

FF-B-561C  
December 1, 1970  

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SUPERSEDING  
Fed. Spec. FF-B-561B  
April 30, 1962

## FEDERAL SPECIFICATION

### BOLTS, (SCREW), LAG

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 lag bolts having either square heads or hex heads, for fastening applications.

##### 1.2 Classification.

1.2.1 Types, styles and grades. Lag bolts shall be of the following types, styles, and grades as specified (see 6.2).

Type I - Gimlet point, screw thread.  
Type II - Cone point, screw thread.  
Type III - Cone point, fether drive thread.

Style 1 - Hex Head.  
Style 2 - Square Head.

Grade A - (Deleted)  
Grade B - Commercial steel.  
Grade C - Corrosion-resistant steel.  
Grade D - Copper-silicon alloy.

#### 2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids, or request for proposal, form a part of the specification to the extent specified herein.

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Federal Specifications:

- QQ-C-591 - Copper - Silicon Alloy, Rod, Wire, Shapes; and Flat Products (Flat Wire, Strips and Bars.)
- QQ-P-35 - Passivation Treatment for Austenitic, Ferritic, and Martensitic Corrosion-Resisting Steel (Fastening Devices.)
- QQ-P-416 - Plating Cadmium (Electrodeposited.)
- QQ-Z-325 - Zinc Coating Electrodeposited, Requirement for.

Federal Standard:

- Fed. Std. No. 66 - Steel: Chemical Composition and Hard-ability.
- Fed. Test Method Std. No. 151 - Metals, Test Methods.
- Fed. Test Method 151/111.2 - Chemical Analysis.
- Fed. Test Method 151/112.2 - Spectrochemical Analysis.
- Fed. Std. No. 123 - Marking for Domestic Shipment (Civil Agencies).

(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, DC 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, Standards, and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

Military Specifications:

- MIL-P-3982 - Hardware (Fasteners and related items), Packaging and Packing for Shipment and Storage of.

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- MIL-C-13924 - Coating, Oxide, Black, for Ferrous Metals.
- MIL-P-16232 - Phosphate Coatings, Heavy Manganese or Zinc Base (For Ferrous Metals.)
- MIL-I-17214 - Indicator, Permeability; Low-Mu (Go-No-Go.)
- MIL-C-81562 - Coating, Cadmium or Zinc (Mechanically Deposited).

#### Military Standards:

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
- MIL-STD-129 - Marking for Shipment and Storage.
- MS-16992 - Bolt (Screw) Lag, Hex Head, Gimlet Point.

(Copies of Military Specifications and Standards required by the 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 a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

#### American Society for Testing and Materials (ASTM) Standards:

- A153 - Zinc Coating (Hot-Dip) On Iron and Steel Hardware.
- A219 - Local Thickness of Electrodeposited Coatings.
- A307 - Low-Carbon Steel Externally and Internally Threaded Standard Fasteners.
- A370 - Mechanical Testing of Steel Products.
- B117 - Salt Spray (Fog) Testing.
- E18 - Rockwell Hardness of Metallic Materials.

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

#### American National Standards Institute (ANSI) Standard:

- B18.2.1 - Square and Hex Bolts and Screws.

(Application for copies should be addressed to the American National Standards Institute, 10 East 40th St., New York, NY 10016.)

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National Motor Freight Traffic Association, Inc. Agent:

National Motor Freight Classification.

(Application for copies should be addressed to the National Motor Freight Traffic Association, Inc., Agent, 1616 P Street N.W., Washington, DC 20036.)

Uniform Classification Committee, Agent:

Uniform Freight Classification.

(Application for copies should be addressed to the Uniform Classification Committee, Tariff Publishing Officer, Room 202 Union Station, 516 W. Jackson Blvd., Chicago, IL 60606.)

(Technical society and technical association specifications and standards are generally available for reference from libraries.)

### 3. REQUIREMENTS

#### 3.1 Design.

3.1.1 Type I, style 1 and style 2. Type I, style 1 and style 2 lag bolts shall conform to the dimensions and tolerances of MS-16992 or ANSI B18.2.1.

3.1.2 Type II, style 1 and style 2. Type II, style 1 and style 2 lag bolts shall conform to the dimensions and tolerances of ANSI B18.2.1.

