

FF-B-575C
May 26, 1970
SUPERSEDING
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September 12, 1960
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January 9, 1934

FEDERAL SPECIFICATION

BOLTS, HEXAGON AND SQUARE

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers the physical and mechanical properties of various types of hexagon and square head bolts having nominal diameters of 1/4 inch and larger.

1.2 Classification. Bolts shall be of the following types and sizes, as specified (see 6.2).

1.2.1 Types.

- Type I - Square head bolts.
- Type II - Hexagon head bolts.
- Type III - Heavy hexagon head bolts.
- Type IV - Heavy hexagon head structural bolts.

1.2.2 Sizes. Bolts shall be classified according to size by the basic thread diameter.

2. APPLICABLE DOCUMENTS

2.1 Specifications and standards. The following specifications and standards, of the issues in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

Federal Specifications:

- QQ-A-225/6 - Aluminum Alloy Bar, Rod and Wire; Rolled, Drawn or Cold Finished, 2024.
- QQ-B-637 - Brass, Naval: Rod, Wire, Shapes, Forgings and Flat Products with Finished Edges (Bar, Flat Wire and Strip).

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- QQ-B-728 - Bronze Manganese; Rod, Shapes, Forgings and Flat Products (Flat Wire, Strip, Sheet, Bar and Plate).
- QQ-B-750 - Bronzes Phosphor; Bar., Plate, Rod, Sheets Strip, Flat Wire and Structural and Special Shaped Sections.
- QQ-C-591 - Copper-Silicon, Copper-Zinc-Silicon and Copper-Nickel-Silicon Alloy: Rod, Wire, Shapes, Forgings and Flat Products (Flat Wire, Strip, Sheet, Bar and Plate).
- QQ-N-281 - Nickel-Copper Alloy Bar, Plate, Rod, Sheet, Strip, Wire, Forgings and Structural and Special Shaped Sections.
- QQ-N-286 - Nickel-Copper-Aluminum Alloy, Wrought.
- QQ-P-35 - Passivation Treatments for Austenitic, Ferritic and Martensitic Corrosion-Resisting Steel (Fastening Devices).
- QQ-P-416 - Plating, Cadmium (Electrodeposited).
- QQ-Z-325 - Zinc Coating, Electrodeposited, Requirements For.

Federal Standards:

- Fed. Std. No. 66 - Steel: Chemical Composition and Hardenability.
- Fed. Std. No. 123 - Marking for Domestic Shipment (Civilian Agencies).
- Fed. Test Method Std. No. 151 - Metals; Test Methods.

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the index of Federal Specifications and Standards and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C 20402.)

(Single copies of this specification and other Federal specifications required by activities outside the Federal Government for bidding purposes are available without charge from Business Service Centers at the General Services Administration Regional Offices in Boston, New York, Washington D.C., Atlanta, Chicago, Kansas City, Mo., Fort Worth, Denver, San Francisco, Los Angeles and Seattle, Washington.)

(Federal Government activities may obtain copies of Federal Specifications and Standards and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

Military Specifications

- MIL-F-495 - Finish, Chemical, Black, for Copper Alloys.
- MIL-H-3982 - Hardware (Fasteners and Related Items), Packaging and Packing for Shipment and Storage of.
- MIL-A-8625 - Anodic Coatings, for Aluminum and Aluminum Alloys.
- MIL-P-16232 - Phosphate Coatings, Heavy, Manganese or Zinc Base (for Ferrous Metals).
- MIL-I-17214 - Indicator, Permeability, Low-Mu (Go-No Go).

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Military Standards

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
- MIL-STD-129 - Marking for Shipment and Storage.
- MS35355 - Bolt, Machine, Square Head (Regular), Steel, Cadmium or Zinc Plated, UNC-2A.
- MS35356 - Bolt, Machine, Square Head (Unfinished), Steel Phosphate Coated, UNC-2A.

