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MILITARY SPECIFICATION

CABLE, TELEPHONE, ELECTRICAL (INFANTRY FIELD WIRE, TWISTED PAIR, WIRE WD-1/TT AND WD-14/TT)

This specification is mandatory for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 **Scope.** This specification covers stranded conductor, polyethylene-insulated, nylon-jacketed-or-braided, electrical telephone cable (twisted pair infantry field wire), hereinafter called "field wire".

1.2 **Classification.** This specification covers the following types of field wire, as specified (see 6.2):

Type WD-1/TT — Extruded jacket.

Type WD-14/TT — Braided outer covering.

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.

SPECIFICATIONS

FEDERAL

J-C-98 — Cable and Wire, Insulated; Methods of Sampling and Testing.

L-P-39) — Plastic, Molding Material, Polyethylene, Low and Medium Density.

QQ-S-561 — Solder Silver.

QQ-S-781 — Steel Strapping, Flat.

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

QQ-W-461 — Wire, Steel, (Carbon), Bare and Coated.

PPP-B-636 — Boxes, Fiberboard.

PPP-B-640 — Box, Fiberboard, Corrugated, Triple-Wall.

PPP-F-320 — Fiberboard, Corrugated and Solid, Sheet Rock (Container Grade) and Cut Shapes.

FSC 6145

PPP–S–760 — Strapping, Nonmetallic, (and Connectors).

PPP–T–76 — Tape, Pressure-Sensitive Adhesive Paper, Water Resistant, For Carbon Sealing).

PPP–T–97 — Tape, Pressure-Sensitive Adhesive, Filament Reinforced.

MILITARY

MIL–P–116 — Preservation, Methods of.

MIL–C–572 — Cords, Yarns and Monofilaments — Organic Synthetic Fiber.

MIL–S–3140 — Spool DR–8–A.

MIL–R–3241 — Reels, Cable (Reels DR–5, DR–7, DR–15B, RL–159/U).

MIL–C–10869 — Cable, Telephone, Field, For Rapid Payout (MX–306A/G).

MIL–F–14256 — Flux, Soldering, Liquid (Rosin Base).

MIL–B–43291 — Boxes Fiberboard, Corrugated, Double-Wall, Weather Resistant.

STANDARDS

MILITARY

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

MIL–STD–109 — Inspection Terms and Definitions.

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

MIL–STD–147 — Palletized and Unit Container Loads.

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

3. REQUIREMENTS

3.1 Materials (See 4.3.3).

3.1.1 *Copper strands.* Copper strands shall be tinned, soft or annealed copper wire in accordance with Specification QQ–W–343. Each strand shall be 0.011 inch ±5 percent in diameter.

3.1.2 *Steel strands.* Steel strands shall be round steel wire 0.011 inch ±5 percent in diameter. The wire shall be coated with a smooth, continuous, uniform, and adherent zinc coating of commercially pure zinc (galvanized). The weight of zinc shall be not less than 25 grams of zinc per kilogram of coated strand (see 4.4.2).

3.1.3 *Insulating compound.* The insulating compound shall be type III, grade 6a, in accordance with Specification L–P–390.

3.1.4 *Jacketing compound.* The jacketing compound for type WD-1/TT field wire shall be a heat-and-light stabilized non-oxidizing nylon compound such as Zytel 3606 NC-10 manufactured by E. I. du Pont de Nemours and Company, Inc., or equal.

3.1.5 *Textiles.*

3.1.5.1 *Braid.* The braid yarn for type WD-14/TT field wire shall be a bright, high-tenacity yarn, type P, form Y, in accordance with Specification MIL-C-572 (see 4.3.3). It shall have a total of 260 denier and 17 filaments per end (see 4.4.1).

3.1.5.1.1 *Color.* The braid yarn shall be dyed, before braiding, with an olive-drab dye composed of the three dyestuffs or equal described below. The olive drab may be a composite of 2.5 percent (A), 0.2 percent (B), and 0.1 percent (C). The yarn shall be rinsed after dyeing.

Prototype No.[1]		Source	Description at source
(A)	242	E. I. du Pont de Nemours and Co., Inc, Wilmington, Del.	Acetamine Yellow CG.
(B)	236	Calco Chemical Division of American Cyanamid Co, Bound Brook N.J.	Acetate Red GG Ex. Conc.
		Interchemical Corp, Fair Lawn N. J.	Interchem Acetate Red RN.
		General Dyestuff Corp, 435 Hudson Street, New York City N. Y.	Celliton Fast Red GGA Ex. Conc. CF.
(C)	227	General Dyestuff Corp, 435 Hudson Street, New York City N. Y.	Celliton Fast Blue AF.

[1] As per the Technical Manual and Year Book of the American Association of Textile Chemists and Colorists.

3.2 Construction (see 4.4.1).

3.2.1 *Conductors.* Each conductor shall be composed of four coated copper strands and three coated steel strands (see 3.1.1 and 3.1.2).

3.2.1.1 *Stranding.* The maximum length of lay of the strand conductor shall be 1 inch, and the direction of lay shall be left hand. The outside strands shall lie evenly and smoothly around the central strand without crowding. An antioxidant, such as Liquid Antox manufactured by E. I. du Pont de Nemours and Company, Inc. Wilmington, Del., or an equally satisfactory light oil, may be used as a lubricant in the stranding operation, in which case there shall be no excess oil on the finished stranded conductor.

3.2.2 *Insulation.* Each conductor shall be insulated with a tight, well-centered compound, as specified in 3.1.3, with a minimum wall thickness of 14.0 mils, when measured as specified in 4.4.1. The insulation shall strip cleanly and readily with the use of pliers.

3.2.3 *Outer covering.*

3.2.3.1 *Jacket.* Each insulated conductor of type WD-1/TT field wire shall be covered with a jacket (see 3.1.4) applied by the continuous-extrusion process, and providing a smooth, continuous, tight-fitting covering containing no flaws or breaks. The average wall thickness of the jacket shall be not less than 6.0 mils. At no point shall the wall thickness of the jacket be less than 4.0 mils.

