

MIL-B-8906C
 18 April 1988
~~SUPERSEDING~~
 MIL-B-008906B(AS)
 12 May 1986

MILITARY SPECIFICATION

BOLT, ALLOY STEEL, SHEAR AND TENSILE
 (132 KSI MIN F_{su} AND 220 KSI MIN F_{tu}), 450°F, SPLINE DRIVE,
 GENERAL SPECIFICATION FOR

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

1. SCOPE

1.1 Scope. This specification covers external wrenching, tensile and shear bolts. The bolts shall be used in temperatures not greater than 450°F.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. Unless otherwise specified, the following specifications and standards 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

MILITARY

MIL-C-8837 Coating, Cadmium (Vacuum Deposited)

MIL-H-6875 Heat Treatment of Steel, Process for

MIL-N-8922 Nut, Self-Locking, Alloy Steel, 220 KSI F_{tu} ,
 450°F

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Systems Engineering and Standardization Department (Code 53), Naval Air Engineering Center, Lakehurst, NJ 08733-5100, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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SPECIFICATIONS (Continued)

MILITARY (Continued)

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-129 Marking for Shipment and Storage

MIL-STD-410 Nondestructive Testing Personnel Qualification and Certification

MIL-STD-1312 Fastener Test Methods

MIL-STD-1949 Inspection, Magnetic Particle

(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 activity.)

2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B46.1 Surface Texture (Surface Roughness, Waviness and Lay)

(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, NY 10018.)

AMERICAN SOCIETY OF TESTING AND MATERIALS

ASTM E 112 Determining Average Grain Size

(Application for copies should be addressed to the American Society of Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

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NATIONAL AEROSPACE STANDARDS

NAS 1348

Fasteners - Recommended Tensile Stress Areas for
External Threaded

(Application for copies should be addressed to the National Aerospace Standards Committee, 1725 DeSales Street, N.W., Washington, DC 20036.)

UNIFORM CLASSIFICATION COMMITTEE

Uniform Freight Classification Rules

(Application for copies should be addressed to the Uniform Classification Committee, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern. If a specific requirement specified herein is not required for an item, it shall be so indicated on the specification sheet.

3.2 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.

3.3 Material. Material shall be alloy steel in accordance with the applicable specification sheet.

3.4 Design and construction.

3.4.1 Dimensions. The dimensions shall be as specified in the applicable specification sheet or drawing.

3.4.2 Threads.

3.4.2.1 Form and dimensions. Dimensions, form and contour shall be as specified in MIL-S-8879 and shall be right handed.

3.4.2.2 Rolling. Threads shall be fully formed after final heat treatment by a process which incorporates a single rolling operation for forming the thread.

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3.4.2.3 Incomplete threads. The threads shall be faired onto the shank as shown on Figures 1 and 1A. The root and flanks of runout thread may deviate from true thread form but shall be smooth and free of tool marks.

3.4.2.4 Grain flow. The grain flow in the threads shall be continuous and shall follow the thread contour with the maximum density at the bottom of the root radius as shown on Figure 2.

3.4.3 Bolt heads. The bolt heads shall be forged. Machined or forged holes for reduction of weight are acceptable. Only the minimum amount of metal shall be removed from the bearing surface of the bolt head as is necessary to obtain the specified angularity and a clean, smooth surface.

3.4.3.1 Wrenching element. A wrenching element shall be as specified in the applicable specification sheet or drawing.

3.4.3.2 Bearing surface. The bearing surface of bolt heads shall be at right angles to the shank within the limits shown on Figure 3. 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 from head equal to the diameter of the bolt.

3.4.3.3 Head structure and grain flow. A section of the head shall show no detrimental defects, see 4.5.1.1.3. Flow lines in the fillet area immediately below the surface shall conform to the fillet contour as shown on Figure 4. The intersection of the longitudinal axis of the bolt and the approximate transverse axis of the flow lines shall be not less than $D/7$ inches from the bearing surface of the bolt where "D" is the nominal diameter of the bolt. The metal removed from the bearing surface shall be as small as practicable to obtain a clean, smooth surface.

3.4.4 Fillet (head-to-shank). The head-to-shank fillet radius shall be cold worked to meet the fatigue strength requirements specified herein. The fillet shall be furnished to the radius specified in the applicable specification sheet. The fillet shall show no evidence of seams or inclusions, see 4.5.3.2.

3.4.4.1 Distortion of radius. Distortion of the radius (due to cold work) shall be not greater than height A and depth B and the distorted area shall not extend beyond C, see Figure 5.

3.5 Surface texture. The surface texture of the bolts after coating shall be not greater than the values specified in Table I or as specified in the applicable specification sheet or drawing. The surface texture shall be measured as specified in ANSI B46.1, see 4.5.1.1.1 and 4.5.1.1.4.

3.6 Metallurgical properties.

3.6.1 Discontinuities. All bolts shall be examined by magnetic particle inspection, see 4.5.3.2. Any bolts having discontinuities equal to or exceeding the limitations specified herein shall be rejected. Care must be exercised to avoid confusing cracks, as described herein with other discontinuities.

