

MIL-W-6712C  
3 October 1984  
SUPERSEDING  
MIL-W-6712B  
28 March 1967

## MILITARY SPECIFICATION

### WIRE; METALLIZING

This specification is approved for use by the Army Materials and Mechanics Research Center, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

#### 1. SCOPE

1.1 Scope. This specification covers wire for use in depositing metallic coatings by flame-spray techniques (see 6.1).

1.2 Classification. Flame-spray, metal wire shall be furnished in the specified compositions and dimensions (see tables I, II, and III and 6.2).

#### 2. APPLICABLE DOCUMENTS

##### 2.1 Government documents.

2.1.1 Specifications and Standards. Unless otherwise specified (see 6.2), the following specifications and standards of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation, form a part of this specification to the extent specified herein.

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Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Director, US Army Materials and Mechanics Research Center, ATTN: AMXMR-SMS, Watertown, MA 02172 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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/FSC 3439/

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SPECIFICATIONS

MILITARY

MIL-W-10430 - Welding Rods and Electrodes; Preparation for Delivery of

STANDARDS

FEDERAL

FED - STD- 151 - Metals, Test Methods

MILITARY

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

(Copies of specifications and standards required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 Material. Each coil or spool shall contain one continuous length of wire made from a single heat of material.

3.2 Chemical composition. Unless otherwise specified in the contract or purchase order, (see 6.2) the chemical composition of the wire materials shall be as specified in table I or table II (see 6.5).

3.3 Dimensional and weight requirements. Products shall conform to the requirements and tolerances as stated in table III for wire diameter, coil weight, and coil inside diameter.

3.4 Winding. Coils shall be wound left-hand configuration so the wire turns off the horizontal wire-wheel in a counter-clockwise direction. The starting end of each coil shall be tagged to permit ready identification.

3.5 Finish. All wire surfaces shall be essentially clean and free from substances, such as oil or scale, which would adversely affect the density or adhesion of the sprayed coatings. However carbon steel wire shall have a rust-inhibiting coating, such as a thin copper or copper alloy or a suitable oxide.

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3.6 Workmanship. The wire shall be clean and of uniform composition and quality, free of seams, cracks, nicks or burrs. The wire shall be capable of uncoiling readily and be free from sharp bends, kinks, waves, slivers, overlapping, or wedging that would prevent its passage through the spray gun. Spooled filler metal shall be closely wound in layers, but adjacent turns within a layer need not necessarily touch.

## 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by 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 supplies and services conform to prescribed requirements.

4.2 Lot. A lot shall consist of all material of the same composition and size, manufactured by the same process, and submitted for inspection at the same time, for the same purchase order or contract.

4.3 Sampling. Perform all sampling in accordance with MIL-STD-105. For sampling purposes, the unit of product shall be a coil or spool of wire.

4.3.1 For chemical analysis. Take samples at inspection level S-4 and acceptable quality level (AQL) - 1.0 percent defective.

4.3.2 For examination of workmanship, finish, coil weight, and preparation for delivery. Sampling shall be in accordance with inspection level I. The acceptable quality level (AQL) shall be 1.0 percent defective.

4.3.3 For dimensional examination. Sampling shall be in accordance with inspection level II. The acceptable quality level (AQL) shall be 1.0 percent defective.

4.4 Examination and tests.

4.4.1 Chemical analysis. From each coil- or spool-sample taken in accordance with 4.3.1, prepare and analyze one representative test specimen in accordance with method 111 or 112 of FED-STD-151. In case of dispute, use method 111 for referee analysis. The contractor shall furnish a certified analysis of each lot, showing the percentages of the elements specified in table I or table II, as applicable.

4.4.2 Examination of workmanship, finish, coil weight, and preparation for delivery. Examine each coil or spool taken in accordance with 4.3.2 for workmanship (3.6), finish (3.5) coil or spool weight (table III), and for compliance with the requirements for preparation for delivery (section 5).

