

QQ-W-428B
 May 26, 1969
 SUPERSEDED
 Fed. Spec. QQ-W-423A
 March 6, 1961

FEDERAL SPECIFICATION
 WIRE, STEEL, CORROSION-RESISTING

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 corrosion-resisting steel wire for use where welding and elevated temperatures are not involved.

1.2 Classification.

1.2.1 Forms, compositions, and conditions. Steel wire shall be furnished in the following forms, compositions, and conditions (temper), as specified (see 6.2):

Form I - Round wire.
 Form II - Other wire of standard sections.
 Composition 302.
 Composition 304.
 Composition 305.
 Composition 316.
 Composition 321.
 Composition 347.
 Composition 410.
 Composition 420.
 Composition 430.
 Condition A - Annealed (all compositions).
 Condition B - Spring temper (compositions 302, 304, 305, 316, 321 and 347).
 Condition C - Heat-treated (compositions 410 and 420).

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 Specifications:

PPP-B-585 - Boxes, Wood, Wirebound.
 PPP-B-601 - Boxes, Wood, Cleated-Plywood.
 PPP-B-621 - Boxes, Wood, Nailed and Lock-Corner.

Federal Standards:

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

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(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 Standard:

MIL-STD-129 - Marking 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.

Uniform Classification Committee:

Uniform Freight Classification Rules.

(Application for copies should be addressed to the Uniform Classification Committee, 202 Union Station, Chicago, Ill. 60606.)

3. REQUIREMENTS

3.1 Material. The wire shall be manufactured of induction furnace or electric arc furnace steel.

3.2 Chemical requirements.

3.2.1 Chemical composition. Check analysis made on the wire shall comply with the requirements for the composition required as specified in Fed. Std. No. 66.

3.2.2 An analysis of each heat or lot of steel from which the wire is made shall be furnished by the contractor. The ladle analysis shall conform to the requirements specified in Fed. Std. No. 66.

3.3 Dimensional requirements.

3.3.1 Size. The wire shall be furnished in the sizes specified (see 6.2).

3.3.2 Form I, round wire. The variation of the diameter (size) of round wire and the out of round shall not exceed the amounts specified in Fed. Std. No. 48.

3.3.3 Form II, other wire of standard sections. Wire shall not vary from the ordered cross-sectional dimension by more than the amount specified (see 6.2).

3.4 Mechanical properties.

3.4.1 Wire shall conform to the requirements specified in table I for condition A, table II for condition B, and shall be as specified in 3.4.2 for condition C.

TABLE I. Mechanical properties (condition A)

| Composition | Tensile strength | |
|---------------------------------|------------------|---------|
| | Minimum | Maximum |
| | p.s.i. | p.s.i. |
| 302, 304, 305, 316, 321 and 347 | 80,000 | 120,000 |
| 310 - - - - - | 90,000 | 140,000 |
| 410 - - - - - | 70,000 | 90,000 |
| 420 - - - - - | 70,000 | 115,000 |
| 430 - - - - - | 70,000 | 95,000 |

TABLE II. Mechanical properties compositions 302, 304, 305, 316, 321 and 347 in condition B

