



Issued: 01/21/2019
Supersedes: 01/09/2001

Specification: 0062
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**ELECTRICAL EQUIPMENT
AND MATERIAL SPECIFICATION**

SUBSTATION, FENCE WITH BARBED WIRE

SUBSTATION FENCE WITH BARBED WIRE

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ELECTRICAL EQUIPMENT AND MATERIAL SPECIFICATION

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1. SCOPE

This specification defines the requirements for a chain link fence to be furnished and installation practices.

2. USE OF EQUIVALENTS

When equivalent equipment to the specified equipment is allowed, the manufacturer shall provide documentation regarding the design and operation of the proposed equivalent equipment with the review drawings to enable the Company to determine the suitability of the substitute.

3. CODES AND STANDARDS

Chain link fence furnished under this specification shall meet the requirements of the latest revision of the following standards, unless stated otherwise in this specification. If any of the requirements of this specification are in conflict with these standards, the manufacturer shall notify the Company.

- A. American Society for Testing and Materials (ASTM) No. A121, Specification for Metallic-Coated Carbon Steel Barbed Wire.
- B. American Society for Testing and Materials (ASTM) No. A123, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- C. American Society for Testing and Materials (ASTM) No. A491, Specification for Aluminum-Coated Steel Chain-Link Fence Fabric.
- D. American Society for Testing and Materials (ASTM) No. F567-14a, Standard Practice for Installation of Chain-Link Fence.
- E. American Society for Testing and Materials (ASTM) No. F626, Standard Specification for Fence Fittings.
- F. American Society for Testing and Materials (ASTM) No. A653, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- G. American Society for Testing and Materials (ASTM) No. A817, Standard Specification for Metallic-Coated Steel Wire for Chain-Link Fence Fabric and Marcelled Tension Wire.
- H. American Society for Testing and Materials (ASTM) No. A824, Specification for Metallic-Coated Steel Marcelled Tension Wire for Use with Chain Link Fence.
- I. American Society for Testing and Materials (ASTM) No. F900, Standard Specification for Industrial and Commercial Swing Gates.
- J. American Society for Testing and Materials (ASTM) No. F1043, Standard Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
- K. American Society for Testing and Materials (ASTM) No. F1083, Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.

4. DESCRIPTION OF TERMS

- A. Chain link fabric – A fencing material consisting of wire helically wound and interwoven in such a manner as to provide a continuous mesh without knots or ties except in the form of knuckling or twisting at the top and bottom of the mesh to form the fabric selvage.
- B. Selvage – The top and bottom edge finish on woven chain link formed by joining adjacent pairs of wire pickets. The selvage may be knuckled or twisted.
- C. Knuckled selvage refers to bending the adjacent pairs of wire back into a tight loop.



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- D. Twisted selvage refers to twisting the adjacent pairs of wire together in a close helix of 1 ½ machine turns, which is equivalent to three full twists.
- E. Mesh size – The minimum clear distance between the wires forming the parallel sides of the mesh.
- F. Terminal post – A post to which the chain link fabric is terminated using specific fittings; end post, corner post, gate post and pull post (a terminal post used to accommodate a grade or placed at intervals on long stretches of fence).
- G. Line post- Intermediate posts set no greater than 10 feet on center between the terminal posts.
- H. See drawing Typical Fence Section for details of various fence fittings; tension bar, truss rod, tension band, brace band, rail end and barb arm.

5. ALLIANT ENERGY STANDARDS, DRAWINGS AND SUBMITTALS

- A. Alliant Energy Standard fence and detail drawing: STND-03-908A and STND-03-908B.
- B. Alliant Energy Standard Double Industrial Drive Gate Latch fabrication drawing: STND-07-913.
- C. The substation fence layout drawing(s) will accompany the Bid Quotation and/or the Purchase Order.
- D. Shop Drawings will accompany the Purchase Order: Included are complete details of fence and gate construction, fence height, post spacing, dimensions, and unit weights of framework and concrete footing details. If installation, in addition to material is required, a substation layout drawing shall additionally be supplied.