3.2.3.2 *Braid.* Each insulated conductor of type WD-14/TT field wire shall be covered with a smooth, closely woven, tight-fitting, dyed nylon-yarn braid (see 3.1.5.1 and 3.1.5.1.1) composed of 6 carriers, single ply, two ends, forming a minimum of 24 picks per inch. An adhesive, such as R and A No. 411, manufactured by the Rubber and Asbestos Corporation, Bloomfield, N. J. or equal, shall be applied over the insulation as the wire passes through the braider, to preclude fraying of the braid when cut. A minimum amount of adhesive shall be applied so that no drying period is necessary and so that the turns of wire on the reel, spool, or dispenser, as applicable, do not adhere to one another.

3.2.3.3 *Overall diameter.* The average overall diameter of the finished single conductor shall not exceed 0.088 inch, when measured as specified in 4.4.1.

3.2.4 *Finished field wire.* Two finished single conductors shall be twisted closely together with a right-hand lay which shall not exceed 6 inches when averaged over a 10 foot length, to form a twisted pair. Uniform tension shall be maintained on both conductors during the twisting operation to prevent looping or bunching of the conductor.

3.3 Physical condition.

3.3.1 *Insulated conductor.*

3.3.1.1 *Tubing.* The insulated conductor, shall show no visible strains or cracking of the insulation, when tested as specified in 4.4.3.

3.3.1.2 *Deformation.* The decrease in diameter of the insulated conductor, when tested as specified in 4.4.4, shall not exceed 15 percent.

3.3.1.3 *Cold bend.* The insulated conductor, shall not crack, when tested as specified in 4.4.5.

3.3.2 *Jacketed conductor.*

3.3.2.1 *Tubing.* The jacketed conductor shall show no visible strains or cracks in the jacket, when tested as specified in 4.4.3.

3.3.2.2 *Cold bend.* The jacket of the conductor shall not crack either before or after aging, when tested as specified in 4.4.5 and 4.4.5.1.

3.3.2.3 *Cutting.* The average cutting load shall be not less than 55 pounds, and the cutting load for any one specimen shall be not less than 45 pounds (see 4.4.6).

3.3.2.4 *Breaking load.* The breaking load shall be not less than 85 pounds (see 4.4.7).

3.4 Performance. Finished field wire, wound on its final shipping reel, spool, or dispenser, as applicable, (see 6.2) shall meet the following requirements:

3.4.1 *DC resistance.* The direct-current (dc) resistance of field wire, at or corrected to 20°C, shall not exceed 46 ohms per 1,000 loop-feet (see 4.4.8).

3.4.2 *Dielectric strength.* Field wire shall withstand a potential of 1,000 volts root-mean-square (see 4.4.9).

3.4.3 *Insulation resistance.* Insulation resistance of field wire, at or corrected to 15.6° C, shall be not less than 10,000 meg-

ohms — 1,000 single conductor feet (see 4.4.10).

3.5 **Flatness.** Field wire shall lie flat and straight when uncoiled from a reel or spool or dispenser onto a level surface (see 4.4.11).

3.6 **Workmanship.** Field wire shall be manufactured and processed in a careful and workmanlike manner, in accordance with sound practice (see 4.4.12).

3.6.1 *Splices or repairs.*

3.6.1.1 *Individual-strand joints.* When joints are required in the individual strands, they shall be of the butt type. Joints in steel strands shall be welded or brazed. Joints in copper strands shall be brazed with a type Ag solder, in accordance with Specification QQ-S-561. A brazed or welded joint shall be not less than the same diameter as the original strand, nor more than 0.013 inch maximum. Dressing of joints or removal of burrs is acceptable to meet this requirement. Welded joints shall be annealed to remove any brittleness. Joints in steel strands shall have an average tensile strength of not less than 35 percent of the average tensile strength of the strands adjacent to the joints, when tested on not less than 12 samples as specified in 4.4.7 (see 4.4.12.1).

3.6.1.2 *Seven-strand splices.* Splices may be made in the uninsulated conductor by joining the individual strands as described in 3.6.1.1. Joints in the steel strands shall be spaced at least 3 feet apart. Strands shall not be kinked and the smoothness of lay shall not be altered. When a splice has been made in this manner, it shall be possible to move a die having a diameter of 0.038 inch and a length of 1 inch along the length of the spliced conductor without any binding or necessity for the exertion of a definite pressure (see 4.4.12.2).

3.6.1.3 *Conductor splices.*

3.6.1.3.1 *Number and location (see 4.4.1).* Not more than 12 percent of the lengths if ordered in 1-mile or 1 1/3-mile lengths, nor more than 6 percent if ordered in ¼-mile or ½-mile lengths, nor more than 18 percent if ordered in 2½-mile lengths, shall contain conductor splices. Only one splice per conductor per length shall be permitted, and splices in the twisted pair shall be staggered at least 3 feet (see 6.2).

3.6.1.3.2 *Procedure.* The strands of the two conductor ends shall be thoroughly cleaned with alcohol or other solvent. The four copper strands shall be separated from the three steel strands and cut ½ inch shorter than the steel strands. The copper strands of each end shall be butted, allowing the steel strands to overlap. Around this assembly, a tinned copper strip shall be twisted helically, leaving a space of approximately 1/32 inch between turns. The tinned copper strip shall be approximately 0.005-inch thick, 1/16-inch wide, and of such length that it will extend one turn beyond the strand ends. The ends of the strip shall be pressed close to the conductor to eliminate sharp edges. The joint shall then be soldered, using a rosin-base liquid soldering flux in accordance with Specification MIL-F-14256 Excess flux shall be removed with a solvent after soldering. The splice shall have a tensile strength of at least 90 percent of that of an unspliced adjacent section, when tested as specified in 4.4.7 (see 4.4.12.3)

3.6.1.4 *Insulation repairs.* Insulation repairs shall be of the heat-molded type, and shall be made with the polyethylene compound specified in 3.1.3 (see 4.3.3). The repair shall be cylindrical and smooth, with no flash of excess patching compound, and the minimum wall thickness shall be 14.0 mils, when measured as specified in 4.4.1. The diameter over insulation repairs, when there is no splice in the underlying conductor and when the outer covering has not yet been applied, shall be such as to permit the extrusion of a continuous nylon jacket over

the repair for type WD-1/TT field wire, or the application of a continuous nylon braid for type WD-14/TT field wire. When the outer covering has been applied, the outer covering shall be cut back to permit the molding operation. The original insulation shall be removed from the faulty section. The cut ends of the polyethylene may be taper-cut to a pencilled point. All insulation repairs, other than those made over a splice, shall undergo the cold-bend test specified in 4.4.5. There shall be no visible cracking of the patch, nor of the joints between the patch and the original insulation. When the outer covering has previously been applied, the repaired section shall then be covered with a nylon braid as specified in 3.2.3.2 (see 4.4.12.4).