| Finished diameter | Bend test minimum number of bends | Tensile strength 302 and 304 1/ | | Tensile strength 305, 316, 321 and 347 1/ | |
|-------------------------|--|---------------------------------------|---------|---|---------|
| | | p.s.i. | | p.s.i. | |
| Inch | | Minimum | Maximum | Minimum | Maximum |
| Up to .009 | | 325,000 | 355,000 | 245,000 | 275,000 |
| Over .009 to .010 incl. | | 320,000 | 350,000 | 245,000 | 275,000 |
| Over .010 to .011 incl. | | 318,000 | 348,000 | 240,000 | 270,000 |
| Over .011 to .012 incl. | | 316,000 | 346,000 | 240,000 | 270,000 |
| Over .012 to .013 incl. | | 314,000 | 344,000 | 240,000 | 270,000 |
| Over .013 to .014 incl. | — | 312,000 | 342,000 | 240,000 | 270,000 |
| Over .014 to .015 incl. | — | 310,000 | 340,000 | 240,000 | 270,000 |
| Over .015 to .016 incl. | — | 308,000 | 338,000 | 235,000 | 265,000 |
| Over .016 to .017 incl. | — | 306,000 | 336,000 | 235,000 | 265,000 |
| Over .017 to .018 incl. | — | 304,000 | 334,000 | 235,000 | 265,000 |
| Over .018 to .019 incl. | — | 302,000 | 332,000 | 235,000 | 265,000 |
| Over .019 to .020 incl. | — | 300,000 | 330,000 | 235,000 | 265,000 |
| Over .020 to .022 incl. | — | 296,000 | 326,000 | 235,000 | 265,000 |
| Over .022 to .024 incl. | — | 292,000 | 322,000 | 235,000 | 265,000 |
| Over .024 to .026 incl. | 10 | 289,000 | 319,000 | 235,000 | 265,000 |
| Over .026 to .028 incl. | 10 | 286,000 | 316,000 | 235,000 | 265,000 |
| Over .028 to .031 incl. | 10 | 277,000 | 307,000 | 235,000 | 265,000 |
| Over .032 to .036 incl. | 10 | 273,000 | 303,000 | 235,000 | 265,000 |
| Over .036 to .041 incl. | 10 | 269,000 | 299,000 | 235,000 | 265,000 |
| Over .041 to .047 incl. | 10 | 262,000 | 292,000 | 230,000 | 260,000 |
| Over .047 to .054 incl. | 10 | 260,000 | 290,000 | 225,000 | 255,000 |
| Over .054 to .062 incl. | 9 | 255,000 | 285,000 | 220,000 | 250,000 |
| Over .062 to .072 incl. | 9 | 250,000 | 280,000 | 215,000 | 245,000 |
| Over .072 to .080 incl. | 9 | 245,000 | 275,000 | 210,000 | 240,000 |
| Over .080 to .092 incl. | 9 | 240,000 | 270,000 | 205,000 | 235,000 |
| Over .092 to .105 incl. | 7 | 232,000 | 262,000 | 200,000 | 230,000 |
| Over .105 to .120 incl. | 5 | 225,000 | 255,000 | 195,000 | 225,000 |
| Over .120 to .148 incl. | 3 | 210,000 | 240,000 | 185,000 | 215,000 |
| Over .148 to .166 incl. | 3 | 205,000 | 235,000 | 180,000 | 210,000 |
| Over .166 to .177 incl. | 3 | 195,000 | 225,000 | 170,000 | 200,000 |
| Over .177 to .207 incl. | 3 | 185,000 | 215,000 | 160,000 | 190,000 |
| Over .207 to .225 incl. | 3 | 180,000 | 210,000 | 155,000 | 185,000 |
| Over .225 to .250 incl. | 3 | 175,000 | 205,000 | 150,000 | 180,000 |
| Over .250 to .312 incl. | 1 | 160,000 | 190,000 | 135,000 | 165,000 |
| Over .312 to .375 incl. | 1 | 140,000 | 170,000 | 115,000 | 145,000 |

1/When wire is specified in straightened and cut lengths, the minimum tensile strength shall be 90 percent of the tabular value.

3.4.2 Mechanical properties of composition 410 to 420 in condition C shall be as specified (see 6.2).

3.4.3 Uniformity. After being subject to the coiling and stretching test specified in 4.5.3, wire in condition B shall show uniform pitch with no splits or fractures.

3.4.4 Simulated service. When specified (see 6.2), composition 420 wire shall withstand the simulated service test specified in 4.5.4.

3.4.5 Wrapping. When specified (see 6.2), condition B wire shall withstand the test specified in 4.5.5 without cracking or splitting.

3.5 Decarburization. When specified (see 6.2), the depth of decarburization of composition 420 wire shall not exceed 0.0025 inch.

3.6 Finish. Annealed temper wire shall be furnished in the cold-drawn or cold-drawn and annealed condition. Spring temper wire shall be furnished in the cold-drawn condition.

3.6.1 Passivation. The wire shall receive a passivation treatment after final processing.

3.6.2 Coating, where necessary, shall be as specified (see 6.2).

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3.7 Unit quantities. Unless otherwise specified (see 6.2), wire shall be furnished in catch-weight units specified in table III for condition A and in table IV for conditions B and C.

