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SUPERSEDING
Int. Fed. Spec. QQ-W-00428A(GSA-FSS)
September 16, 1970 and
Fed. Spec. QQ-W-428
April 7, 1959

FEDERAL SPECIFICATION

WIRE, STEEL, CARBON (HIGH CARBON, ROUND, FOR MECHANICAL SPRINGS, GENERAL PURPOSE)

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 uncoated, round, high carbon steel wire for the fabrication of mechanical springs and wire forms for general purpose use.

1.2 Classification.

1.2.1 Types and class. Spring wire shall be of the following types and classes, as specified (see 6.2):

Type I - Oil-tempered spring wire.

Class 1 - Wire with tensile properties shown in table II.
2 - Wire with tensile properties shown in table II.

Type II - Hard-drawn spring wire.

Class 1 - Wire with tensile properties shown in table II.
2 - Wire with tensile properties shown in table II.

Type III - Soft spring wire.

Class 1 - Spheroidize-annealed at finish size.
2 - Spheroidize-annealed and lightly drawn.
3 - Patented or equivalent thermal treatment and lightly drawn.

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 this specification to the extent specified herein.

Federal Standards:

Fed. Std. No. 66 - Steel: Chemical Composition and Hardenability.
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, 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, DC, Atlanta, Chicago, Kansas City, MO, Fort Worth, Denver, San Francisco, Los Angeles, and Seattle, WA.

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(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 Standard:

MIL-STD-163 - Steel Mill Products Preparation for Shipment and Storage.

(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 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) Standard:

E8 - Methods of Tension Testing of Metallic Materials.

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

3. REQUIREMENTS

3.1 Process. Steel for wire shall be manufactured by the open hearth, basic oxygen, or electric furnace process.

3.1.1 Type I, classes 1 and 2. Wire shall be quenched and tempered.

3.1.2 Type II, classes 1 and 2. Wire shall be cold drawn.

3.1.3 Type III. Soft wire for springs shall be hardened after cold forming.

3.1.3.1 Class 1. Wire shall be spheroidize-annealed at finished size.

3.1.3.2 Class 2. Wire shall be spheroidize-annealed, and lightly drawn.

3.1.3.3 Class 3. Wire shall be patented, or given an equivalent thermal treatment at the manufacturer's option, and lightly drawn.

3.2 Chemical requirements. A ladle analysis of each heat of steel from which the wire is made shall be furnished by the contractor and shall be in conformance to the requirements of table I. When specified (see 6.2), a check analysis shall be performed on the finished wire by the contractor and shall be in accordance with Fed. Std. No. 66, requirements for check analysis (see 4.4.1).

TABLE I. Chemical requirements (heat analysis) percent by weight

Type	Carbon	Manganese	Silicon	Phosphorus	Sulfur
				Maximum	Maximum
I, II	0.55 to 0.85	0.60 to 1.20 1/	0.10 to 0.35	0.040	0.050
II	.45 to .85 2/	.60 to 1.30 3/	.10 to .30	.040	.050
III	.55 to .85	.60 to 1.20	.10 to .35	.040	.050

1/ Manganese shall be between 0.80 and 1.20 percent for diameters 0.192 inch and larger, and it shall be between 0.60 and 0.90 percent for sizes smaller than 0.192 inch. Unless otherwise specified (see 6.2), choice of composition shall be at the manufacturer's option.

2/ Not varying more than 0.13 percent in any one lot.

3/ Not varying more than 0.30 percent in any one lot.

3.3 Mechanical properties, and size of wire. Mechanical properties for types I and II wires shall be in accordance with table II. Mechanical properties for type III wire shall be at the manufacturer's option unless otherwise specified (see 6.2). Size of wire for types I, II, and III shall be in accordance with table II, and shall be as specified (see 6.2).

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TABLE II. Tensile requirements

Decimal size	Tensile strength, k.s.i. 1/							
	Type I				Type II			
	Class 1		Class 2		Class 1		Class 2	
Inch	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
0.0204	293	323	324	354	283	323	324	364
.0230	289	319	320	350	279	319	320	360
.0258	286	316	317	347	275	315	316	356
.0286	283	313	314	344	271	311	312	352
.0317	280	310	311	341	266	306	307	347
.0348	274	304	305	335	261	301	302	342
.0410	266	296	297	327	255	293	294	332
.0475	259	289	290	320	248	286	287	325
.0540	253	283	284	314	243	279	280	316
.0625	247	277	278	308	237	272	273	308
.0720	241	271	272	302	232	266	267	301
.0800	235	265	266	296	227	261	262	296
.0915	230	260	261	291	220	253	254	287
.1055	225	255	256	286	216	248	249	281
.1205	220	250	251	281	210	241	242	273
.1350	215	240	241	266	206	237	238	269
.1483	210	235	236	261	203	234	235	266
.1620	205	230	231	256	200	230	231	261
.1770	200	225	226	251	195	225	226	256
.1920	195	220	221	246	192	221	222	251
.2070	190	215	216	241	190	218	219	247
.2253	188	213	214	239	186	214	215	243
.2437	187	212	213	238	183	211	212	239
.2500	185	210	211	236	182	210	211	239
.3125	183	208	209	234	174	200	201	227
.3750	180	205	206	231	167	193	194	220
.4375	175	200	201	226	165	190	191	216
.5000	170	195	196	221	156	180	181	205
.5625	165	190	191	216	152	176	177	201
.6250	165	190	191	216	147	170	171	194

1/ Tensile strength values for intermediate diameters may be interpolated.

