

**QQ-W-470b**

December 14, 1965

SUPERSEDING

Fed. Spec. QQ-W-470a

October 22, 1954

## FEDERAL SPECIFICATION

**WIRE, STEEL, CARBON, SPRING, MUSIC**

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

**1. SCOPE**

1.1 This specification covers one type of round, cold drawn, high carbon, steel wire with a bright smooth finish which is termed "music spring wire".

**2. APPLICABLE STANDARDS AND OTHER PUBLICATIONS**

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

**Federal Standards:**

Fed. Std. No. 48—Tolerances for Steel and Iron Wrought Products.

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 product specifications required by activities outside the Federal Government for bidding purposes are available without charge at the General Services Administration Regional Offices in Boston, New York, Washington, D. C., Atlanta, Chicago, Kansas City, Mo., Dallas, Denver, San Francisco, Los Angeles, and Seattle, Wash.

(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 Standards:**

MIL-STD-105—Sampling Procedures and Tables for Inspection by Attributes.

MIL-STD-129—Marking for Shipment and Storage.

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 document forms 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.

**American Society for Testing and Materials (ASTM) Publication:**

A 318—Tension Testing of Steel Spring Wire.

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

**3. REQUIREMENTS**

3.1 Material. The steel shall be manufactured by the open-hearth or electric furnace process.

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### 3.2 Chemical requirements.

3.2.1 *Chemical composition.* The chemical composition of the wire shall conform to the requirements of table I. Individual determinations may vary from the specified range to the extent shown in the check analysis column except that the elements in any heat shall not vary both above and below the specified range.

3.2.2 *Chemical analysis.* A chemical analysis of each lot of wire or each heat of steel from which the wire is made shall be furnished by the contractor to show the percentages of those elements in table I.

TABLE I. *Chemical composition*

Element	Composition range (percent)	Check analysis tolerance, over the maximum limit or under the minimum limit (percent)
Carbon .....	0.70—1.00 <sup>1</sup>	0.02
Manganese ..	0.20—0.60 <sup>2</sup>	0.02
Silicon .....	0.12—0.30	0.02
Phosphorus ..	0.025 max.	0.005 <sup>3</sup>
Sulfur .....	0.03 max.	0.005 <sup>3</sup>

<sup>1</sup> Shall not vary more than 0.10 percent within a lot.

<sup>2</sup> Shall not vary more than 0.20 percent within a lot.

<sup>3</sup> Over the maximum limit only.

### 3.3 Dimensional requirements.

3.3.1 *Diameter.* The wire shall be the specified diameter and shall not exceed the diameter tolerance of Fed. Std. No. 48, table 17a6.

3.3.2 *Out-of-round.* The wire shall not exceed an out-of-round tolerance of one-half the diameter tolerance.

### 3.4 Mechanical requirements.

3.4.1 *Torsion, bend, and tensile strength.* The wire shall conform to the torsion, bend, and tensile strength requirements specified in table II.

3.4.2 *Coil test.* A coil of the wire shall have a uniform pitch and no splits or fractures when tested in accordance with 4.5.5. This test applies only to wire if diameter 0.102 inch or smaller.

3.4.3 *Wrap.* The wire shall have no splits or fractures when tested in accordance with 4.5.6.

3.4.4 *Cast.* The wire shall lie flat on itself and not spring up or show a wavy condition when tested in accordance with 4.5.7.

3.5 *Continuity.* The wire shall be furnished in one continuous length without splices on each spool, reel, or coil.

TABLE II. *Torsion, bend, and tensile strength requirements.*

Diameter of wire, inch	Torsion, number of 360° twists	Bend, number of bends	Tensile strength, thousand p.s.i.	
	Minimum	Minimum	Minimum	Maximum
.004	—	—	439	485
.005	—	—	426	471
.006	—	—	415	459
.007	—	—	407	449
.008	—	—	399	441
.009	—	—	393	434
.010	90	—	387	428
.011	88	—	382	422
.012	85	—	377	417
.013	82	—	373	412
.014	80	—	369	408
.015	78	—	365	404
.016	75	—	362	400
.018	70	—	358	398
.020	67	—	350	387
.022	63	—	345	382
.024	60	—	341	377
.026	47	—	337	373
.028	54	—	333	368
.030	51	—	330	365
.032	49	—	327	361
.034	48	54	324	358
.036	47	51	321	355
.038	45	48	318	352
.040	44	46	315	349
.042	42	43	313	346
.043	41	40	309	342
.048	39	36	306	339
.051	37	32	303	335
.055	34	28	300	331
.059	31	24	296	327
.063	29	21	293	324
.067	28	18	290	321
.072	26	15	287	317
.076	25	14	284	314
.080	23	13	282	312
.085	22	12	279	308
.090	21	10	276	305

