## SECTION 1043

## FENCE MATERIAL

**1043.1 Scope.** This specification covers the material required in the construction of chain-link fence and woven wire fence.

**1043.2 Chain Link Fence Material.** Material used in the construction of fences and gates shall consist of chain-link fence fabric, posts, rails, ties, bands, bars, rods, tension wire and other fittings and hardware designed to support the fabric in a vertical, taut position.

**1043.2.1 Zinc Coated Steel Fabric.** Zinc coated steel fabric shall be in accordance with AASHTO M 181, Type 1, Class D, with the following exceptions. The weight of zinc coating shall be at least 2.0 ounces per square foot of uncoated wire surface, determined from the average of all specimens representing the lot and no less than 1.8 ounces per square foot on an individual specimen. Sections of fencing with excessive lumps, beads and drops of zinc will be removed before determining weight of coating.

**1043.2.2 Aluminum Coated Steel Fabric.** Aluminum coated steel fabric shall be in accordance with AASHTO M 181, Type 2, with the following exceptions. An individual specimen shall have at least 0.30 ounce per square foot of uncoated wire surface on 0.148 or 0.192-inch specified diameter wire and no less than 0.25 ounce per square foot on 0.120-inch specified diameter wire.

**1043.2.3 Vinyl Coated Steel Fabric.** Vinyl coated steel fabric shall be in accordance with AASHTO M 181, Type IV, Class A or Class B. In addition to the referenced colors, brown will also be acceptable.

**1043.2.4 Aluminum Alloy Fabric.** Aluminum alloy fabric shall be in accordance with AASHTO M 181, Type III.

**1043.2.5 Posts, Braces, Rails and Gate Frames.** These members shall be in accordance with AASHTO M 181, Grade 1 or Grade 2, and of the shape and dimension shown on the plans. These members may be used with either Type I, Type II, Type III or Type IV fabric.

**1043.2.5.1 Zinc Coated Steel Members.** Zinc coated steel members shall be in accordance with ASTM F 1043, heavy industrial fence Group IA, with Type A interior and exterior coating, and the plans.

**1043.2.5.2 Zinc Plus Organic Coated Steel Members.** Zinc plus organic coated steel members shall be in accordance with ASTM F 1043, heavy industrial fence Group IC, with Type B or D interior coating and Type B exterior coating, and the plans.

**1043.2.5.3 Aluminum Alloy Members.** Aluminum alloy members shall be in accordance with ASTM F 1043, heavy industrial fence Group IB, and the plans.

**1043.2.6 Tension Wire.** Tension wire shall be in accordance with AASHTO M 181 Type I, Class I.

**1043.2.7 Fabric Fasteners.** Fabric fasteners shall consist of wire ties, hog rings and C-clips. Fasteners for use with zinc or aluminum coated steel fabric shall be in accordance with Sec 1043.2.7.1 or Sec 1043.2.7.2; those for use with aluminum alloy fabric shall be in accordance with Sec 1043.2.7.2; and those for use with vinyl coated steel fabric shall be in accordance with Sec 1043.2.7.3. Fasteners shall be capable of withstanding a 180-degree bend over the fasteners own diameter without fracture of the wire or loss of adherence of coating. The wire shall have a finished or coated diameter of no less than 0.143 inch, except C-clips for attaching fabric to H section posts shall have a finished or coated diameter of no less than 0.187 inch. Aluminum alloy C-clips will not be permitted for fastening fabric to H section posts.

**1043.2.7.1 Zinc or Aluminum Coated Fabric Fasteners.** Wire shall be zinc coated at a rate of no less than 0.70 ounce per square foot or aluminum coated at a rate of no less than 0.30 ounce per square foot.

**1043.2.7.2 Aluminum Alloy Fabric Fasteners.** Wire shall be of aluminum alloy having a minimum tensile strength of 16,000 psi.

**1043.2.7.3 Vinyl Coated Fabric Fasteners.** Wire may be of steel or aluminum alloy and shall be uniformly coated with the same vinyl material as used to coat the fence fabric. Vinyl coating thickness shall be a minimum of 0.010 inch. Aluminum alloy wire shall have a minimum tensile strength of 16,000 psi.