3.1.3 Type III, style 1 and style 2. Type III, style 1 and style 2 head dimensions and tolerances shall conform to ANSI B18.2.1. The fether-drive threads shall conform to the dimensions shown in figure 1 and table IV (see 6.4).

3.2 Material. Lag bolt material shall be of uniform quality having the mechanical properties specified in 3.5.

3.2.1 Grade B. When specified (see 6.2), lag bolts shall be low-carbon steel conforming to grade A of ASTM A307.

3.2.2 Grade C. When specified (see 6.2), lag bolts shall be corrosion-resistant steel conforming to the requirements of compositions 302, 303, 304, 305, 310 or 316 specified in Fed. Std. No. 66.

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3.2.2.1 Magnetic permeability. Corrosion-resistant lag bolts shall have a maximum magnetic permeability ( $\mu$ ) of 2.0 when tested as specified in 4.5.6.

3.2.3 Grade D. When specified (see 6.2), lag bolts shall be copper-silicon alloy conforming to the requirements of copper alloy numbers 651 or 655 specified in QQ-C-591.

### 3.3 Sizes.

3.3.1 Nominal diameter and length. Lag bolts shall be of the nominal size (diam.) and lengths shown in table I, and as specified (see 6.2 and 6.3).

TABLE I. Nominal diameter and lengths

Nominal Size (diam.inches):	No. 10*; 1/4; 5/16; 3/8; 7/16; 1/2; 9/16*; 5/8; 3/4; 7/8*; 1*; 1 1/8*; 1 1/4*
Length (inches):	1; 1 1/4; 1 1/2; 1 3/4; 2; 2 1/2; 3; 3 1/2; 4; 4 1/2; 5; 5 1/2; 6; 6 1/2; 7; 8; 9; 10; 11; 12

\* Apply only to type III lag bolts.

### 3.4 Finish.

3.4.1 Uncoated. Unless otherwise specified (see 6.2), lag bolts shall be furnished uncoated except that a black oxide coating meeting the requirements of MIL-C-13924 will be acceptable.

#### 3.4.2 Zinc coating.

3.4.2.1 Hot-dip, galvanizing. When specified (see 6.2), lag bolts shall be zinc-coated by the hot-dip process in accordance with AFTM A153.

3.4.2.2 Electrodeposited zinc. When specified (see 6.2), lag bolts shall be zinc-coated by the electrolytic deposition process conforming to type II, class 3, of QQ-Z-325.

3.4.2.3 Mechanically deposited zinc. When specified (see 6.2), mechanically deposited zinc coating on lag bolts shall conform to the requirements of type I, class 1 or type II, class 2 of MIL-C-81562.

3.4.3 Cadmium coating. When specified (see 6.2), lag bolts shall be coated with cadmium in accordance with the requirements of type II, class 3, of QQ-P-416.

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3.4.4 Phosphate coating. When specified (see 6.2), phosphate coatings on lag bolts shall conform to the requirements of type Z of MIL-P-16232.

3.4.5 Passivation. When grade C, corrosion-resistant bolts are specified, they shall be passivated in accordance with the requirements of QQ-P-35.

3.5 Mechanical properties. Unless otherwise specified (see 6.2), lag bolts shall have the following mechanical properties when tested as specified in 4.5.2 and 4.5.3.

	<u>Grade B</u>	<u>Grade C</u>	<u>Grade D</u>
Tensile strength, p.s.i. (min.)	55,000	70,000	55,000
Elongation, in 2 inches, % (min.)	18	40	10
Hardness Rockwell B (min.)	60	--	--

3.6 Salt spray resistance. When specified (see 6.2), and tested in accordance with 4.5.5, lag bolts shall show no signs of rust or white salt, except at the crest of threads or at sharp edges.

3.7 Workmanship. Lag bolts shall be uniform in quality and appearance, and shall be free from rust, scale, burrs, fins, seams, and other defects that may affect their serviceability. Screw threads shall be smooth, clean, and true to form. Lag bolts, with protective finishes, shall be uniform and free from cracks, nicks, blisters or other defects that would affect the quality of the coating.

#### 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, the supplier may utilize his own facilities or any commercial laboratory acceptable to 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.

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4.2 Classification of inspection. The examination and testing of bolts shall be classified as quality conformance inspection.

