



Designation: **F 1665 – 9501**

## **Standard Specification for Poly(Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Barbed Wire Used With Chain-Link Fence<sup>1</sup>**

This standard is issued under the fixed designation F 1665; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### **1. Scope**

1.1 This specification covers poly(vinyl chloride) and other conforming organic polymer-coated steel barbed wire consisting of two ~~poly(vinyl chloride)-coated~~ polymer-coated strands, with four-point barbs of zinc-coated steel or aluminum alloy wire. Poly(vinyl chloride) and other organic polymer coatings hereinafter will be designated ~~PVC~~ as polymer coating.

1.2 Barbed wire strand wire, produced from three classes of wire coatings, is covered as follows:

1.2.1 *Class 1*, consisting of ~~PVC~~ a polymer coating extruded over zinc-coated or aluminum-coated or zinc-5 % aluminum-mischmetal alloy-coated steel wire;

1.2.2 *Class 2a*, consisting of ~~PVC~~ a polymer coating extruded and adhered to zinc-coated or aluminum-coated or zinc-5 % aluminum-mischmetal alloy-coated steel wire; and

1.2.3 *Class 2b*, consisting of ~~PVC~~ a polymer coating fused and adhered to zinc-coated or aluminum-coated or zinc-5 % aluminum-mischmetal alloy-coated steel wire.

1.3 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

### **2. Referenced Documents**

2.1 *ASTM Standards:*

A 90/A90M Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings<sup>2</sup>

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee F14 on Fences and is the direct responsibility of Subcommittee F14.40 on Chain Link Fence and Wire Accessories.

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- A 370 Test Methods and Definitions for Mechanical Testing of Steel Products<sup>3</sup>  
 A 428 Test Method for Weight of Coating on Aluminum-Coated Iron or Steel Articles<sup>2</sup>  
 A 700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment<sup>4</sup>  
 D 1499 Practice for Operating Light- and Water-Exposure Apparatus (Carbon-Arc Type) for Exposure of Plastics<sup>5</sup>  
 F 552 Terminology Relating to Chain Link Fencing<sup>2</sup>  
~~F 668 Specification for Poly(Vinyl Chloride) (PVC)-Coated Steel Chain-Link Fence Fabric<sup>2</sup>~~  
~~F 934 Specification~~ 934 Specification for Standard Colors for Polymer Coated Chain Link Fence Materials<sup>2</sup>  
 G 23 Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials<sup>6</sup>  
 G 26 Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials<sup>6</sup>  
 2.2 *Federal Standard:*<sup>7</sup>  
 Fed. Std. No. 123 Marking for Shipments (Civil Agencies)  
 2.3 *Military Standards:*<sup>7</sup>  
 MIL-STD-129 Marking for Shipment and Storage  
 MIL-STD-163 Steel Mill Products, Preparation for Shipment and Storage

### 3. Terminology

3.1 Definitions—For definitions of terms such as ~~fabric (chain-link fence) and fence~~, PVC, and polymer coating, see Terminology F 552.

### 4. Classification

- 4.1 ~~PVC~~Polymer-coated steel barbed wire is supplied in a choice of two types as follows:  
 4.1.1 *Type I (Standard)*, with barbs spaced on 5-in. (127-mm) centers; and  
 4.1.2 *Type II (High Security)*, with barbs spaced on 3-in. (76-mm) centers.

### 5. Ordering Information

- 5.1 Orders for barbed wire purchased in accordance with this specification shall include the following information:  
 5.1.1 Quantity (expressed in number of spools);  
 5.1.2 Length of spools (1320 or 1000 ft (402 or 305 m); see 9.4);  
 5.1.3 Class of ~~PVC~~ a polymer coating to be applied to metallic-coated steel strand wire;  
 5.1.4 Color of coating;  
 5.1.5 Type of barbs (galvanized steel or aluminum alloy; see 6.3);  
 5.1.6 Type of barbed wire (Type I or II; see 4.1.1 and 4.1.2);  
 5.1.7 Selection of type of metallic coating on the steel strand wire substrate, which shall be the choice of the producer unless otherwise specified;  
 5.1.8 Packaging requirements;  
 5.1.9 ASTM designation and year of issue; and  
 5.1.10 Certification, if required;  
 5.2 Any tests required other than those covered specifically in this specification must be stipulated by the purchaser in the order or contract.  
 5.3 All spools of barbed wire accepted by the purchaser shall be billed on the basis of the number and original length.

NOTE 1—A typical ordering description is as follows: 20 spools ~~PVC-coated~~ polymer-coated steel barbed wire, 1000-ft (305-m) spools, Class 2b coating, olive green color, aluminum alloy barbs, Type II (high security), on pallets, certified to ASTM F1665.