**1043.2.8 Miscellaneous Fittings and Hardware.** Miscellaneous fittings and hardware shall be in accordance with AASHTO M 181. Aluminum alloy fittings shall not be used with zinc coated steel posts, rails or gate frames.

**1043.2.9 Gates.** Frames shall be fastened at the corners by clamps and braces, or by welding. If corners are to be welded, the ends of the vertical members shall be hemispherically notched to fit snugly to the horizontal members. The joint shall be uniformly and continuously fillet welded. The welded area and adjacent damaged coating shall be recoated by the hot-dip process or metallizing process; or covered with two coats of zinc-rich paint. The material for repair of welded areas and applications shall meet the approval of the engineer. Each gate frame shall be cross-braced with no less than two 3/8-inch adjustable truss rods. The filler for gates shall be chain-link fabric of the same kind used for the fence. This filler shall be attached to the frame with stretcher bars and wire ties or clamps. Gates 6 feet high or less shall be equipped with two hinges, and gates more than 6 feet high shall have three hinges. All gates, walks and drives, shall be equipped with a latch and locking attachment. Gatekeepers and center rests of an approved design shall be installed for double drive gates.

**1043.2.10 Barbed Wire.** Barbed wire for use with chain-link fence shall be zinc-coated steel, aluminum-coated steel or aluminum alloy, and shall be in accordance with AASHT0 M 280, with the following exceptions. Zinc-coated barbed wire shall consist of two No. 12 1/2, 13 1/2 or 15 1/2 gage line wires twisted with 4-point barbs uniformly spaced approximately 4 or 5 inches apart in accordance with and the minimum weight of coating shall be 0.80 ounce per square foot of uncoated wire surface for all gages. Aluminum-coated barbed wire shall be in accordance with the requirements for zinc-coated barbed wire, except that the coating shall be aluminum alloy. The weight of coating per square foot of surface shall be no less than 0.25 ounce for both line wires and barbs. However, barbs of suitable aluminum alloy will be permitted. Aluminum alloy barbed wire shall be aluminum alloy 5052-H38, ASTM B 211. Aluminum alloy barbed wire shall consist of two 0.110-inch line wires twisted with 4-point 0.080-inch diameter wire barbs spaced 5 inches apart.

**1043.3 Woven Wire Fence Material.** Woven wire fence shall be composed of woven wire, barbed wire, brace wire, posts, ties, fittings and hardware.

**1043.3.1 Fabric.** Fabric shall be made of zinc-coated or aluminum-coated steel wire. Zinc coated fabric shall be in accordance with AASHTO M 279, for Design Number 939-6-11, Grade 60 or 939-6-12.5, Grade 125. The minimum weight of zinc coating shall be Class 3 for all gages. Line wires shall have tension curves. Aluminum-coated fabric shall be in accordance with the requirements for zinc-coated fabric, except that the coating shall be aluminum alloy applied at the rate of no less than 0.25 ounce per square foot of uncoated wire surface.

**1043.3.2 Barbed Wire.** Barbed wire for use with zinc-coated steel fabric or aluminum-coated steel fabric shall be in accordance with Sec 1043.2.10.

**1043.3.3 Wood Posts.** Wood posts and braces shall be in accordance with Sec 1050.

**1043.3.4 Steel Posts.** Steel posts and braces shall be in accordance with Sec 1043.2.5. Corner, end and pull posts shall be pipe of the sizes and weights shown on the plans. Line posts shall be of the lengths and shapes shown on the plans. Posts shall have a nominal weight of 1.33 pounds per linear foot and a minimum weight of 1.28 pounds per linear foot, exclusive of anchor plate.

**1043.3.5 Post Tops and Miscellaneous Hardware.** Post tops and miscellaneous fittings and hardware shall be in accordance AASHTO M 181.

**1043.3.6 Brace Wire.** Brace wire shall be no less than 0.143 inch in diameter and shall be of material in accordance with Sec 1043.3.1.

**1043.3.7 Staples.** Staples shall be of the screw shank-type or equivalent, a minimum of 1 1/4 inches long, galvanized, and of good commercial quality.