4.3 Sampling.

4.3.1 Lot. All lag bolts of the same type, style, grade, diameter, and length, offered to the Government at one time, shall be considered a lot for the purpose of inspection.

4.3.2 Sample unit. The sample unit shall be one lag bolt.

4.3.3 Sampling for visual and dimensional examination. A random sample of lag bolts shall be selected from each lot in accordance with MIL-STD-105, at inspection level II. The acceptable quality level shall be 4 percent defective for major defects.

4.3.4 Sampling for tests. A random sample of lag bolts shall be selected from each lot offered to the Government in accordance with MIL-STD-105 at inspection level S-1. The acceptable quality level shall be 2.5 percent defective.

4.3.5 Sampling for chemical composition. When specified (see 6.2), material shall be selected for chemical analysis prior to fabrication in accordance with MIL-STD-105 at inspection level S-1.

4.3.6 Sampling for magnetic permeability. When grade C lag bolts are specified (see 6.2), samples shall be selected in accordance with level S-3 of MIL-STD-105 to perform the magnetic permeability test specified in 4.5.6. The acceptable quality level shall be 2.5 percent defective.

4.3.7 Sampling for coating thickness test. Unless otherwise specified (see 6.2), zinc-coated or cadmium-coated lag bolts shall be sampled in accordance with MIL-STD-105 at inspection level S-1. The acceptable quality level shall be 2.5 percent defective.

4.4 Examination. Each sample selected in accordance with 4.3.3 shall be visually and dimensionally examined to determine conformance with defects specified in table II.

4.5 Tests.

4.5.1 Chemical analysis test. When specified (see 6.2), samples

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selected in accordance with 4.3.5 shall be determined by method 111.2 or 112.2 of Fed. Test Method Std. No. 151 to determine if the requirements of 3.2.1, 3.2.2, or 3.2.3 have been met. Failure to meet the requirements shall be cause for rejection of the lot.

TABLE II. Classification of defects

Categories	Defects	Reference Paragraph
Major:		
101	Type, style, or grade not as specified.	1.2.1
102	Size not as specified.	3.3.1
103	Length not as specified.	3.3.1
104	Protective coating not as specified.	3.4
105	Protective coating not uniform, or free from nicks or cracks.	3.7
106	Burrs, rust or scale not removed.	3.7
Minor: None defined.		

4.5.2 Tensile strength (wedge-tension method) test. Samples selected in accordance with 4.3.4 shall be tested by the wedge-tension test method specified in ASTM A370 to determine if the requirement of 3.5 has been met. Failure to meet the tensile and elongation requirements shall be cause for rejection of the sample.

4.5.3 Hardness test. When the length of the bolt or the thread is too short for performance of the tension test specified in 4.5.2, the hardness test, specified in ASTM E18 shall be substituted. The hardness of a bolt shall be measured on a transverse section through the threaded portion of the bolt. The hardness shall be determined at a point one-eighth of the nominal diameter from the axis of the bolt and at one diameter distance from the end of the bolt.

4.5.4 Thickness of coating. The thickness of coated bolts, sampled in accordance with 4.3.7, shall be determined in accordance with ASTM A219. Failure to meet the requirements shall be cause for rejection of the sample.

4.5.5 Salt spray test. When specified (see 6.2), sample bolts selected in accordance with 4.3.4 shall be subjected to the salt spray test specified in ASTM B 117. Unless otherwise specified, the test shall last 96 hours. Failure to meet the requirements of 3.6 shall be cause for rejection of the sample.



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4.5.6 Magnetic permeability. Samples selected in accordance with 4.3.6 shall be tested with a permeability indicator by method specified in MIL-I-17214.

4.6 Inspection of preparation for delivery. The preservation, packaging, packing, and marking of the lag bolts shall be inspected to determine conformance to the applicable requirements for section 5 of this specification.

## 5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging. Preservation and packaging shall be level A or C as specified (see 6.2).

5.1.1 Level A. The lag bolts shall be preserved and packaged in accordance with the applicable level A requirements of MIL-P-3982.