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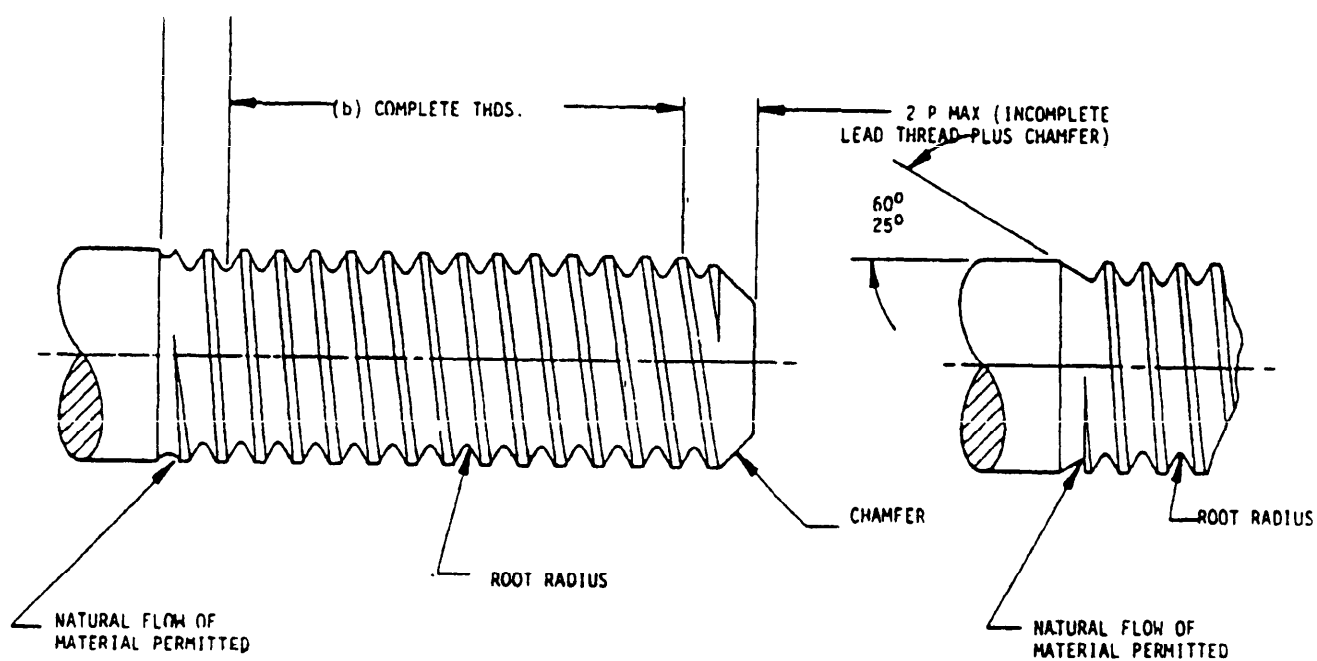


FIGURE 1. Incomplete threads and root radius.

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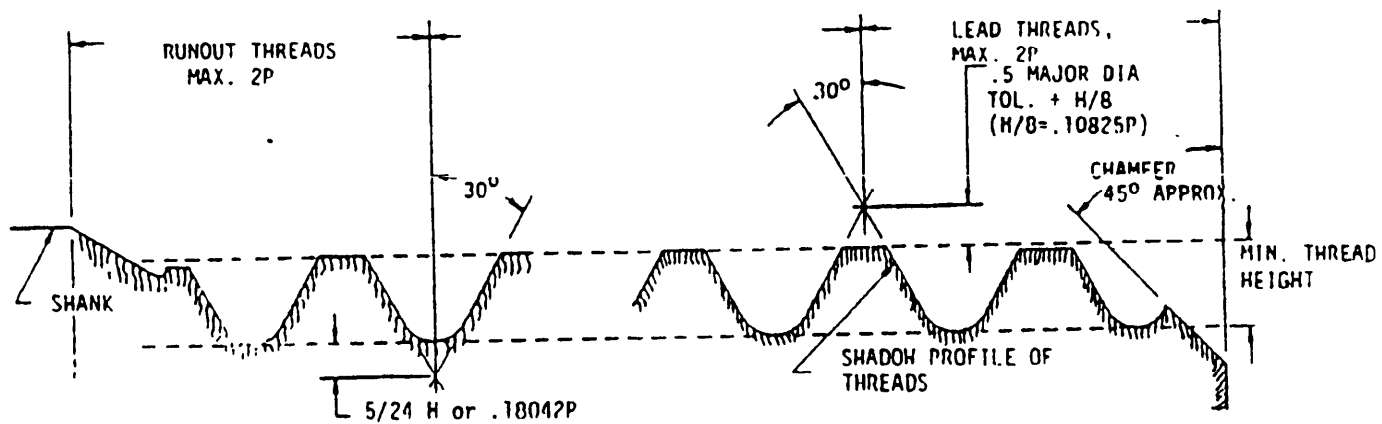


FIGURE 1A. Determination of incomplete threads.