3.4 Dimensional tolerances, types I, II and III. Dimensional tolerances in diameter of wire and out-of-round shall be in accordance with table III (see 4.3.1).

TABLE III. Dimensional tolerances, inch

Wire diameter	Variation in diameter 1/
Inch	Plus or minus
0.020 to 0.027	0.0008
over .027 to .072	.001
over .072 to .375	.002
over .375 to .625	.003

1/ The wire shall not be out of round more than 1/2 of the permissible variation in diameter.

3.5 Wrap requirements. When tested in accordance with 4.4.3, wire 0.162 inch and smaller in diameter shall wind on itself without breakage. All type wire, 0.312 inch diameter and smaller, shall wrap without fracture around cylindrical mandrel sizes in accordance with table IV. There are no wrap requirements for wire over 0.312 inch in diameter.

3.6 Type II, cast. Wire shall be substantially flat and shall not spring up or show a wavy condition when tested in accordance with 4.4.4.

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3.7 Unit quantities. Unless otherwise specified (see 6.2), wire shall be furnished in catchweight coils. Each coil shall be one continuous length of wire properly coiled and securely tied.

3.8 Identification marking. Unless otherwise specified (see 6.2), an identification tag containing the manufacturer's name or trademark, ordered wire size, specification number or symbol, type number, class number, and heat or lot number shall be attached to each coil. Where practical, the tag shall be placed on the inside diameter of the coil.

3.9 Workmanship.

3.9.1 Types I and II. Wire shall be uniform in quality and shall not be wavy or crooked. Type I wire shall be uniformly tempered.

3.9.2 Type II. Wire shall not be kinked.

3.9.3 Types I, II and III, surface condition. The surface of the wire shall be smooth and free from rust and injurious marks, scratches or seams.

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 inspection are deemed necessary to assure that supplies and services conform to prescribed requirements.

4.2 Sampling.

4.2.1 Lot size. A lot shall consist of coils of wire having the same diameter, type and class submitted for inspection at the same time.

4.2.2 Samples for visual examination and tests. One specimen from each ten coils or fraction thereof in a lot shall be selected for visual examination and tests.

4.3 Examination.

4.3.1 Visual and dimensional. Measure diameter of wire using a micrometer, and measure out-of-roundness at three locations on a wire specimen by measuring the diameter twice at 90 degrees and at each location (see 3.4). Examine surface of wire for defects listed under 3.9.

4.3.2 Preservation, packaging, packing and marking. Preservation, packaging, packing and marking for shipment and storage shall be examined to determine compliance to the requirements of Section 5.

4.4 Test methods.

4.4.1 Chemical composition. Check analysis for chemical composition shall be performed in accordance with method 111 or 112 of Fed. Test Methods Std. No. 151 (see 3.2). In case of dispute, analysis by method 111 shall be the basis for acceptance or rejection.

4.4.2 Tensile strength. Test wire for tensile strength using wedge or snubbing grips in accordance with ASTM E8. Wire specimen should be at least 10 inches long (see 3.3).

4.4.3 Wrap test. Wire samples shall be wound on a mandrel of the number of wire diameters in table IV and shall conform to the requirements in 3.5. The wrapping test is not required for wire with diameters larger than 0.312 inch in diameter.

TABLE IV. Wrap test

Wire diameter, inch	Mandrel diameter (number of wire diameters)				
	Type I		Type II		Type III
	Class 1	Class 2	Class 1	Class 2	Class 1, 2 and 3
0.162 and smaller	1X 1/	1X	1X	2X	1X
over 0.162 to 0.132 inclusive	2X	2X	2X	4X	2X

1/ For 1X mandrel, wire may be wound on itself.

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4.4.4 Cast test, type II, hard drawn wire. Carefull cut a sample of two full turns of wire and place it on a flat surface (see 3.6).

4.5 Rejection and retest. Unless otherwise specified (see 6.2), rejection and retest shall be conducted in accordance with the general section of Fed. Test Method Std. No. 151.

5. PREPARATION FOR DELIVERY

5.1 Preservation, packaging, packing and marking. The wire shall be preserved, packaged, packed and marked in accordance with MIL-STD-163. The levels of packaging and packing shall be A or C, as specified (see 6.2).

6. NOTES

6.1 Intended use. Types I, II and III wires are intended for the manufacture of mechanical springs and wire forms.

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 and class (see 1.2.1).
(c) Chemical requirements (see 3.2 and table I).
(d) Size of wire (see 3.3 and table II).
(e) Mechanical properties for type III wire (see 3.3).
(f) Unit quantities (see 3.7).
(g) Identification marking (see 3.8).
(h) Rejection and retest (see 4.5).
(i) Level of packaging and packing required (see 5.1).

6.3 Sub-contracted material and parts. The preparation for delivery requirements of referenced documents listed in Section 2 do not apply when material and parts are procured by the supplier for incorporation into the equipment and lose their separate identity when the equipment is shipped.

6.4 Classification comparison. Classification comparison between this specification and QQ-W-428 is as follows:

QQ-W-428B	QQ-W-428
Type I	Type I
Class 1	----
Class 2	----
Type II	Type II
Class 1	----
Class 2	----
Type III	Type III
Class 1	Condition A
Class 2	Condition B
Class 3	------

Review activities:

Army - MU
Navy - AS
Air Force - 84
DSA - IS

User activity:

Army - AV

Cordinating activity:

Navy - OS

Preparing activity:

GSA-FSS

Orders for this publication are to be placed with the General Services Administration, acting as an agent for the Superintendent of Documents. See section 2 of this specification to obtain extra copies and other documents referenced herein. Price 10 cents each.