(Copies of Military Specifications and Standards required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

National Bureau of Standards (NBS) Handbook:

H28 - Part I - Screw-Thread Standards for Federal Services

(Application for copies should be addressed to the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.)

American National Standards Institute (ANSI) Standard:

ANSI B18.2.1 - Square and Hex Bolts and Screws

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

Society of Automotive Engineers (SAE) Standard:

SAE J429 - Mechanical and Quality Requirements for Externally Threaded Fasteners

(Application for copies should be addressed to the Society of Automotive Engineers, 485 Lexington Ave., New York, N. Y. 10017.)

American Society for Testing and Materials (ASTM) Standards:

- ASTM A153 - Zinc Coating (Hot-Dip) On Iron and Steel Hardware.
- A325 - High-Strength Bolts for Structural Steel Joints, Including Suitable Nuts and Plain Hardened Washers.
- A370 - Mechanical Testing of Steel Products.
- A490 - Quenched and Tempered Alloy Bolts for Structural Steel Joints.
- E8 - Tension Testing of Metallic Materials.

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- E10 - Brinell Hardness of Metallic Materials.
- E18 - Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials.
- E112 - Estimating the Average Grain Size of Metals.

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

3. REQUIREMENTS

3.1 Material. Unless otherwise specified (see 6.2), bolts shall be made of the materials specified in 3.1.1 thru 3.1.3.

3.1.1 Carbon and alloy steel. Carbon and alloy steel shall be in accordance with Grades 1, 2, 5, 7 or 8 of SAE J429, except for Type IV - Structural Bolts, which shall be in accordance with ASTM A325 or A490, as specified (see 6.2).

3.1.2 Corrosion-resisting steel. Corrosion-resisting steel shall be in accordance with the 300 series of Fed. Std. No. 66 or any other corrosion-resisting steel developed for cold heading or free machining, i.e., steel which meets the mechanical properties specified herein.

3.1.2.1 Magnetic permeability. Corrosion-resisting steel bolts shall have a magnetic permeability of 2.0 max (air = 1.0) for a field strength of $H = 200$ oersteds when using a magnetic indicator in accordance with MIL-I-17214.

3.1.3 Non-ferrous. Non-ferrous bolts shall be made from the materials specified in Table III.

3.2 Mechanical properties.

3.2.1 Carbon and alloy steel. Mechanical properties of carbon and alloy steel bolts shall be in accordance with Table II and Table IV.

3.2.2 Corrosion-resisting steel. Mechanical properties of corrosion-resist steel bolts shall be in accordance with the following for diameters thru 5/8 inch:

a. Ultimate tensile strength	80,000 p.s.i. min.
b. Yield strength (0.2% offset)	30,000 p.s.i. min.
c. Rockwell hardness	B80 min.
d. Elongation	30 percent min.
e. Reduction in area	40 percent min.

For diameters over 5/8 inch, ultimate tensile strength shall be 70,000 p.s.i. min. and have a Rockwell hardness of B74 min.

3.2.3 Non-ferrous. Mechanical properties of non-ferrous bolts shall be in accordance with Table III.

3.3 Protective finish.

3.3.1 Cadmium plating. When specified (see 6.2), carbon and alloy steel bolts shall be cadmium plated in accordance with QQ-P-416, type II, class 3.

3.3.2 Zinc coating. When specified (see 6.2), carbon and alloy steel bolts shall be zinc coated in accordance with QQ-Z-325, type II, class 3.

3.3.2.1 Zinc coating (hot dip). When specified (see 6.2), carbon and alloy steel bolts shall be hot dip galvanized in accordance with ASTM A153.

3.3.3 Phosphate coating. When specified (see 6.2), carbon and alloy steel bolts shall be phosphate coated in accordance with MIL-P-16232, type Z, class 2.

3.3.4 Hydrogen embrittlement. Alloy steel bolts required to be electroplated or phosphate coated shall be subjected to a hydrogen embrittlement relief treatment conducted in accordance with the applicable plating or coating specification, immediately after plating or coating to minimize the resulting embrittlement.