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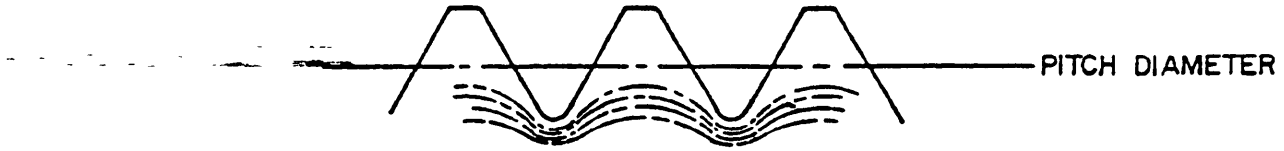


FIGURE 2. Grain flow.

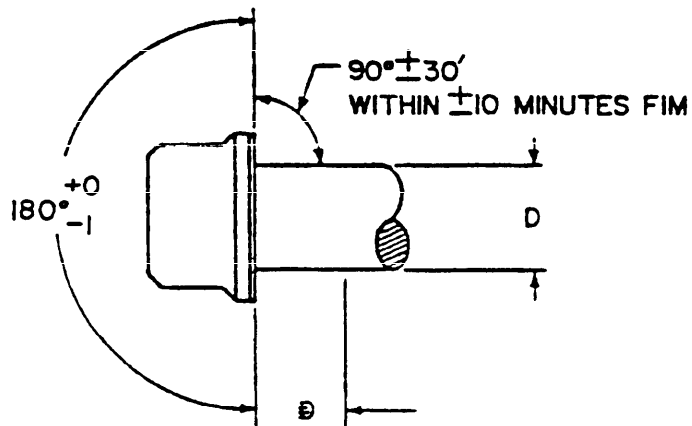


FIGURE 3. Head angularity.

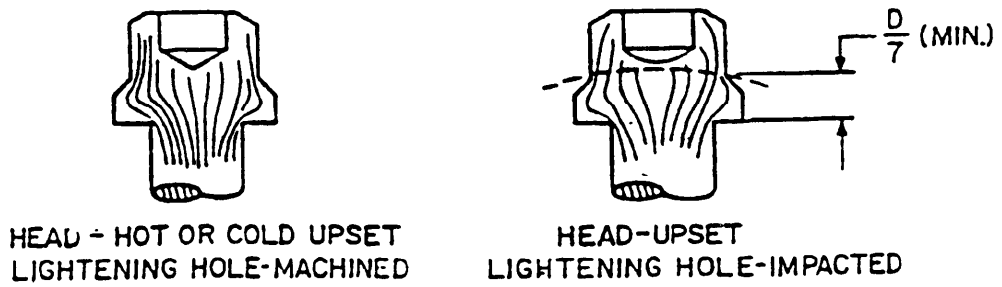
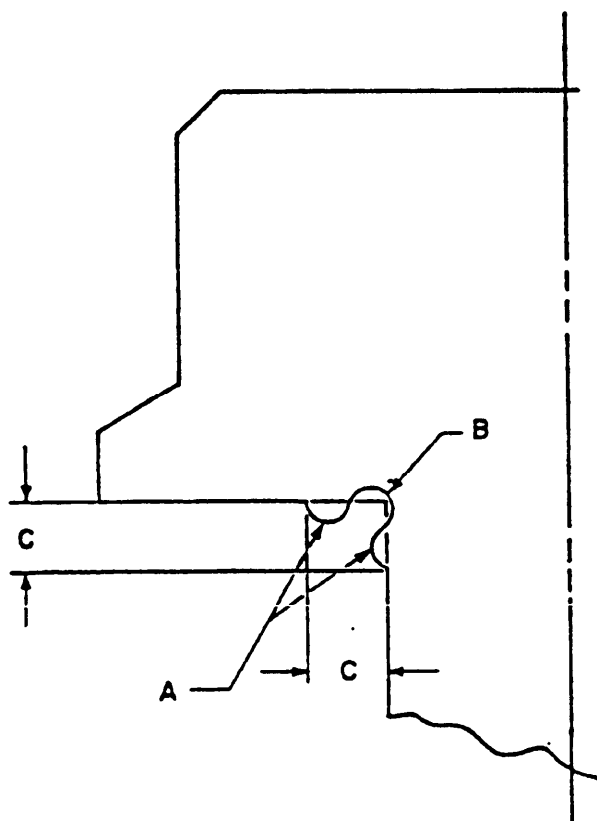


FIGURE 4. Head structure and grain flow.

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Nominal Size	Less Than 0.312	0.312 and 0.375	0.437 Thru 0.625	0.750 Thru 1"	Greater Than 1"
A & B max	0.002	0.002	0.003	0.003	0.004
C max	0.062	0.094	0.125	0.156	0.188

DIMENSIONS IN INCHES.

FIGURE 5. Fillet rolling permissible distortion.

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TABLE I. Surface texture.

Area	Microinches (Max)
Shank and underside of head	32
Head-to-shank fillet	32
Flanks of thread and root area	32
Other surfaces	125

3.6.1.1 Cracks. Bolts shall be free from cracks in any direction or location, see 4.5.3.2 and 6.4.2.

3.6.1.2 Laps and seams. Bolts may possess laps and seams, except in locations specified in 3.6.1.5. The depths shall not be greater than the amounts specified in Table II, see 6.4.3 and 6.4.4.

TABLE II. Discontinuity depths. 1/

Nominal Size (Inches)	0.190, 0.250, 0.312	0.375	0.4375	0.500 Through 1.125, Incl.
Discontinuity depth (inch maximum)	0.005	0.006	0.007	0.008

1/ Depth of discontinuity shall be measured normal to the surface at point of greatest penetration.