TABLE III. Catch-weight units, condition A

| Wire diameter | Units |
|---------------------------|----------------|
| Inch | |
| 0.010 to 0.0625 - - - - - | 1 pound spools |
| .063 to .135 - - - - - | 10 pound coils |
| .135 to .165 - - - - - | 25 pound coils |

TABLE IV. Catch-weight units conditions B and C

| Wire diameter | Units |
|----------------------------|----------------|
| Inch | |
| 0.006 to 0.018 - - - - - | 1 pound spools |
| .019 to .063 - - - - - | 5 pound coils |
| .072 to .135 - - - - - | 10 pound coils |
| .136 and greater - - - - - | 25 pound coils |

3.8 Workmanship.

3.8.1 The wire shall be of uniform quality and temper, smooth, clean, free from kinks, waviness, splits, cracks, laps, seams, scale, segregation, and other defects which may impair the serviceability of the wire.

3.8.2 Wire shall be furnished either in coils, spools, or straightened and cut lengths. When furnished in coils, or spools, each unit shall be of one continuous length without joints of any kind except welds made prior to drawing.

3.9 Identification marking. The marking shall include the mill name or trademark, the composition, and the condition. This information shall be marked on both sides of each spool. Each coil or bundle shall be tagged in at least two places with one tag on the inside near the middle of the bundle.

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.

4.2 Sampling.

4.2.1 Size of lot.

4.2.1.1 Wire identified by heat. A lot shall consist of all wire of the same form, composition, condition, and size, manufactured by the same process from one heat of steel, and submitted for inspection at the same time.

4.2.2 Sampling for chemical analysis.

4.2.2.1 Wire identified by heat. From each lot sufficient wire shall be selected to prepare a sampling weighing not less than 2 ounces. The sample shall consist of fine chips free from oil, dirt, and other foreign matter.

4.2.2.2 Wire not identified by heat. From each lot, samples shall be selected from two separate coils or lengths in the lot. Insofar as possible, the samples shall represent different parts of the lot. Each sample shall consist of not less than 2 ounces of fine chips, free from oil, dirt, and other foreign matter.

4.2.2.3 The samples shall be forwarded to a laboratory satisfactory to the procuring agency for chemical analysis. Failure of composition of the sample to comply with this specification shall be cause for rejection of all wire made from that heat if the heat is identified, or all wire from the lot when the heat is not identified.

4.2.3 Sampling for mechanical tests.

4.2.3.1 Wire identified by heat. Three coils shall be selected from each lot. Insofar as possible one coil each shall be selected from the beginning, the middle, and the last of the run. If any test specimen fails, the entire lot shall be rejected. When this is not possible, the sampling plan of 4.2.3.2 shall apply.

4.2.3.2 Wire not identified by heat. Sample coils shall be selected in accordance with table V. If the number of failing specimens exceeds the number allowed in table V, this shall be cause for rejection of the lot.

TABLE V. Sampling for inspection and test

| Lot size (pounds) | Inspection and mechanical tests | | Decarburization tests | |
|---------------------------|---------------------------------|--|------------------------------|----------------------------------|
| | Number of coils in sample | Maximum number of failures allowed | Number of coils in sample | Number of failures allowed |
| Under 1,000 - - - - - | 3 | 0 | 1 | 0 |
| 1,000 to 3,000 - - - - - | 5 | 0 | 1 | 0 |
| 3,001 to 10,000 - - - - - | 10 | 1 | 2 | 0 |
| over 10,000 - - - - - | 20 | 2 | 4 | 0 |

4.2.3.3 Straightened and cut wire. Sample lengths shall be selected in the same manner as sample coils in 4.2.3.1 and 4.2.3.2.

4.2.3.4 Test Samples. From each sample coil or length selected in accordance with 4.2.3.1, 4.2.3.2 and 4.2.3.3, a test sample shall be selected long enough for test purposes to determine compliance with this specification. Each test sample shall be identified by sample coil and lot number.

4.3 Chemical analysis. Chemical analysis shall be made by standard chemical methods or by spectrographic method except that, in the event of a dispute, analysis by standard chemical methods shall be the basis for acceptance or rejection.

4.4 Examination.

4.4.1 Visual and dimensional. The wire shall be subject to dimensional, surface, and visual examination to verify that the material conforms to the requirements of this specification.