5.1.2 Level C. The lag bolts shall be preserved and packaged in accordance with the supplier's standard practice.

5.2 Packing. Packing shall be level A, B, or C as specified (see 6.2).

5.2.1 Level A. The lag bolts shall be packed in accordance with the applicable level A requirements of MIL-P-3982.

5.2.2 Level B. The lag bolts shall be packed in accordance with the applicable level B requirements of MIL-P-3982.

5.2.3 Level C. The lag bolts shall be packed to insure carrier acceptance and safe delivery to destination at lowest rates in compliance with Uniform Freight Classification rules, and National Motor Freight Classification rules.

5.3 Marking. In addition to any special marking required by the contract or order, interior packages and shipping containers shall be marked in accordance with Fed. Std. 123 or MIL-STD-129 as applicable.

## 6. NOTES

6.1 Intended use. The lag bolts covered by this specification are intended for fastening applications, such as the fastening of metal to wood or wood to masonry.

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**6.2 Ordering data.** Purchasers should select the preferred options permitted herein and include the following information in procurement documents:

- a. Title, number, and date of this specification.
- b. Type, style, and grade of lag bolt required (see 1.2.1).
- c. Size, and length of lag bolt required (see 3.3.1 and 6.3).
- d. Kind of finish required, if different (see 3.4).
- e. If different mechanical properties are required (see 3.5).
- f. If chemical composition test is required (see 4.3.5).
- g. If the sampling plan for coated lag bolts is different (see 4.3.7).
- h. If salt spray test is required (see 3.6 and 4.5.5).
- i. Level of preservation and packing, and level of packing required (see 5.1 and 5.2).

**6.3 Production sizes.** Although lag bolts can be obtained in any sizes and lengths when ordered in sufficient quantities, purchases, insofar as practicable, should be confined to the stock sizes and lengths indicated by asterisks in table III. Galvanized lag bolts normally stocked are indicated by "xx" in table III.

TABLE III. Stock production sizes of lag bolts  
(uncoated and galvanized).

Length in inches	Diameter in inches						
	1/4	5/16	3/8	7/16	1/2	5/8	3/4
1	(*)	(*)	(*)	--	--	--	--
1 1/4	(*)	(*)	(*)	--	--	--	--
1 1/2	(*)	(*)	(*)	(*)	(*)	--	--
	xx	xx	xx				
1 3/4	(*)	(*)	(*)	--	--	--	--
2	(*)	(*)	(*)	(*)	(*)	(*)	--
	xx	xx	xx		xx		

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TABLE III. Stock production sizes of lag bolts  
(uncoated and galvanized). (con.)

Length in inches	Diameter in inches						
	1/4	5/16	3/8	7/16	1/2	5/8	3/4
2 1/2	(*) xx	(*) xx	(*) xx	(*)	(*) xx	(*)	(*)
3	(*) xx	(*) xx	(*) xx	(*)	(*) xx	(*)	(*)
3 1/2	(*)	(*)	(*)	(*)	(*) xx	(*)	(*)
4	(*)	(*)	(*)	(*)	(*) xx	(*)	(*)
4 1/2	(*)	(*)	(*)	(*)	(*)	(*)	(*)
5	(*)	(*)	(*)	(*)	(*)	(*)	(*)
5 1/2	--	(*)	(*)	--	(*)	(*)	--
6	(*)	(*)	(*)	(*)	(*)	(*)	(*)
6 1/2	--	--	--	--	(*)	--	--
7	--	--	(*)	--	(*)	(*)	(*)
8	--	--	(*)	--	(*)	(*)	(*)
9	--	--	--	--	(*)	(*)	(*)
10	--	--	--	--	(*)	(*)	(*)
11	--	--	--	--	--	(*)	(*)
12	--	--	--	--	--	(*)	(*)

\* Uncoated lag bolts.

xx Stock production sizes of galvanized lag bolts.

6.4 Fetter drive threads. No generally recognized standard for fetter drive threads exists, which accounts for variance in the number of threads per inch and thread form. Figure 1 presents a recommended thread design and dimensions which may ultimately provide the basis of a standard. The only limits recommended in figure 1 are the minimum minor diameter and the maximum crest width. The root radius is not critical but should preferably be not less than basic.

