

**MIL-W-12567C**

17 SEPTEMBER 1964

SUPERSEDING

MIL-W-12567B

21 JANUARY 1959

**MILITARY SPECIFICATION****WIRE STRAND, STEEL (WIRES WS-3/U,  
WS-4/U, W-90, W-115, AND W-116)**

*This specification has been approved by the Department of Defense and is mandatory for use by the Departments of the Army, the Navy, and the Air Force.*

**1. SCOPE**

1.1 Scope. This specification covers steel wire, zinc coated, composed of seven strands, suitable for use as guy wire, messenger wire, span wire, and other similar purposes. The wire strand is referred to in this specification as "strand" and the seven wires making up the "strand" are referred to as "wires."

1.2 Classification. Steel wire strands shall be classified as follows:

Type	Diameter of strand
WS-3/U	3/16 inch.
W-115	5/16 inch.
W-90	3/8 inch.
W-116	1/2 inch.
WS-4/U	1/2 inch.

**2. APPLICABLE DOCUMENTS**

2.1 The following specifications, standards, and publications, of the issue in effect on date of invitation for bids, form a part of this specification:

**STANDARDS****MILITARY**

MIL-STD-105 — Sampling Procedures

and Tables for Inspection by Attributes.

MIL-STD-163 — Preparation of Steel Products for Domestic Shipment (Storage and Overseas Shipment).

2.2 Other publications. The following documents form a part of this specification. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

**AMERICAN SOCIETY FOR TESTING  
MATERIALS**

ASTM A299-41 — Uniformity of Coating by the Preece Test (Copper Sulphate Dip) on Zinc-Coated (Galvanized) Iron or Steel Articles, Test for.

**3. REQUIREMENTS**

3.1 Material. The base metal of the steel wire shall be of such quality that when drawn, galvanized, and stranded, the finished wire shall have the properties designated in

FSC 4010

## MIL-W-12567C

this specification.

3.2 Construction. Each strand shall be composed of seven zinc-coated steel wires of sizes within tolerances specified in table I. Six of these wires shall be stranded with a left hand lay around a seventh (core) wire to form the complete strand.

3.2.1 *Stranding*. The six outer wires shall be tightly stranded with a left hand lay about the seventh (core) wire so as to min-

imize separations between the outer wires and the core wire. There shall be no appreciable reduction in the diameter of a straight length of the finished strand, due to closing of separations between wires, when the strand is subjected to a load equal to 10 percent of the minimum breaking strength specified in table I. Light lubricant may be applied to the individual wires during the stranding operations. The manufacturer, however, shall take precautions necessary to insure the absence of grease or oil in the finished product.

TABLE I.

Type	Diameter of wire (Inch)	Length of lay (Inches) maximum	Breaking strength (pounds) minimum	Elongation — 1% in 24 inches	
				Maximum	Minimum
WS-3/U	0.065 ± 0.003	3	2,400	21	10
W-115	0.109 ± 0.003	5	6,000	21	10
W-90	0.120 ± 0.004	6	11,500	13½	4½
W-116	0.144 ± 0.005	7	18,000	12	4½
WS-4/U	0.165 ± 0.005	8	25,000	12	4½

3.2.2 *Brazed joints*.

3.2.2.1 *Workmanship*. All brazed joints in the individual wires shall be of the lap type. The scarfing of the ends of the individual wires shall be smooth, the brazing shall completely cover the scarfed ends at the joint. A paint mark shall be placed on the finished strand at each point where a joint is made.

3.2.2.2 *Dimension*. The length of the scarf shall be not less than three times the diameter of the individual wire. No two joints of the individual wires of the finished strand shall be less than 150 feet apart.

3.2.2.3 *Finish*. All brazed joints shall be galvanized to provide a protective coating at least equal to that of the unbrazed part of the wire.

3.2.2.4 *Tensile strength*. When tested in accordance with 4.15 the percent tensile as computed in 4.15(e) shall not be less than 75 percent and the tensile strength of any

individual joint in the test group shall not be less than 70 percent of 4.15(d).

4.2.3 *Welded joints*.

3.2.3.1 *Workmanship*. All electric welds shall be of the butt type. Joints shall be annealed to remove all brittleness. Care shall be taken to prevent injury to the wire by overheating. A paint mark shall be placed on the finished strand at each point where a joint is made.