3.3.5 Passivation. Unless otherwise specified (see 6.2), corrosion-resisting steel bolts shall be passivated in accordance with QQ-P-35.

3.3.6 Anodic coating. Unless otherwise specified (see 6.2), aluminum alloy bolts shall be anodized in accordance with MIL-A-8625 2 type II, class 1.

3.3.7 Black oxide. When specified (see 6.2), brass bolts shall be treated with a black chemical finish in accordance with MIL-P-495.

3.4 Dimensions. Dimensions and tolerances of bolts shall be in accordance with MS35355, MS35356 and ANSI B18.2.1., as specified (see 6.2).

3.4.1 Lengths. Unless otherwise specified (see 6.2), bolts shall be furnished in the following length increments:

Lengths thru 5/8 inch	- 1/16 inch increments
over 5/8 thru 1-1/2 inches	- 1/8 inch increments
over 1-1/2 thru 5 inches	- 1/4 inch increments
over 5 inches	- 1/2 inch increments

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3.4.2 Threads. Bolt threads shall be Class 2A, UNC, UNF, UNRC or UNRF, as specified (see 6.2), in accordance with Handbook H28 except that the UNR threads shall have a root radius between the limits of 0.10825p and 0.14434p. Thread dimensions shall not exceed the basic size after plating or coating.

3.5 Metallographic requirements.

3.5.1 Decarburization. When specified (see 6.2), the partial decarburization of threads of carbon and alloy steel bolts shall not exceed the amounts shown in Figure 1.

3.5.2 Grain size of copper alloy. When specified (see 6.2), the grain size of copper alloy bolts shall be determined in accordance with the applicable material specification.

3.6 Surface discontinuities (Type IV - Structural bolts only). Type IV bolts shall contain no longitudinal discontinuities (located parallel to the axis of the bolt in the threads, body, fillet or underside of head) with a depth normal to the surface greater than 0.03D, where D is the nominal bolt size in inches. Type IV bolts shall contain no transverse cracks (located perpendicular to the axis of the bolt in the threads, body, fillet or underside of head). Type IV bolts shall contain no bursts having a width greater than 0.010 in. plus 0.025D, where D is the Nominal bolt size in inches. This requirement applies to bolts made of ASTM A490 material only.

3.7 Head marking. Bolts shall be marked with the applicable grade identification symbol in accordance with SAE J429, ASTM A325 and A490. Bolts shall also be marked with the manufacturer's identification symbol. Markings shall be located on the top of the head, and shall be either raised or depressed, at the manufacturer's option.

3.8 Workmanship. Bolts shall be free from burrs, rust, nicks, lumps and other surface contamination.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier 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 that supplies and services conform to prescribed requirements.

4.2 Inspection lot. A lot shall consist of all bolts of the same type, sizes material, finish, threads and length, produced by, the same manufacturer under essentially the same conditions, and offered for acceptance at one time.

4.3 Sampling for lot acceptance.

4.3.1 Sampling for examination. A random sample of bolts shall be taken from each lot in accordance with MIL-STD-105, Inspection Level S-4. The Acceptable Quality Level (AQL) shall be as specified in Table I.

4.3.2 Spring for test of mechanical properties, metallographic requirements and chemical analysis. A random sample of bolts shall be taken from each lot in accordance with MIL-STD-105, Inspection Level S-1. The AQL shall be 1.5 percent defective.

4.3.3 Sampling for test of discontinuities. Sampling for test of discontinuities shall be in accordance with ASTM A490. (Type IV - Structural bolts made of ASTM A490 material only.)

4.3.4 Sampling for protective finish. Sampling for tests of protective finish shall be in accordance with the applicable specification of 3.3.

4.3.5 Sampling for packaging and packing. Sampling for test of preservation, packaging packing and marking shall be in accordance with MIL-H-3982.

