

MIL-C-13077A(EL)

27 May 1971

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SUPERSEDING  
MIL-C-13077(SigC)  
14 October 1953

## MILITARY SPECIFICATION

CABLE, SPECIAL PURPOSE, ELECTRICAL  
(CORDAGE CO-212; AND CABLE, SPECIAL  
PURPOSE, ELECTRICAL, WD-32/U)

### 1. SCOPE

1.1 This specification covers two types of two-conductor concentric type low voltage power cables, designated as Cordage CO-212; and Cable, Special Purpose, Electrical, WD-32/U. These cables are insulated and jacketed with low temperature (-55°C) styrene butadiene rubber (SBR), and rated at 150 volts ac. They are designed for service entrance use.

1.1.1 CO-212. This cable consists of two #8 AWG tinned copper conductors, positioned concentrically. The inner conductor is rope-lay stranded. The outer conductor consists of wire strands which are laid adjacent to each other in a single helical layer around the insulated inner conductor.

1.1.2 WD-32/U. This cable consists of two #12 AWG tinned copper conductors, positioned concentrically. The inner conductor is bunch stranded. The outer conductor consists of wire strands which are laid adjacent to each other in a single helical layer around the insulated inner conductor.

### 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.

FSC 6145

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## SPECIFICATIONS

## FEDERAL

QQ-W-343 Wire, Electrical (Uninsulated).

## MILITARY

MIL-C-572 Cords, Yarns and Monofilaments, Organic Synthetic Fiber.  
 MIL-I-631 Insulation, Electrical, Synthetic-Resin Composition, Non-Rigid.  
 MIL-I-3930 Insulating and Jacketing Compounds, Electrical (For Cable, Cord, and Wire).  
 MIL-C-12000 Cable, Cord and Wire, Electric; Packaging and Packing For.  
 MIL-C-45662 Calibration System Requirements.

## STANDARDS

## FEDERAL

FED-STD-228 Federal Test Method Standard; Cable and Wire, Insulated; Method of Testing.

## MILITARY

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

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

## 3. REQUIREMENTS

3.1 General. The cable types and related dimensions and characteristics shall be as specified in table I.

3.2 Construction. Cables CO-212 and WD-32/U are two-conductor cables, with the conductors positioned concentrically. The inner conductor of each cable type shall be stranded, tinned copper wires (size as specified in table I), covered with a close wound separator and insulated with styrene butadiene rubber (SBR). The separator may be omitted if the insulation is free stripping. The outer conductor of each cable type shall be stranded, tinned copper wires (size as specified in table I), with the strands laid adjacent to each other in a single helical layer around the insulated inner conductor. A closely wound serving shall be applied over the outer conductor strands, and an SBR jacket applied over the serving.

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Table I. Cable types, dimensions <sup>1/</sup> and characteristics.

Type designation	CO-212	WD-32/U
No. of conductors	2	2
Size of conductors (AWG)	8	12
Inner conductor -		
No. of strands	49 (7x7)	41
Strand dia.	0.0184 (25 AWG)	0.0126 (28 AWG)
Outer conductor -		
No. of strands	41-43	41-43
Strand dia.	0.0201 (24 AWG)	0.0126 (28 AWG)
Insulation thickness, min.	0.050	0.042
Jacket thickness, min.	0.080	0.040
Outside dia. (+0.010)	0.516	0.350
DC resistance, ohms/1000		
loop feet, max.	1.44	3.56
Length of lay, outer		
conductor strands, max.	3-1/2	2-1/2

<sup>1/</sup> All dimensions are in inches.

3.3 **Materials.** The materials used in the fabrication of cables CO-212 and WD-32/U shall be as hereinafter specified.

3.3.1 **Conductors.** Conductors shall be soft or drawn-and-annealed tinned copper wire conforming to QQ-W-343. The inner conductor shall be type RC, class G (rope-lay stranded) for CO-212; and type B, class J (bunch stranded) for WD-32/U. The outer conductor strands shall be type S. The conductor size for each type cable shall be as specified in table I.

3.3.2 **Separators and servings.** All yarn employed as separators and servings shall be synthetic fiber conforming to MIL-C-572, type P or CTA, or polyester yarn conforming to MIL-I-631, type G, form T<sub>F</sub>. The yarn used shall be clean, dry, and substantially free from all foreign particles, knots, lumps, or any substance that might impair the insulation of the wire.