6. GENERAL

The chain link fence is to include fence fabric, line posts, gate and terminal posts, top rails, bottom rails, brace rail, gates, barbed wire extension arms, barbed wire, and associated hardware, such as fittings, including truss rod assembly, tension and brace bands, tension bars, terminal post dome caps, line post loop tops, rail and brace ends, boulevard clamps, gate wings, cane bolt, concrete apron, and footings all as specified.

Table 1 - Summary of Fence Design Specifications	
Standard Chain Link	
Alliant Energy Standard Drawing Number	STND-03-908A & 908B
Fencing Fabric Type Chain link	2" opening, Aluminum – Coated (Aluminized) 9 gauge, KT (Top Twisted, Bottom Knuckle)
Fabric Dimensions	9' (108") Height Roll
Amount of Fabric Buried in Crushed Rock	1'
Overall Above Grade Fabric Height	8'
Barbed Wire Height	1'
Total Fence Height Above Finished Grade (Fabric + Barbed Wire)	9'
Gate/Terminal/Corner Post Footing Depth and Type	5' footing, 4' min. post embedment – Concrete
Line Post Footing Depth and Type	5' footing, 4' min. post embedment – Concrete
Line Post Spacing	10' 0" on center
Line Post Size/Weight Round Steel Pipe Spec	2.875 inch OD (2.5 inch NPS), 5.79 lbs/ft. Sch. 40, 30,000 PSI (ASTM F1083)
Corner or Terminal Post/Weight Round Steel Pipe Spec	3.50 inch OD (3 inch NPS), 7.58 lbs/ft. Sch. 40, 30,000 PSI (ASTM F1083)
Gate Post Size/Weight	4.0 inch OD (3.5 inch NPS), 9.12 lbs/ft.



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Round Steel Pipe Spec	Sch. 40, 30,000 PSI (ASTM F1083)
Top, Bottom and Brace Rail Size/Weight Round Steel Pipe Spec	1.66 inch OD (1.25 inch NPS), 2.27 lbs/ft. Sch. 40, 30,000 PSI (ASTM F1083)
Gate Frame Size/Weight Round Steel Pipe Spec	1.900 inch OD (1.50 inch NPS), 2.72 lbs/ft. Sch. 40, 30,000 PSI (ASTM F1083)
Step Thru Gate Frame Size/Weight Round Steel Pipe Spec	1.66 inch OD (1.25 inch NPS), 2.27 lbs/ft. Sch. 40, 30,000 PSI (ASTM F1083)
<u>Fabric Attachment Hardware/Spacing:</u> Line Posts: Gate/Terminal Posts: Top and Bottom Rail: Horizontal Gate Frame: Vertical Gate Frame:	9 ga round aluminum alloy wire every 14" Tension bands every 14" 9 ga round aluminum alloy wire every 24" 9 ga round aluminum alloy wire every 14" Tension bands every 14"

7. LOCATION

The chain link fence shall be erected at the location as indicated on the Purchase Order/Purchase Order Release. If materials only are required (no installation required), this will be noted on the Purchase Order. Delivery location of the materials will be noted as well.

8. SCHEDULE

If fence installation is required, in addition to materials supplied, the approximate installation dates shall be stated on the Purchase Order. The exact date of the installation to be determined by the Alliant Energy Construction Coordinator and the successful bidder.

9. DESIGN AND MATERIALS

A. Steel Chain Link Fabric

- i. Fabric shall be 9 gauge steel wire woven in a 2 inch diamond mesh, aluminum coated (aluminized) before weaving per ASTM A491.
- ii. Metallic-coated carbon steel wire, Type I Aluminum-Coated, shall conform to ASTM A817.
- iii. Width of mesh fabric is 108 inches.
- iv. Top selvage is Twisted (barbed) and the bottom selvage is Knuckle finish, K&T.
- v. Bottom 12 inches mesh installed below grade gravel.