3.6.1.3 Inclusions. Bolts shall show no evidence of surface or sub-surface inclusions at the thread root or head-to-shank fillet, see 4.5.3.2. Small inclusions in other parts of the bolt which are not indicative of unsatisfactory quality shall not be cause for rejection.

3.6.1.4 Head and shank discontinuities (seams, inclusions or folds). The bolt heads and shanks shall not possess seams, inclusions, or folds greater than twice the depth limits specified in Table II. Bolts having seams on the bearing surface greater than the limits specified in Table II shall be cause for rejection. Discontinuities shall not be permitted on the head-to-shank fillet.

3.6.1.5 Thread discontinuities (laps, seams and surface irregularities). Threads shall have no laps at the root or along the flanks as shown on Figure 6. Laps are permissible at the crest as shown on Figure 7. Laps at the crest shall be not greater than 25 percent of the basic thread depth. Slight deviation from the thread contour is permissible at the crest of the thread as shown on Figure 7. The incomplete thread at each end of the thread may also deviate slightly from contour.

3.6.2 Work effect. The bolt threads and head-to-shank fillet shall show evidence of working, see 4.5.4.2.

3.6.3 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, see 4.5.4.10.

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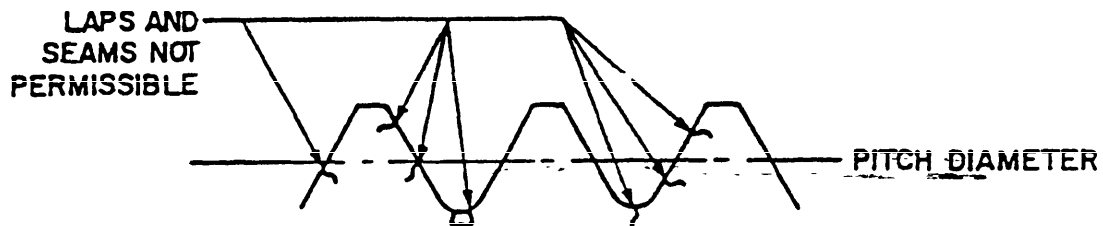


FIGURE 6. Nonpermissible laps, seams and surface irregularities.

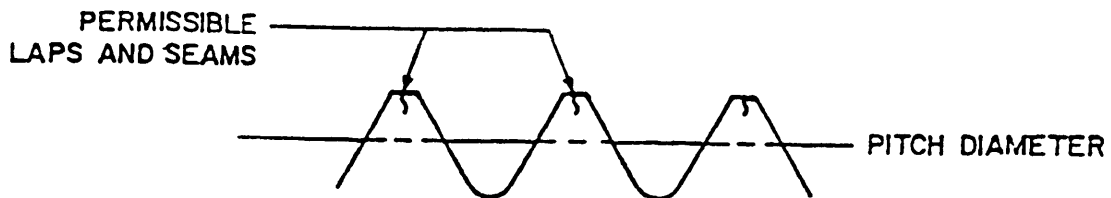
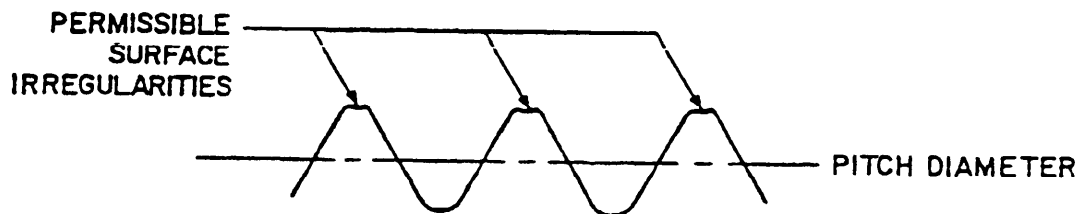


FIGURE 7. Permissible laps, seams and surface irregularities.

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3.6.4 Grinding burns. The bolts shall show no evidence of grinding burns, see 4.5.4.8.

3.7 Straightness. The straightness of the bolt shank shall be within the values specified in Table III, see 4.5.1.1.1.

TABLE III. Straightness of shank.

Nominal size	Bolt shank straightness FIM (inch per inch of bolt length) (Maximum)
0.312 and smaller	0.0030
0.375 and 0.437	0.0025
0.500 and larger	0.0020

3.8 Heat treatment. Bolts shall be heat treated, including triple tempering, to develop the mechanical properties specified herein (see Table IV). Bolts shall be retempered, subsequent to grinding and prior to thread rolling and radius forming, at a temperature of 25°F below the original tempering temperature. The heat treatment shall be in accordance with MIL-H-6875.

3.9 Cadmium plating. Bolts shall be vacuum cadmium plated in accordance with MIL-C-8837, Type II, Class 2, see 4.5.1.1.4.

3.10 Mechanical properties.

3.10.1 Ultimate tensile load. The bolts shall meet the minimum and maximum ultimate tensile loads specified in Table IV, see 4.5.4.3.

