QQ-W-390C
February 25, 1970
SUPERSEDING
Fed. Spec. QQ-W-390B
October 14, 1963

FEDERAL SPECIFICATION

WIRE, NICKEL-CHROMIUM-IRON ALLOY

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 nickel-chromium-iron alloy wire.

1.2 Classification.

1.2.1 Tempers. Nickel-chromium-iron alloy wire shall be furnished in the following tempers, as specified:

Temper A - Annealed.
Temper B - Cold drawn, regular temper.
Temper C - Cold drawn, spring temper.

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-566 - Box, Folding, Paperboard
PPP-B-601 - Box, Wood, Cleated-Plywood
PPP-B-621 - Box, Wood, Nailed and Lock-Corner
PPP-B-636 - Box, Fiberboard
PPP-B-640 - Box, Fiberboard, Corrugated, Triple-Wall
PPP-B-665 - Box, Paperboard Metal Stayed (Including Stay Material)
PPP-B-676 - Box, Setup

FSC 9525

Federal Standard:

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 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 the established distribution points in their agencies.)

Military Specifications:

MIL-P-116 - Preservation, Methods of
MIL-L-10547 - Liners, Case, and Sheet, Overwrap, Water-Vaporproof or Waterproof, Flexible

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 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:

E 8 - 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.)

(Technical society and technical association specifications and standards are generally available for reference from libraries. They are also distributed among groups and using Federal agencies.)

3. REQUIREMENTS

3.1 Chemical composition. The wire shall conform to the chemical requirements specified in table I.

TABLE I. Chemical composition

Element	Percentage
Nickel, minimum[a]	72.0
Chromium	14.0-17.0
Iron	6.0-10.0
Manganese, maximum	1.0
Copper, maximum	0.50
Carbon, maximum	.15
Silicon, maximum	.50
Sulfur, maximum	.015

[a]Cobalt counting as nickel.

3.2 Mechanical properties.

3.2.1 Tensile strength. The wire shall conform to the tensile requirements as specified in table II.

TABLE II. Tensile strength requirements
(see 6.3)

Temper and size	Tensile strength, p.s.i.	
	Minimum	Maximum
Temper A, annealed:		
Under 0.032 inch	80,000	115,000
0.032 inch and over	80,000	105,000
Temper B, cold-drawn, Regular temper	120,000	165,000
Temper C, cold-drawn, spring temper:		
Up to 0.057 inch, inclusive	185,000	-
Over 0.057 to 0.114 inch, inclusive	175,000	-
Over 0.114 to 0.229 inch, inclusive	170,000	-
Over 0.229 to 0.329 inch, inclusive	165,000	-
Over 0.329 to 0.375 inch, inclusive	160,000	-
Over 0.375 to 0.500 inch, inclusive	155,000	-
Over 0.500 to 0.563 inch, inclusive	140,000	-

3.2.2 Wrapping. The wire shall withstand the wrapping test specified in 4.3.2.3 without fracture or development of a pebbled or orange-peel surface.

3.3 Dimensional tolerances. The wire shall conform to the dimensional tolerances specified in table III.

TABLE III. Tolerances in diameter

Specified diameter, inch	Tolerances, inch	
	Plus	Minus
To 0.0044, inclusive	0.0002	0.0002
Over 0.0044 to 0.0079, inclusive	.00025	.00025
Over 0.0079 to 0.0149, inclusive	.0003	.0003
Over 0.0149 to 0.0199, inclusive	.0004	.0004
Over 0.0199 to 0.031, inclusive	.0005	.0005
Over 0.031 to 0.045, inclusive	.0006	.0006
Over 0.045 to 0.079, inclusive	.0007	.0007
Over 0.079 to 0.1875, inclusive	.001	.001
Over 0.1875 to 0.406, inclusive	.001	.002
Over 0.406 to 0.499, inclusive	.002	.002
Over 0.499 to 0.563, inclusive	.0025	.003

3.3.1 The wire in all tempers shall not be out of round by more than one-half of the permissible variation in diameter.

3.4 Workmanship. The wire shall be uniform in quality and temper, clean, sound, smooth, and free from injurious foreign material, scrapes, cold shuts, laps, cracks, twists, scale, damaged ends, welds, scores, pits, galls, and other defects which are not in accordance with best practice for high quality material.