4.4 Examination. Each bolt taken as specified in 4.3.1 shall be examined to verify conformance with this specification. Examination shall be conducted in accordance with Table I. Any bolt having one or more defects shall be rejected and if the number of defective bolts in any sample exceeds the acceptance number of the sample, the represented lot shall be rejected.

TABLE I

Classification of Defects

<u>Categories</u>	<u>Defects</u>	<u>Inspection Method</u>
Critical	None defined	
Major	AQL = 2.5 percent defective	
101	Threads, not as specified (3.4.2)	SIE*
102	Type and size, not as specified (1.2)	SIE
103	Length, not as specified (3.4.1)	SIE
104	Width across flats, not as specified (3.4)	SIE

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Categories	Defects	Inspection Method
Minor	AQL = 4.0 percent defective	
201	Other dimensions not as specified (3.4)	SIE
202	Magnetic permeability (3.1.2.1)	SIE
203	Head marking (3.7)	Visual
204	Workmanship (3.8)	Visual

* Standard Inspection Equipment

4.5 Tests.

4.5.1 Hardness. Samples taken in accordance with 4.3.2 shall be hardness tested in accordance with ASTM E10 or ASTM E18 to verify conformance with the requirements of this specification. A transverse section through the threaded portion of the bolts shall be taken one nominal diameter from the point, or when too short, halfway between the bearing surface and the point. The hardness shall be measured at a point on this section, one quarter diameter from the axis of the bolt.

4.5.2 Proof load. Samples taken in accordance with 4.3.2 shall be proof load tested in accordance with ASTM A370 - Supplement III to verify conformance with the requirements of this specification. Bolts too large to be proof load tested full size shall be tested using machined test specimens (see 4.5.3.2).

4.5.3 Tensile strength.

4.5.3.1 Full size bolts. Samples taken in accordance with 4.3.2, shall be tensile strength tested in accordance with ASTM E8 to verify conformance with the requirements of this specification.

4.5.3.2 Machined test specimens. When bolts cannot be tested full size for proof load and tensile strength requirements, tests shall be conducted using test specimens machined from the bolts.

For 1-1/2 diameter and larger bolts a standard 0.500 in. round, 2,000 in. gage length shall be turned from the bolt with the axis of the specimen located midway between the center and outside surface of the bolt, as shown in Figure 3. Bolts 3/4 thru 1-3/8 in. diameter shall have their shanks machined to a standard 0.500 in. round, 2,000 in. gage length test specimen concentric with the axis of the bolt, leaving the bolt head and threaded sections intact, as shown in Figure 2. Bolts 1/4 thru 5/8 in. diameter shall have their shanks machined to a standard 0.250 in. round, 1,000 in. gage length test specimen, as shown in Figure 2.

The test specimens shall be proof load tested in accordance with 4.5.2 and tensile strength tested in accordance with 4.5.3.1.

4.5.3.2.1 When specified (see 6.2), machined test specimens shall be tested for yield strength, elongation and reduction in area in accordance with ASTM A370 - Supplement III.

4.5.3.3 Wedge tensile strength. Samples taken in accordance with 4.3.2 shall be tensile strength tested with a wedge in accordance with ASTM A370 - Supplement III, to verify conformance with the requirements of this specification. Bolts used in the proof load test may be used for this test.

4.5.3.4 Short bolts. Bolts too short to be tensile strength tested shall be subjected to a hardness test in accordance with 4.5.1 to verify conformance with the requirements of this specification.

4.5.4 Metallographic tests.

4.5.4.1 Decarburization. When specified (see 6.2), samples taken in accordance with 4.3.2 shall be subjected to a decarburization test. The threaded part shall be sectioned longitudinally through the axis and polished so that rounding of the thread edges is held to a minimum. The section shall be etched with the usual metallographic enchants (such as nital) and examined with a metallographic microscope. Measurements shall be made from the crest of the thread to the end of the decarburized zone. Such distance shall not exceed that indicated in Figure 1. Measurements shall be made with a fixed-scale micrometer eye-piece, or the image of the threading may be thrown on the ground glass of the camera and measured with dividers and a scale. This test does not apply to corrosion-resisting steel.

