerance of 10 minutes, as measured between the bearing surface of the head and the shank at a length along the shank equal to the diameter of the bolt.
- 3.3.3.2 Head structure and grain flow. A section of the head shall show no detrimental defects and shall show grain-flow lines substantially as shown on figure 4. The grain-flow lines may be slightly broken by the finish machining or grinding.
- * 3.4 Surface texture. The surface texture of the bolt shall not exceed the values specified in table I. The surface texture shall be measured in accordance with ANSI B46.1.

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TABLE I. Surface roughness.

Area	Microinches (maximum)
Shank and underside of head	63
Head to shank fillet	32
Sides of thread and root area	32
Other surfaces	125

* 3.5 Straightness. The straightness of the bolt shall be within the values specified in table II.

TABLE II. Shank straightness.

Bolt size	Bolt shank straightness TIR (inch per inch of bolt length) (maximum)
10	0.0040
1/4, 5/16	0.0030
3/8, 7/16	0.0025
1/2 & larger	0.0020

3.6 Mechanical properties.

3.6.1 Tensile and rupture strength. The tensile and rupture strength of the bolts shall be as specified in table III.

3.6.2 Shear strength. The ultimate double shear strength of bolts shall be as specified in table III.

3.6.3 Hardness. Hardness shall be Rockwell C27 to C37.

TABLE III. Tensile and shear strength.

Bolt size	Tensile breaking strength (pounds minimum)		Double shear strength (pounds minimum)
	Room temperature	23 hour stress rupture at 1200°F	
10	3,000	1,100	4,700
1/4	5,400	2,100	8,300
5/16	8,600	3,400	13,000
3/8	13,300	5,300	18,800
7/16	18,000	7,100	25,600
1/2	24,000	9,700	33,400
9/16	30,500	12,300	42,200
5/8	38,100	15,600	52,200
3/4	55,300	22,800	75,100
7/8	75,500	31,200	102,000
1	98,400	42,000	133,500
1-1/8	126,000	52,800	169,000
1-1/4	157,000	66,600	208,600

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3.7 Metallurgical properties.

* 3.7.1 Carburization and nitrogenization. The bolts shall show no decarburization, carburization, recarburization or increase in nitrogenization on the bearing surface of the head, head-to-shank fillet, shank or threads.

3.7.2 Discontinuities. Discontinuities shall not exceed the following limitations.

3.7.2.1 Cracks. There shall be no cracks in any location. A crack is defined as a clean crystalline break passing through the grain or grain boundary without inclusion of foreign elements.

3.7.2.2 Laps and seams. Bolts may possess laps and seams, except in locations specified in 3.7.2.3. Depth of discontinuities, when measured normal to the surface at the point of greatest penetration, shall not exceed 0.005 inch for No. 10 through 3/8 inch diameter, 0.007 for 7/16 and 0.008 for 1/2 through 1-1/4.

3.7.2.3 Thread discontinuities (laps, seams and surface irregularities). Thread shall have no multiple or single laps at the root or on the sides, as shown on figure 3, except that laps are permissible at the crest which do not exceed 25 percent of the basic thread depth and on the sides outside the pitch diameter. Slight deviation from the thread contour is permissible at the crest of the thread.

3.8 Test nut. The nut used for the tensile and stress rupture tests shall conform to MIL-N-7873, except that it shall be heat treated to develop the full strength of the bolt and have threads in accordance with MIL-S-8879.

3.9 Identification marking. Bolts shall be identified in accordance with the applicable military standards.

3.10 Workmanship. Workmanship shall be in accordance with the design requirements specified herein.

* 3.11 Recycled, virgin and reclaimed materials. There is no exclusion to the use of recycled or reclaimed materials and no mandate for the use of virgin materials as long as it meets the requirements of this specification.

4. QUALITY ASSURANCE PROVISIONS

* 4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

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4.1.1 Inspection records. All inspection records of examinations and tests shall be certified and shall be supplied for each production lot or portion thereof (see 6.2.2). The records and reports shall be submitted to the purchaser with the shipper's list and not in each individual package.

4.2 Classification of inspections. The inspections shall be classified as follows:

- a. Qualification inspection (see 4.3).
- b. Qualification conformance inspection (see 4.4).