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4.4.3 Dimensional examination. At least twelve feet of wire from the end of each coil- or spool-sample shall be selected in accordance with 4.3.3. The wire shall be gaged three times at four-foot intervals for conformance to the dimensional requirements of table III.

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Table I. Chemical composition of ferrous wires

Weight percent

Element	Carbon steels			Alloys steels			Stainless steels			
	0.10C	0.25C	0.80C	Comp. A 1	Comp. B 2	Comp. C 3	18-8	Chrome	18-51	17-121
Carbon	0.08-0.15	0.18-0.28	0.75-0.88	0.10 max	1.0 max	1.0 max	0.10 max	0.3-0.4	0.15 max	0.08 max
Chromium	-	-	-	1.0-2.0	1.35-1.65	1.60-2.00	18-20	12-14	17-19	16-18
Copper (max)	-	-	-	-	-	-	-	-	-	-
Manganese	0.25-0.60	0.30-0.60	0.5-0.9	2.5 max	0.25-0.40	1.65-1.95	2.0 max	0.5 max	7.5-10	2.0 max
Nickel	-	-	-	3.75-5.0	-	-	8-12	0.6 max	4-6	10-14
Phosphorus (max)	0.045	0.045	0.045	0.03	0.02	0.01	0.045	0.02	0.06	0.04
Silicon (max)	-	-	-	0.353	0.50	0.353	1.0	0.5	1.0	1.0
Sulfur (max)	0.050	0.050	0.050	0.03	0.02	0.004	0.045	0.02	0.03	0.03
Titanium	-	-	-	-	-	0.11-0.15	-	-	-	-
Aluminum	-	-	-	-	-	-	-	-	-	-
Molybdenum	-	-	-	1.0-3.0	-	0.15-0.25	-	-	-	2-3
Iron	-	-	-	-	BALANCE	-	-	-	-	-

1 Electric arc and gas flame spray wire

2 Electric arc spray wire only

3 Silicon content 0.50 max in electric arc spray wire

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Table II. Chemical composition of nonferrous materials

Percent by weight

Wire composition type	Al	Sb	Cr	Cd	C	Cu	Fe	P	Pb	Mn	Ni	Si	S	Sn	Zn	Ag	Pt
Aluminum	99.0 min																
Rabbit, lead base		12-11				0.75 max	0.08 max		76-80					8-10			
Rabbit, tin base		7-8				3.5-4.5			0.35 max					87.5-89.5			
Rabbit, lead-free		4-5				4-5			None					90-91			
Brass, machinable						64-69	0.06 max		0.15 max								
Naval brass						57-61	1.0 max										
Brone (copper-ni)						89-91	0.05 max		0.05 max					0.5-1.0			
Aluminum bronze	9-10					88.0 min	0.7-1.3										
Phosphor bronze						93.0-96.5											
Copper						99.9 min <sup>1</sup>		0.03-0.35									
Lead																	
Molybdenum									99.5 min								
Nickel	99.0 min					0.25 max	0.40 max										
Nickel-copper						Rem	2.50 max										
Tin																	
Zinc																	
Silicon aluminum	92.0 min					0.30 max	0.80 max										
Cadmium																	
Antimony-lead		5-7							Rem								
Nickel-niobium <sup>2</sup>	11-22																
Nickel-niobium (high Fe)																	
Nickel-niobium (low Fe)																	
Nickel-chromium																	
Nickel-chromium (low Fe)																	
Silver alloy	99.0 min					6.50 max	6-10										
						37-39	Rem										

1. Arsenic, 0.10 percent max

2. Including silver

3. Including cobalt

4. Including 0.15 percent max

5. The wire material shall produce an exothermic reaction during the metallizing operation

6. Including 1.0 percent max

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Table III. Dimensions and tolerances for wire and wire coils.