3.10.2 Double shear strength. The bolts shall meet or exceed the double shear values specified in Table IV, see 4.5.4.4.

3.10.3 Fatigue strength. Bolts, when loaded as specified in Table V, shall be capable of withstanding an average fatigue life of 65,000 cycles. If no failure occurs at 130,000 cycles, testing may be discontinued, see 4.5.4.5.

3.10.4 Stress durability. There shall be no failure of the bolt when subjected to the stress durability test, see 4.5.4.6.

3.10.5 Hardness. Bolts shall have a Rockwell hardness in the range of C46 to C50, see 4.5.4.5 or 4.5.3.2, as applicable.

3.11 Identification of product. Each bolt shall be marked as specified in the applicable specification sheet. The manufacturer's identification and code marking for traceability by production lot shall be marked on the top or side of the head, on the base of the lightening hole or on the point of the bolt. Traceability code marking is required for all bolt sizes. Markings may be formed by forging, stamping or laser marking. Marking may be raised or indented. Marking depth shall be not greater than 0.010-inch.

3.12 Workmanship. The bolts shall be free from burrs, scale, excessive seams and other defects which would interfere with their intended use.

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TABLE IV. Mechanical properties.

Nominal Size	Ultimate Tensile Load Pounds Min <u>1/</u>	Area at Nominal Shank Diameter (In. ²) <u>2/</u>	Double Shear Strength Pounds (Min) <u>2/</u>
0.190-32	4,770	0.0284	7,480
.250-28	8,540	0.0491	13,000
.312-24	13,500	0.0767	20,200
.375-24	20,900	0.1104	29,100
.437-20	28,300	0.1503	39,700
.500-20	37,800	0.1963	51,800
.562-18	47,900	0.2485	65,600
.625-18	59,900	0.3068	81,000
.750-16	86,900	0.4418	117,000
.875-14	119,000	0.6013	159,000
1.000-12	155,000	0.7854	207,000
1.125-12	198,000	0.9940	262,000
1.250-12	247,000	1.2270	324,000
1.375-12	301,000	1.4850	392,000
1.500-12	361,000	1.7670	466,000

1/ The stress areas used for the calculations of the ultimate tensile load values are in accordance with NAS 1348 except .190-32, .250-28 and .312-24 which are 98 percent of the values in NAS 1348.

2/ The listed shear values are based on a minimum single shear strength of 132 ksi and the stress area at the basic shank diameter.

TABLE V. Fatigue loading.

Nominal Size	High-Tension Load (Pounds) <u>+2</u> Percent <u>1/</u>	Low-Tension Load (Pounds) <u>+2</u> Percent <u>2/</u>
0.190-32	2,480	248
.250-28	4,440	440
.312-24	7,020	702
.375-24	10,900	1,090
.437-20	14,700	1,470
.500-20	19,600	1,960
.562-18	24,900	2,490
.625-18	31,200	3,120
.750-16	45,200	4,520
.875-14	61,700	6,170
1.000-12	80,400	8,040
1.125-12	103,000	10,300
1.250-12	128,000	12,800
1.375-12	157,000	15,700
1.500-12	188,000	18,800

1/ High-tension fatigue load is based on $0.52 \times F_{tu}$ minimum of Table IV.

2/ Low-tension fatigue load is 10 percent of high tension load.

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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.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection, see 4.3.
- b. Quality conformance inspection, see 4.4.

4.3 Qualification inspection. Qualification inspections shall consist of all the inspections specified in Table VI.

TABLE VI. Qualification inspections.

Type of Inspection	No. of Inspections	Requirement Paragraph	Test Paragraph
Threads	3	3.4.2	4.5.1.1.2
Finish Dimensions and Surface Texture	3	3.5	4.5.1.1.4
Cracks and Discontinuities	3	3.6.1 3.6.1.1	4.5.3.2
Fatigue Strength	3	3.10.3	4.5.4.5
Ultimate Tensile Strength	3	3.10.1	4.5.4.3
Double Shear Strength	3	3.10.2	4.5.4.4
Carburization and Nitrogenization	1	3.6.3	4.5.4.10
Work Effect	1	3.6.2	4.5.4.2
Head Structure and Grain Flow	1	3.4.3.3	4.5.1.1.3
Grinding Burns	3	3.6.4	4.5.4.8
Coating Adhesion and Salt Spray	3	3.9	4.5.4.9
Stress Durability	3	3.10.4	4.5.4.6
Hardness	3	3.10.5	4.5.3.3

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4.3.1 Sampling plan. The qualification inspection samples shall consist of 20 bolts for each diameter upon which qualification is desired. The number of tests or examinations shall be as specified in Table VI. Samples up to and including 0.4375-inch diameter shall have a grip length of not less than 1.750 inches; samples from 0.500-inch diameter and above shall have a grip length of not less than 4.500 inches. The manufacturer shall supply at least 20 nuts conforming to MIL-STD-1312-11. 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 Certified test report. The manufacturer shall make available to the activity responsible for qualification a certified test report showing that the manufacturer's product conforms to this specification. The test report shall include as a minimum, actual numerical results of each of the tests or examinations specified herein and listed in the order of their appearance in Table VI, including photographs of macro-and micro-examinations. When this report is submitted, it shall be accompanied by a detail drawing which completely describes the manufacturer's product by specifying all dimensions and tolerances, composition of material, selected coating or plating applied, and the heat treatment. The manufacturer's part number for each size and length shall be included on the above drawing. Failure of a manufacturer to furnish a satisfactory certified test report with the qualification samples shall be sufficient cause for rejection of the qualification request.