4.5.4.2 Grain size of copper alloys. When specified (see 6.2), copper alloy samples taken in accordance with 4.3.2 shall be tested for grain size in accordance with ASTM E112.

4.5.5 Chemical analysis. When specified (see 6.2), samples taken in accordance with 4.3.2 shall be tested for chemical analysis in accordance with Method 111.2 of Fed. Test Method Std. No. 151. When a material certification can be furnished, it will be acceptable.

4.5.6 Discontinuities. Samples taken in accordance with 4.3.2 shall be tested for discontinuities in accordance with ASTM A490, to verify conformance to 3.6.

4.5.7 Protective finish. Examination and test of protective finish shall be in accordance with the applicable specification of 3.3.

4.5.8 Packaging and packing. Examination and test of preservation, packaging, packing and marking shall be in accordance with MIL-H-3982.

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4.5.9 Hydrogen embrittlement. The contractor shall furnish the Government certification that electroplated or phosphate coated alloy steel bolts have been subjected to the hydrogen embrittlement relief treatment specified in 3.3.4. When specified (see 6.2), electroplated or phosphate coated alloy, steel bolts shall be subjected to the embrittlement relief test specified in the applicable plating or coating specification, except that the bolts shall be held under load for 23 hours and then examined for cracks or fracture.

5. PREPARATION FOR DELIVERY

5.1 Preservation, packaging and packing. Preservation and packaging shall be level A or C and packing shall be level A, B or C, as specified (see 6.2), in accordance with MIL-H-3982.

5.2 Marking.

5.2.1 Civil agencies. In addition to markings required by the contract or order, interior packages and shipping containers shall be marked in accordance with Fed. Std. No. 123.

5.2.2 Military activities. In addition to markings required by the contract or order, interior packages and shipping containers 3.1 shall be marked in accordance with MM-STD-129.

6. NOTES

6.1 Intended use. Hexagon and square head bolts are designed for insertion through holes in assembled parts and are normally intended to be tightened or released by torquing a nut.

6.2 Ordering data. Purchasers should exercise any desired options offered herein, and procurement documents should specify the following:

- (a) Title, number and date of this specification.
- (b) Type and size required (1.2).
- (c) Material (3.1).
- (d) Protective finish required (3.3).
- (e) Length required (3.4.1).
- (f) Threads (3.4.2).
- (g) Other tests, if required (4.5.3.2.1).
- (h) Metallographic tests, if required (4.5.4).
- (i) Chemical analysis, if required (4.5.5).
- (j) Embrittlement relief test, if required (4.5.9).
- (k) Selection of applicable level of packaging and packing (5.1).

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6.3 Civil procurement. When level B packaging or packing is required for civil agency procurement, the requirements of level A will apply (see 5.1).

6.4 Supersession data. This specification includes the requirements of FF-B-571a in part, dated January 9, 1934 and FF-33-575b, dated September 12, 1960. The cross reference between the types is as follows:

77-B-571a	FF-B-575b	FF-B-575C
Type A1 - Square head, unfinished bolts	Type 1 - Regular square bolts	Type I - Square head bolts
Type A2 - Square head, semi-finished bolts	None	None
Type A3 - Square head, finished bolts	None	None
Type B1 - Hexagonal head, unfinished bolts	Type 2 - Regular, hexagon bolts	Type II - Hexagon head bolts
Type B2 - Hexagonal head, semi-finished bolts	Type 3 - Regular semi-finished hexagon bolts	None
Type B3 - Hexagonal head, finished bolts	None	None
	Type 4 - Heavy hexagon bolts	Type III - Heavy hexagon head bolts
	Type 5 - Ready semi-finished hexagon bolts	None
	Type 6 - Heavy finished hexagon bolts	Type IV - Heavy hexagon head structural bolts

Military Custodians:

