



Designation: **F 1664 – 9501**

Standard Specification for Poly(Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Tension Wire Used with Chain-Link Fence¹

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1. Scope

1.1 This specification covers poly(vinyl chloride) and other conforming organic polymer-coated steel tension wire for use with chain link fence. Poly(vinyl chloride) and other organic polymer coatings hereinafter will be designated ~~PVC~~ as polymer coating.

1.2 Tension 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/A 90M Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings²

¹ 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 Products³
- A 428 Test Method for Weight of Coating on Aluminum-Coated Iron or Steel Articles²
- D 1499 Practice for Operating Light- and Water-Exposure Apparatus (Carbon-Arc Type) for Exposure of Plastics⁴
- F 552 Terminology Relating to Chain Link Fencing²
- F 934 Specification for Standard Colors for Polymer Coated Chain Link Fence Materials²
- G 23 Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials⁵
- G 26 Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials⁵

3. Terminology

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

4. Ordering Information

- 4.1 Orders for tension wire purchased in accordance with this specification shall include the following information:
 - 4.1.1 Quantity (expressed in number of coils);
 - 4.1.2 Class of ~~PVC~~ coating to be applied to metallic-coated steel wire;
 - 4.1.3 Color of coating;
 - 4.1.4 Selection of type of metallic coating on the steel wire substrate, which shall be the choice of the producer unless otherwise specified;
 - 4.1.5 Core diameter of wire or minimum wire breaking strength, or both;
 - 4.1.6 Packaging requirements; and
 - 4.1.7 Certification, if required.
- 4.2 Any tests required other than those covered specifically in this specification must be stipulated by the purchaser in the order or contract.

NOTE 1—A typical ordering description is as follows: 20 coils ~~PVC-coated~~ polymer-coated steel tension wire, Class 2b coating, olive green color, 7-gage (0.177-in. [4.50 mm]) core wire, in 1000-ft (305-m) coils, certified to ASTM F 1664.

5. Materials

5.1 *Base Metal*—The base metal shall be steel of such quality and purity that, when drawn to the size of wire specified and coated with ~~PVC,~~ an organic polymer, the finished wire shall be of uniform quality and have properties and characteristics as prescribed in this specification.

~~5.2 PVC-Coated Wire—Wire~~

~~5.2 Wire~~ used for the manufacture of tension wire shall meet the requirements of this specification. ~~The PVC polymer coating shall be plasticized formulated and compounded thoroughly so that there is full dispersement produced properly to conform to the requirements of pigments, stabilizer, and other components. this specification.~~

6. Manufacture

- 6.1 Class 1 ~~PVC-coated~~ polymer-coated wire shall have the ~~PVC~~ coating extruded onto wire that conforms to the requirements as given in Table 1.
- 6.2 Class 2a ~~PVC-coated~~ polymer-coated wire shall have the ~~PVC~~ coating extruded and adhered to wire that conforms to the requirements as given in Table 1.
- 6.3 Class 2b ~~PVC-coated~~ polymer-coated wire shall have the ~~PVC~~ coating fused and adhered to wire that conforms to the requirements as given in Table 1.

7. Size of Wire

7.1 The permissible variation from the specified diameter of the core wire, 0.177 in. (4.50 mm) 7 gage or 0.148 in. (3.76 mm) 9 gage, shall be ± 0.005 in. (0.13 mm).

² Annual Book of ASTM Standards, Vol 01.06.
³ Annual Book of ASTM Standards, Vol 01.03.
⁴ Annual Book of ASTM Standards, Vol 08.01.
⁵ Annual Book of ASTM Standards, Vol 06.01.

TABLE 1 Breaking Strength of Metallic-Coated Core Wire

Specified Diameter of Core Wire, in. (mm)	Minimum Breaking Strength, lbf (N)
0.177 (4.50)	1950 (8670)
0.148 (3.76)	1290 (5740)

8. Breaking Strength

8.1 Tension wire shall meet the minimum breaking strength indicated in Table 2 when tested in accordance with Test Methods and Definitions A 370.

8.2 Specimens to establish conformance with this requirement shall comprise individual pieces from a coil of the tension wire. The specimens shall be of sufficient length so as to be gripped firmly in the testing machine. The PVC polymer coating may be removed from the sample by chemical or mechanical means before testing.

9. Weight of Metallic Coatings

9.1 The weight of the metallic coating shall conform to Table 1.

9.2 The weight of the coating shall be determined on an individual piece of wire over 12 in. (305 mm).

9.3 The weight of the zinc or zinc-5 % aluminum mischmetal alloy coating shall be determined by the method contained in Test Method A 90/A 90M after stripping the PVC polymer coating as outlined in Section 10.