4.3.3 Retention of qualification. To maintain status on a Qualified Products List (QPL), certification shall be made available to indicate continued compliance with the requirements of this specification. Certification shall be requested by NAVAIRDEVEN (Naval Air Development Center), Code 6013, Warminster, PA 18974, from each manufacturer. NAVAIRDEVEN will forward certification to NAVAIRENGCEN who is acting as agent for NAVAIRSYSCOM (Naval Air Systems Command), AIR-53033G. 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 (i.e., 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 shall be reprinted to show the date of validation. (DD Form 1718, Certification of Qualified Products, shall be used for obtaining certification.)

4.3.4 Manufacturer's certification report. Each inspection lot of bolts shall be accompanied by a copy of the manufacturer's certification report, signed by an authorized representative of the manufacturer. This report shall state that the bolts are from a production lot that was manufactured, inspected and accepted in accordance with the requirements of this specification. This report shall identify the part number and production lot number, and shall include as a minimum, actual numerical results of each of the tests specified herein, as applicable.

4.4 Quality conformance inspections. The quality conformance inspections shall consist of all the inspections specified in Table VII.

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TABLE VII. Quality conformance inspections.

Test	Requirement Paragraph	Test Paragraph
Threads	3.4.2	4.5.1.1.2
Head Structure and Grain Flow	3.4.3.3	4.5.1.1.3
Finish Dimensions and Surface Texture	3.5	4.5.1.1.4
Cracks and Discontinuities	3.6.1 3.6.1.1	4.5.3.2
Carburization and Nitrogenization	3.6.3	4.5.4.10
Work Effect	3.6.2	4.5.4.2
Grinding Burns	3.6.4	4.5.4.8
Ultimate Tensile Load	3.10.1	4.5.4.3
Coating Adhesion and Salt Spray	3.9	4.5.4.9
Double Shear Strength	3.10.2	4.5.4.4
Stress Durability	3.10.4	4.5.4.6
Fatigue Strength	3.10.3	4.5.4.5
Hardness	3.10.5	4.5.3.3

4.4.1 Production lot. A production lot shall consist of bolts that are of the same diameter, fabricated from a single mill heat, heat treated, and coated by identical processes respectively, and produced as one continuous run.

4.4.2 Inspection lot. An inspection lot shall consist of bolts from a single production lot, of one part number that indicates one size, one grip length, and whether the heads are drilled or undrilled.

4.4.3 Random sample. A random sample is a sample drawn in such a manner that each bolt in the inspection lot has the same chance of being the first bolt in the random sample; after the first bolt in the sample is drawn each of the remaining bolts in the inspection lot has the same chance of being the second bolt in the sample, etc.

4.5 Test methods.

4.5.1 Visual and dimensional inspection.

4.5.1.1 Sampling. A random sample shall be selected from each inspection lot in accordance with MIL-STD-105, acceptable quality level (AQL) of 1.0 percent defective for Major defects, 2.5 percent defective for Minor A defects and 4.0 percent defective for Minor B defects.

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4.5.1.1.1 Straightness and surface texture. Straightness shall be measured by the use of a dial-type indicator gage. Surface texture of threads shall be determined by a visual comparator method.

4.5.1.1.2 Threads. The threads shall be examined for conformance to 3.4.2.

4.5.1.1.3 Head structure and grain flow. Head structure and grain flow shall be determined by macroexamination at a magnification of 10X. Specimens shall be taken from the finished bolt as shown on Figure 8. The bolts shall be etched in an aqueous solution containing 50 percent (by volume) hydrochloric acid at 160° to 180°F for sufficient time to reveal the macrostructure properly.

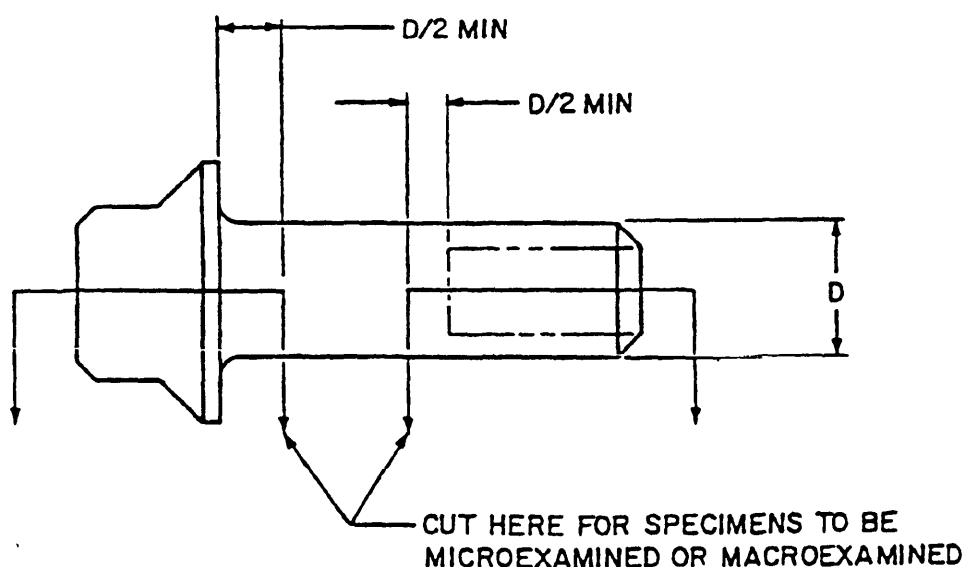


FIGURE 8. Metallurgical specimens.

