

MIL-S-6715  
12 June 1950MILITARY SPECIFICATION  
SPRINGS; HELICAL, AIRCRAFT

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

## 1. SCOPE

1.1 Scope. This specification establishes the requirements for forming helical springs from wire or rod, and heat treatment after coiling.

1.2 Types. The springs shall be of the following types:

Type I - Compression  
Type II - Extension

1.3 Classes. Classes of helical springs shall be as shown in table I.

TABLE I

Class	Specification	Material Description	Shear Modulus of Elasticity "G" psi <u>1/</u>
A	AN-S-58	Chrome-Vanadium Steel Rod and Wire	11,500,000
B	AN-S-5	Carbon Steel Rod	11,500,000
C	MIL-W-6101	Spring Steel Wire	11,500,000
D	AN-W-23	Corrosion-Resisting Steel Wire	11,000,000
E	MIL-W-6713	Corrosion-Resisting Steel Wire	11,000,000
F	AN-N-4	Nickel-Chromium-Iron Alloy Wire	11,000,000
G	QQ-W-401	Phosphor-Bronze Spring Wire	6,250,000

1/ Value to be used in test calculations.

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## 2. APPLICABLE SPECIFICATIONS AND OTHER PUBLICATIONS

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

2.1.1 Specifications.Federal

QQ-M-151 Metals; General Specification for Inspection of  
 QQ-P-416 Plating; Cadmium (Electrodeposited)  
 QQ-W-401 Wire; Phosphor-Bronze, Spring

Military

MIL-S-5002 Surface Treatments (Except Priming and Painting) for  
 Metal and Metal Parts in Aircraft  
 MIL-W-6101 Wire; Spring Steel (for Aircraft Applications)  
 MIL-W-6713 Wire; Corrosion-Resisting (Grade G) Steel  
 JAN-STD-105 Sampling Inspection Table for Inspection by  
 Attributes  
 JAN-B-121 Barrier-Materials, Greaseproof  
 JAN-P-105 Packaging and Packing for Overseas Shipment - Boxes,  
 Wood, Cleated, Plywood  
 JAN-P-106 Packaging and Packing for Overseas Shipment - Boxes;  
 Wood, Nailed  
 JAN-P-108 Packaging and Packing for Overseas Shipment - Boxes,  
 Fiberboard (V-Board and W-Board), Exterior and  
 Interior  
 JAN-P-125 Packaging and Packing for Overseas Shipment -  
 Barrier-Materials, Waterproof, Flexible  
 JAN-P-130 Packaging and Packing for Overseas Shipment - Barrier-  
 Material; Utility, Noncorrosive, Paper  
 JAN-P-133 Packaging and Packing for Overseas Shipment - Boxes,  
 Set-Up, Paperboard

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Military (Continued)

JAN-P-139      Packaging and Packing for Overseas Shipment - Plywood, Container Grade

JAN-P-140      Packaging and Packing for Overseas Shipment - Adhesives, Water-Resistant, Case-Liner

Air Force-Navy Aeronautical

AN-H-201      Heat Treatment of Steels (Aircraft); Process for

AN-I-30      Inspection; Fluorescent Penetrant, Method of

AN-I-32      Inspection Process; Magnetic Particle

AN-N-4      Nickel-Chromium-Iron Alloy; Wire and Welding Rod

AN-P-13      Preservation and Packaging; Parts and Equipment (General Specification For)

AN-S-5      Steel; Carbon (1095) Bar and Rod

AN-S-58      Steel; Chrome-Vanadium (6150) Rod and Wire

AN-W-23      Wire; Corrosion-Resisting (Grade MCR) Steel

U. S. Army

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

2.1.2      Other publications.

Air Force-Navy Aeronautical Bulletin

No. 143      Specifications and Standards; Use of

Bureau of Supplies and Accounts

Navy Shipment Marking Handbook

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

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## 3. REQUIREMENTS

3.1 Selection of materials. Specifications and standards for all materials, parts, and Government certification and approval of processes and equipment, which are not specifically designated herein and which are necessary for the execution of this specification, shall be selected in accordance with ANA Bulletin No. 143.

3.2 Forming. The springs shall be cold formed from wire or rod uniform in quality and free from seams, except that class A and class B springs may be hot formed unless otherwise specified.

3.3 Maximum allowable working stress. The maximum allowable stress at full deflection shall not exceed 100,000 pounds per square inch as determined by the following formula:

$$S = \frac{FGd}{3.14ND^2} K^2 \quad (\text{for round wire})$$

$$S = \frac{FGd}{2.32ND^2} K^2 \quad (\text{for square wire}) \text{ where:}$$

S = Maximum allowable stress, in pounds per square inch

F = Total deflection under load, in inches

G = Shear modulus of elasticity, in pounds per square inch, from table I

d = Rod or wire diameter, in inches

N = Number of active coils

D = Mean coil diameter, in inches

K = Stress correction factor which allows for non-uniform distribution of shearing stress due to the finite ratio of D/d  
Values of this factor are obtained from figure 1.