4.3 Qualification inspection.

4.3.1 Sampling instructions. Qualification test samples shall consist of 30 bolts for each size and type of which qualification is desired. The grip length of the bolts shall be approximately 2-1/2 inches. The self-locking nuts in accordance with 3.8 shall be furnished with each set of qualification test sample bolts. Samples shall be identified as required and forwarded to the activity responsible for qualification designated in the letter of authorization from that activity (see 6.3).

4.3.2 Tests. The qualification inspection of bolts shall consist of all the tests of this specification as specified under inspection methods (see 4.5).

* 4.3.2.1 Certified test report. The manufacturer shall furnish a certified test report showing that the manufacturer's product satisfactorily conforms to this specification (see 6.2.2). The test report shall include actual results of the tests specified herein. When this report is submitted, it shall be accompanied by a dated drawing which completely describes the manufacturer's product by specifying all dimensions and tolerances, composition of materials selected, coating or plating applied, forming process (machined, stamped, forged or drawn) and the heat treatment. The manufacturer's part number for each size shall be included on the specified drawing.

* 4.3.2.2 Retention of qualification. Certification shall be requested by the Naval Air Development Center (NAVAIRDEVCEN), Code 6013, Warminster, PA 18974, from each manufacturer. NAVAIRDEVCEN will forward certification to the Naval Air Systems Command (NAVAIRSYSCOM) (AIR-5303B). Certification shall be at the time of the two year review and shall be signed by a responsible official of management, attesting that the listed product(s) is still available from the listed plant, can be produced under the same conditions as originally qualified; (ie, same process, materials, construction, design, manufacturer's part number, or designation); and meets the requirements of the current issue of the specification. Failure to provide the certification will be cause for removal from the QPL. After completion of the certification review, the QPL will be reprinted to show the date of certification. (DD Form 1718, Certification of Qualified Products, shall be used for obtaining certification.)

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4.4 Quality conformance inspection. The quality conformance inspection shall consist of the following tests, as specified under inspection methods (see 4.5). In addition, bolts shall be subjected to any of the other tests specified herein which the inspector considers necessary to determine conformance to this specification.

- a. Examination of product (see 4.5.1)
- b. Tensile strength (see 4.5.3)
- c. Head structure (see 4.5.6)

4.4.1 Tests. The bolt manufacturer shall be responsible for accomplishing the quality conformance inspection specified herein.

4.4.2 Inspection lot. The inspection lot definition, formation and size shall be in accordance with MIL-STD-105.

4.4.3 Sampling plan. The sample bolt shall be selected at random from the inspection lot for examination of product in accordance with MIL-STD-105, inspection level II, acceptance quality level as follows:

Major defects	2.5 percent defective
Minor A defects	4.0 percent defective

For the tensile and macro-etch tests a sample of two bolts from each inspection lot shall be selected to determine conformance with 4.5.3 and 4.5.6. The acceptance number shall be zero.

4.4.3.1 Classification of defects. Defects shall be classified as shown in table IV.

TABLE IV. Classification of defects.

AQL percent defective	Classification	Dimensional characteristics
2.5	<u>Major</u>	
	101	Thread size and form
	102	Shank diameter
	103	Incomplete threads and thread runout
	104	Grip length
	105	Radius under head
	106	Squareness between head and shank
	107	Straightness of shank
	108	Surface texture
	110	Washer face diameter
	111	Dimension across flats
	112	Nonacceptance discontinuities

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TABLE IV. Classification of defects. - Continued.

AQL percent defective	Classification	Dimensional characteristics
4.0	<u>Minor A</u>	
	201	Overall length
	202	Head height
	203	Identification
	204	Chamfer on thread end
	205	Chamfer on head
	206	Burrs and tool marks