4.5.1.1.4 Finish dimensions and surface texture. Dimensions and surface texture shall be inspected by means of applicable gages or by a visual comparator method.

4.5.1.2 Classification of defects. All dimensional characteristics are considered defective when out of tolerance. The classification of defects for bolts shall be as specified in Table VIII.

4.5.2 Use of identical sample bolts. Identical sample bolts may be used for the various acceptance inspections and tests, provided that none of the characteristics of the sample bolts are altered during the examination procedure.

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TABLE VIII. Classification of defects.

Category	Defect
Critical	None defined
Major: 101 102 103 104 105 106 107 108 109 110 111 112 113 114	Thread size and form Shank diameter Incomplete threads Grip length Radius under head Drilled holes in head missing (when required) Squareness between head and shank (bearing surface) Straightness of shank Surface texture Burrs and tool marks Cadmium coating (thickness) (when required) Identification Overall length, under size Wrenching dimensions
Minor A: 201 202 203 204 205 206 207	Overall length, over size Head diameter (and chamfer) Head height Concentricity of head and shank Concentricity of shank and thread pitch diameter Drilled hole diameters and location Lightening hole dimensions
Minor B: 301 302	Chamfer on thread end Flange height

4.5.3 Nondestructive tests.

4.5.3.1 Sampling. A random sample shall be selected from each inspection lot in accordance with MIL-STD-105, acceptable quality level (AQL) of 1.0 percent defective for Major defects, 2.5 percent defective for Minor A defects and 4.0 percent defective for Minor B defects.

4.5.3.2 Cracks and discontinuities. Magnetic particle inspection shall be used to determine the presence of cracks and discontinuities such as laps, seams and inclusions. Magnetic particle indications in and of themselves shall not be cause for rejection. 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 whether the indicated discontinuities exceed the limits specified herein.

4.5.3.2.1 Magnetic particle inspection. Magnetic particle inspection shall be performed in accordance with MIL-STD-1949. Personnel conducting magnetic particle inspection shall be qualified in accordance with MIL-STD-410.

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4.5.3.3 Hardness. Each bolt of the random sample shall be inspected for Rockwell hardness in accordance with MIL-STD-1312-6 on the threaded end of the bolt. Each bolt of the random sample shall have a Rockwell hardness in the range of C46 to C50 for the inspection lot and the production lot to be considered acceptable. If the readings are obtained outside this range, two samples each of the softest and hardest bolts shall be further tested in accordance with 4.5.4.5.

4.5.4 Destructive tests.

4.5.4.1 Sampling plan. The sampling plan shall be as specified in MIL-STD-105. Normal inspection shall be used at the start of each production lot. The AQL shall be 1.0 percent defective and the inspection level shall be S-2. For quality conformance tests, the AQL shall be zero percent defective. The sample units may be selected from those that have been subjected to and passed the nondestructive tests with additional bolts selected at random from the inspection lot as necessary.

4.5.4.2 Work effect. The cold work of the bolt threads shall be determined by microexamination, see 4.5.4.10. Work effect on the head-to-shank fillet shall be determined by visual examination.

4.5.4.3 Ultimate tensile strength. The bolts shall be tested in tension between the head of the bolt and a threaded member as specified in MIL-STD-1312-8.

4.5.4.4 Double shear strength. The double shear strength test shall be performed on the unthreaded portion of the bolt as specified in MIL-STD-1312-13. Bolts having a grip length of less than twice their shank diameter need not be shear tested.

4.5.4.5 Fatigue strength. The fatigue test shall be conducted at room temperature. The tension-tension fatigue testing method and fixture requirements shall be as specified in MIL-STD-1312-11. Bolts having a grip length less than twice their shank diameter need not be fatigue tested.

4.5.4.6 Stress durability. The stress durability test shall be in accordance with MIL-STD-1312-5. The load shall be maintained for 24 hours.

4.5.4.7 Traverse hardness. The acceptance of bolts having grip lengths less than twice the nominal diameter shall be based on the traverse hardness test taken on a circular cross section halfway between the head bearing surface and the thread. The Rockwell hardness range for acceptance shall be C46 to C50. Readings shall be taken at distances of 1/8 inch from the surface, at one-half the radius where practicable, and at the core.

4.5.4.8 Grinding burns. Indications of grinding burns (untempered martensite) are white streaks appearing on the surface of the test sample after the test is conducted as follows:

- a. Remove all foreign matter from the bolt such as grease, dirt, plating or oxide fiber.

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- b. Rinse the bolt in cold water. If water breaks occur, bolts shall be recleaned.
- c. Immerse and agitate the bolt in a 4 percent solution of nitric acid for approximately 30 seconds.
- d. Rinse in cold water and dry bolt.
- e. Immerse the bolt in 2 percent solution of hydrochloric acid in acetone for 30 seconds.
- f. Rinse in cold water.
- g. Rinse the bolt in 5 percent sodium bicarbonate solution.
- h. Rinse the bolt in hot water and dry.