3.6.1.5 *Outer-covering repairs.* When repairs are required which involve the removal of nylon covering, the repairs shall be made, using a split braider, by braiding on a section of a smooth, closely woven, tight-fitting, dyed nylon-yarn braid in accordance with 3.2.3.2. The rebraiding shall extend over the cut ends of the original nylon. Prior to braiding, the insulation shall be dipped into an adhesive such as vinyl solution A-35, manufactured by the Bakelite Division of Union Carbide and Carbon Corporation, New York, N. Y., or equal, to insure a tight bond between the insulation and the braid repair. Care shall be taken to wipe off excess adhesive immediately. The ends of the rebraiding shall be secured to prevent raveling, by serving the ends and by the application of an adhesive, as described above, over the served ends, with care taken to wipe the repair thoroughly. The overall diameter over a repair in the braid alone, or over a braid and insulation repair, shall not exceed 0.125 inch. The overall diameter over a splice, repaired insulation, and braid shall not exceed 0.145 inch. The length of a braid repair shall not exceed 6 inches (see 4.4.12.5).

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for 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 supplies and services conform to prescribed requirements.

4.2 Test equipment and inspection facilities. Test equipment and inspection facilities shall be of sufficient accuracy, quality, and quantity to permit performance of the required acceptance inspection. The manufacturer shall establish adequate calibration of test equipment to the satisfaction of the Government.

4.3 Acceptance inspection. Acceptance inspection shall consist of basic-materials inspection, groups A, B, and C, and preparation-for-delivery inspection.

4.3.1 *Definitions.* Definitions for inspection terms used herein shall be as defined in MIL-STD-109, and as modified herein.

4.3.1.1 *Unit of product.* The unit of product shall be a continuous length of bare, insulated, or finished conductor, or finished field wire, wound on a reel, spool, or dispenser, as applicable (see 6.2).

4.3.1.2 *Sample unit.* A sample unit shall consist of a unit of product except for the inspection of conductor splices (see 4.3.5.2).

4.3.1.3 *Specimen.* A specimen shall consist of a length of field wire taken from each sample unit as specified in 4.4.

4.3.2 *Resubmitted lots.* If an inspection lot is rejected, the manufacturer may rework the lot or screen out defectives and resubmit it for acceptance inspection. Resub-

mitted lots shall be kept separate from new lots. The resubmitted lot shall be inspected, using tightened inspection.

4.3.3 *Basic-materials inspection.* Basic-materials inspection shall consist of verification that the materials used in constructing field wire, listed in table I, are in accordance with the applicable requirements or referenced subsidiaries to this specification.

TABLE I. *Basic-materials inspection*

Material	Requirement paragraph	Applicable specification or paragraph
Copper strands	3.3.1	QQ-W-343
Steel strands (coating)	3.1.2	QQ-W-461 and 4.4.2
Insulating compound	3.1.3	L-P-390
Jacketing compound	3.1.4	
Textiles:		
Braid	3.1.5.1	MIL-T-5372
Color	3.1.5.1.1	
Insulation repairs	3.6.1.4	L-P-390

4.3.4 *Group A inspection.* Group A inspection shall consist of the examinations and tests specified in table II. Statistical sampling and inspection shall be in accordance with MIL-STD-105. The acceptable quality level (AQL) shall be as specified in table II.

TABLE II. *Group A inspection*

Inspection	Requirement paragraph	Inspection method paragraph	AQL (percent defective)
Visual and dimensional examination:	(See table VII)	4.4.1	1.0 for the group
Braid (yarn construction)	3.1.5.1	ditto	
Color of braid	3.1.5.1.1	ditto	
Conductors [1]	3.2.1	ditto	
Stranding [1]	3.2.1.1	ditto	
Insulation	3.2.2	ditto	
Jacket	3.2.3.1	ditto	
Braid	3.2.3.2	ditto	
Overall diameter	3.2.3.3	ditto	
Workmanship	3.6 and 3.6.1.3.2	ditto	

TABLE II. *Group A inspection*—Continued

Inspection	Requirement paragraph	Inspection method paragraph	AQL (percent defective)
Number and location of conductor splices.[1]	3.6.1.3.1	——do——	1.0
Performance:			
DC resistance	3.4.1	4.4.8	1.0 for the group
Dielectric strength	3.4.2	4.4.9	
Insulation resistance	3.4.3	4.4.10	

[1] Made on lots of conductors before insulating

4.3.4.1 *Inspection lot.* An inspection lot shall consist of all units of product of one type produced under substantially the same conditions and offered for inspection at one time.

4.3.5 *Group B inspection.*

4.3.5.1 *Subgroup 1.* Group B, subgroup 1 inspection shall consist of the examinations specified in table III.

TABLE III. *Group B, subgroup 1 inspection*

Inspection	Requirement paragraph	Inspection method paragraph
Finished field wire	3.2.4	4.4.1
Flatness	3.5	4.4.11
Footage	——	4.4.13

4.3.5.1.1 *Inspection lot.* An inspection lot shall consist of all the finished field wire of one type produced under substantially the same conditions and offered for inspection at one time.

4.3.5.1.2 *Sampling procedure.* The sampling procedure shall be in accordance with the small-sample inspection of MIL-STD-105, using special inspection levels. The AQL shall be 4.0 percent defective and the inspection level shall be S-4 for normal, tightened, and reduced inspection.