9.4 The weight of the aluminum coating shall be determined by the method contained in Test Method A 428 after stripping the PVC polymer coating as outlined in Section 10.

10. Thickness of PVC Coating

10.1 The thickness of the PVC coating shall be in accordance with Table 3.

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

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

10.4 For Class 2b material, strip the PVC 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.

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

11. Properties of PVC Polymer-Coated Tension Wire

11.1 The PVC-coated polymer-coated tension wire shall have a demonstrated ability to conform to the following requirements:

11.2 *Adhesion Tests:*

11.2.1 Class 2a must conform to the requirements of 11.2.2. Class 2b must conform to the requirements of 11.2.3.

11.2.2 Three specimens from each lot shall be tested. Measure a distance of 3-4³/₄ 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.

11.2.3 Three specimens from each lot shall be tested. Make two cuts parallel to the axis of the wire through the coating, approximately ~~1-6 in.~~ 1/16 in. (1.6-mm) apart, at least ~~1-1/2 in.~~ (12.7 mm) long. With a knife, peel back a section of the coating between ~~1-8/16 in.~~ 1-1/4 in. (3.2 and 6.4 mm) long to produce a tab. Attempt to remove the ~~1-1/6 in.~~ 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.

11.3 *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:

~~11.3.1 The wire fails to withstand the mandrel bend test described in 11.4;~~

~~11.3.2 Shrinkage~~

~~11.3.1 Shrinkage~~ of the PVC polymer coating ~~is shall be no~~ greater than ~~1-6/16 in./ft~~ (51.26 mm/305 mm) of wire, or

~~11.3.2 There shall be no~~ significant change in color or gloss of the PVC polymer surface as determined by visual inspection.

~~11.4 Mandrel Bend:~~

~~11.4.1 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.~~

TABLE 2 Weight of Metallic Coatings

Specified Diameter of Core Wire, in. (mm)	Minimum Weight of Zinc Coating, oz/ft ² (g/m ²)	Minimum Weight of Aluminum Coating, oz/ft ² (g/m ²)	Minimum Weight of Zinc-5 % Aluminum-Mischmetal Coating, oz/ft ² (g/m ²)
0.177 (4.50)	0.40 (122)	0.20 (61)	0.40 (122)
0.148 (3.76)	0.30 (92)	0.20 (61)	0.30 (92)

TABLE 3 Thickness of PVColymer 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)	0.012 (0.30)

11.4.2 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).

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

12. Workmanship

12.1 The ~~PVC-coated~~ polymer-coated tension wire shall be produced by methods recognized as good commercial practices. The PVC coating shall be without voids. The ~~PVC-coated~~ coated wire shall be manufactured without tears or cuts that reveal the substrate.

13. Standard Length of Coils

13.1 The standard length of coils shall be 1000 ft (305 m) ± 1 % except as otherwise agreed upon at the time of purchase.

14. Field Sampling and Number of Tests

14.1 The purchaser may select at random one coil from every 50 coils or fraction thereof for test purposes, except that in no case shall fewer than two coils be sampled.

14.2 Sample coils thus selected shall be checked for wire size (Section 7).

14.3 Test specimens taken from the outside end of the sample coils shall be tested for the class of PVC polymer coating (Section 6 and Section 11), core wire size (Section 7), breaking strength (Section 8), weight of metallic coating (Section 9), and thickness of PVC polymer coating (Section 10).

14.4 If any specimen tested fails to conform to the specified requirements, the coil represented by the specimen shall be rejected and two additional coils shall be tested, both of which shall meet the requirements in every respect; otherwise the lot represented by the samples may be rejected.

15. Inspection

15.1 The supplier is responsible for the performance of all inspection and test requirements as specified herein. The supplier may use his own or other suitable facilities for inspection and testing unless the purchaser does not approve at the time the order is placed. The purchaser has the right to make any of the inspection and tests outlined where such are deemed necessary.

16. Certification and Report

16.1 Upon the request of the purchaser in the contract or order, a manufacturer's certification that the material was produced in accordance with the specification shall be furnished.

17. Packaging, Package Marking, and Loading

17.1 Marking shall be by a tag attached securely to each coil of tension wire and shall indicate the identity of the producer, quantity, core wire size, type of coating, class of coating (if applicable), and ASTM designation.

17.2 Packaging of the coils of wire shall be agreed upon between the producer and the purchaser. This agreement may include the coil dimension and weight.

18. Keywords

18.1 chain-link fence; ~~PVC-coated~~ polymer-coated steel wire; steel wire; tension wire; wire

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