Indication of brining burns shall be cause for rejection.

4.5.4.9 Coating adhesion and salt spray. The cadmium coating adhesion and salt spray tests shall be conducted in accordance with MIL-C-8837.

4.5.4.10 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 in Figure 8. The etchant shall be 5 percent nital. Microscopic examination shall be made at 100 magnification. In case of discrepancy over carburization, decarburization, recarburization and 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 requirement does not apply to the threads or fillet area.

4.5.5 Resubmitted inspection lots. The paragraph titled "Resubmitted Lots" of MIL-STD-105 shall apply except that a resubmitted inspection lot shall be inspected by contractor, using tightened inspection. Before an inspection lot is resubmitted, full particulars concerning the cause of previous rejection and the action taken to correct the defects found in the inspection lot shall be furnished by the contractor to the Government inspector.

4.6 Inspection of packaging. The sampling and inspection of the preservation, packing and container marking shall be in accordance with Section 5.

5. PACKAGING

5.1 Bolts shall be preserved, packaged, packed and marked for shipment in accordance with PPP-H-1581. Preservation and packaging shall be level A or C as specified in the contract or purchase order, see 6.2.

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5.2 Packing shall be level A, B or C as specified in the contract or purchase order, see 6.2.

5.3 Marking of shipments. In addition to any special requirements of the contract or order, shipments shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. Bolts procured to this specification are intended for use in tension applications which require a bolt with 220 ksi strength and high-fatigue strength and not intended for use in applications greater than 450°F. These bolts shall be used in conjunction with high strength nuts as specified in MIL-N-8922.

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, see 3.1.
- c. Applicable levels of packing and packaging.

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 (QPL 8906) whether or not such products have actually been so listed by that date. The attention of the 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, Navy Department, Washington, DC 20361; and information pertaining to qualification of products may be obtained from that activity.

6.3.1 Qualification tests will be authorized only upon presentation of certified test reports indicating that the bolts conform to this specification (see 4.3.3) and the applicable military specification sheet or a standard approved by the activity responsible for qualification.

6.4 Definitions applicable to the tests under this specification.

6.4.1 Defective. A defective is defined as an item containing one or more defects.

6.4.2 Crack. A crack is defined as a clean crystalline break passing through the grain or grain boundary without the inclusion of foreign elements.

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6.4.3 Lap. A lap is defined as a surface defect appearing as a seam caused by fo~~l~~ding over hot metal fins or sharp corners and then rolling or forging them into the surface, but not welding them.

6.4.4 Seam. A seam is defined as an unwelded fold or lap which appears as an opening in the raw material as received from the source.

6.5 Subject term (key word) listing.

Bolt
Steel
Shear
Tensile
132 KSI F_{su}
220 KSI F_{tu}
Spline Drive

Custodians:
Navy - AS
Air Force - 99
Army - AV

Preparing Activity:
Navy - AS
(Project No. 5306-1205)

Reviewer activity:
Army - AR
DSA - IS
Air Force - 82

User activity:
Army - MI

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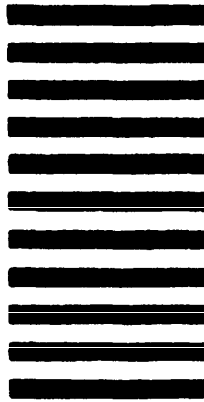
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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER
MIL-B-8906 Rev C

2. DOCUMENT TITLE BOLT, ALLOY STEEL, SHEAR AND TENSILE (132 KSI MIN
 F_{su} AND 220 KSI MIN F_{tu}), 450°F, SPLINE DRIVE, GEN SPEC FOR

3a. NAME OF SUBMITTING ORGANIZATION

4. TYPE OF ORGANIZATION (Mark one)

VENDOR

USER

MANUFACTURER

OTHER (Specify) _____

3b. ADDRESS (Street, City, State, ZIP Code)

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER (Last, First, MI) - Optional

7b. WORK TELEPHONE NUMBER (Include Code) - Optional

8. MAILING ADDRESS (Street, City, State, ZIP Code) - Optional

8. DATE OF SUBMISSION (YYMMDD)

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INCH-POUND

MIL-B-8906C
Amendment 1
6 August 1990

1 of 1

MILITARY SPECIFICATION

BOLT, ALLOY STEEL, SHEAR AND TENSILE
(132 KSI MIN FSU AND 220 KSI MIN Ft_u), 450°F, SPLINE DRIVE

This amendment forms a part of military specification MIL-B-8906C dated 18 April 1988, and is approved for use by all Departments and Agencies of the Department of Defense.

PAGE 11

Paragraph 3.10.3: Delete "average" and substitute "minimum," i.e. average fatigue life of 65,000 cycles should be minimum fatigue life of 65,000 cycles.

Custodians:

Army - AV
Navy - AS
Air Force - 99

Preparing Activity

Navy - AS
(Project No. 5306-1414)

Reviewer Activity:

Army - AR
Air Force - 82
DLA - IS

User Activity:

Army - MI

AMSC N/A

FSC 5306

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