### 6. Materials

6.1 *Base Metal*—The base metal shall be steel of such quality and purity that, when drawn to the size of wire specified, it shall be of uniform quality and have properties and characteristics as prescribed in this specification.

#### 6.2 ~~PVC-Coated Wire~~—Wire

6.2 Wire used for the manufacture of strand wire shall meet the ~~PVC coating~~ requirements of ~~Specification F 668~~; this specification. The ~~PVC polymer coating~~ shall be ~~plasticized formulated and compounded thoroughly so that there is full dispersment produced properly to conform to the requirements of pigments, stabilizer, and other components~~; this specification.

<sup>2</sup> Annual Book of ASTM Standards, Vol 01.06.

<sup>3</sup> Annual Book of ASTM Standards, Vol 01.03.

<sup>4</sup> Annual Book of ASTM Standards, Vol 01.05.

<sup>5</sup> Annual Book of ASTM Standards, Vol 08.01.

<sup>6</sup> Annual Book of ASTM Standards, Vol 06.01.

<sup>7</sup> Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

**6.3 Materials for Barbs:**

6.3.1 *Zinc-Coated Steel Wire*, if used for the barbs, shall be 14 gage, 0.080 in. (2.03 mm), having a Class 3 zinc coating, minimum 0.70 oz/ft (215 g/m) when tested in accordance with Test Method A 90/A 90M.

6.3.2 *Aluminum Alloy Wire*, if used for the barbs, shall be 14 gage, 0.080 in. (2.03 mm), Alloy 5000-H38, 6061-T94, or equal, as agreed upon between the manufacturer and the purchaser at the time of purchase.

6.3.3 The choice of either zinc-coated steel wire or aluminum alloy wire for the barbs shall be that of the manufacturer, unless otherwise specified by the purchaser.

**7. Manufacture**

7.1 Class 1 ~~PVC-coated~~ polymer-coated wire shall have the ~~PVC~~ coating extruded onto the strand wire that conforms to the requirements as given in Table 1.

7.2 Class 2a ~~PVC-coated~~ polymer-coated wire shall have the ~~PVC~~ coating extruded and adhered to the strand wire that conforms to the requirements as given in Table 1.

7.3 Class 2b ~~PVC-coated~~ polymer-coated wire shall have the ~~PVC~~ coating fused and adhered to the strand wire that conforms to the requirements as given in Table 1.

**8. Size and Construction**

8.1 All barbed wire furnished in accordance with this specification shall be fabricated from two strands of 14 gage, 0.080-in. (2.03-mm) metallic-coated core, ~~PVC-coated~~ polymer-coated steel wire, with four-point barbs of 14 gage, 0.080-in. zinc-coated steel or aluminum alloy wire.

**9. Size and Permissible Variations**

9.1 *Line Wire*—The permissible variation from the nominal diameter of the wire shall be ±0.004 in. (0.10 mm).

9.2 *Barbs*—Due to the mechanics of the manufacture when forming the barbs, a certain amount of out-of-roundness can be expected, and this precludes barbs from being subjected to checks for other than nominal diameter and length. Measured from the center of the two strand wires, the barb length shall be 3/8 in. (9.5 mm), minimum.

9.3 *Spacing of Barbs*—Barbs shall be spaced as indicated in 4.1.1 or 4.1.2. The individual barb spacing shall be measured from the edge of one barb at the strand to the corresponding edge of the adjacent barb. Cumulative spacing is established by counting the total number of barbs in a 25-ft (7.6-m) length of barbed wire. Barbs are subject to relocation during fabrication and handling; therefore, a rigid interpretation of the spacing requirement may lead to undue rejections. Any sample with 93.5 % of the individual barb spacings conforming to the specified spacing (±3/4 in. (19 mm)) and containing a minimum of 55 barbs (5-in. (127-mm) spacing) or a minimum of 86 barbs (3-in. (76-mm) spacing) in 25 ft shall be considered acceptable.

9.4 The length of barbed wire in each spool shall be 80 rods (402 m). This is equivalent to one-quarter mile, or 1320 ft. At the option of the manufacturer, 1000-ft (305-m) spools may be offered.

**10. Joints and Workmanship**

10.1 Splicing of individual wires by means of a wrap joint or an electric butt weld is permitted. Not more than three splices or joints shall exist in any spool of barbed wire. Such splices or joints shall be made in a workmanlike manner.

10.2 The strands shall be twisted with a uniform length of lay. The direction of twisting may be either right or left hand. Alternate left and right hand twisting is not permitted.