3.4 Taper of the end coils of type I springs. The spring wire shall be tapered uniformly at each end for a length equal to 270 degrees, plus or minus 20 degrees of the circular coil and shall have a thickness at the tip 1/4 the diameter of the unground section. The shoulders between the tapered end and the circular sections shall be rounded to avoid sharp edges.

3.5 Free length tolerances. The free overall length tolerance of the spring shall be as specified on the applicable drawing, after the maximum working load has been released as specified in paragraph 4.3.2.1.1.

3.6 Concentricity. The coil shall be concentric with the axis of the load, as specified on the applicable drawing.

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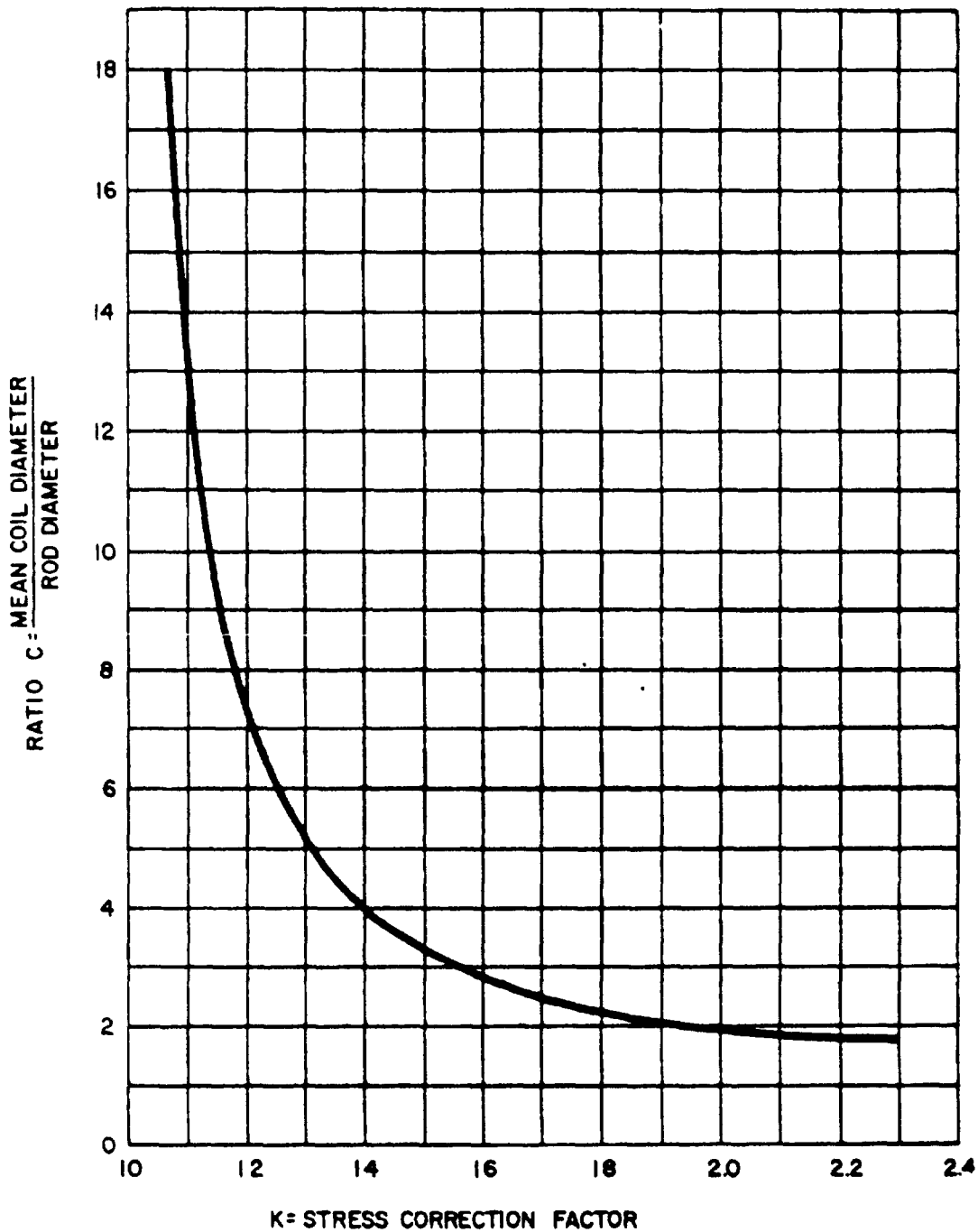


FIGURE 1.