4.3.5.2 *Subgroup 2.* Group B, subgroup 2 inspection shall consist of test of conductor splices (see 3.6.1.3.2), and shall be made on samples from lots of splices in finished twisted pairs.

4.3.5.2.1 *Inspection lot.* An inspection lot shall consist of from 50 to 150 splices. Lots shall contain splices made only by operators qualified in accordance with 4.4.12.3.

4.3.5.2.2 *Sampling procedure.* The number of splices specified in table IV for the applicable inspection plan shall be selected from the lot, separated into groups of 5 each, and tested as specified in 4.4.7, with the results for each group being kept separately.

4.3.5.2.2.1 *Acceptance criteria.* The sample arithmetic mean and sample average range shall be determined, using the computation procedures specified in 4.3.5.2.2.4.

The lot shall be considered acceptable if the lower specification limit (L) for percent tensile strength specified in 3.6.1.3.2, subtracted from the sample arithmetic mean

(X) percent tensile strength, divided by the sample average range ($\bar{R}$), is equal to or greater than the applicable acceptance constant (K) specified in table IV.

$$\frac{\bar{X} - L}{\bar{R}} \geq K$$

Lots which fail to meet this criterion shall be rejected. A lot shall also be rejected if the sample contains any individual splices with less than 76 pounds tensile strength. Rejected lots shall be respliced and resubmitted as new lots for acceptance inspection.

TABLE IV. *Acceptance criteria for inspection of conductor splices — AQL = 1 percent*

Inspection plan	Sample size (n)	Individual group range (R)	Sample average range ($\bar{R}$)	Acceptance constant (K)
Normal	10	The difference between the highest and lowest observation in an individual group.	$\bar{R} = \frac{\Sigma R \text{ for each group}}{2}$	0.708
Reduced	5	$R = X_h - X_l$	$\bar{R} = R$ (only one group involved)	0.617

4.3.5.2.2.2 *Normal inspection.* Normal inspection shall be instituted after operators have been qualified as specified in 4.4.12.3. Normal inspection shall be continued until the criterion for reduced inspection is met (see 4.3.5.2.2.3), or until two lots in succession are rejected, whereupon operator qualification shall again be required.

4.3.5.2.2.3 *Reduced inspection.* Reduced inspection may be instituted after ten consecutive lots have been accepted under the normal inspection plan. Once instituted, reduced inspection shall continue until a lot is rejected, whereupon normal inspection shall be resumed.

4.3.5.2.2.4 *Computation.*

(a) Record the breaking load for each splice, maintaining separate records for each group, when applicable.

(b) Record the breaking load of an unspliced section adjacent to each splice being tested.

(c) Compute and record the percent tensile strength (X) for each splice, using the data of (a) and (b) above.

(d) Determine the arithmetic mean ($\bar{X}$) percent tensile strength of the splices, that is, $\bar{X} =$

$$\frac{\Sigma X}{\text{number of splices}}$$

(e) For each group, determine the range (R), that is, the difference in percent tensile strength between the highest and the lowest observation in the group.

(f) Determine the sample average range ($\bar{R}$), that is, the summation of the individual group ranges (ΣR) divided by the number of individual groups, that is,

$$\bar{R} = \frac{\Sigma R}{2}$$

4.3.5.3 *Subgroup 3.* Group B, subgroup 3 inspection shall consist of the examinations and tests specified in table V.

4.3.5.3.1 *Inspection lot.* An inspection lot shall consist of the amount of finished single conductor produced in one full working day, except where the amount produced therein is more than 600 miles. In those cases where the amount exceeds 600 miles, a lot shall be defined as 600 miles. By agreement between the manufacturer and the Government, a day's production may be broken down into smaller lots such as the production of one shift or the daily production of a group of machines, provided each such lot retains its identity and can be segregated any time prior to shipping.

TABLE V. *Group B, subgroup 3 inspection*

Inspection	Requirement paragraph	Inspection method paragraph
Construction:		4.4.1
Insulation	3.2.2	do
Jacket	3.2.3.1	do
Braid	3.2.3.2	do
Overall diameter	3.2.3.3	
Physical condition:		
Insulated conductor:		
Tubing	3.3.1.1	4.4.3
Deformation	3.3.1.2	4.4.4
Cold bend	3.3.1.3	4.4.5
Jacketed conductor:		
Tubing	3.3.2.1	4.4.3
Cold bend	3.3.2.2	4.4.5
Cutting	3.3.2.3	4.4.6
Breaking load	3.3.2.4	4.4.7

4.3.5.3.2 *Sampling procedure.* Six sample units shall be selected from the lot, and one specimen inspected from each sample unit. If any specimen fails to meet the specified examinations or tests, two additional adjacent specimens shall be taken from the sample unit which failed and inspected to determine whether the failure was caused by damage in the preparation of the specimen. Failure of either of the two additional specimens shall be cause for rejection of the wire represented by the sample.

4.3.5.4 *Disposition of sample units.* Sample units, specimens from which have passed group B inspection, shall be delivered on the contract or order, if the lot is accepted.

4.3.6 *Group C inspection.*

4.3.6.1 *Subgroup 1.* Group C, subgroup 1 inspection shall consist of cold bend of jacketed conductor after aging (see 4.4.5.1).

4.3.6.1.1 *Sampling procedure.* Six sample units shall be selected from each 2,500 miles of finished single jacketed conductor, and one specimen shall be cut from each sample

unit. If any specimen fails to meet the specified inspection, two additional adjacent specimens shall be taken from the sample unit which failed and inspected to determine whether the failure was caused by damage in the preparation of the specimen. Failure of either of the two additional specimens shall be cause for rejection of the sample unit. A single defective sample unit shall be cause for rejection of the lot.

4.3.6.2 *Subgroup 2.* Group C, subgroup 2 inspection shall consist of the determination, by operator qualification and process surveillance, that the joints, splices, and repairs, listed in table VI, are in accordance with the requirements of this specification.