3.4.1 Tempers A and B wire shall have a bright to dull matte surface depending on the method of final processing. Temper C wire shall have a surface with a thin coating of lead or other lubricant, unless the bare (de-leaded or cleaned) wire having a dull matte surface is specified (see 6.1.4).

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 use 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. The sample size levels of inspection shall be in accordance with MIL-STD-105.

4.2.1 Lot.

4.2.1.1 For chemical analysis. Unless otherwise specified, a lot shall consist of all material from the same heat or melt.

4.2.1.2 For mechanical testing and examination of coated wire. Unless otherwise specified, a lot shall consist of all wire from the same heat or melt in the same temper and of the same diameter processed at the same time.

4.2.2 Samples for chemical analysis. One representative sample shall be obtained from each lot. Samples may be taken from the ladle or the finished product. Samples shall be taken in accordance with method 111 or 112 of Fed. Test Method Std. No. 151.

4.2.3. Samples for mechanical tests. Samples for mechanical tests shall be selected in accordance with table IV. The number of samples for the tension and wrapping tests shall be the same.

TABLE IV. Sampling for mechanical tests (tension and wrapping) and examination of coated wire

Lot size, pounds	Number of samples	Maximum number of failures allowed
For wires 1/4 inch diameter or less:		
Under 500	3	0
500 to 1,000	4	0
1,001 to 1,500	5	0
1,501 to 2,000	7	0
2,001 to 3,000	10	1
3,001 to 10,000	20	2
Over 10,000	30	3
Alternate (over 10,000)[1]	50	4
For Wires over 1/4 inch diameter:		
For each 500 pounds or fraction thereof:	1	0

[1]Alternate sample is for use where identity of material is obscure (see 4.2.3.1).

4.2.3.1 If the material is not identifiable as to heat or melt and manufacture, or if the identity of any portion of the lot is obscure in any respect, table IV shall be applied by choosing the number of tension tests and wrapping tests samples for the next larger lot size.

4.3 Examination.

4.3.1 Uncoated wire. All uncoated wire shall be carefully examined to determine conformance with this specification with respect to workmanship and tolerances.

4.3.2 Coated wire. The surface of lead-coated temper C wire shall be examined on samples selected in accordance with table IV. The wire samples shall be deleaded for this examination by immersion in 10 to 15 percent (by weight) nitric acid for 15 to 30 minutes at 140°F. to 180°F. followed by washing with water.

4.4 Examination of preparation for delivery. The preservation, packaging, packing and marking shall be examined to determine compliance with the requirements of Section 5 of this specification.

4.5 Tests.

4.5.1 Test specimens.

4.5.1.1 Tension test. Specimens for tension test shall be of the full cross section of the wire and not less than 15 inches in length. Specimens shall be free from sharp bends or kinks.

4.5.1.2 Wrapping test. Specimens for the wrapping test shall be full-size sections of the wire of a suitable length.

4.5.2 Test procedures.

4.5.2.1 Chemical analysis. The samples selected and forwarded in accordance with 4.2.2 shall be analyzed in accordance with method 111 or method 112 of Fed. Test Method Std. No. 151 to determine conformance with 3.1. A single analysis of a composite sample may be made. In case of dispute, the analysis by the wet method (method 111) shall be the basis of acceptance.

4.5.2.2 Tension tests. All tension tests shall be conducted in accordance with ASTM E 8. The distance between the jaws of the testing machine, with the specimen in place ready for testing, shall be not less than 10 inches.