4.4.2 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.

4.5 Tests.

4.5.1 Tension. The tension test shall be conducted in accordance with Federal Test Method Standard No. 151.

4.5.2 Bend. For wire in condition B, a piece not more than 10 inches long shall be selected from each test sample selected in accordance with 4.2.3.4. These specimens shall be tested in a bending machine conforming substantially to figure 1. Bends shall be made at as nearly a uniform rate as possible, not exceeding 50 bends per minutes, and in no case shall the speed be so great as to cause undue heating of the wire. The test specimen shall be bent back and forth through a total angle of 180 degrees until failure occurs. Each 90-degree movement in either direction shall be counted as one bend. The wire shall withstand the minimum number of bends specified in table II.

4.5.3 Uniformity. A specimen shall be wound on an arbor of the size specified in table VI, to form a tightly wound coil. After winding, the coil shall be stretched to a permanent set of four times its as-wound length. After this treatment, the coil shall be examined to determine conformance to 3.4.3.

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TABLE VI. Arbor diameter for uniformity test

| Wire diameter | Arbor diameter |
|------------------------------------|----------------|
| Inch | Inch |
| 0.034 and under - - - - - | 0.102 |
| Over 0.034 to 0.045, incl. - - - - | .145 |
| Over .045 to .055, incl. - - - - | .212 |
| Over .055 to .125, incl. - - - - | .250 |
| Over .125 to .180, incl. - - - - | .350 |

4.5.4 Simulated service. One spring shall be made from each sample coil and shall be subjected to 20,000 cycles under simulated service conditions. The springs shall meet the standards of acceptability specified (see 3.4.4 and 6.2).

4.5.5 Wrapping. When the wrapping test is required (see 3.4.5), a piece of each test sample of condition B shall be wrapped at least 8 turns in a closed helix (pitch approximately equal to the diameter of the wire) around a mandrel. For wire 0.162 inch in diameter and smaller, the mandrel diameter shall be equal to the wire diameter. For larger wire, the mandrel diameter shall be twice the wire diameter.

4.5.6 Decarburization. The wire shall be subjected to a microscopic examination to determine conformance with 3.5.

5. PREPARATION FOR DELIVERY

(The preparation for delivery requirements specified herein apply only for direct Government procurements. For the extent of applicability of the preparation for delivery requirements of referenced documents listed in section 2, see 6.4.)

5.1 Wrapping.

5.1.1 Level A. The wire on spools and coils shall be wrapped with minimum 30-pound-basis weight kraft paper secured with tape. Cut lengths shall be wrapped in 30-pound-basis weight kraft paper secured with tape.

5.1.2 Level C. The wire shall be packaged in accordance with commercial practice.

5.2 Packing.

5.2.1 Level A. The packaged coils and spools shall be packed in overseas type cleated plywood, nailed wood, or wirebound boxes conforming to PPP-B-601, PPP-B-585, class 2 or 3, respectively. The gross weight of the boxes shall not exceed 200 pounds. Only one form, composition, condition, or size shall be packed in a container.

5.2.2 Level B. The packaged coils and spool shall be packed in domestic type cleated plywood, nailed wood, or wirebound boxes conforming to PPP-B-601, or PPP-B-585, class 1, respectively. The gross weight of the boxes shall not exceed 200 pounds. Only one form, composition, condition, or size shall be packed in a container.

5.2.3 Level C. The packaged coils and spool shall be packed in a manner to insure carrier acceptance and safe delivery to destination. Containers shall be in accordance with the Uniform Freight Classification Rules or regulations of other carriers as applicable to mode of transportation.

5.3 Marking.

5.3.1 Military agencies. In addition to any special marking required by the contract or order (see 6.2), or herein, interior and exterior shipping containers shall be marked in accordance with MIL-STD-129.

5.3.2 Civil agencies. In addition to any special marking specified in the contract or order (see 6.2) each unit and intermediate package and shipping container shall be marked in accordance with Fed. Std. No. 123.

6. NOTES

6.1 Intended use. The material covered by this specification is intended for use where a corrosion-resisting steel wire is desired, but where welding and elevated temperatures are not involved.