3.3.3 **Insulation.** A black styrene butadiene rubber (SBR) insulating compound conforming to MIL-I-3930, type IS-L, shall be applied concentrically over the inner conductor or separator, when present to the thickness specified in table I. The insulation shall be well-centered; the minimum thickness of the insulation, measured at any cross-section along the length of the insulated conductor, shall be not less than 70 percent of the maximum thickness at that cross-section.

3.3.4 **Jacket.** A black styrene butadiene rubber (SBR) jacketing compound conforming to MIL-I-3930, type JS-L, shall be applied concentrically over the cable core to the thickness specified in table I. The jacket shall be well-centered over the insulated conductors, and the minimum thickness of the

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jacket, measured at any cross-section along the length of the completed cable, shall be not less than 70 percent of the maximum thickness at that cross-section.

3.3.5 Length of lay. The length of lay of the strands comprising the outer conductor of the cable shall be as specified in table I. The strand coverage over the insulated inner conductor shall be 85  $\pm$  5 percent.

3.3.6 Outside diameter. The outside diameter of the completed cables shall be within the dimensions specified in table I.

### 3.4 Electrical requirements.

3.4.1 Dielectric withstanding voltage. The insulated conductors shall withstand for one minute an applied voltage of 750 volts (rms) when tested as specified in 4.5.2.1, and shall show no evidence of breakdown.

3.4.2 Insulation resistance. Immediately after the insulated conductors have withstood the dielectric withstanding voltage test, the insulation resistance shall be measured as specified in 4.5.2.2. The insulation resistance shall be not less than 500 megohms-1000 feet at 15.6°C minimum.

3.4.3 DC resistance. Each conductor in the finished cable shall be continuous and shall have a dc resistance as indicated in table I, when measured at a temperature of, or corrected to 20°C. If the resistance value is lower or equal to that specified when the measurement is made at a temperature greater than 20°C, no correction factor need be employed. (See 4.5.2.3.)

### 3.5 Physical properties.

3.5.1 Cold bend. Neither the jacket nor the insulation shall show evidence of cracks, flaws, or other damage when tested in accordance with 4.5.3.1 at a temperature of -55°  $\pm$  2°C.

3.6 Workmanship. Cables CO-212 and WD-32/U shall be constructed and finished in a thoroughly workmanlike manner in accordance with accepted high grade production techniques. The cables shall be a uniform and consistent product and shall be free from any defects which will adversely affect the serviceability of the product, such as lumps, kinks, splits, abrasions, scrapes, corroded surfaces, skin impurities and faulty extruded surfaces.

## 4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities

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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 that supplies and services conform to prescribed requirements.

4.1.1 Inspection equipment and facilities. Inspection equipment and facilities shall be established and maintained in accordance with MIL-C-45662.

4.2 Classification of inspections. The examinations and tests of cables are classified as follows:

- (a) Materials inspection. (See 4.3.)
- (b) Quality conformance inspection. (See 4.4.)
  - 1. Inspection of product for delivery. (See 4.4.1.)
  - 2. Inspection of preparation for delivery. (See 4.6.)

4.3 Materials inspection. Materials inspection shall consist of certification supported by verifying data that the materials listed in table II, used in fabricating the designated cable type (see 3.1), are in accordance with the applicable referenced specification or requirements prior to such fabrication.

Table II. Materials inspection.

Material	Requirement paragraph	Applicable specification
Conductors	3.3.1	QQ-W-343
Separators and servings	3.3.2	MIL-C-572
Insulation	3.3.3	MIL-I-3930
Jacket	3.3.4	MIL-I-3930

#### 4.4 Quality conformance inspection.

4.4.1 Inspection of product for delivery. Inspection of product for delivery shall consist of groups A and C inspection.

4.4.1.1 Inspection lot. An inspection lot shall consist of all cables of the same type (see 3.1) produced under essentially the same conditions and submitted for inspection at the one time.

4.4.1.2 Unit of product. Unless otherwise specified in the contract or order, the unit of product for purposes of sampling shall be each continuous length of cable contained on a reel or spool.

4.4.1.3 Sample. The sample shall consist of that number of randomly selected units of product required by the applicable sampling plan for the presented lot.