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3.7 Opening between coils. The opening between coils for type I springs shall not vary more than plus or minus 5 percent of the opening specified on the applicable drawings. The opening between coils at the ends shall taper uniformly to full opening within 360 degrees and not less than 270 degrees from the coil ends.

3.8 Spring ends. The spring ends shall be ground as shown on the applicable drawings.

3.9 Heat treatment. Springs of class A and class B shall be heat treated in accordance with Specification AN-H-201, if necessary, to obtain the required physical characteristics, and shall have a smooth finish when cleaned. Care shall be exercised while heat treating to prevent internal or surface cracks. The springs shall be given a set after heat treatment to prevent any change in operation under normal loading.

3.9.1 Decarburization. The surface of heat-treated springs shall not be decarburized, except that springs having a total decarburization of 0.001 inch or less may be furnished at the discretion of the Procuring Service.

3.10 Cleaning and descaling. All springs of classes A, B, and C shall be thoroughly cleaned and descaled by a process suitable for the purpose intended.

3.11 Bending. The wire in a finished spring shall withstand the Bend test specified herein.

3.12 Strain relief. After forming, ferrous alloy springs shall be given a suitable strain-relieving treatment. Suggested treatments are baking for 1 hour at 350<sup>o</sup>F or baking for not more than 10 minutes at 600<sup>o</sup>F. Copper base alloy springs shall be strain-relieved by baking at 375<sup>o</sup>F for 1 hour.

3.13 Cleaning. All springs of classes D and E shall be passivated immediately after treatment for strain relief in accordance with Specification MIL-S-5002. The entire spring shall be immersed at one time.

3.14 Plating. Springs shall be cadmium plated, when specified by contract or purchase order, in accordance with Specification P-416.

3.15 Embrittlement relief after plating. Springs which have been cadmium plated shall be baked at the temperature and the time

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specified in Specification QQ-P-416 to relieve embrittlement. The baking treatment shall be the last operation before oiling or coating with rust-preventive.

3.16 Rust preventive. All springs of classes A, B, and C which are not to be painted shall be coated with a suitable rust preventive.

3.17 Workmanship. Workmanship shall be in accordance with high-grade commercial practice covering this class of work. The coils of the finished springs shall be entirely free from cracks, seams, nicks, dents, or other surface imperfections.

#### 4. SAMPLING, INSPECTION, AND TEST PROCEDURES

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

#### 4.2 Sampling.

4.2.1 Lot. A lot shall consist of all the springs of the same type, design, and dimensions made from the same material, and submitted for inspection at the same time.

4.2.2 Sampling for workmanship and drawing conformance. Samples shall be randomly selected in accordance with table I, Inspection Level III, Acceptable Quality Level (AQL) class 2.2 to 3.2 of JAN-STD-105, Sampling Inspection Table for Inspection by Attributes. A random sample is defined in Specification JAN-STD-105.

4.2.3 Sampling for mechanical tests. Unless otherwise specified samples shall consist of random samples selected in accordance with table II.

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TABLE II  
Sampling for Mechanical Tests

Single Plans

Lot Size in Springs	Sample Size	Maximum Allowable Number of Defective Items
1 - 20	1	0
21 - 100	3	0
101 - 300	7	0
301 - 500	10	0

Double Plans

		Accumulative Acceptance No.	Accumulative Rejection No.
501 - 1000	First 13	0	2
	Second 26	1	2
1001 - 2000	First 20	0	2
	Second 40	1	2
2001 - 4000	First 35	1	3
	Second 70	2	3
Over 4000	First 50	1	4
	Second 100	3	4

4.3 Tests.

4.3.1 Workmanship or drawing conformance. Random samples selected in accordance with paragraph 4.2.2 shall be examined to determine if they conform to their detail drawings and the standard or workmanship specified in Section 3.

4.3.2 Mechanical tests.4.3.2.1 Compression and extension.

4.3.2.1.1 Free length. Measure the length of the spring after the maximum working load specified on the applicable drawing, has been applied and released. This length measurement shall conform to the length measurement specified on the applicable drawing. Free length measurements shall be made at the approximate center of the spring. The minimum value obtained from three loadings shall apply.



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4.3.2.1.2 Rate of deflection. Measure the deflection under 80 percent and under 10 percent of the maximum working load and apply the following formula:

$$\text{Rate of deflection} = \frac{0.80Q - 0.10Q}{\Delta \text{ at } 0.80Q - \Delta \text{ at } 0.10Q} \quad \text{where}$$

Q = Maximum working load, in pounds

$\Delta$  = Measured deflection under applied load, in inches

4.3.2.1.3 Maximum deflection. The maximum deflection of the spring shall be determined by applying 1-1/4 times the working load and measuring the perpendicular distance between the plates of the testing machine. The difference between this measurement and the free length is the maximum deflection.