Army - WC
Navy - None
Air Force - 82

Preparing activity:

Army - WC

Reviewer activities:

Army - AT, AV, MI
Navy - None
Air Force - None
DSA - IS

Civilian agencies:

DC
GSA
HUD
NSA

User activities:

Army - CE, GL, ME
Navy - AS, MC, OS, YD
Air Force - None

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TABLE II - MECHANICAL PROPERTIES OF STEEL BOLTS

GRADE	NOMINAL SIZE	FULL SIZE BOLTS		MACHINED TEST SPECIMENS			HARDNESS			
		PROOF LOAD PSI	TENSILE STRENGTH MIN, PSI	YIELD STRENGTH AT 0.2% OFFSET MIN, PSI	ELONGA- TION IN 2.00 IN. MIN-%	REDUC- TION IN AREA MIN-%	BRINELL		ROCKWELL	
							MIN	MAX	MIN	MAX
1	All sizes	33,000	60,000	36,000	18	35	121	241	B70	B100
2	1/4 thru 3/4*	55,000	74,000	57,000	18	35	149	241	B80	B100
	Over 3/4 thru 1-1/2**	33,000	60,000	36,000	18	35	121	241	B70	B100
5	1/4 thru 1	85,000	120,000	92,000	14	35	255	321	C25	C34
	Over 1 thru 1-1/2	74,000	105,000	81,000	14	35	223	285	C19	C30
	Over 1-1/2 thru 3	55,000	90,000	58,000	14	35	183	235	B90	C22
7	1/4 thru 1-1/2	105,000	133,000	115,000	12	35	277	321	C28	C34
8	1/4 thru 1-1/2	120,000	150,000	130,000	12	35	302	352	C32	C38
	Over 1-1/2 thru 3	85,000	120,000	92,000	12	35	255	321	C25	C34
ASTM A325	1/2 thru 1	85,000	120,000	92,000	14	35	241	331	C23	C35
	Over 1 thru 1-1/2	74,000	105,000	81,000	14	35	223	293	C19	C31
ASTM A490	1/2 thru 2-1/2	120,000	150,000	130,000	14	40	302	352	C32	C38
	Over 2-1/2 thru 4	105,000	140,000	115,000	14	40	285	341	C30	C36

* 6" and less in length.

** All diameters if length exceeds 6".

TABLE III - MECHANICAL PROPERTIES OF NON-FERROUS BOLTS

MATERIAL	APPLICABLE SPECIFICATION	COMP. OR CLASS	CONDITION	TENSILE STRENGTH P.S.I. MIN.	YIELD STRENGTH AT 0.2 PERCENT OFFSET OR AT EXTENSION INDICATED		ELONGATION PERCENT MIN.
					P.S.I. MIN.	EXTENSION UNDER LOAD	
Manganese bronze	QQ-B-728	Class A	Soft	55,000	22,000	0.5 percent	20 <u>3/</u>
Phosphor bronze	QQ-B-750	Comp. A	Hard	60,000	33,000	---	15 <u>1/</u>
Silicon bronze	QQ-C-591	Alloy 651	Hard	60,000	40,000	0.5 percent	10 <u>3/</u>
Naval brass	QQ-B-637	Alloy 464	Half-hard	60,000	27,000	0.5 percent	25 <u>2/</u>
Aluminum alloy	QQ-A-225/6	2024	Temper T4	62,000	40,000	0.0058 in. per in.	10 <u>3/</u>
Nickel-copper alloy	QQ-N-281	Class A	Hot finished	80,000	40,000	0.0071 inch per 2 inches	30 <u>1/</u>
Nickel-copper-aluminum alloy	QQ-N-286	Class A	Age hardened	130,000	90,000	---	20 <u>1/</u>

- 1/ In 2 inch gage length
2/ In 4 times diameter or thickness (min)
3/ In 2 inches or 4 times diameter (min)

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TABLE IV
PROOF LOAD AND TENSILE STRENGTH REQUIREMENTS FOR STEEL BOLTS