3.2.3.2 *Dimensions*. The welded joint shall be of the same diameter as the wire. No two joints of the individual wires of the finished strand shall be less than 150 feet apart.

3.2.3.3 *Finish*. All welded joints shall be galvanized to provide a protective coating at least equal to that of the unwelded parts of the wire.

3.2.3.4 *Tensile strength*. When tested in accordance with 4.15 the percent tensile as

computed in 4.15(e) shall not be less than 75 percent and the tensile strength of any individual joint in the test group shall not be less than 70 percent of 4.15(d).

**3.3 Physical requirements.** The finished strand shall meet the requirements of table I.

**3.3.1 Elongation requirements of strand containing joints.**

Type No.	Elongation percent in 24 inches	
	Maximum	Minimum
WS-3/U .....	21	8
W-115 .....	21	8
W-90 .....	18½	8½
W-116 .....	12	3½
WS-4/U .....	12	8½

**3.4 Ductility.** Individual wires of each type of strand shall not split or break when subjected to the test of 4.9.

**3.5 Zinc coating.** Zinc-coated (galvanized)

wire shall be uniformly and completely coated with zinc applied by either the hot dip (molten bath) or electroplating process. The molten zinc bath shall contain not less than 98 percent pure zinc.

**3.5.1 Weight of coating.** The weight of coating on the individual wires in ounces per square foot of uncoated wire surface shall meet the requirements of table II.

**3.5.1.1** The weight of coating shall be determined by the hydrochloric acid-antimony chloride method specified in 4.10.

**3.5.2 Uniformity of coating.** Using the Preece test in accordance with ASTM Standard A239, the individual wires of each type of strand shall not show adherent copper, indicating exposed steel, after the number of immersions given in table II. For one immersion, the specimen shall be dipped into the solution for one minute and then removed. For any one-half immersion, it shall be dipped for one-half minute and then removed.

TABLE II.

Type	Wt. of coating on/sq. ft. (minimum)	Number of immersions (minimum)	
		Hot dip process	Electro-galvanizing
WS-3/U .....	1.00	5	4
W-115 .....	1.60	8	6
W-90 .....	1.70	8	6
W-116 .....	1.80	8	6
WS-4/U .....	1.80	8	6

**3.5.3 Adherence of coating.** The zinc coating shall not flake, crack or be removable by rubbing with the bare fingers, when the wire is subjected to the test specified in 4.12.

**3.6 Workmanship.** All individual wires and finished strands shall be free from all die marks, scales, splints, flaws, kinks, or other imperfections which would effect the serviceability of the strand. Workmanship shall be such as to meet all applicable requirements of this specification and any referenced

subsidiary specification or other document when inspected in accordance with 4.14 including the following paragraphs:

3.1 Material.

3.2 Construction.

3.2.1 Stranding.

3.2.2 Brazed joints.

3.2.3 Welded joints.

#### 4. QUALITY ASSURANCE PROVISIONS

## MIL-W-12567C

4.1 Unless otherwise specified herein the supplier is responsible for the performance of all inspection requirements prior to submission for Government inspection and acceptance. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. Inspection records of the examinations and tests shall be kept complete and available to the Government as specified in the contract or order.

4.2 Classification of inspection. Inspection shall be classified as follows: Acceptance inspection shall be the inspection performed by the contractor and by the Government, as specified by 4.3 and section 5.

- (a) Acceptance inspection of items before preparation for delivery (see 4.3).
- (b) Acceptance inspection of preparation for delivery (see section 5).

4.3 Acceptance inspection of items before preparation for delivery. The minimum inspection performed by the contractor shall be as specified by (a) through (c) below — to demonstrate compliance with specified requirements. The government will review and evaluate the contractor's inspection procedures and examine the contractor's rec-

ords. In addition, the Government at its discretion will verify, by product inspection, the contractor's compliance with specified requirements (see 6.3). Such verification shall not exceed the amount of inspection required herein of the contractor.