TABLE VI. *Group C, subgroup 2 inspection.*

Inspection	Requirement paragraph	Inspection method paragraph
Workmanship:	3.6	4.4.12
Individual-strand joints	3.6.1.1	4.4.12.1
Seven-strand splices	3.6.1.2	4.4.12.2
Insulation repairs	3.6.1.4	4.4.12.4
Outer-covering repairs	3.6.1.5	4.4.12.5

4.3.6.2.1 *Inspection.* Inspection shall be performed on all the joints, splices, or repairs produced by the same operator.

4.3.6.2.2 *Procedure.* The operator shall be qualified by the Government as specified in 4.4.12.1 to 4.4.12.5, inclusive, prior to production. If joints, splices, or repairs during production are not in accordance with the applicable requirements, the operator shall make no further joints, splices, or repairs until he is requalified.

4.3.6.3 *Noncompliance.* If a sample fails to pass group C inspection, the manufacturer shall take corrective action on the process and on all units of product which can be corrected and which were manufactured with the same conditions, materials, processes, etc. and are considered subject to the same test failure. Acceptance inspection shall be discontinued until corrective action has been taken. After the corrective action, sample units shall be subjected to the necessary group C inspection (all inspections, or the failed inspections, at the option of the Government), Groups A and B inspection may be reinstituted; however, final acceptance shall be withheld until the group C inspection has shown that the corrective action was successful.

4.3.7 *Preparation-for-delivery inspection.*

4.3.7.1 *Preservation and packaging.* Inspection of preservation and packaging shall be as specified in MIL-P-116. Classification of defects shall be as listed below:

Major defects:

(a) Quantity per unit package not in accordance with the contract or order.

(b) Incorrect packaging method applied.

(c) Use of improper or defective material.

(d) Cushioning or padding not applied or inadequate for the protection of the barrier material from projections, sharp edges, or other similar features of the item.

(e) Cushioning inadequate or not applied when required for the physical and/or mechanical protection of the item.

(f) Stock number omitted, incorrect, or illegible.

(g) Nomenclature incorrect or missing

(h) Quantity of items in package not indicated.

Minor defects.

(a) Item not properly blocked or braced within the unit package to prevent movement.

(b) Packaging material damaged.

(c) Any item of marking information other than (f), (g), and (h) listed under major defects missing or illegible.

Notes:

1. Failure of a package to meet any of the group B tests specified in MIL-P-116 shall be considered a major defect.
2. When a group C rough-handling test is performed on a completed pack as prepared for shipment, visual examination, as defined in section 4 of MIL-P-116, shall be classified in accordance with the classification of defects outlined herein. Any defect found as a result of the performance of the required tests (see 4.3.2.3) after the rough-handling tests, as defined in section 4 of MIL-P-116, shall be considered a major defect.

4.3.7.2 *Packing and marking of exterior containers.* Packing and marking of exterior containers shall be subjected to visual examination for the defects listed in 4.3.7.1 and below, and to determine conformance with the approved process sheet furnished by the manufacturer (see 6.2).

CLASSIFICATION OF DEFECTS FOR PACKING AND MARKING

Major defects

(a) Box closure not in accordance with specification.

(b) Type, grade, class and style of the shipping container do not meet the minimum requirements.

(c) Strapping when required is omitted, inadequate, or incorrectly applied.

(d) Items not adequately blocked, braced, or cushioned within the shipping container to prevent movement and/or damage.

(e) Gross weight in excess of contract limitation.

(f) Use of improper or defective material.

(g) Shipping documents or packing list omitted (when required).

(h) Stock number (when required) omitted, incorrect, or illegible.

(i) Nomenclature (when required) omitted or illegible.

(j) Quantity incorrect or missing.

(k) Destination marking incorrect or illegible.

(l) Service designation (color marking) missing.

(m) Special marking and labeling requirements cited in the contract, such as MAP labels, shipment digit markings, etc, not applied.

(n) Overseas-code marking — illegible, incomplete, or missing.

Minor defects

(a) Unsealed carton.

(b) Defective taping or sealing of carton.

(c) Any other box defect which may be considered minor by definition of MIL–STD–105.

(d) Any item of required marking information, other than (h) through (n) listed under major defects, missing or illegible.

4.3.7.2.1 *Inspection lot.* A lot for visual inspection of the pack shall be all completed packs which are identical and are submitted for inspection at one time.

4.3.7.2.2 *Sampling procedure.* The sampling procedure shall be in accordance with the special inspection level S–4 of MIL–STD–105. The AQL shall be 4.0 (percent defective) for major defects and 10.0 (percent defective) for minor defects.

4.3.7.2.3 *Rough handling.* When rough handling is specified (see 6.2), the following tests shall be conducted to determine freedom from malfunction caused by rough handling:

(a) Ic resistance (see 4.4.8).

(b) Dielectric strength (see 4.4.9).

(c) Insulation resistance (see 4.4.10).

4.4 Methods of examination and test.

4.4.1 *Visual and dimensional examination.* Field wire shall be examined to verify that the characteristics listed in table VII are in accordance with the applicable requirements. The examinations and measurements specified in table VII, with the exception of preparation for delivery, shall be made on specimens not less than 2 feet in length and cut no closer than 5 feet from the end of the sample unit. The examinations and measurements shall be made as specified in table VII.

TABLE VII. *Visual and dimensional examination*

Examination	Requirement paragraph	Test method
Braid:		
Yarn construction	3.1.5.1	
Color	3.1.5.1.1	
Construction:		
Conductors	3.2.1	
Stranding	3.2.1.1	
Insulation	3.2.2	[1] Method 1018, Specifications J–C–98
Jacket	3.2.3.1	[1] Method 1018, Specification J–C–98
Braid	3.2.3.2	

TABLE VII. *Visual and dimensional examination—Continued*

Examination	Requirement paragraph	Test method
Overall diameter [1]	3.2.3.3	[1] Method 1011, Specification J–C–98
Finished field wire	3.2.4	
Workmanship	3.6 and 3.6.1.3.2	
Number and location of conductor splices	3.6.1.3.1	
Preparation for delivery	Section 5	Specification MIL–P–116

[1] An average diameter shall be considered to be the average of the readings obtained by making two measurements at right angles to each other at three different points along the length of a 12-inch specimen.