NOMINAL SIZE AND THREADS	STRESS AREA SQ. IN.	GRADE 1		GRADE 2		GRADE 3		GRADE 7		GRADE 8		ASTM A125		ASTM A490	
		PROOF LOAD LBS.	TENSILE STRENGTH LBS.-MIN.	PROOF LOAD LBS.	TENSILE STRENGTH LBS.-MIN.	PROOF LOAD LBS.	TENSILE STRENGTH LBS.-MIN.	PROOF LOAD LBS.	TENSILE STRENGTH LBS.-MIN.	PROOF LOAD LBS.	TENSILE STRENGTH LBS.-MIN.	PROOF LOAD LBS.	TENSILE STRENGTH LBS.-MIN.	PROOF LOAD LBS.	TENSILE STRENGTH LBS.-MIN.
COARSE THREAD SERIES - UNC															
1/4 - 20	.0318	1,050	1,900	1,750	2,350	2,700	3,800	3,350	4,250	3,800	4,750	---	---	---	---
5/16 - 18	.0524	1,750	3,150	2,900	3,900	4,450	6,300	5,500	6,950	6,300	7,850	---	---	---	---
3/8 - 16	.0775	2,550	4,650	4,250	5,750	6,600	9,300	8,150	10,300	9,300	11,600	---	---	---	---
7/16 - 14	.1063	3,500	6,400	5,050	7,050	9,050	12,800	11,200	14,100	12,800	15,900	---	---	---	---
1/2 - 13	.1419	4,700	8,500	7,800	10,500	12,100	17,000	14,900	18,900	17,000	21,300	12,050	17,050	17,050	21,300
9/16 - 12	.182	6,000	10,900	10,000	13,500	15,500	21,800	19,100	24,200	21,800	27,300	---	---	---	---
5/8 - 11	.226	7,450	13,600	12,400	16,700	19,200	27,100	23,700	30,100	27,100	33,900	19,200	27,100	27,100	33,900
3/4 - 10	.334	11,000	20,000	18,400	24,700	28,400	40,100	35,100	44,400	40,100	50,100	28,400	40,100	40,100	50,100
7/8 - 9	.462	15,200	27,700	15,200	27,700	39,300	55,400	48,500	61,400	55,400	69,300	39,250	55,450	55,450	69,300
1 - 8	.606	20,000	36,400	20,000	36,400	51,500	72,700	63,600	80,600	72,700	90,900	51,500	72,700	72,700	90,900
1-1/8 - 7	.763	25,200	45,800	25,200	45,800	56,500	80,100	80,100	101,500	91,600	114,400	56,450	80,100	91,550	114,450
1-1/4 - 7	.969	32,000	58,100	32,000	58,100	71,700	101,700	101,700	127,700	116,300	145,400	71,700	101,700	116,300	145,350
1-3/8 - 6	1.155	38,100	69,300	38,100	69,300	85,500	121,300	121,300	153,600	138,600	173,200	85,450	121,300	138,600	173,250
1-1/2 - 6	1.405	46,400	84,300	46,400	84,300	104,000	147,500	147,500	186,900	168,600	210,800	104,000	147,500	168,600	210,750
FINE THREAD SERIES - UNF															
1/4 - 28	.0364	1,200	2,200	2,000	2,700	3,100	4,350	3,800	4,850	4,350	5,450	---	---	---	---
5/16 - 24	.0580	1,900	3,500	3,200	4,300	4,900	6,950	6,100	7,700	6,950	8,700	---	---	---	---
3/8 - 24	.0878	2,900	5,250	4,800	6,500	7,450	10,500	9,200	11,700	10,500	13,200	---	---	---	---
7/16 - 20	.1187	3,900	7,100	6,550	8,800	10,100	14,200	12,500	15,800	14,200	17,800	---	---	---	---
1/2 - 20	.1599	5,300	9,600	8,600	11,800	13,600	19,200	16,800	21,300	19,200	24,000	---	---	---	---
9/16 - 18	.203	6,700	12,200	11,200	15,000	17,300	24,400	21,300	27,000	24,400	30,400	---	---	---	---
5/8 - 18	.256	8,450	15,400	14,100	18,900	21,800	30,700	26,900	34,000	30,700	38,400	---	---	---	---
3/4 - 16	.373	12,300	22,400	20,500	27,600	31,700	44,800	39,200	49,600	44,800	56,000	---	---	---	---
7/8 - 14	.509	16,800	30,500	16,800	30,500	43,300	61,100	53,400	67,700	61,100	76,400	---	---	---	---
1 - 12	.663	21,900	39,800	21,900	39,800	56,400	79,600	69,600	88,200	79,600	99,400	---	---	---	---
1-1/8 - 12	.856	28,200	51,400	28,200	51,400	63,300	89,900	89,900	113,800	102,700	128,400	---	---	---	---
1-1/4 - 12	1.073	35,400	64,400	35,400	64,400	79,400	112,700	112,700	142,700	128,800	161,000	---	---	---	---
1-3/8 - 12	1.315	43,400	78,900	43,400	78,900	97,300	138,100	138,100	174,900	157,800	197,200	---	---	---	---
1-1/2 - 12	1.581	52,200	94,900	52,200	94,900	117,000	166,000	166,000	210,300	189,700	237,200	---	---	---	---