- (a) Acceptance inspection shall consist of group A, group B, and group C inspection as specified in 4.3.1 through 4.3.3.1.
- (b) When MIL-STD-105 specifies actions by the Government, the Government may authorize the contractor to perform any of such actions except that responsibility for acceptance rest with the Government.
- (c) Group B, sub-group 1 inspection shall normally be performed on inspection lots of the finished wire strand that have passed group A inspection, and on samples selected from units that have been subjected to, and have met, group A inspection.

4.3.1 *Group A inspection.* This inspection (including sampling) shall conform to table III and MIL-STD-105 and shall be performed on inspection lots as defined in paragraph 4.4.2.

TABLE III. Government group A inspection

Inspection	Requirement paragraph	Test paragraph	AQL
Diameter .....	3.3	4.7	1% major.
Length of lay .....	3.3	4.8	4% minor.
Workmanship .....	3.6	4.14	For combined group.

4.3.2 *Group B inspection.* Group B inspection shall consist of the tests specified in table IV.

TABLE IV. Group B inspection

Inspection	Requirement paragraph	Inspection paragraph	Sampling plan
<b>Subgroup 1:</b>			
Stranding	3.2.1	4.13	6.5% combined.
Breaking strength	3.3	4.5	
Elongation	3.3	4.6	
Ductility	3.4	4.9	
<b>Subgroup 2:</b>			
Weight of zinc coating.	3.5.1	4.10	6.5%
Uniformity of zinc coating.	3.5.2	4.11	6.5%
Adherence of zinc coating.	3.5.3	4.12	6.5%

4.3.2.1 *Sampling procedure.* The sampling procedure shall be in accordance with Standard MIL-STD-105 for small sample inspection. Unless otherwise specified herein, normal inspection shall be used at the start of the contract. Small sample reduced inspection procedure shall be R-1. The AQL shall be 4.0 (percent defective) and the inspection level shall be L7 for normal and tightened inspection and L5 for reduced inspection.

4.3.2.2 *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 submit it again to inspection. Resubmitted lots shall be kept separate from new lots and shall be clearly identified as resubmitted lots. Resubmitted lots shall be inspected, using tightened inspection.

4.3.2.3 *Disposition of sample units.* Sample units which have been subjected to group B inspection shall not be delivered on the contract or order.

4.3.3 *Group C inspection.* This inspection shall consist of sub-group 1 and sub-group

2 inspection.

4.3.3.1 *Sub-group 1 inspection.* This inspection is for operator's qualification by the Government for brazed or welded joints. This inspection shall be performed in accordance with 4.15 at the start of production and once every 90 days thereafter. However, any individual operator may be required to re-qualify within a period of 90 days when the Government deems such requalification necessary.

4.3.3.2 *Sub-group 2 inspection.* This inspection shall be performed by a periodic surveillance of the contractor's processes during the stranding operation (see 4.16).

4.3.4 *Compliance.* Sub-group 1 inspection.

4.3.4.1 *Initial qualification.* Prior to an operator making production joints, inspection for the 3 groups of joints in accordance with 4.15 must be completed without failure.

4.3.4.2 *Requalification.* An operator failing requalification shall not make any production joints until he has successfully passed the requirements of 4.15 without failure.

MIL-W-12567C

TABLE V. Group C inspection

Inspection	Requirement paragraph	Inspection paragraph
<i>Sub-group 1:</i>		
Brazed joints .....	3.2.2	.....
Workmanship .....	3.2.2.1, 3.6	4.14
Dimensions .....	3.2.2.2	4.14
Finish .....	3.2.2.3	4.14
Tensil strength .....	3.2.2.4	4.14, 4.15
Welded Joints .....		
Workmanship .....	3.2.3	.....
Dimensions .....	3.2.3.1, 3.6	4.14
Finish .....	3.2.3.2	4.14
Tensil strength .....	3.2.3.3	4.14
Tensil strength .....	3.2.3.4	4.14, 4.15
<i>Sub-group 2:</i>		
Length between joints .....	3.2.2.2, 3.2.3.2	4.14, 4.16
Marking .....	3.2.2.1, 3.2.3.1	4.14, 4.16

#### 4.4 DEFINITIONS

**4.4.1 Wire.** All finished wire on reels prior to stranding produced under the same conditions and offered for inspection at one time.

**4.4.1.1 Strand.** All finished wire strand on reels produced under the same conditions and offered for inspection at one time.