[2] The average wall thickness shall be considered equal to one-half the difference between the average diameter of the finished conductor and the insulated conductor for the same specimen.

4.4.2 *Coating (see 3.1.2).* The weight, uniformity, and adherence of zinc coating on steel strands shall be determined as specified in the tests for weight of tin or zinc coating, uniformity of zinc coating (Preece method), and adherence of zinc coating for classes 1, 2 and 3 wire of Specification QQ–W–461, with the following modifications of the Preece method:

(a) All specimens shall withstand at least one immersion.

(b) Uniformity shall be determined on three specimens from each sample unit of strand, and the time of immersion shall be 15 $\pm \frac{1}{0}$ seconds. The coating shall be considered uniform if all three specimens withstand the same number of immersions ± 1 before the end point is reached.

(c) The length the specimen shall be 5 feet.

4.4.3 *Tubing.* The specimen (insulated conductor or jacketed conductor shall be looped back and wound tightly on itself for five close turns. The ends shall be securely taped, and the specimen shall be placed in an air oven maintained at a temperature of 95° ± 1° C. for 1 hour $\pm \frac{5}{0}$ minutes.

The specimen shall then be removed from the oven and the insulation or jacket, as applicable, examined for strains or cracks under a magnification of at least three diameters (focal distance 8 centimeters (cm)) see 3.3.1.1 and 3.3.2.1.

4.4.4 *Deformation.* The gage shall consist of a dial micrometer graduated to read in increments of 0.001 inch and equipped with a flat anvil not less than 0.375 inch in diameter and a flat pressure foot 0.375 ± 0.001 inch in diameter attached to a plunger. The anvil and pressure foot shall be parallel to within 0.0001 inch. The plunger shall be designed to support a weight of 250 grams. The gage shall be placed in an oven maintained at a temperature of 95° ± 1° C for a period of 1 hour $\pm \frac{5}{0}$ minutes. A specimen of insulated conductor at room temperature shall then be placed on the platform, centrally located under the foot, and its diam-

eter shall be read exactly 5 seconds after being so placed. The gage and specimen shall then remain in the oven for a period of 1 hour $\pm \frac{5}{0}$ minutes at the above temperature and the diameter of the specimen again read without disturbing the specimen or gage (see 3.3.1.2).

4.4.5 *Cold bend.* The specimen of insulated or jacketed conductor, as applicable, and a mandrel of 0.080 ± 0.003-inch diameter for insulated conductor, 0.090 ± 0.003-inch diameter for jacketed conductor, and 0.160 ± 0.005-inch diameter for conductor with insulation repairs, shall be placed in a cold chamber maintained at a temperature of −40° ± 1° C for a period of 24 $\pm \frac{1}{0}$ hours. At the end of this time, while still in the cold chamber, the specimen shall be wound around the mandrel for five close turns at the rate of approximately one turn per second. The specimen shall then be examined under a magnifying glass at least three diameters magnification (focal distance 8 cm) for visible evidence of cracking of the insulation or jacket, as applicable. During the above processing, no object having a temperature higher than −40° ± 1° C shall come within 12 inches of the part of the specimen being examined (see 3.3.1.3, 3.3.2.2 and 3.6.1.4).

4.4.5.1 *After aging.* A specimen of jacketed conductor shall be dried in an air oven for a period of at least 24 hours at 80° ± 1° C and then transferred directly (within 5 minutes) from the air oven to an oxygen bomb containing an atmosphere of oxygen at 300 ± 10 pounds per square inch at a temperature of 70° ± 1° C, and held there for a period of 96 $\pm \frac{2}{0}$ hours. Alternately, the specimen may be transferred directly to a desiccator containing a drying agent to preclude reabsorption of water and then to the oxygen bomb when the bomb is available. After 96 $\pm \frac{2}{0}$ hours in the oxygen bomb, the specimen shall be transferred directly to a desiccator containing a drying agent, and held there for at least 24 hours and until such time as the specimen is transferred directly to a cold chamber. The conditioned specimen shall then be tested as specified in 4.4.5 (see 3.3.2.2).

4.4.6 *Cutting.* A specimen of jacketed conductor shall be cut in half, and the insulation stripped from one end of each piece. One piece shall be formed into a loop, the ends of which shall be tightly clamped in one of the grips of a tensile tester. The second piece shall be passed through the loop and its ends shall be tightly clamped in the other grip of the tensile tester. The two bared ends shall be connected in series with an electrical-alarm circuit and a load shall be applied to the looped conductors by separation of the jaws at a rate of 2 inches per minute until they cut through the outer covering and insulation, thus making electrical contact as indicated by the electrical alarm. One of the metal grips of the tensile machine may have to be electrically insulated from the rest of the machine to avoid false indications (see 3.3.2.3).

4.4.7 *Breaking load.* The breaking load or tensile strength, as applicable, shall be determined using the apparatus and method described in method 3211 of Specification J-C-98 (see 3.3.2.4, 3.6.1.1, and 3.6.1.3.2).

4.4.8 *Dc resistance.* The dc resistance of field wire shall be determined as specified in method 6021 of Specification J-C-98, except that the immersion period shall be 4 hours, immediately prior to shipment (see 3.4.1).

4.4.9 *Dielectric strength (see 3.4.2).* The dielectric strength of field wire shall be determined as specified in method 6111 of Specification J-C-98, except that:

(a) The immersion period shall be 4 hours.

(b) One terminal shall be both conductors connected together, and the other shall be the water.

4.4.10 *Insulation resistance (see 3.4.3).* The insulation resistance of field wire shall be determined as specified in method 6031 of Specification J-C-98, except that

(a) The immersion period shall be 4 hours.

(b) The test voltage shall be not less than 100 volts dc.

(c) The polarity of the conductors shall be maintained negative with respect to the water.

(d) One terminal shall be both conductors connected together, and the other shall be the water.

(e) For purposes of computation, twice the field wire footage shall be taken as the length of conductor under test.