6.5 Classification change. The classification of lag bolts in this document differs from the superseded specification in the following respects:

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Type I, style 1

Type II, style 1

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Type I  
Type II  
Type III

**MILITARY CUSTODIANS**

Army - WC  
Navy - YD  
Air Force - 82

**Review activity:**

Army - MI

**User activities:**

Army - GL, AV  
Navy - MC

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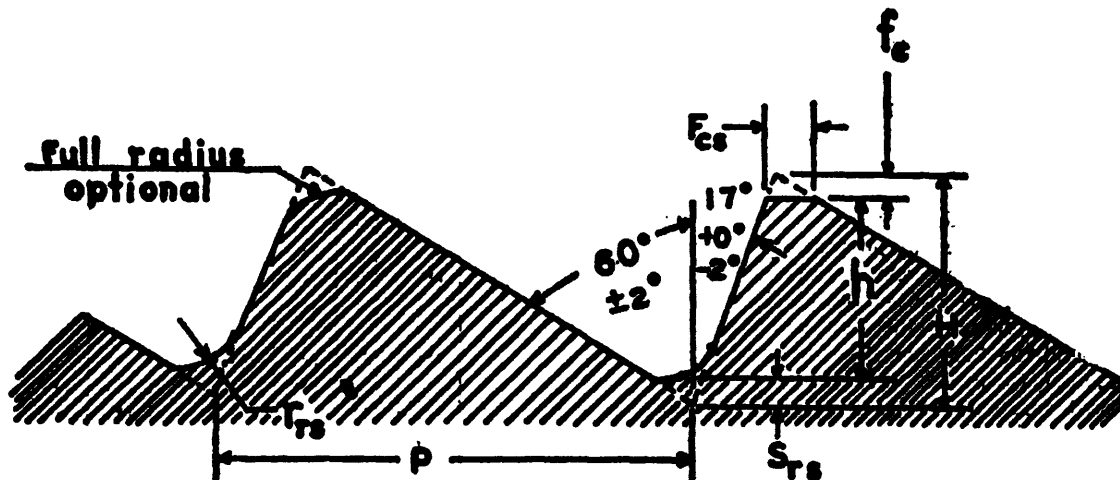
Type III, style 1  
Type I, style 2  
Type II, style 2  
Type III, style 2

**Preparing activity:**

Navy - YD

**CIVIL AGENCY INTEREST:**

GSA-FSS



**Figure 1. Recommended Thread Form for Fetter Drive Threads. (See table IV.)**

**Table IV. Recommended Fetter Drive Thread Dimensions. (see figure 1.)**

Nominal size	Threads per inch, n	Pitch, p	Depth of fundamental triangle h=0.4673p	Depth of thread, basic, h=0.375p	Major diameter, basic, D	Minor diameter, min., K-D=2h	Gross & root truncation, basic, $F_{gr}=0.0576p$	Width of flat at crest		Root radius	
								Basic $F_{cs}=0.1273p$	Max. $F_{cs}=0.187p$	Basic $F_{rs}=0.127p$	Ap-prox.
1	2	3	4	5	6	7	8	9	10	11	12
No. 10	13	.07692	.07775	.08005	.1900	.1323	.0045	.0091	.0096	.0090	.010
1/4	12	.08091	.08061	.07909	.2500	.1818	.0055	.0107	.0114	.0106	.010
5/16	9	.11111	.09455	.09167	.3125	.2292	.0064	.0131	.0139	.0130	.015
3/8	8	.12500	.08134	.06688	.3750	.2612	.0072	.0147	.0156	.0146	.015
7/16	7	.14286	.07810	.05337	.4375	.3304	.0083	.0168	.0179	.0167	.015
1/2	6	.16667	.08179	.06250	.5000	.3750	.0096	.0197	.0208	.0195	.020
5/8	6	.16667	.08179	.06250	.5625	.4375	.0096	.0197	.0208	.0195	.020
3/4	5	.20000	.09813	.07500	.6250	.4750	.0116	.0236	.0250	.0234	.025
7/8	4 1/2	.22222	.10905	.08333	.7500	.5833	.0129	.0262	.0278	.0260	.025
1	4	.25000	.12266	.09375	.8750	.6875	.0145	.0295	.0312	.0292	.030
1 1/8	3 1/2	.28571	.14021	.10714	1.0000	.7857	.0165	.0337	.0357	.0334	.035
1 1/4	3 1/4	.30769	.09099	.11538	1.1250	.8948	.0178	.0363	.0385	.0360	.035
1 1/4	3 1/4	.30769	.09099	.11538	1.2500	1.0192	.0178	.0363	.0385	.0360	.035

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