10.3 The barbs shall be sharp, well-formed, wrapped tightly, and spaced in accordance with 9.3.

**11. Weight of Metallic Coating**

11.1 The minimum weight of zinc coating for the galvanized barbs shall be 0.70 oz/ft (215 g/m). The minimum weight of the strand wire metallic coating shall conform to Table 1 when tested in accordance with Test Method A 90/A 90M or Test Method A 428, as applicable.

**12. Breaking Strength**

12.1 The minimum breaking strength of the stranded barbed wire shall be 760 lbf (3380 N) when tested in accordance with Test Methods and Definitions A 370. This breaking strength value reflects that of both strand wires together as one unit.

**TABLE 1 Weight of Strand Wire Metallic Coatings**

Specified Core Diameter of Strand Wire, in. (mm)	Minimum Weight of Zinc Coating, oz/ft (g/m)	Minimum Weight of Aluminum Coating, oz/ft <sup>2</sup> (g/m <sup>2</sup> )	Minimum Weight of Zinc-5 % Aluminum-Mischmetal Coating, oz/ft (g/m)
0.080 (2.03)	0.25 (75)	0.20 (61)	0.25 (75)

**13. Properties of PVC Polymer-Coated Barbed Wire**

13.1 The ~~PVC-coated~~ polymer-coated barbed wire shall have a demonstrated ability to conform to the following requirements:

13.2 *Adhesion Tests:*

13.2.1 Class 2a shall conform to the requirements of 13.2.2. Class 2b shall conform to the requirements of 13.2.3.

13.2.2 Three specimens from each lot shall be tested. Measure a distance of 3/4 in. (19 mm) from the end of the specimen. With a regular hand grip wire stripper, exert maximum hand pull parallel to the axis of the wire. Attempt to remove the measured portion of the ~~vinyl polymer~~ sleeve from the core wire. The lot shall be acceptable if the ~~vinyl polymer~~ sleeve is not capable of being removed from the core wire on all three samples.

13.2.3 Three specimens from each lot shall be tested. Make two cuts parallel to the axis of the wire through the coating, approximately 1/16 in. (1.6 mm) apart, at least 1/2 in. (12.7 mm) long. With a knife, peel back a section of the coating between 1/8 and 1/4 in. (3.2 and 6.4 mm) long to produce a tab. Attempt to remove the 1/16-in. (1.6 mm) strip of coating by pulling the tab. The lot shall be acceptable if the coating breaks rather than separates from the core wire on all three specimens.

13.3 *Accelerated Aging*—The ~~PVC-coated~~ polymer-coated wire shall withstand exposure for 1000 h without failure at a black panel temperature of 145°F (63°C) when tested in accordance with Practice D 1499. Type D, E, or F apparatus described in Practice G 23 or Type BH apparatus described in Practice G 26 shall be used for the test. The product shall be construed to have failed the test if one of the following occurs:

~~13.3.1 The wire fails to withstand the mandrel bend test described in 13.4,~~

~~13.3.2 Shrinkage~~

~~13.3.1 Shrinkage of the PVC polymer coating is greater than 1/16 in./ft (51.26 mm/305 mm) of wire, or,~~

~~13.3.2 There shall be no significant change in color or gloss of the PVC polymer surface as determined by visual inspection.~~

~~13.4 Mandrel Bend:~~

~~13.4.1 When subjected to a single bend at -20°F (-29°C) around a mandrel no larger than ten times the diameter of the wire, PVC-coated wire shall not exhibit breaks or cracks in the PVC coating.~~

~~13.4.2 The mandrel bend test shall be performed on an individual piece of wire. This specimen may be any length of wire over 12 in. (305 mm).~~

~~13.5 Color~~—Unless otherwise stipulated by the purchaser, the color of the ~~PVC polymer~~ shall be in accordance with the standard colors contained in Specification F 934: green, olive green, brown, and black.

**14. Thickness of PVC Polymer Coating**

14.1 The thickness of the ~~PVC polymer~~ coating shall be in accordance with Table 2.

14.2 The thickness of the ~~PVC polymer~~ coating shall be determined on an individual piece of wire. This specimen may be any length of wire over 12 in. (305 mm).

14.3 For Class 1 and Class 2a material, strip the ~~PVC polymer~~ coating mechanically from the wire and measure the minimum and maximum thickness of the ~~PVC polymer~~ coating with a suitable micrometer.

14.4 For Class 2b material, strip the ~~PVC polymer~~ coating by chemical means and determine the diameter of the bare wire. Scrape the coating from one side of the wire and measure the reduced diameter with a micrometer. The thickness of the coating at this point is the difference between the measurement thus obtained and the measured diameter of the bare wire. In a similar manner, determine the thickness of the coating at right angles to the first determination.