(f) If the measurement is made at a temperature other than 15.6°C the manufacturer shall correct the measured value of insulation resistance to the resistance at 15.6°C. However, if the insulation resistance is equal to or greater than that required by 3.4.3, when the measurement is made at a temperature greater than 15.6°C, no correction factor need be employed. The manufacturer shall demonstrate that the correction factor is accurate for his compound.

(g) The insulation-resistance test may be terminated in less than 1 minute if the galvanometer has ceased fluctuating and the reading indicates that steady insulation-resistance value has been obtained. However, readings obtained on 5 percent of the lengths after 1-minute electrification shall be recorded to establish a continuous check of quality.

4.4.11 *Flatness.* One hundred feet of field wire shall be pulled from a reel or spool or dispenser, as applicable, and allowed to lie free on a flat floor. With no strain on the free end, a point along the wire 3 feet from the free end shall be not less than 96 feet from the original 100-foot mark on the wire (see 3.5).

4.4.12 *Workmanship.* Field wire shall be inspected for workmanship at any stage of production. Any faulty workmanship pointed out by the Government shall be corrected by means satisfactory to both the manufacturer and the Government. If suitability of means of correction of any workmanship defect cannot be resolved, the matter shall be referred to the contracting officer (see 3.6).

4.4.12.1 *Individual-strand joints.* Joints in individual steel strands shall be made only by operators who have been qualified by the Government by preparing three successive groups of 12 specially prepared samples. To qualify, no individual splice shall have a tensile strength less than 85 percent of the average tensile strength of the strand adjacent to the splice. At the option of the Government, an operator may be required to qualify for making joints in copper strands, using the same procedure as for operator qualification for steel strands. If, in the opinion of the Government, joints in individual strands checked on the production line do not meet specified requirements, the operator shall make no further joints until he is requalified (see 3.6.1.1).

4.4.12.2 *Seven-strand splices.* Seven-strand splices shall be made only by operators who have been qualified to make individual-strand joints, and shall be subject to

the procedures and requirements applicable to operators making individual-strand joints (see 3.6.1.2).

4.4.12.3 *Conductor splices (qualification of operators).* The responsibility for qualifying operators shall rest with the manufacturer. The manufacturer shall conduct all qualification - of - operator inspection, maintain all test data, and, upon request, shall make available to the Government the results of qualification-of-operator inspection. The identification numbers of qualified operators their machine location, and other information necessary for the identification of the position of qualified operators shall be made available to the Government. The manufacturer shall qualify operators to start production work on conductor splices by inspecting 40 completely fabricated samples of single conductor splices taken consecutively during the span of not less than 2 working days, and considered as 10 groups of 4 splices each.

4.4.12.3.1 *Computation.*

(a) Determine the average percent tensile strength ($\bar{X}$) for each group of four as follows:

$$\bar{X} = \frac{\text{sum of percent tensile for group of four.}}{4}$$

(b) Determine the grand average percent tensile strength ($\bar{\bar{X}}$) for 10 groups of four, as follows:

$$\bar{\bar{X}} = \frac{\text{sum of the } 10\bar{X}\text{'s}}{10}$$

(c) Determine the range (R) for each group of four, as follows:

R = largest percent tensile of the four minus smallest percent tensile of the four.

(d) Determine the average range ($\bar{R}$) for groups of four as follows:

$$\bar{R} = \frac{\text{Sum of the 10R's}}{10}$$

4.4.12.3.2 *Acceptance criteria for qualification-of-operator inspection.*

(a) All average percent tensiles ($\bar{X}$) of of groups of four shall be above the process control limit for averages ($\bar{\bar{X}} - 0.729\bar{R}$).

(b) All ranges for the groups of four shall be below the acceptance control limit for ranges (2.282R).

(c) All individual values shall be at least 90 percent tensile (see 3.6.1.3.2).

(d) The process control limit for average ($\bar{\bar{X}} - 0.729\bar{R}$) shall be greater than the acceptance control limit for average (90 + $0.729\bar{R}$).

4.4.12.4 *Insulation repairs.* Repairs in the insulation shall be made only by qualified operators. An operator may be qualified by the Government by preparing 12 specially prepared samples. Six of these samples shall be checked for wall thickness and the remaining six samples shall be tested for cold bend (see 4.4.5). Failure of any of the samples shall disqualify an operator. However, an operator will be permitted to make groups of samples until he becomes proficient in the operation and qualifies. If in the opinion of the Government, insulation repairs checked on the production line do not meet specified requirements, an operator shall make no further insulation repairs until he is requalified (see 3.6.1.4).

4.4.12.5 *Outer-covering repairs.* Outer-covering repairs shall be made only by oper-

ators who have been qualified to make such repairs, and shall be subject to the procedures and requirements applicable to operators making insulation repairs (see 3.6.1.5).

4.4.13 *Footage.* Units of product shall be checked for length to insure that footage counters and measuring machines are accurate.

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.*

5.1.1.1 *Cleaning.* Cable, Telephone, Electrical (Infantry Field Wire, Twisted Pair, Wire, WD–1/TT and WD–14/TT) shall be cleaned in accordance with process C–1 of MIL–P–116.

5.1.1.2 *Drying.* Cable, Telephone, Electrical, (Infantry Field Wire, Twisted Pair, Wire WD–1/TT and WD–14/TT) shall be dried in accordance with MIL–P–116.

5.1.1.3 *Unit packaging.* Unit protection shall be in accordance with the methods prescribed in MIL–P–116 and as specified herein.

5.1.1.3.1 *Wire on Reels RL–159( )/U or DR–5.* The wire on reels RL–159( )/U or DR–5 (both covered by MIL–R–3241) shall be packaged method III as follows: Wire, in the required length, shall be fully and evenly wound on reels. Secure the outside end of the wire to the adjacent turn of wire. The inside end of the wire, previously extended outside the reel for testing, shall be cut back to one foot and pushed through the oval access hole into the center of the reel. Each reel with wire shall be overwrapped with one thickness of fiberboard conforming to PPP–F–320, type SF, class-weather resistant, grade V3S, of sufficient width to extend the full distance between the reel flanges and of sufficient length to overlap the ends by at least six inches. The fiberboard overwrap shall be secured with two bands of reinforced filament tape conforming to Specification PPP–T–97, Type IV, equally spaced between the reel flanges for RL–159( )/U. The overwrap on Reel DR–5 shall be secured with two bands of flat steel strapping conforming to Specification QQ–S–781, Type 1, Class B, ½ inch wide by 0.020 inch thick.