B. Steel Fence Framework

- i. Round steel pipe and rail; ASTM F1043 Group IA Heavy Industrial Fence Framework, schedule 40 galvanized pipe per ASTM F1083. (Regular yield strength 30,000 PSI.)
- ii. Hot dipped galvanized process; Exterior zinc coating minimum average 1.8 oz/ft², interior hot dipped zinc coating minimum average 1.8 oz/ft².
- iii. Line Posts
 - 1) 2.875 inch OD (2.5 inch NPS), 5.79 lbs/ft.
 - 2) Length shall be min 13 ft. to allow 4 ft. embedment in concrete or alternately driven.
- iv. Terminal, End, or Corner Posts
 - 1) 3.50 inch OD (3 inch NPS), 7.58 lbs/ft.
 - 2) Length shall be min 14 ft. to allow 4 ft. embedment in concrete and support termination of 1 ft. three strand barb wire.
- v. Top, Bottom, and Brace Rails
 - 1) 1.66 inch OD (1.25 inch NPS), 2.27 lbs/ft.

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- C. Tension Wire
 - i. Metallic Coated Steel Marcellled Tension Wire: 7 gauge (0.177 in.) marcellled wire complying with ASTM A824.
 - ii. Type I Aluminum-Coated (Aluminized) 0.40 oz/ft² (122 g/m²).
- D. Barbed Wire
 - i. Metallic Coated Steel Barbed Wire: Comply with ASTM A121, Design Number 12-4-5-14R, double 12-½ gauge (0.099 in.) twisted strand wire, with 4 point 14 gauge (0.080 in.) round barbs spaced 5 inches on center.
 - ii. Coating Type A – Aluminum-Coated (Aluminized): Strand wire coating Type A - 0.30 oz/ft² (90 g/m²) with aluminum alloy barbs.
- E. Fittings
 - i. Tension and Brace Bands
 - 1) Galvanized pressed steel complying with ASTM F626, minimum steel thickness of 12 gauge (0.105 in.), minimum width of ¾ in. and minimum zinc coating of 1.20 oz/ft² (366 g/m²).
 - 2) Bands supplied with 5/16 in. or 3/8 in. galvanized steel carriage bolts.
 - ii. Terminal Post Caps, Line Post Loop Tops, Rail and Brace Ends, Boulevard Clamps, Rail Sleeves
 - 1) In compliance to ASTM F626, pressed steel galvanized after fabrication having a minimum zinc coating of 1.20 oz/ft² (366 g/m²).
 - iii. Truss Rod Assembly
 - 1) In compliance with ASTM F626, 3/8 in. diameter steel truss rod with a pressed steel tightener, minimum zinc coating of 1.2 oz/ft² (366 g/m²), assembly capable of withstanding a tension of 2,000 lbs.
 - iv. Tension Bars
 - 1) In compliance with ASTM F626. Galvanized steel one-piece length 2 in. less than the fabric height. Minimum zinc coating 1.2 oz. /ft² (366g/m²).
 - 2) Bars for 2 in. mesh shall have a minimum cross section of 3/16 in. by 3/4 in.
 - v. Barbed Wire Arms
 - 1) In compliance with ASTM F626, pressed steel galvanized after fabrication, minimum zinc coating of 1.20 oz. /ft² (366 g/m²), capable of supporting a vertical 250 lbs load.
 - 2) Type I – three strand 45 degree arm.
 - 3) Angle the arm out from the secured area.
 - 4) Not Installed on Terminal, End, Corner, or Gate posts. Barb wire 3 strands terminated directly on terminal, end, or Gate posts.
- F. Tie Wire and Hog Rings
 - i. Tie wire and hogs rings per ASTM F626.
 - 1) 9 gauge (0.148 in.) aluminum alloy ties.
 - 2) 9 gauge (0.148 in.) aluminum alloy hog rings.
- G. Swing Gates
 - i. Gate fabric 96 inches with 12 inch three strand barbed wire.
 - 1) Galvanized steel welded fabrication in compliance with ASTM F900.
 - 2) Gate frame members 1.900 inch OD (1.50 inch NPS), 2.72 lbs/ft, ASTM F1043 Group IA Heavy Industrial Fence Framework, schedule 40 galvanized pipe per ASTM F1083 (regular yield strength 30,000 PSI).
 - 3) Frame members spaced no greater than 8 ft. apart vertically and horizontally.