4.5.2.3 Wrapping tests. The wire shall be wrapped eight consecutive turns in a closed helix (pitch approximately equal to the diameter of the wire) around a mandrel as follows:

(1) For all temper A and B wire and for temper C wire 0.229 inch in diameter and less: Same as the diameter of the wire.

(2) For temper C wire over 0.229 inch in diameter: Twice the diameter of the wire.

4.6 Rejection.

4.6.1 Examination of defects. Any lot of Temper A or B wire having one or more defects shall be rejected. Any lot of Temper C wire exceeding the maximum number of failures allowed in accordance with table IV shall be rejected. Resubmission of defective lots shall be subject to the direction of the procuring activity.

4.6.2 Test failure. A lot shall be rejected if the number of units failing to meet the test requirements of 4.5 exceeds the maximum number of failures allowed in table IV.

4.7 Retests. Retests shall be permitted in accordance with Fed. Test Method Std. No. 151. Where failure of any lot of material to meet the requirements of this specification is due to inadequate heat treatment, the material may be reheat-treated and resubmitted for test. Only two such reheat-treatments will be allowed.

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 wire shall be furnished as specified in coils or on spools as indicated in table V.

TABLE V. Coil and spool sizes

Temper	Wire Diameter	Standard spool size	Maximum weight of wire on each spool
	Inch	Pounds	Pounds
Temper A and B on spools	Under 0.010	2	2-1/2
	0.010 to 0.018, incl.	5	6
	Over 0.018 to 0.040, incl.	10	15
		Approximate mean coil diameter	Maximum weight per coil
		Inches	Pounds
Temper A,B, and C in coils	Under 0.010	8	15
	0.010 to 0.018, incl.	8	25
	Over 0.018 to 0.040, incl.	8 to 12	40
	Over .040 to .081, incl.	16 to 20	100
	Over .081 to .499, incl.	18 to 22	140
	Over .499 to .563, incl.	22 to 28	140

5.1.1.1 Coils or spools not exceeding twenty five pounds. Coils or spools not exceeding twenty five pounds shall be packaged in accordance with method III of MIL-P-116. Unit containers shall be either fiberboard boxes, folding cartons, set-up or metal stayed boxes conforming to PPP-B-636, PPP-B-566, PPP-B-676, or PPP-B-665, respectively. Gross weight of cartons or boxes shall not exceed the weight limitation of the applicable box specification. Box closures shall be in accordance with the applicable box specification or appendix thereto.

5.1.1.2 Coils or spools exceeding twenty five pounds. Coils or spools exceeding twenty five pounds shall be packaged in accordance with MIL-STD-163 as specified for Wire, Stainless Steel.

5.1.2 Level C. Wire shall be protected and packaged to prevent physical damage during shipment from the supply source to the first receiving activity.

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

5.2.1 Level A.

5.2.1.1 Coils or spools not exceeding twenty five pounds. Coils or spools not exceeding twenty five pounds, packaged as specified in 5.1.1.1 shall be packed in containers conforming to PPP-B-601, overseas type; PPP-B-621, class 2; PPP-B-640, class 2, grade A; or PPP-B-636, class weather resistant. Wood and wood-cleated boxes shall be lined with a case liner conforming to MIL-L-10547 and sealed in accordance with the appendix thereto. Fiberboard boxes closed, waterproofed and reinforced in accordance with the appendix of the box specification will not require case liners. The gross weight of wood or wood cleated boxes shall not exceed 200 pounds, and the gross weight of fiber boxes shall not exceed the limitations of the box specification. Strapping and closure shall be in accordance with the appendix to the applicable container specification.

5.2.1.2 Coils or spools exceeding twenty five pounds. Coils or spools exceeding twenty five pounds shall be packed in accordance with MIL-STD-163 as specified for Wire Stainless Steel.

5.2.2 Level B.

5.2.2.1 Wire packaged as specified in 5.1.1.1 shall be packed as specified for level A except that the shipping containers shall be of the domestic type and class as applicable and case liners are not required.