4.5 Inspection methods.

- * 4.5.1 Examination of product. The bolts shall be examined for conformance with the requirements of this specification with respect to material, design, workmanship and dimensions.
- * 4.5.2 Surface texture and straightness. Surface texture shall be inspected by means of applicable gages. Surface texture of threads shall be determined by a visual comparator method. Straightness shall be measured by the use of a dial type indicator gage. In case of discrepancy, gages certified by government laboratories shall be used.
- * 4.5.3 Tensile strength. Sample bolts shall be tested in tension between the head of the bolt and a nut conforming to 3.8. The bearing face of the nut shall be located a minimum of two and a maximum of three pitches from the bolt thread termination. Bolts with a grip length of less than twice the shank diameter need not be tested. The tensile test shall be in accordance with MIL-STD-1312, Test 8.
- * 4.5.4 Double shear strength. The double shear strength test shall be performed in accordance with MIL-STD-1312, Test 13. If the bolt length is less than twice the shank diameter, test coupons of the same material, diameter, heat treatment or cold work, or both, shall be prepared and subjected to the double shear test.
- * 4.5.5 Stress rupture strength. Samples of the bolts shall be tested at $1200^{\circ}\text{F} \pm 10^{\circ}\text{F}$ in tension between the head of the bolt and a nut conforming to 3.8. The rupture test shall be in accordance with MIL-STD-1312, Test 10 and shall consist of the application of a static tensile load as specified in table III to the bolt for 23 hours.
- * 4.5.6 Head structure and grain flow. Head structure and grain flow shall be determined by macroexamination at 10X magnification. Specimens shall be taken from the finished bolt as shown in figure 5. The bolts shall be etched in an aqueous solution containing 50 percent (by volume) of commercial hydrochloric acid at 71°C to 82°C (160°F to 180°F) for sufficient time to reveal the macrostructure properly.

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* 4.5.7 Hardness. Each bolt of the random samples shall be tested in accordance with MIL-STD-1312, Test 6, for a Rockwell hardness on the end of the bolt. Each bolt of the random sample shall meet the requirements of 3.6.3.

* 4.5.8 Carburization and nitrogenization. Carburization, decarburization, recarburization, or nitrogenization on the bearing surface of the head, head-to-shank fillet, shank, and threads shall be determined by microexamination. Specimens shall be taken from the finished bolt as shown on figure 5. The etchant shall be 5 percent nital. Microscopic examination shall be made at 100X magnification. In case of discrepancy over carburization, decarburization, recarburization, or nitrogenization, microhardness testing of the shank shall be used as an arbitration method. Bolts shall conform to this requirement if the difference in Vicker's microhardness, when measured in a zone between 0.003 and 0.063 from the surface, is 45 points. This does not apply to the threads or fillet area.

* 4.5.9 Cracks and discontinuities. Fluorescent penetrant inspection in accordance with MIL-I-6866, Type I, any method, shall be used to determine the presence of cracks and discontinuities such as laps, seams and inclusions. If indications are considered cause for rejection, representative samples shall be taken from those bolts showing indications and these samples shall be further examined by microexamination to determine if the indicated discontinuities are greater than the limits specified herein.

* 4.6 Inspection of packaging. The sampling and inspection of the preservation, packing and container marking shall be in accordance with the requirements of PPP-H-1581.

5. PACKAGING

* 5.1 Packaging requirements. The requirements for packaging shall be in accordance with PPP-H-1581.

6. NOTES

6.1 Intended use. The bolts covered by this specification are intended for use with nuts conforming to MIL-N-7873 at temperatures not exceeding 1200°F in aircraft and engines.

6.2 Ordering data.

* 6.2.1 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number and date of this specification.
- b. MS part number of the bolt and the quantity desired.
- c. Levels of preservation-packaging and packing (see 5.1).

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* 6.2.2 Data requirements. When this specification is used in an acquisition which incorporates a DD Form 1423, Contract Data Requirements List (CDRL), the data requirements identified below shall be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved CDRL incorporated into the contract. When the provisions of DAR 7-104.9(n)(2) are invoked and the DD Form 1423 is not used, the data specified below shall be delivered by the contractor in accordance with the contract or purchase order requirements. Deliverable data required by this specification is cited in the following paragraphs:

Paragraph No.	Data Requirement Title	Applicable DID No.	Option
a. 4.3.2.1	Test and demonstration reports	DI-T-1906	----

(Data item descriptions related to this specification, and identified in section 6 will be approved and listed as such in DoD 5000.19L, Vol. II, AMSDL. Copies of data item descriptions required by the contractors in connection with specific acquisition functions should be obtained from the Naval Publications and Forms Center or as directed by the contracting officer.)