TABLE II. *Torsion, bend, and tensile strength requirements (cont'd)*

Diameter of wire, inch	Torsion, number of 360° twists	Bend, number of bends	Tensile strength, thousand p.s.i.	
	Minimum	Minimum	Minimum	Maximum
.095	20	10	274	303
.100	19	9	271	300
.102	19	9	270	299
.107	18	8	268	298
.110	17	8	267	295
.112	17	8	266	294
.121	15	7	263	290
.125	15	7	261	288
.130	14	7	259	286
.135	14	6.5	258	285
.140	13	6	256	283
.145	12	6	254	281
.150	12	5.5	253	279
.156	11	5.5	251	277
.162	10	5	249	275
.177	10	5	245	270
.192	10	5	241	267
.207	10	5	238	264
.225	9	4.5	225	—
.250	8	4	220	—

3.6 Identification marking. Each spool and reel shall be marked on the ends and each coil shall be tagged to show the mill name or trademark, commercial designation or specification data, and heat number.

3.7 Workmanship. The wire shall have a smooth bright finish, free from defects such as seams, pits, die marks, scrapes, cold shuts, and other imperfections which could impair use of the wire for springs.

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

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. Unless 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.

#### 4.2 Lot.

4.2.1 For chemical analysis, a lot of wire shall consist of all wire made from the same melting furnace heat.

4.2.2 For inspecting and testing physical properties, a lot shall consist of all spools, reels, and coils of wire of the same diameter, manufactured from the same heat, and submitted for inspection at the same time.

#### 4.3 Sampling.

4.3.1 *Sampling for chemical analysis.* One sample, which weighs not less than 2 oz., shall be taken from each lot (4.2.F), in accordance with the latest revision of method III, Fed. Test Method Std. No. 151. If the heat from which the wire is manufactured is not identified, 3 samples, each weighing not less than 2 oz., shall be taken from each lot.

4.3.2 *Sampling for dimensional inspection.* This sampling shall be in accordance with MIL-STD-105. The unit of sample shall be a spool, reel, or coil.

4.3.3 *Sampling for torsion, bend, tension, coil, and wrap tests.* Individual specimens shall be selected from the first, last, and any intermediate coil of each lot of the same heat at the time the wire is being unreel to form small coils for shipment. When this is not possible, the samples shall be taken from at least 10 percent of the coils, but from not less than two coils in each lot.

4.3.4 *Sampling for cast test.* Two samples, consisting of a few turns of wire, shall be cut from different coils in the lot. This wire may be used for other tests after completion of the test for cast.

4.3.5 *Sampling for inspection of preparation for delivery.* This sampling shall be in accordance with MIL-STD-105. The

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unit of sample shall be a spool, reel, or coil fully prepared for delivery.

## 1.4 Inspection.

4.4.1 *Inspection of wire.* The wire samples (4.3.2) shall be inspected to determine compliance to the requirements in 3.3.1, 3.3.2, 3.5, 3.6, and 3.7. The level for this inspection shall be II and the acceptable quality level (AQL) 4.0 percent defective. Inspection shall include the following items:

Examine	Defect
Diameter	Incorrect
Diameter tolerances	Exceeded
Out-of-round tolerance	Exceeded
Identification marking	Incomplete, incorrect, or illegible
Workmanship	Not smooth or bright; flaws
Continuity	Splices

4.4.2 *Inspection of preparation for delivery.* An inspection shall be made to determine that preservation, packaging, packing, and marking comply with the requirements in section 5. The level for this inspection shall be II and the AQL 4.0 percent defective. Inspection shall include the following items:

Examine	Defect
Preservation	Improper or insufficient.
Wrapping paper	Not securely fastened
Packaging materials	Not as specified
Coil weight and size	Overweight or offsize
Shipping weight	Over 250 lbs. per shipping unit
Marking	Incomplete, improper, or illegible

## 4.5 Tests.

4.5.1 *Chemical analysis.* The samples (4.3.1) shall be prepared in accordance with method III, Fed. Test Method Std. No. 151 and analyzed in accordance with any appropriate ASTM method, unless a particular method is specified.