NOTES:

- Proof loads and tensile strengths are computed by multiplying the proof load stresses and tensile strength stresses given in Table II by the stress area of the thread.
- The stress area of sizes and thread series not included in this Table may be computed from the formula: $A_s = 0.7854 \left[D - \frac{0.9743}{n} \right]^2$ where D = nominal diameter in inches, n = threads per inch.



THREADS PER INCH	$1/2 ha$	THREADS PER INCH	$1/2 ha$
80	.002	18	.009
72	.002	16	.010
64	.003	14	.012
56	.003	13	.012
48	.003	12	.014
44	.004	11	.015
40	.004	10	.016
36	.005	9	.018
32	.005	8	.020
28	.006	7	.023
24	.007	6	.027
20	.008		

$1/2 ha = 1/2 \text{ ADDENDUM}$

FIGURE 1.
DECARBURIZATION CLASSIFICATION OF BOLT THREADS

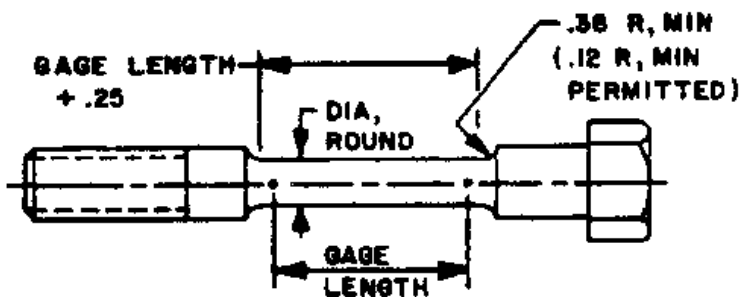


FIGURE 2.
**TEST SPECIMEN FOR BOLTS
WITH TURNED DOWN SHANK**

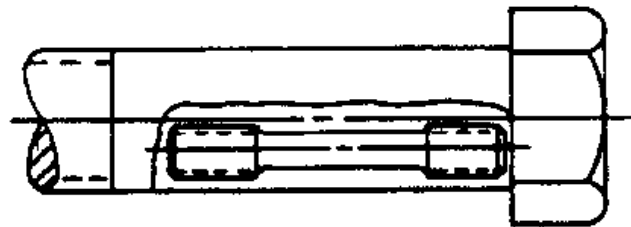


FIGURE 3.
**LOCATION OF STANDARD ROUND
2.00 INCH GAGE LENGTH TEST
SPECIMEN WHEN TURNED FROM
LARGE SIZE BOLT**