Metal or alloy	Nominal wire di- ameter, inch <sup>1/</sup>	Wire diameter tolerances inch		Coil weight lb <sup>2/</sup>	Coil T.D
		Plus	Minus		
Aluminum	0.0907	0.0005	0.0025	20-30	17-22
	.1250	.0005	.0025	20-30	17-22
	.1875	.0005	.0040	20-30	17-22
Silicon aluminum	.1250	.0005	.0025	20-30	17-22
	.1875	.0005	.0040	20-30	17-22
Babbitt, lead or tin base	.1250	.0005	.0025	22-28	9-12 <sup>3/</sup>
	.1250	.0005	.0025	22-28	9-12 <sup>3/</sup>
Machinable brass	.0907	.0005	.0025	45-55	17-22
	.1250	.0005	.0025	45-55	17-22
Naval brass	.0907	.0005	.0025	22-28	17-22
	.1250	.0005	.0025	22-28	17-22
	.1875	.0005	.0040	45-55	17-22
Commercial bronze	.1250	.0005	.0025	45-55	17-22
Phosphor bronze	.1250	.0005	.0025	45-55	17-22
Copper	.0907	.0005	.0025	45-55	17-22
	.1250	.0005	.0025	45-55	17-22
	.1875	.0005	.004	45-55	17-22
Lead	.1250	.0005	.0025	9-11 } on 22-28 } spool 45-55 } only	N.A.
Molybdenum	.0907	0.000	0.003	4-7	16-22
	.1250	0.000	0.004	4-7	16-22
Nickel	.0907	.0005	.0025	22-28	17-22
	.1250	.0005	.0025	22-28	17-22
	.1875	.0005	.004	45-55	17-22
Nickel-copper alloy	.0907	.0005	.0025	22-28	17-22
	.1250	.0005	.0025	22-28	17-22
	.1875	.0005	.004	45-55	17-22
Carbon and alloy steels	.0907	.001	.001	45-55	17-22
	.1250	.0005	.0025	45-55	17-22
	.1875	.0005	.004	45-55	17-22
Stainless steels	.0907	.0005	.0025	22-28, 45-55	17-22
	.1250	.0005	.0025	22-28, 45-55	17-22
	.1875	.0005	.004	45-55	17-22
Tin	.1250	.0005	.0025	22-28	9-12 <sup>3/</sup>
Zinc	.1250	.0005	.0025	22-28, 45-55	11-16
	.1875	.0005	.004	45-55	11-16
	.1250	.0005	.0025	22-28	17-22
Aluminum bronze	.1875	.0005	.004	45-55	17-22
Cadmium	.1250	.0005	.0025	22-28	9-12

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Table III - (continued)

Metal or alloy	Nominal wire di- ameter, inch <sup>1/</sup>	Wire diameter tolerances inch		Coil weight lb <sup>2/</sup>	Coil T.D
		Plus	Minus		
Antimony-lead	.1250	.0005	.0025	9-11 } on 22-28 } spool 45-55 } only	N.A.
Nickel-aluminum	.1250	0.000	0.000	5-10 on spool only	N.A.
Nickel-chromium & Nickel-chromium- iron	.1250	<u>4/</u>	<u>4/</u>	<u>5/</u>	<u>6/</u>
Silver alloy <u>7/</u>	0.0907	0.001	0.001	14-21	<u>6/</u>
	.1250	.001	.001	14-21	
Electric arc spray wire: all metals	.0641	.001	.001	22.5-27.5 (plastic spools only)	

1/ 0.0907 inch = B&S Gage (AWG) No. 11. 0.0641 inch = B&S Gage (AWG) No. 14.

2/ 90 percent of wire coils of any size in each shipment shall be within the specified range of coil weights.

3/ Available on spools, also. Coils shall be individually boxed.

4/ Dimensional tolerances shall be specified by agreement between purchaser and seller.

5/ Coil weight shall be specified by agreement between purchaser and seller.

6/ Coil I.D. shall be specified by agreement between purchaser and seller.