4.5.2 *Tension test.* The samples (4.3.3) shall be prepared and tested in accordance with ASTM A 318. Determine compliance to 3.4.1.

4.5.3 *Torsion test.*

4.5.3.1 *Wire over 0.032 inch diameter.*

The samples (4.3.3) for the torsion test of wire over 0.032 inch diameter, shall be not less than 10 inches long. One end of the sample shall be clamped in the fixed head of the testing machine and the other end clamped in the moveable head. The distance between the clamps in which the wire is held shall be 8 inches. The wire shall be twisted at a uniform rate, in one direction, until failure occurs. The speed of the machine shall be such as not to cause undue heating of the wire, and in no case shall the speed exceed 33 r.p.m. for wire diameters 0.125 inch or less or 20 r.p.m. for wires of larger diameters. Sufficient tension shall be applied longitudinally to the wire to keep it from kinking during the test. Determine compliance to 3.4.1.

4.5.3.2 *Wire 0.032 inch diameter and less.* The samples (4.3.3) for the torsion test of wire 0.032 inch diameter and less shall be not more than 30 inches long. The center of this length of wire shall be passed around a hook held in the moveable head of the testing machine. The loose ends shall then be clamped together in the stationary head and the test conducted as specified above for wire over 0.032 inch diameter. Determine compliance to 3.4.1.

4.5.4 *Bend test.* The samples (4.3.3) for the bend test shall be straight and not less than 10 inches long. One end of the sample shall be clamped in a vise, or the bending machine, figure 1, the jaws of which shall be rounded to a radius of 3/16 inch, and the wire bent back and forth at a uniform rate, through a total angle of 180°. Each 90° movement in either direction shall be counted as one bend. The speed of bending shall be such as not to cause undue heating of the wire. Guides shall be so placed that the wire will be in a plane at right angles to the jaws of the vise. Determine compliance to 3.4.1.

4.5.5 *Coil test (for wire 0.102 inch diameter or less).* The samples (4.3.3) shall be wound into a tightly closed coil, using an arbor 3 to 3.5 times the diameter of the

wire; and a 5 inch length of coil shall be stretched so that it sets to approximately three times its original length. Examine the coil for compliance to 3.4.2.

4.5.6 *Wrap test.* The samples (4.3.3) shall be wrapped 8 consecutive turns around a mandrel having a diameter equal to the diameter of the wire, maintaining a pitch approximately equal to the diameter of the wire. Examine the wire for compliance to 3.4.3.

4.5.7 *Cast test.* The samples (4.3.4) shall be dropped on a flat surface and shall be examined for compliance to 3.4.4.

4.6 *Rejection criteria.* Failure of a sample to conform to the chemical or mechanical requirements of this specification shall be

cause for rejection of the entire lot. Rejection due to inspection defects shall be in accordance with MIL-STD-105.

## 5. PREPARATION FOR DELIVERY

5.1 *Preservation and packaging.* Preservation and packaging shall be level A or C.

### 5.1.1 *Level A.*

5.1.1.1 *Preservation.* The wire shall be coated with preservative, type A, as defined in MIL-STD-163.

5.1.1.2 *Packaging.* The wire shall be packaged in accordance with guidelines for high carbon and special grade wire, MIL-STD-163.

