SECTION 607

FENCING

SECTION 607.10 CHAIN-LINK FENCE

607.10.1 Description. This work shall consist of furnishing and erecting chain-link fence and gates as shown on the plans or as directed by the engineer.

607.10.2 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section
Chain-Link Fence	1043

607.10.2.1 The contractor may select either zinc-coated steel, aluminum-coated steel, aluminum alloy or vinyl-coated steel fencing material, except that the same kind of material shall be used throughout the project.

607.10.2.2 Walk gates and drive gates, if required, shall be of the same material as that selected for the fence. If the project requires an extension of an existing fence, the new fence material for the extension shall match the existing material.

607.10.3 Construction Requirements.

607.10.3.1 The contractor shall fill, cut or trench where necessary to produce a smooth and uniform ground surface so the bottom of the fabric is no more than 3 inches (75 mm) above the finished ground line. All posts shall be set plumb, true to line and grade. Terminal posts, defined as end, gate, corner and pull posts, shall be set in concrete. Concrete for the footings shall be Class B concrete or a commercial mixture in accordance with Sec 501. The concrete footing shall be a uniform thickness around the post and shall have a cone or dome shaped top. At the option of the contractor, line posts may be driven or placed in dug or drilled holes and set in concrete or quick-setting polyurethane foam in accordance with Sec 903.3.1.2. If the contractor elects to drive line posts, the posts shall be of the length and driven to the depth shown on the plans. If posts cannot be driven to the correct depth, the posts shall be removed and placed in dug or drilled holes and set in foam or concrete footings. Posts damaged during installation shall be removed and replaced at the contractor's expense.

607.10.3.2 Fabric shall not be attached to posts until the concrete footings have cured for at least five days. Fabric shall be securely attached to end, corner, gate and pull posts in accordance with manufacturer's recommendations. The fabric shall be attached to the tension wire with hog rings, spaced as shown on the plans. The fabric shall be attached to line posts with wire ties or bands spaced in accordance with manufacturer's recommendations. All fabric shall be taut before attaching to line posts and tension wire.

607.10.3.3 Drive gates shall have an approximate full circle opening swing. Walk gates shall have positive stops to prevent the gates from swinging into the right of way.

607.10.3.4 If the chain link fence is required to be topped with barbed wire, the barbed wire support arm shall be at a 45-degree angle, ± 5 degrees, from the vertical plane of the fence line

extended above the fence, and shall be fitted with clips, slots or other device for attaching three strands of barbed wire to the arm. The top strand shall be located 12 inches (300 mm) horizontally from the fence line, ± 3 inches (75 mm), with the other wires spaced uniformly between the top of the fence fabric and the top outside strand of barbed wire. The barbed wire arm shall be of sufficient strength to withstand a weight of 250 pounds (113 kg) applied at the outer strand of barbed wire without causing any permanent deflection of the arm. Each strand of barbed wire shall be pulled taut to remove all sag before the strand is attached to the extension arm.

607.10.3.5 Post braces shall be installed for each gate, corner, pull and end post. The brace shall extend from the mid point of the gate, corner, pull and end post to the midpoint of the adjacent line post. A truss rod shall be connected to the midpoint of the line post and run back to the bottom of the gate, corner, pull and end post. The truss rod shall be equipped with a turnbuckle or other equivalent device for adjustment.

607.10.4 Method of Measurement. Measurement of chain-link fence will be made to the nearest linear foot (0.5 m), measured along the slope of the fabric, but shall not include gates. Measurement for gates will be made for each unit assembled, installed and complete in place. Double drive gates will be considered a single unit. Measurement for the 3-strand barbed wire extension will be made to the nearest linear foot (0.5 m), measured along the slope of the fence, but will not include gates.

607.10.5 Basis of Payment. The accepted quantity of chain-link fence, walk and drive gates, and barbed wire extensions, complete in place, will be paid for at the contract unit price for each of the pay items included in the contract. No direct payment will be made for concrete footings, post hole excavation or for excavation and embankment necessary to smooth the area under the fence.

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 (mass) of zinc coating shall be at least 2.0 ounces per square foot (610 g/m^2) of uncoated wire surface, determined from the average of all specimens representing the lot and no less than 1.8 ounces per square foot (550 g/m^2) on an individual specimen. Sections of fencing with excessive lumps, beads and drops of zinc will be removed before determining weight (mass) 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 (92 g/m^2) of uncoated wire surface on 0.148 or 0.192-inch (3.8 or 4.9 mm) specified diameter wire and no less than 0.25 ounce per square foot (76.3 g/m^2) on 0.120-inch (3.1 mm) 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 (3.6 mm), except C-clips for attaching fabric to H section posts shall have a finished or coated diameter of no less than 0.187 inch (4.8 mm). 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 (210 g/m^2) or aluminum coated at a rate of no less than 0.30 ounce per square foot (91.5 g/m^2).

1043.2.7.2 Aluminum Alloy Fabric Fasteners. Wire shall be of aluminum alloy having a minimum tensile strength of 16,000 psi (110 MPa).

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 (254 μm). Aluminum alloy wire shall have a minimum tensile strength of 16,000 psi (110 MPa).

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 (9.5 mm) 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 (1828 mm) high or less shall be equipped with two hinges, and gates more than 6 feet (1828 mm) 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 (2.5 mm, 2.2 mm or 1.7 mm) gage line wires twisted with 4-point barbs uniformly spaced approximately 4 or 5 inches (100 or 125 mm) apart in accordance with and the minimum weight (mass) of coating shall be 0.80 ounce per square foot (245 g/m^2) 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 (mass) of coating per square foot (m^2) of surface shall be no less than 0.25 ounce (75 g) 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 (2.8 mm) line wires twisted with 4-point 0.080-inch (2.0 mm) diameter wire barbs spaced 5 inches (125 mm) 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 (mass) 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 (75 g/m^2) 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 (masses) shown on the plans. Line posts shall be of the lengths and shapes shown on the plans. Posts shall have a nominal weight (mass) of 1.33 pounds per linear foot (1.98 kg/m) and a minimum weight (mass) of 1.28 pounds per linear foot (1.90 kg/m), 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 (3.6 mm) 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 (30 mm) 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 (2.9 mm).

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 (Mass). Weight (mass) 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 (mass) 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.