7/ Weight may be specified in troy ounces. For both diameters, the coil weight is 200-300 troy ounces.



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## 5. PREPARATION FOR DELIVERY

5.1 Preservation, packaging and packing. Unless otherwise specified, preservation, packaging and packing shall be in accordance with level A, B, or C requirements of MIL-W-10430 as specified (see 6.2).

5.2 Marking. In addition to any special marking required in the contract or purchase order (see 6.2), the interior packages and shipping containers shall be marked in accordance with the requirements of MIL-W-10430.

## 6. NOTES

6.1 Intended use. The flame-spraying materials provided under this specification are intended for employment in manufacturing processes, electrical circuitry, reclamation, corrosion prevention, and decoration.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Type of coating material, size, and tolerance, as applicable (see 3.2, and 3.3).
- (c) Additional requirements for wire useability, if applicable (see 6.4 and 6.5.)
- (d) Total wire weight required.
- (e) If the option on finish is to be used it should be specified (see 3.5).
- (f) Selection of applicable levels of preservation and packaging, and packing (see 5.1).
- (g) Special marking if required (see 5.2).

6.3 Densities. Typical densities of wire materials before spraying are as follows:

<u>Metal or alloy</u>	<u>Density, lb/in<sup>3</sup></u>	<u>Metal or alloy</u>	<u>Density, lb/in<sup>3</sup></u>
Aluminum	0.098	Machinable brass	0.307
Silicon aluminum	0.097	Aluminum bronze	0.270
Babbitt, lead base	0.36	Commercial bronze	0.318
Babbitt, tin base	0.267	Phosphor bronze	0.320
Babbitt, lead-free	0.265	Molybdenum	0.370
Lead	0.410	Nickel	0.321
Tin	0.264	Nickel-copper alloy	0.312
Zinc	0.258	Nickel-aluminum alloy	0.262
Copper	0.323	Nickel-chromium	0.300
Antimony-lead	0.393	Carbon steel	0.283
Naval brass	0.304	13% chrome stainless steel	0.280
Cadmium	0.313	18-8 stainless steel	0.290
		Silver alloy	0.33

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6.4 Suitability of metallizing wire. The metallizing wire should be suitable for use with the particular spraying equipment, procedures, and deposition rates to be used. Consideration should be given to additional requirements relating to the performance characteristics of specific types of wire in the intended spraying procedures.

6.5 Properties of sprayed coatings. The properties of sprayed coatings vary considerably from that of the original material. Most types of materials have specific applications for which they are best suited. Surface preparation and application technique are as critical criteria as material selection in effecting the properties of the sprayed coat.

6.6 Metric Units. When metric units are required, units for inch, feet and pound may be converted to the metric equivalent by multiplying them by the following factors:

English	Multiply by	Equals	Metric SI unit
inch	2.54	=	centimeter (cm)
feet	0.3048	=	meter (m)
ounce	31.10348	=	gram (g)
pound	453.5924	=	gram (g)

Note: Conversion factors can be associated with ASTM E380 entitled "Standard For Metric Practice"

6.7 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodian:

Army - MR  
Navy - SH  
Air Force - 20

Preparing activity:

Army - MR  
Project No. 3439-0554

Review Activities:

Army - ME  
Navy - AS  
Air Force - 84, 99  
DLA - GS

User activities:

Army - AR, MI  
Navy - OS

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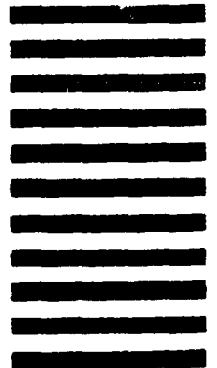
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(See Instructions - Reverse Side)

1. DOCUMENT NUMBER

2. DOCUMENT TITLE

3a. NAME OF SUBMITTING ORGANIZATION

4. TYPE OF ORGANIZATION (Mark one)

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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 Area Code) - Optional

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