5.2.2.2 Wire packaged as specified in 5.1.1.2 shall be packed as specified for level A of MIL-STD-163 except wooden boxes will not require a 30-30-30 waterproof paper liner.

5.2.3 Level C. Wire packaged as specified (see 6.2) shall be packed in accordance with commercial practice adequate to insure acceptance by common carrier and safe delivery to the destination at the lowest transportation rating. Containers and methods shall conform to the rules and regulations or other carrier regulations as applicable to the mode of transportation.

5.3 Marking. In addition to any special marking specified in the contract or order, interior and exterior containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use. Nickel-chromium-iron alloy possesses good resistance to corrosion and to oxidation at elevated temperatures. The limiting elevated temperature uses will be governed by temperatures, atmospheres, and other incidental conditions of exposure. The indicated limiting service conditions are as follows:

Sulfur-free atmospheres	
Oxidizing	2,000°F.
Reducing (H_2 and CO)	2,100°F.

Sulfurous atmospheres	
Oxidizing	1,500°F.
Reducing	1,000°F.

Steam
1,500°F.

6.1.1 Temper A and temper B wires covered by this specification are intended for use in the manufacture of parts which require good resistance to corrosion or are subjected to oxidation at elevated temperatures up to 1,800°F.

6.1.2 Temper C wire is intended for use in the manufacture of springs or other parts requiring high strength, good corrosion resistance, low magnetic permeability, or retention of spring properties at relatively high temperatures (600° to 700°F.).

6.1.3 Springs for corrosive or elevated temperature service should be stress relieved after forming by holding at 850° to 900°F. for 1 hour and furnace or air cooling.

6.1.4 Temper C wire with a thin lead-coated surface is recommended for coiling on automatic machines, the lead acting as a metallic lubricant to minimize tendency to gall. For hand or lathe coiling the as-drawn surface has been found to be satisfactory.

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) Temper required (see 1.2).
(c) Diameter and length required.
(d) When bare temper C wire is required (see 3.4.1).
(e) Level of preservation and packaging (see 5.1).
(f) Whether wire shall be furnished on spools or in coils.
(g) Level of packing (see 5.2).
(h) Special marking, if required (see 5.3).

6.3 Temper A wire in straightened and cut lengths will have tensile strengths approximately 15,000 pounds per square inch higher than wire in coil; tembers B and C wire in straightened and cut lengths will have tensile strengths approximately 15,000 pounds per square inch lower than in coils.

6.4 The wire covered by this specification is not to be used as material for springs covered by MIL-S-23192(Ships) which requires special heat resisting material

MILITARY CUSTODIANS:

Army - MR
Navy - AS
Air Force - 11

Review activities:

Army - MI, EL, MU
Navy - SA
Air Force - 84, 85
DSA - IS

User activities:

Army - ME, GL
Navy - SH

Preparing activity:

Army - MR

Orders 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 copies and other documents referenced herein. Price 15 cents each.

SPECIFICATION ANALYSIS SHEET

Form Approved Budget Bureau No. 119-R004

INSTRUCTIONS

This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity.

SPECIFICATION

QQ-W-390C Wire, Nickel-Chromium-Iron Alloy

ORGANIZATION		CITY AND STATE
CONTRACT NO.	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT $

MATERIAL PROCURED UNDER A

☐ DIRECT GOVERNMENT CONTRACT ☐ SUBCONTRACT

1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?
   A. GIVE PARAGRAPH NUMBER AND WORDING

   B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3. IS THE SPECIFICATION RESTRICTIVE?

   ☐ YES ☐ NO IF "YES", IN WHAT WAY?

4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity.)

SUBMITTED BY (Printed or typed name and activity)	DATE

DD FORM 1426 REPLACES NAVSHIPS FORM 4063, WHICH IS OBSOLETE

FOLD

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY

Commanding Officer
U.S. Army Materials Research Agency
ATTN: AMXMR-QS
Watertown, Massachusetts 02172

FOLD