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- 4) Welded joints protected by applying zinc-rich paint in accordance with ASTM Practice A780.
- 5) Galvanized malleable iron or heavy gauge pressed steel post and frame hinges.
- 6) Match gate fabric to that of the fence system.
- ii. Gate Width 12 ft -0 in to 25 ft – 0 in (Gate leaf 6 ft to 12 ft – 6 inches).
 - 1) Gate Posts - Round steel pipe; ASTM F1043 Group IA Heavy Industrial Fence Framework, schedule 40 galvanized pipe per ASTM F1083. (Regular yield strength 30,000 PSI.)
 - a) 4.0 inch OD (3.5 inch NPS), 9.12 lbs/ft.
 - b) Length shall be min 14 ft. to allow 4 ft. embedment in concrete and support termination of 1 ft. three strand barb wire.
 - 2) The frames shall utilize 3/8-inch diameter adjustable galvanized steel truss rod assemblies fabricated per ASTM F626.
- iii. Gate Width 25 ft – 1 in or longer (Gate leaf 12 ft. – 7 inches or longer).
 - 1) Gate Posts - Round steel pipe: ASTM F1043 Group IA Heavy Industrial Fence Framework, schedule 40 galvanized pipe per ASTM F1083. (Regular yield strength 30,000 PSI.)
 - a) Posts manufactured with yield strength 35,000 PSI to ASTM A53, exceeds F1083 requirements is also acceptable.
 - 2) Hot dipped galvanized process; Exterior zinc coating minimum average 1.8 oz/ft², interior hot dipped zinc coating minimum average 1.8 oz/ft².
 - a) 6.625 inch OD (6 inch NPS), 18.99 lbs/ft.
 - b) Length shall be min 14 ft. to allow 4 ft. embedment in concrete and support termination of 1 ft. three strand barb wire.
 - 3) The frames shall utilize 3/8-inch diameter adjustable galvanized steel truss rod assemblies fabricated per ASTM F626.
- iv. Gate Hinges
 - 1) Each gate hinge assembly, consisting of a post hinge and frame hinge, shall be two-way, of adequate strength for the gate that is being supported and with large bearing surface for clamping to the gatepost and gate frame. The hinges shall not twist or turn under the full swing of the gate. The gate hinge assembly shall be designed to provide a 3-inch maximum opening between the gatepost and the gate frame.
- v. Gate Latch
 - 1) Double Drive Industrial Latch manufactured according to Alliant Energy Standard Fabrication Template STND-07-913.
 - 2) Alternatively: PL152 Industrial Gate Latch (also referred to as the Pioneer Latch 152) 18 lbs. International Security Products, Brooklyn Park, MN.
- vi. Gate Cane Bolt
 - 1) One of the gate wings shall be supplied with a plunger type device (e.g. 3/4" steel cane bolt) designed to hold one wing in a stationary position when the gate is in the closed position.
 - 2) The cane bolt shall be operational from the inside and the outside of the substation gate. Provisions for the insertion of the bottom of the cane bolt shall be integrated into the concrete apron – 1 1/2" PVC pipe embedded in apron.
- vii. Gate Wing Holdbacks
 - 1) Drop down holdbacks, constructed from Schedule 40 round steel pipe, 1.90 inch OD (1.50 inch NPS), attached on outside of each gate wing.
 - 2) Detail per Alliant Energy standard fence drawing.
- viii. Step through Gate