6.1.1 Material in condition B is intended for use in the fabrication of springs and cowl pins. The physical properties indicated herein for material in condition B are obtained by cold working (strain hardening) and not by heat treatment. Therefore, the material should not be heated to temperatures which will adversely affect the physical properties or corrosion-resistance before, during, and after fabrication.

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) Form, composition, and condition required (see 1.2).
- (c) Size required (see 3.3.1).
- (d) Tolerance for form II wire (see 3.3.3).
- (e) Mechanical properties of compositions 410 and 420 in condition C (see 3.4.2).
- (f) Whether simulated service test is required for composition 420, and the requirements and standards of acceptability (see 3.4.4).
- (g) If wrapping test is requested for condition B (see 3.4.5).
- (h) If decarburization limit is required in composition 420 (see 3.5).
- (i) Coating, if required (see 3.6.2).
- (j) When unit quantities other than those specified are desired (see 3.7).
- (k) Whether packaging should be for Level A or C, and packing for level A, B, or C (see 5.1 and 5.2).
- (l) Special marking, if required (see 5.3).

6.3 This specification covers only the forms, compositions, conditions, and sizes of the commodity as generally purchased by the Federal Government, and is not intended to include all of the forms, compositions, conditions, and sizes which are commercially available.

6.4 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.

MILITARY INTEREST

Custodians:

Army - MR
Navy - SH
Air Force - 84

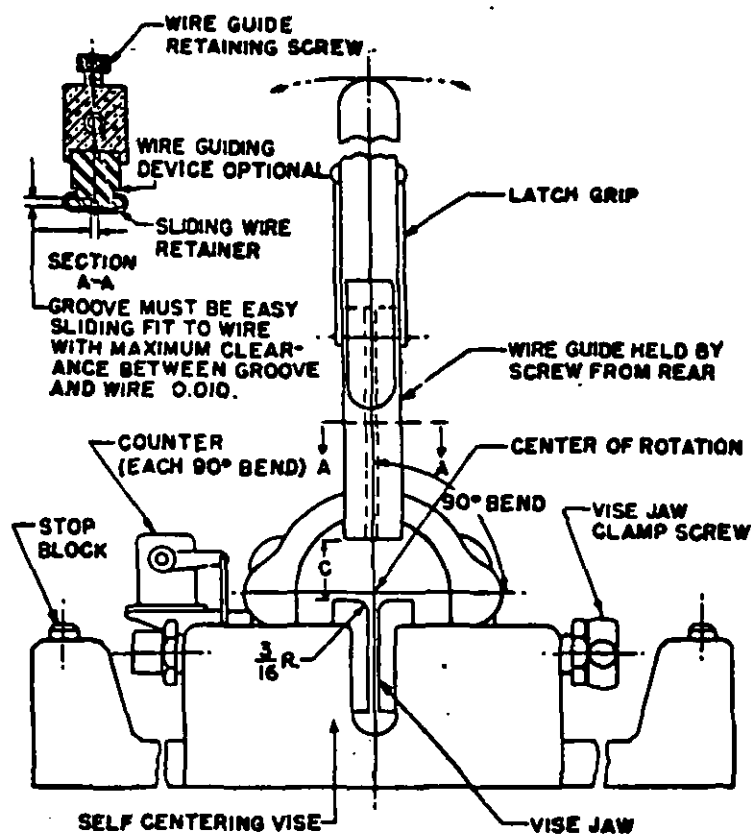
Review activities:

Army - MR
Navy - SH, AS, YD
Air Force - 84, 85

Preparing activity:

Navy -- SH

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| Diameter of wire | Clearance $C \pm 0.005$ |
|---------------------------|----------------------------|
| Inch | Inch |
| Over 0.026 to 0.105 incl. | 0.688 |
| Over .105 to .162 incl. | .813 |
| Over .162 to .180 incl. | .938 |

Figure 1. - Schematic arrangement of bending machine.

Order for this publication are to be placed with 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.

INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge (**DO NOT STAPLE**), and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

NOTE: This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

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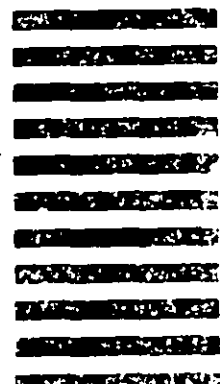
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