14.5 Take care not to remove any of the metallic surface when removing ~~PVC polymer~~ coating by scraping.

**15. Sampling**

15.1 For the purpose of the tests, one spool from every 50 spools or fraction thereof in a lot shall be selected at random, or a total of seven samples, whichever is less. A lot shall consist of all of the spools of a single type of barbed wire offered for delivery at the same time.

15.2 *Test Specimens*—A 4-ft (1.2-m) length of barbed wire shall be cut from the end of the spool for the tests prescribed in Sections 11 through 14. Each strand wire shall be tested for its metallic and ~~PVC polymer~~ coating. The breaking strength value shall be determined by having the twisted strand tested as a composite.

15.3 Instead of testing wire for its coating and breaking strength from the completed barbed wire in accordance with 15.2, the manufacturer may elect to establish compliance with Sections 11 through 14 by tests made on wire prior to fabrication. If the manufacturer makes this election, the purchaser still reserves the right to test wire from the completed barbed wire for compliance.

15.4 For the purpose of inspection, a maximum of two spools from the lot (as described in 15.1) may be subjected to observations for barb length and spacing, overall length, and general workmanship.

**TABLE 2 Thickness of PVC Polymer Coating**

	Class 1 and Class 2a, in. (mm)	Class 2b, in. (mm)
Minimum thickness at any point	0.015 (0.38)	0.006 (0.15)
Maximum thickness at any point	0.025 (0.64)	0.010 (0.25)

15.5 Instead of inspecting for length by unrolling full spools in accordance with 15.4, the purchaser and the manufacturer may agree on a weight per spool related to the wire size or measuring tools used during manufacturing. The purchaser still reserves the right to confirm the length by actual measurement.

15.6 Inspection for barb spacing is normally performed on the outer 25-ft (7.6-m) length of a spool; this permits repackaging of the spool. Any other selection shall be as agreed upon between the manufacturer and the purchaser.

## 16. Retests and Rejection

16.1 Should one or more of the individual wire specimens fail the coating tests or a strand specimen fail the breaking strength test, the lot shall be subjected to retest. Four additional spools of barbed wire for each 50 spools offered shall be sampled for retest purposes. The lot size then becomes 50, except that this lot size may vary slightly to accommodate pallet count when the barbed wire is palletized.

16.2 *Retesting for Coating*—Should more than two of the individual strand wires of the retest specimens fail to meet the specified coating, the entire lot represented by the retest may be rejected.

16.3 *Retesting for Breaking Strength*—Should any of the retest specimens fail to meet the minimum breaking strength values specified, the entire lot represented by the specimens may be rejected.

16.4 Instead of rejecting the entire lot as provided for in 16.2 and 16.3, the producer or purchaser may test specimens from every spool, as provided for in 15.2, and the purchaser may reject only those spools failing the weight of coating or breaking strength requirements.

16.5 *Reinspection for Barb Spacing, Barb Length, and Overall Length*—Should either of the sample spools fail to meet the requirements of 9.2 through 9.4, two additional spools shall be selected for inspection. The lot may be rejected if either of these spools fails to meet the requirements.

## 17. Inspection

17.1 Unless otherwise specified in the purchase order or contract, the manufacturer is responsible for performance of all inspection and test requirements specified in this specification. Except as otherwise specified in the purchase order or contract, the manufacturer may use his own or any other suitable facilities for performance of the inspection and test requirements unless disapproved by the purchaser at the time the order is placed. The purchaser shall have the right to perform any of the inspection and tests set forth in this specification when such inspections and tests are deemed necessary to ensure that the material conforms to prescribed requirements.

## 18. Certification

18.1 When specified in the purchase order or contract, a producer's or supplier's certification shall be furnished to the purchaser that the material was manufactured, sampled, tested, and inspected in accordance with this specification and has been found to meet the requirements. When specified in the purchase order or contract, a report of the test results shall be furnished.

## 19. Packaging and Marking

19.1 Unless otherwise specified, packaging, marking, and loading for shipment shall be in accordance with Practices A 700.

19.2 When specified in the contract or order, and for direct procurement by or direct shipment to the U.S. government, when Level A is specified, preservation, packaging, and packing shall be in accordance with the Level A requirement of MIL-STD-163.

19.3 When specified in the contract or order, and for direct procurement by or direct shipment to the U.S. government, marking for shipment, in addition to the requirements specified in the contract or order, shall be in accordance with MIL-STD-129 for U.S. military agencies and in accordance with Fed. Std. No. 123 for U.S. government civil agencies.

## 20. Keywords

20.1 barbed wire; chain-link fence; fencing material; ~~PVC-coated~~ polymer coated steel wire; PVC coated steel wire; wire

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