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- 1) A 3 ft. wide by 6 ft. high step through gate shall be placed in the main vehicular gate, located 1.5 feet above the bottom and at the hinged end of the enclosing swing gate leaf.
 - 2) Step through gate frame members 1.66 inch OD (1.25 inch NPS), 2.27 lbs/ft, ASTM F1043 Group IA Heavy Industrial Fence Framework, schedule 40 galvanized pipe per ASTM F1083 (Regular yield strength 30,000 PSI).
 - 3) Welded joints protected by applying zinc-rich paint in accordance with ASTM Practice A780.
 - 4) Commercial Chain Link Double Arm Latch Set Cat# CL-CDL hot dipped galv.
 - a) Nationwide Industries Inc. 10333 Windhorst Rd Tampa, FL 33619.
- ix. Concrete Apron
- 1) An eighteen inch thick concrete apron shall be poured at each vehicular gate in order to provide additional security at the bottom.
 - 2) The concrete apron shall extend the entire length of the gate opening terminating at the outside of each gatepost. The apron shall extend a minimum of 12 inches beyond the front of the gate (outside the substation fence) and 12 inches inside the gate (inside the substation fence) – total 24" wide.
 - 3) The concrete contractor shall install control joints spaced a maximum of 8 feet apart in order to prevent corner and shrinkage cracks.
 - 4) The concrete material shall have rebar support per drawing STND-03-908B.
 - 5) The base material installed under the concrete apron shall be designed in a manner such that proper drainage shall occur, providing for protection against frost heave. If poor drainage conditions are anticipated at the site, appropriate adjustments to the base material (e.g, use of crushed stone, modifying the size and or depth of the base material) shall be made.

10. INSTALLATION**A. Framework Installation**

- i. Posts: Posts shall be set plumb in concrete footings in accordance with ASTM F567. Minimum footing depth, 60 in.
- ii. Top of post concrete footing to be 12 inches below grade crowned to shed water away from the post.
 - 1) Line posts installed at intervals not exceeding 10 ft. on center.
- iii. Top rail: install 21 ft. lengths of rail continuous thru the line post or barb arm loop top. Splice rail using top rail sleeves minimum 6 inches long.
 - 1) The rail shall be secured to the terminal post by a brace band and rail end.
- iv. Bottom rail or intermediate rail shall be field cut and secured to the line posts using boulevard bands or rail ends and brace bands.
- v. Terminal posts: End, corner, pull and gate posts shall be braced and trussed for fence 6 ft. and higher.
 - 1) Horizontal brace rail and diagonal truss rod shall be installed in accordance with ASTM F567.

B. Chain Link Fabric Installation

- i. Chain Link Fabric: Install fabric to outside of the framework. Attach fabric to the terminal post by threading the tension bar through the fabric; secure the tension bar to the terminal post with tension bands and 5/16 in. carriage bolts spaced no greater than 14 inches on center.
 - 1) Chain link fabric to be stretched taut free of sag. Fabric to be secured to the line post with tie wires spaced no greater than 14 inches on center and to rail spaced no greater than 18 inches on center.



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- 2) Aluminum alloy wire ties shall be wrapped around the post or rail and attached to a fabric wire picket on each side of the post or rail by twisting the tie wire around the fabric wire picket two full turns per ASTM F567.
 - 3) Excess wire shall be cut off and bent over to prevent injury. The installed fabric shall be buried 12" below gravel surface.
- C. Barbed Wire Installation
- i. Barbed Wire: Stretched taut between terminal posts and secured in the slots provided on the line post barb arms.
 - 1) Attach each strand of barbed wire to the terminal post using a brace band.
 - ii. Type I 45 degree barb arm, and direction outward.
- D. Gate Installation
- i. Swing Gates: Installation of swing gates and gateposts in compliance with ASTM F567.
 - 1) Direction of swing shall be outward.
 - ii. Gates shall be plumb in the closed position having a bottom clearance of 3 inches to concrete apron.
 - iii. Space between gate wings in the closed position to be no more than 4 inches.
 - iv. Hinge and latch offset opening space from the gate frame to the post shall be no greater than 3 inches in the closed position.
 - v. Double gate drop bar (cane pipe) shall be set in a concrete apron that extends the width of the gate opening.
 - vi. Gate leaf holdbacks shall be installed for all double gates.
- E. Nuts and Bolts
- i. Bolts: Carriage bolts used for fittings shall be installed with the head on the secure side of the fence.
 - ii. All bolts shall be peened over to prevent removal of the nut.

(END)