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Diameter of wire	Clearance C ± 0.0005
Inch	Inch
0.026 to 0.102 incl. ....	0.688
Over 0.102 to 0.162 incl. ....	0.813
Over 0.162 to 0.180 incl. ....	0.988

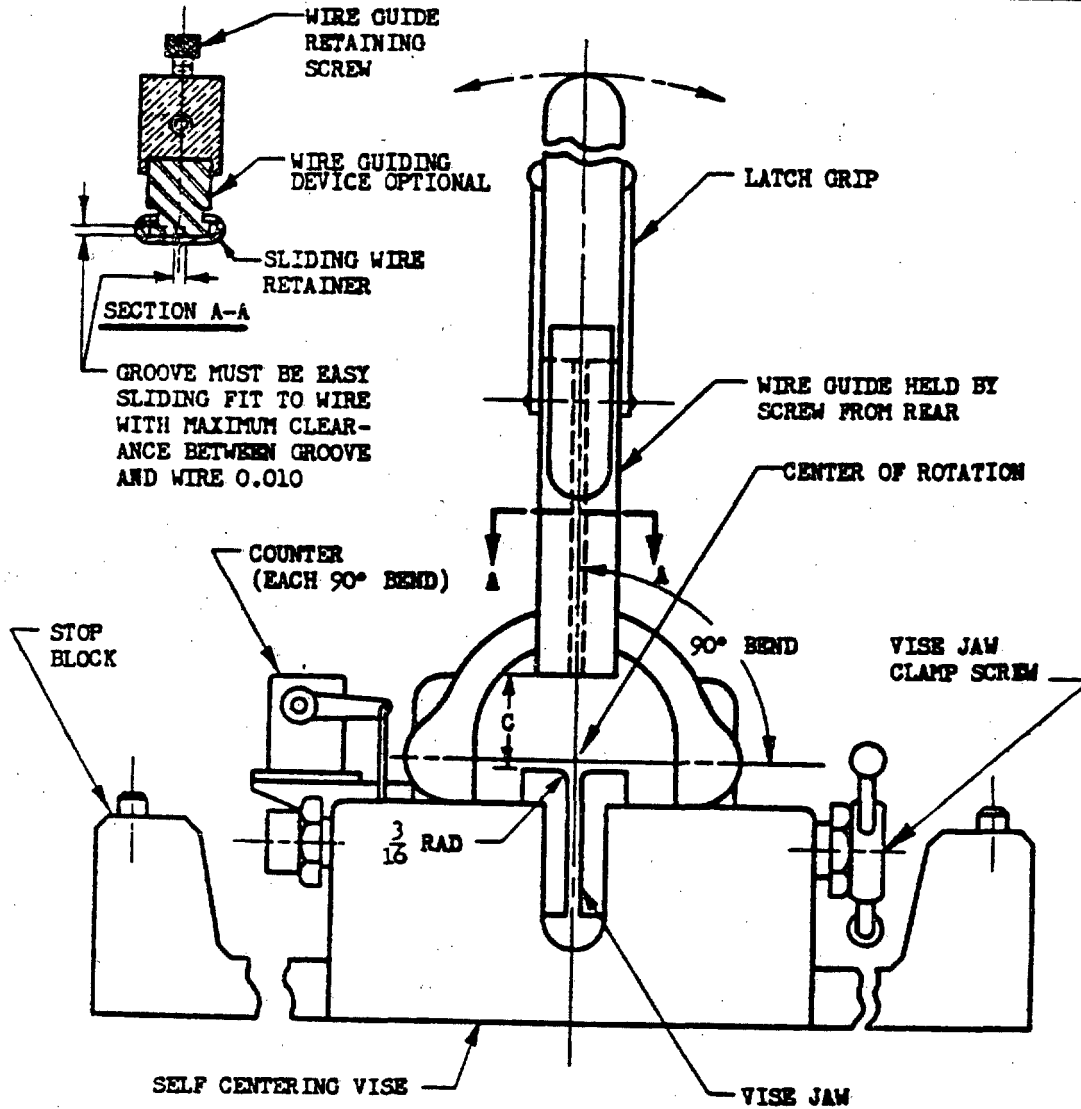


FIGURE 1. Schematic arrangement of bending machine.

5.1.2 Level C.

5.1.2.1 *Preservation.* The wire shall be protected from discoloration and corrosion in accordance with good commercial practice.

5.1.2.2 *Packaging.* Unless otherwise specified, the wire shall be packaged in coils of the weights and diameters specified in table III.