**4.4.2 Lot size.** The lot size shall be the number of units of product in lot. A unit of product shall be defined as a continuous length of strand or wire contained on a reel.

**4.4.3 Specimen.** The specimen shall be the individual piece of strand or wire selected in an unbiased manner which is subjected to a test. Specimens shall be tested from each wire or strand of each sample unit or product.

**4.4.4 Finished strands.** Finished strands are those on which all manufacturing operations have been completed and which is ready to be submitted for inspection.

**4.5 Breaking strength.** Specimens of each type of strand shall be tested for compliance with the breaking strength specified in table I. The length of strand between the jaws of the testing machine shall be, as nearly as practicable, 24 inches when under a load equal to 10 percent of the required minimum

breaking strength of the strand. This length shall be denoted as the zero length of the specimen and the final length shall be the separation of the jaws at failure of the strand under tension. Test data shall be discarded in case the break in the strand occurs within one inch of either jaw of the testing machine. In making the test, the rate of separation of the heads of the testing machine shall be not less than three inches per minute.

**4.6 Elongation.** Compliance with the elongation requirements of 3.3 shall be determined during the breaking strength test specified in 4.5. The percent elongation shall be computed from the increase in the length of the strand between the jaws, at the time of failure.

**4.7 Diameter.** The diameter of the individual wires of the strand shall be gaged to check compliance with limits specified in table I.

**4.8 Length of lay.** Each type of strand shall be measured for compliance with the length of lay requirements of table I.

**4.9 Ductility.** Any of the wires from which the strand is made shall be wrapped around the mandrels, as specified in 4.12, for 5 consecutive turns, at the rate of not more than 15 turns per minute. Examination shall be

made for compliance with 3.4.

4.10 Weight of zinc coating. Prior to stranding, at least three test specimens, preferably not less than 12 inches long shall have a computed weight of coating not less than the minimum specified in 3.5.1.

4.10.1 *Solutions.* The following solutions shall be used in removing the zinc coating from the wire.

4.10.1.1 *Antimony chloride solution.* Dissolve 20 grams of antimony trioxide ( $Sb_2O_3$ ) or 32 grams of antimony trichloride ( $SbCl_3$ ) in 1,000 milliliters of concentrated hydrochloric acid (HCL) having a specific gravity of 1.19.

4.10.1.2 *Stripping solution.* Add 5 milliliters of antimony chloride solution to 100 milliliters of concentrated hydrochloric acid (HCL) having a specific gravity of 1.19.

4.10.2 *Procedure.* The specimen shall be cleaned, rinsed and wiped dry, as required

Weight in oz. (avoirdupois) per sq. ft. = 163 dr

Where: d = diameter of stripped wire in inches

(original weight — (stripped weight))

$$r = \frac{\text{(original weight — (stripped weight))}}{\text{(stripped weight)}}$$

4.11 Uniformity of zinc coating (Preece Method). Prior to stranding, at least 3 test specimens not less than 6 inches long, shall be cut from each test sample. No test specimen shall show bright adherent copper at a distance greater than 1 inch from the ends, after the number of immersions as specified in 3.5.2. Wire having a copper deposit at a distance greater than 1 inch from the ends complies with the requirements for the Preece test, if when lightly scraped with a knife blade the deposit is removed and if the surface beneath is coated with zinc.

4.12 Adherence of coating. Prior to stranding, any of the wires from which the strand is made shall be wrapped around the fol-

by the procedure of the Preece test. The weight of the cleaned specimen shall be determined within an accuracy of 0.01 gram.

4.10.2.1 The zinc coating shall be stripped from the weighted specimen by immersing it in the stripping solution until violent chemical action ceases and only a few bubbles are being evolved. The specimen shall then be removed, washed and wiped dry.

4.10.2.2 The weight of the stripped specimen shall be determined within an accuracy of 0.01 gram.

4.10.2.3 *Diameter of wire.* The diameter of the stripped specimen, in inches, shall be determined by taking the mean of two measurements at right angles to each other. The measurement of the diameter of the specimen shall be determined within an accuracy of 0.001 inch.

4.10.2.4 *Computation of weight of zinc Coating.* The weight of zinc coating shall be computed using the following formula:

lowing mandrels, for five consecutive turns, at the rate of not more than 15 turns per minute. Sharp bends shall be avoided in bringing the wire upon the mandrel for test. Examination shall be made for compliance with 3.5.8.