5.1.1.3.2 *Wire on spool DR–8–A.* The wire on spools DR–8–A (covered by MIL–S–3140) shall be packaged method III as follows: Wire, in the required length, shall be fully and evenly wound on the spool. Both ends of the wire shall be brought out and secured. Each spool shall be placed within a close-fitting, fiberboard box conforming to PPP–B–636, style RSC, grade W5c. Closure shall be in accordance with the appendix to the box specification. In addition, seal all seams and joints with pressure-sensitive tape conforming to PPP–T–76 not less than two inches wide.

5.1.1.3.3 *Wire dispenser, MX–306A/G with wire.* Each dispenser MX–306A/G (covered by MIL–C–10369) with wire shall be packaged method III as follows: Each dispenser with wire shall be placed within a close-fitting fiberboard box conforming to PPP–B–636, style RSC, grade V3c. A liner made of fiberboard conforming to PPP–F–320, type CF, class WR, variety TW, grade 1100, shall be placed against the inside walls of the box. The liner shall have its ends butt in the center of a side panel of the box. The dimensions of the liner shall be such that the liner will fit snugly inside the box. Closure shall be in accordance with the appendix to the box specification. In addition, seal all seams and joints with pressure-sensitive tape conforming to PPP–T–76 not less than two inches wide. The box shall be reinforced in accordance with the appendix to the box specification, using tape conforming to PPP–T–97, type IV.

5.1.2 *Level C.* Cable, Telephone, Electrical (Infantry Field Wire, Twisted-Pair,

Wire WD-1/TT and WD-1/1TT) shall be preserved and packaged in a manner that will afford adequate protection against corrosion, deterioration and 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 *Wire on Reels RL-159( )/U or DR-5.* No packing required. When specified by the Procuring Agency, wire on reels shall be palletized in accordance with MIL-STD-147.

5.2.1.2 *Wire on spools DR-8-A.* A quantity of spools, packaged as specified in 5.1, shall be packed in close-fitting fiberboard boxes conforming to PPP-B-640, class 2, grade A, style E, MIL-B-43291, or PPP-B-636 style RSC, grade V3c. The gross weight of shipping containers conforming to PPP-B-640 shall not exceed 200 pounds. The gross weight of shipping containers conforming to MIL-B-43291 shall not exceed the weight limitation of the box specification. The gross weight of shipping containers conforming to PPP-B-636 shall not exceed the weight limitation of the box specification for special requirements use. The box closure shall be as specified in the appendix to the applicable box specification. Shipping containers shall be reinforced by pressure-sensitive filament tape banding or nonmetallic strapping conforming to PPP-T-97, type IV and PPP-S-760, type II, respectively; selection of the material and application shall be in accordance with the appendix to the applicable box specification.

5.2.1.3 *Wire Dispenser, MX-306A/G with wire.* No packing required.

5.2.2 *Level B.*

5.2.2.1 *Wire on Reels RL-159( )/U or DR-5.* No packing required. When specified by the Procuring Agency, wire on reels shall be palletized in accordance with MIL-STD-147.

5.2.2.2 *Wire on Spools DR-8-A.* A quantity of spools shall be packed as specified in 5.2.1.2 except that the shipping containers shall be limited to PPP-B-640 and PPP-B-636 and shall be class 1 and class domestic, respectively.

5.2.2.3 *Wire Dispenser, MX-306A/G with wire.* No packing required.

5.2.3 *Level C.* Cable, Telephone, Electrical (Infantry Field Wire, Twisted-Pair, Wire WD-1/TT and WD-1/1TT), not furnished on reels, shall be packed in shipping containers in a manner that will afford adequate protection against damage to the package and its contents during shipment from the supply source to the first receiving activity. Shipping containers and reels shall comply with the rules and regulations of the common carrier as applicable to the mode of transportation.

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

6. NOTES

6.1 Intended use. Wire WD-1/TT and wire WD-1/1TT are general-purpose field wires for use in the field as communication wires.

6.2 Ordering data. Procurement documents should specify the following:

(a) Title, number, and date of this specification.

(b) Type required (see 1.2).

(c) Reels, spools, or dispensers will be furnished to the manufacturer

by the Government (see 3.4 and [illegible]).

(d) Lengths on reels or spools or dispensers (see 3.6.1.3.1).

(e) Rough-handling test, if required (see 4.3.7.2.3).

(f) Levels of preservation, packaging, packing, and marking (see section 5.)

(g) The specific paragraphs of section 5 which are applicable to the particular procurement.

6.2.1 *Indirect shipments.* The 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 manufacturer and prime contractor.

6.3 **Contractual requirements.** It is recommended that the following be included in the contract or order:

6.3.1 *Additional inspection.* It should be understood that additional examination, measurement, and nondestructive testing may be performed by the Government when considered necessary to determine compliance with this specification and other applicable documents. Accordingly, the Government may withdraw materials or field wire in any stage temporarily from production for such inspection, performed either at a Government laboratory or the manufacturer's plant.

6.4 **International standardization agreements.** The provisions of this specification are the subject of international standardization agreements. When amendment, revision, or cancellation of this specification is proposed, the departmental custodians will inform their respective Departmental Standardization Office (DEPSO) so that appropriate action may be taken respecting the international agreement concerned.

Custodians:

Army—EL

Navy—YD

Air Force—80

Review:

Army—MI

Navy—YD

Air Force—80

DSA—IS

NSA

User:

Army—AT, AV, ME

Navy—MC

Air Force—17

International (See Sect 6)

Preparing activity:

Army—EL

Project No. 6145-0485

Code "C"

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3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ MANUFACTURER
	☐ OTHER *(Specify)*:

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
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

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