4.3.2.2 Hardness. Hardness tests shall be made in accordance with Specification QQ-M-151.

4.3.2.3 Bend. The wire in a finished spring shall withstand bending 180 degrees around a diameter equal to twice the diameter of the wire.

4.3.2.4 Magnetic particle inspection. Springs of classes A, B, and C shall be inspected in accordance with the requirements of Specification AN-I-32.

4.3.2.5 The sample shall be sectioned, shall be given a metallographic polish, etched with 5 percent nital and examined by a competent metallographist.

#### 4.4 Rejection and retest.

4.4.1 Workmanship and drawing conformance. Any item of any given sample which does not pass inspection (paragraph 4.3) shall be called a defective. If a lot has been rejected according to the sampling plan specified in paragraph 4.2.2, it may be resubmitted for reinspection after having been screened by the manufacturer for such defectiveness.

4.4.2 Mechanical tests. Any item of any given sample which does not pass all of the Mechanical tests shall be called a defective. A lot shall be rejected if the sample fails to meet the acceptance requirements of table II.

### 5. PREPARATION FOR DELIVERY

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

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5.2 Preservation. Unpainted class A, B, and C springs shall be preserved in accordance with method I of Specification AN-P-13. All springs shall be wrapped in barrier material conforming to Specification JAN-B-121, grade A.

5.3 Packaging. Wrapped springs in quantities specified by the Procuring Service shall be snugly packaged in cartons or boxes conforming to Specification JAN-P-130 or JAN-P-133, respectively.

5.4 Packing. Unless otherwise specified, all items shall be afforded domestic packing. Shipping containers shall contain the same number of packages, shall be uniform in size and snugly packed. The gross weight, when packed for shipment, shall not exceed approximately 200 pounds.

5.4.1 Domestic packing. Unless otherwise specified, the packages shall be placed in substantial exterior shipping containers so constructed as to insure acceptance by common or other carrier for safe transportation at lowest rate to the point of delivery specified in the contract or order. Containers shall conform to the requirements of the Consolidated Freight Classification Rules in effect at time of shipment except that fiberboard, when used, shall have a minimum Mullen Test of 275 pounds.

5.4.2 Overseas packing. Unless otherwise specified, the packages shall be packed in wood cleated plywood, nailed wood, or fiberboard boxes conforming to Specification JAN-P-105, JAN-P-106 or JAN-P-108, respectively. Plywood, when used, shall be type A or B, condition I, Specification JAN-P-139. Wood boxes shall be furnished with a sealed case-liner fabricated from case-liner material Specification JAN-P-125, sealed with Specification JAN-P-140 adhesive.

5.5 Marking and labeling.

5.5.1 Packages. Each package shall be durably and legibly marked or labeled with the following information:

Name of Item  
 Specification No.  
 AN Part No. (if applicable)  
 Manufacturer's Part No.  
 Stock No. (USAF or Navy as applicable)  
 Quantity Contained  
 Name of Contractor  
 Contract or Order No.

5.5.2 Shipping containers. Each shipping container shall be marked as specified for packages, including method and preservation and, in addition, in accordance with the requirements applicable to the individual Services, as specified in Specification 94-40645 for the Air Force, and the Navy Shipment Marking Handbook for the Navy.

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## 6. NOTES

6.1 Intended use. The springs covered by this specification are intended for general aircraft use. Valve springs for engines are considered to be a special class and ordinarily should not be purchased under this specification.

6.2 Documents replaced for aeronautical use. For aeronautical purposes, this specification shall be used in lieu of Navy Aeronautical Specification A989 and U. S. Army Specification 94-40092.

6.3 Ordering data. Requisitions, contracts, and orders for springs should refer to the applicable drawings. The following information should preferably appear on the drawings, but otherwise should be included in the requisition, contract or order:

- (a) Type
- (b) Class
- (c) Free length (with tolerances)
- (d) Working loads (range)
- (e) Deflection for specified load (with tolerances)
- (f) Inside and/or outside diameter limits as necessary
- (g) Amount of magnetic particle inspection required, when that specified in paragraph 4.2.3 is not considered adequate
- (h) Cadmium plating if desired

6.3.1 Additional information. The following information should be included on complete manufacturing drawings, but need not be furnished by the Procuring Service.

- (a) Number of active coils
- (b) Finish
- (c) Size of wire
- (d) Hardness limit
- (e) Heat-treating data
- (f) Maximum working stress

NOTICE: When Government drawings, specifications or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specification, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

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