*Diameter of mandrel (inch)*

Type	Spliced wires	Unspliced wires
WS-3/U .....	$\frac{1}{8}$	$\frac{1}{8}$
W-115 .....	$\frac{1}{16}$	$\frac{1}{8}$
W-90 .....	$\frac{1}{8}$	$\frac{1}{8}$
W-116 .....	$\frac{1}{8}$	$\frac{1}{8}$
WS-4/U .....	$\frac{1}{8}$	$\frac{1}{8}$

4.13 Stranding. Compliance with stranding

**MIL-W-12567C**

requirements of 3.2.1 shall be determined when strand is being tested under a tension equal to 10 percent of the minimum breaking strength in accordance with 4.5.

4.14 **Visual examination.** Individual wires or strands shall be inspected for compliance to the referenced paragraphs within 3.6 as applicable.

4.15 **Individual wire joints.** Joints in individual wires shall be made by operators who have been qualified by the Government. The operator shall qualify either for brazed or welded joints as applicable. Each qualifying operator shall prepare 3 successive groups of 12 specially prepared sample splices. Specimens of wire selected for the samples shall be of sufficient length to allow testing of the splice and a section of the wire adjacent to the splice. Specimens for each group shall be tested as follows:

- (a) The tensile strength of each of the 12 sample splices in a group shall be measured.
- (b) The average for (a) above shall be computed.
- (c) The tensile strength of the 12 sections of wire adjacent to the splices shall be measured.
- (d) The average of (c) above shall be computed.
- (e) The percent tensile of average (b) to average (d) shall be computed.
- (f) The requirements of 3.2.2.4 or 3.2.3.4, as applicable, shall be met.
- (g) Each of the two remaining groups shall be tested in accordance with (a) through (f) above.

4.16 **Length between joints and marking of joints.** This inspection shall be performed in accordance with 4.3.3.2 verifying by visual examination that the requirements referenced under sub-group 2 inspection in table V are met.

**5. PREPARATION FOR DELIVERY****5.1 Packaging.**

5.1.1 *Level A.* The wire shall be packaged in accordance with the applicable requirements of Military Standard MIL-STD-163.

5.1.2 *Level C.* The wire shall be packaged in accordance with the supplier's standard practice.

**5.2 Packing.**

5.2.1 *Level A.* The wire shall be packed in accordance with the applicable requirements of Military Standard MIL-STD-163.

5.2.2 *Level B.* The wire shall be packed as specified for level A.

5.2.3 *Level C.* The wire shall be prepared for shipment in a manner which will insure arrival at destination in satisfactory condition and which will be acceptable to the carrier at the lowest rates.

5.3 **Marking.** Marking shall be in accordance with Military Standard MIL-STD-163.

**6. NOTES**

6.1 **Intended use.** These wire strands are intended for use in supporting aerial cables and in guying pole lines.

**6.2 Ordering data.**

- (a) Title, number and date of this specification.
- (b) Type required (see 1.2).
- (c) Level of packaging and level of packing required (see 5.1 and 5.2).
- (d) Length of strand in each coil or reel.
- (e) Whether to be packaged in coils or reels.

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



**MIL-W-12567C**

**6.3.1 Additional testing.** It should be understood that additional inspection and non-destructive testing of equipment may be performed by the Government when considered necessary to determine compliance with this specification and other applicable

documents. The Government, therefore, may withdraw materials or parts temporarily from production for such inspection and testing, performed either at a Government laboratory or the contractor's plant.

**Custodians:**

Army—EL  
Navy—Docks  
Air Force—MOA

**Preparing activity:**

Army—EL  
Project No. 4010-0029

**Review interest:**

Army—  
Navy—  
Air Force—

**User interest:**

Army—MO, MU  
Navy—  
Air Force—

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SPECIFICATION ANALYSIS SHEET		Form Approved Budget Bureau No. 119-R004
<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.		
SPECIFICATION		
ORGANIZATION		CITY AND STATE
CONTRACT NO.	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT \$
MATERIAL PROCURED UNDER A		
<input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> 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? <input type="checkbox"/> YES <input type="checkbox"/> 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