**1043.3.8 Wire Ties.** Wire used for ties shall be in accordance with Sec 1043.2.7, except that the wire may have a minimum diameter of 0.115 inch.

**1043.3.9 Gates.** Gates for woven wire fence shall be in accordance with Sec 1043.2.9, except that the filler shall be woven wire fabric meeting these specifications.

**1043.4 Workmanship and Finish.** Fabrication of chain-link or woven wire fencing material furnished under these specifications shall be in accordance with the sizes, shapes and dimensions shown on the plans. Excessive roughness, blisters, sal-ammoniac spots, bruises, flaking, voids in coating, frozen knuckles or other defects, if present to any considerable extent, will be considered cause for rejection. Polyvinyl chloride coating shall be without voids, tears, cracks or cuts that reveal the substrate. Welded seam pipe shall have smooth welds, without skips or gaps. Non-uniform or damaged organic topcoats will be considered cause for rejection whether caused by fabrication, shipping or handling on the job. All burrs at the ends of posts and rails shall be removed.

**1043.5 Sampling and Testing.**

**1043.5.1 Sampling.** Sampling of material shall be in accordance with the MoDOT Materials Manual.

**1043.5.2 Testing.** When fencing material is tested, tests shall be in accordance with the following methods.

**1043.5.2.1 Weight.** Weight of hot-dip zinc coatings shall be determined in accordance with AASHTO T 65 or, at the option of the engineer, material may be accepted on the basis of

magnetic gauge determinations conducted in accordance with ASTM E 376. Weight of aluminum coating shall be determined in accordance with AASHTO T 213 or, at the option of the engineer, material may be accepted on the basis of magnetic gauge determinations conducted in accordance with ASTM E 376.

**1043.5.2.2 Thickness.** Thickness of zinc-rich organic coating shall be determined by magnetic gauge determinations conducted in accordance with ASTM E 376. Thickness of organic topcoat shall be determined by first determining the total thickness of the organic topcoat and exterior hot-dip zinc coating by magnetic gauge determinations conducted in accordance with ASTM E 376, then chemically stripping the organic topcoat and determining the thickness of only the exterior hot-dip zinc in accordance with AASHTO T 65 or ASTM E 376. The difference between the two measurements shall be the thickness of the organic topcoat.

**1043.5.2.3 Tensile Strength.** Tensile strength or breaking load shall be in accordance with AASHTO T 68.

**1043.6 Inspection..** The engineer shall have access at all times to all parts of the manufacturer's or fabricator's works that concern the manufacture or fabrication of material furnished under this specification. Each product or article furnished under this specification will be subject to inspection at the factory, fabricating plant, in laboratories of the engineer's choosing, or at the point of delivery. The engineer reserves the right to sample and test each product or article subsequent to acceptance at the place of manufacture or fabrication to determine conformance with the requirements of this specification or to verify certification.

**1043.7 Certification.** Certifications will be required as follows.

**1043.7.1 Vinyl Coated Material.** The contractor shall submit to the engineer certification that the vinyl material and vinyl coated fabric meet the requirements of these specifications. If vinyl coated items other than chain-link fabric are furnished, certification will also be required.

**1043.7.2 Aluminum Alloy Material.** The contractor shall submit to the engineer certification that the material is in accordance with the requirements specified. The certificate shall include or have attached a list or description of typical physical properties representative of the material.

**1043.7.3 Organic Topcoated Material.** The contractor shall submit to the engineer certification that the material is in accordance with the requirements specified and that the material is the same as prequalified by the engineer.

**1043.8 Packaging and Marking.** Packaging and marking of the material shall provide ease of handling, storage and identification.

**1043.8.1** Each length of chain-link fabric, woven wire fabric or barbed wire shall be tightly rolled and firmly tied. Each roll shall carry a tag showing, as applicable to the product, the length, kind of base metal, type of coating, specified wire size, mesh size, design (style), height or width of fabric, and the producer name, brand or trademark of the manufacturer.

**1043.9.8.2** Each bundle or container of posts, hardware and fittings shall be marked with the name, brand or trademark of the manufacturer, type of material (steel, cast iron, aluminum alloy number, etc.), type of coating and any additional data required for proper identification or to determine apparent conformance to specified quality requirements.