* 6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time set for opening of bids, qualified for inclusion in the Qualified Products List, whether or not such products have actually been so listed by that date. The attention of contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Naval Air Systems Command, Washington, DC 20361. However, information pertaining to qualification of products may be obtained from the Naval Air Development Center, Code 60132, Warminster, PA 18974.

* 6.4 Changes from previous issue. The margins of this specification are marked with asterisks to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:
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 Navy - AS
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Preparing activity:
 Navy - AS
 Project No. 5306-0785

Review activities:
 Army - AR
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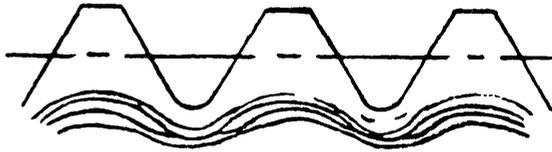


FIGURE 1. Grain flow.

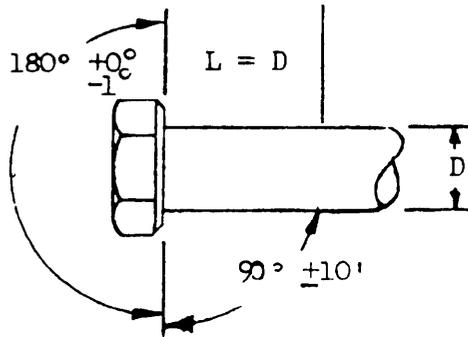


FIGURE 2. Head angularity.

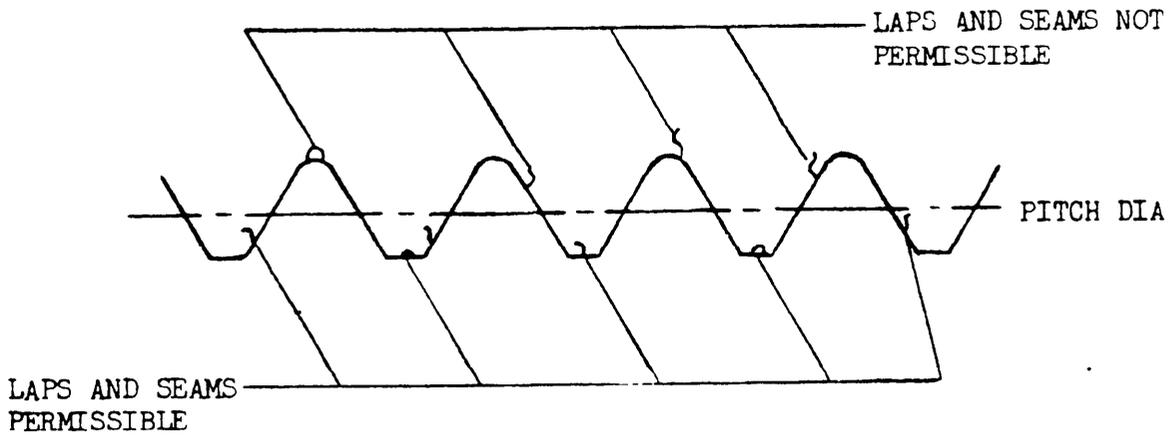


FIGURE 3. Location of permissible and nonpermissible laps, seams and irregularities.

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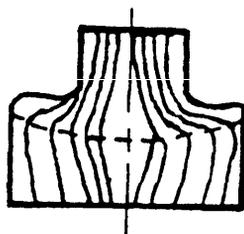
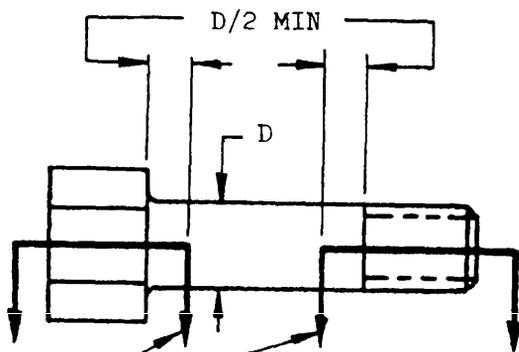


FIGURE 4. Head structure and grain flow.



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MICROEXAMINED AND MACROEXAMINED

FIGURE 5. Metallurgical specimens.

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