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4.4.1.4 Selection of sample units. Sample units for inspection shall be taken from each unit of product which forms part of the sample. A sample unit is defined as a length of cable drawn from a unit of product.

4.4.1.5 Test specimen. A test specimen may be the entire sample unit (length of cable) or any portion of the sample unit which is to be tested.

4.4.2 Group A inspection. Group A inspection shall include the examinations and tests of table III, sub-groups I and II. Major and minor defects shall be as defined in MIL-STD-105.

4.4.2.1 Sub-group I. For sub-group I, the acceptable quality level (AQL) shall be as specified in table III and the inspection level shall be level II in accordance with MIL-STD-105. Sub-group I tests may be performed in any order.

4.4.2.2 Sub-group II. For sub-group II, every length of cable shall be subjected to the tests. Sub-group II tests shall be performed in the order shown in table III. The entire lot shall be rejected if more than 3 defects per 1000 feet in a lot are found. All electrical defects are considered major.

Table III. Group A inspection.

Examination or test	Requirement paragraph	Test method paragraph	AQL (Percent defective)	
			Major	Minor
<u>Sub-group I</u>				
<u>Visual and dimensional</u>				
Construction	3.2	4.5.1	1.0% for the sub-group	4.0% for the sub-group
Conductors	3.3.1			
Separators and servings	3.3.2			
Insulation	3.3.3			
Jacket	3.3.4			
Length of lay	3.3.5			
Outside diameter	3.3.6			
Workmanship	3.6			
<u>Sub-group II</u>				
<u>Electrical</u>				
Dielectric withstanding voltage	3.4.1	4.5.2.1	See 4.4.2.2	
Insulation resistance	3.4.2	4.5.2.2		
DC resistance	3.4.3	4.5.2.3		

4.4.2.3 Rejected lots. If an inspection lot is rejected, the supplier may withdraw the lot from further inspection. The supplier may also rework a rejected lot to correct the defects or screen out the defective units and reinspect the lot using tightened inspection. Rejected lots shall be kept separate from new lots and shall not lose their identity.

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4.4.3 Group B inspection. Not applicable.

4.4.4 Group C inspection. This inspection shall consist of the tests specified in table IV and shall be performed periodically as indicated in 4.4.4.1. Samples shall be selected from lots that have passed group A inspection.

4.4.4.1 Sampling for inspection. One sample shall be selected per each 5,000 feet of cable or fraction thereof, not to exceed a total of five samples per order. Samples shall be selected periodically through the life of the contract to assure representative results.

Table IV. Group C inspection.

Examination or test	Requirement paragraph	Test method paragraph
Cold bend	3.5.1	4.5.3.1

4.4.4.2 Noncompliance. No failures shall be allowed in group C inspection. If a sample unit fails to pass group C inspection, the supplier shall take corrective action on the material or process or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same conditions, with essentially the same materials, processes, etc., and which are considered subject to the same failure. Acceptance of the product shall be discontinued until corrective action, acceptable to the government, has been taken. After the corrective action has been taken, group C inspection shall be repeated on additional sample units (all inspections or the inspection that the original sample failed, at the option of the government). Group A inspection may be reinstituted; however, final acceptance shall be withheld until the group C reinspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure and the corrective action taken shall be furnished to the cognizant inspection activity and the qualifying activity.

#### 4.5 Test methods.

4.5.1 Visual and dimensional inspection. The finished cables shall be given a visual and dimensional inspection for conformance with the applicable requirements of 3.2 to 3.3 inclusive, and 3.6. Visual and dimensional defects shall be classified as major or minor in accordance with the definitions of MIL-STD-105.

#### 4.5.2 Electrical tests.

4.5.2.1 Dielectric withstanding voltage (see 3.4.1). The finished cables shall be tested as specified in FED-STD-228, Method 6111, except for the following:

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- (a) The test shall be performed on finished cables only.
- (b) The immersion period shall be not less than 9 hours.
- (c) One terminal shall be each conductor in turn, and the other terminal shall be the remaining conductor in electrical contact with the water.