TABLE III. *Weight and inside diameter of wire in coils*

Diameter of wire	Weight of wire	Inside diameter of coil (minimum)
<i>Inches</i>	<i>Pounds</i>	<i>Inches</i>
0.014 and smaller	1 to 10	6
0.015 to 0.029	5 to 25	8
0.030 to 0.054	10 to 50	12
0.055 to 0.102	10 to 100	16
Over 0.102	10 to 120	22

5.1.2.2.1 *Even-weight coils.* When specified, the wire shall be furnished in even-weight coils.

5.1.2.2.2 *Wrapping of coils weighing less than two pounds.* Coils weighing less than two pounds shall be secured with not less than three double bands of steel wire or three single bands of equivalent strength steel strip and shall be wrapped with a neutral, acid free, waterproof paper. If specified, cotton tape bands or similar types of bands of equivalent strength may be used in lieu of steel bands.

5.1.2.2.3 *Wrapping of coils weighing two pounds and over.* Coils weighing two pounds and over shall be secured with not less than three double bands of steel wire or three single bands of equivalent strength steel strip and shall be wrapped with a neutral, acid free, waterproof paper, followed by a second wrapping of durable wrapping paper. If specified, cotton tape bands or similar types of bands of equivalent strength may be used in lieu of steel bands.

5.2 Packing. Packing shall be level A or C.

5.2.1 *Level A.* The spools, reels, or coils shall be packed in accordance with MIL-STD-163.

5.2.2 *Level C.* Shipping boxes or containers shall be prepared or constructed to permit their acceptance by common carriers for transportation to the delivery point at the lowest applicable rate, shall afford maximum protection from the normal haz-

ards of transportation, and shall withstand rehandling and reshipment without necessity of repacking.

5.2.2.1 *Shipping weight.* The gross weight of a packed box or container ready for shipment shall not exceed 250 pounds.

5.3 Marking. Marking shall be in accordance with MIL-STD-129 or Fed. Std. No. 123 as applicable. The item description shall include the name of the material, the specification symbol, the diameter, the unit quantity, the name of the contractor, and the number of the contract or order.

## 6. NOTES

6.1 Intended use. This music spring wire is intended for use in the manufacture of springs. It has higher torsion, bend, and tensile strength properties than other types of carbon steel spring wire, to provide high quality springs.

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

- Title, number, and date of this specification.
- Diameter and quantity of wire.
- Level of packaging (see 5.1).
- Level of packing (see 5.2).

Purchasers may exercise the options offered in 4.1, 4.5.1, and under 5.1.2.

6.3 Stress relief of coiled springs. Springs fabricated from music spring wire normally require heating to relieve coiling stresses after forming. A suggested treatment is heat to 500°—550° F. for 30 minutes.

6.4 Transportation descriptions. The transportation descriptions and minimum weights applicable to this commodity are:

### *Rail:*

Wire, plain, steel, not otherwise indexed by name.

Carload minimum weight 40,000 pounds.

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*Motor:*

Wire, plain, steel, not otherwise indexed.  
Truckload minimum weight 40,000  
pounds, subject to Rule 115, Na-  
tional Motor Freight Classification.

*User Activity:*

Navy—YD

*Preparing Activity:*

Air Force—69

**CUSTODIANS:**

Army—MR

Navy—WP

Air Force—69

*Review Activities:*

Army—ML, MR, MO, MU, WC

Navy—WP

Air Force—69

Review/user information is current as of the date of this document. For future co-ordination of changes to this document, draft circulation should be based on the information in the current Federal Supply Classification Listing of DOD Standardization Documents.

★ U.S. GOVERNMENT PRINTING OFFICE: 1969-703350/100

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**STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL***(See Instructions - Reverse Side)*

1. DOCUMENT NUMBER

2. DOCUMENT TITLE

3a. NAME OF SUBMITTING ORGANIZATION

4. TYPE OF ORGANIZATION (Mark one)

 VENDOR USER MANUFACTURER OTHER (Specify): \_\_\_\_\_

b. 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

b. WORK TELEPHONE NUMBER (include Code) - Optional

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

8. DATE OF SUBMISSION (YYMMDD)