4.5.2.2 Insulation resistance (see 3.4.2). The insulation resistance of the finished cables shall be determined as specified in FED-STD-228, Method 6031, except for the following:

- (a) The test shall be performed on finished cables only.
- (b) The immersion period shall be not less than 9 hours.
- (c) The test voltage shall be not less than 100 volts nor more than 500 volts dc.
- (d) The polarity of the conductor shall be maintained negative with respect to the water. One terminal shall be each conductor in turn, and the other terminal shall be the remaining conductor in electrical contact with the water.
- (e) If the measurement is made at a temperature lower than 15.6°C, the supplier shall correct the measured value of insulation resistance to the resistance at 15.6°C.

4.5.2.3 DC resistance. The dc resistance of each conductor in a finished cable shall be determined in accordance with FED-STD-228, method 6021, and shall meet the requirements of 3.4.3.

#### 4.5.3 Physical tests.

##### 4.5.3.1 Cold bend (see 3.5.1).

4.5.3.1.1 Specimens. One specimen shall be cut from each sample unit. Each specimen so cut shall be divided into two parts, one for checking the cable as a whole, and the other for checking the insulation apart from the cable.

4.5.3.1.2 The specimens selected for checking cable as a whole shall be attached to a mandrel of the size specified in table V. The specimens selected for checking the insulation apart from the cable shall have the jacket and outer conductor removed, and the insulated conductor therefrom shall be attached to a mandrel of the size specified in table V. The specimens shall be suspended vertically, with their lower ends weighted sufficiently to keep the specimens taut and to permit bending them without handling. The mandrels and specimens shall be placed for at least 20 hours in a cold chamber at a temperature of  $-55^{\circ} \pm 2^{\circ}\text{C}$  and, while at this temperature, the specimens bent for five close turns around the mandrels at the rate of  $15 \pm 3$  turns per minute. After the test has been completed, the jacket and insulation of each specimen shall be examined through a magnifying glass of at least 3-diameter magnification, and shall comply with the requirements of 3.5.1.



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Table V. Mandrel sizes.

Cable type	Mandrel diameter for whole cable	Mandrel diameter for insulated conductor
CO-212	1.31	0.250
WD-32/U	1.05	0.125

4.6 Inspection of preparation for delivery. Sample packages or packs and the inspection of the preservation, packaging, packing and marking for shipment and storage shall be in accordance with the requirements of section 5.

## 5. PREPARATION FOR DELIVERY

5.1 Preservation, packaging, packing, and marking shall be in accordance with MIL-C-12000. (See 6.2(d).)

## 6. NOTES

6.1 Intended use. The cables covered by this specification are intended for service entrance use, rated up to 150 volts ac. These cables can also be used in low voltage battery systems, rated up to 32 volts dc.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number and date of this specification.
- (b) Type designation of cable required. (See 3.1.)
- (c) Length of finished cables to be delivered.
- (d) Level of packaging and level of packing required. (See 5.1.)

6.2.1 Indirect shipments. The preservation, packaging, packing and marking specified in section 5 apply only to direct purchases by or direct shipments to the government, and are not intended to apply to contracts or orders between the supplier and prime contractor.

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SPECIFICATION ANALYSIS SHEET		Form Approved Budget Bureau No. 22-R255
<p><b>INSTRUCTIONS:</b> 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. Comments and suggestions submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or serve to amend contractual requirements.</p>		
<p><b>SPECIFICATION</b> CABLE, SPECIAL PURPOSE, ELECTRICAL (CORDAGE CO-212; AND CABLE, SPECIAL PURPOSE, ELECTRICAL, WD-32/U)</p>		
<p><b>ORGANIZATION</b></p>		
<p><b>CITY AND STATE</b></p>		<p><b>CONTRACT NUMBER</b></p>
<p><b>MATERIAL PROCURED UNDER A</b></p> <p><input type="checkbox"/> DIRECT GOVERNMENT CONTRACT      <input type="checkbox"/> SUBCONTRACT</p>		
<p><b>1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?</b></p> <p><b>A. GIVE PARAGRAPH NUMBER AND WORDING.</b></p>		
<p><b>B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES</b></p>		
<p><b>2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID</b></p>		
<p><b>3. IS THE SPECIFICATION RESTRICTIVE?</b></p> <p><input type="checkbox"/> YES      <input type="checkbox"/> NO (If "yes", in what way?)</p>		
<p><b>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)</b></p>		
<p><b>SUBMITTED BY (Printed or typed name and activity - Optional)</b></p>		<p><b>DATE</b></p>

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