



PROCESS
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PRACTICES

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Civil

**PIP CVS02830
Chain Link Fence and Gates
Installation Specification**

PURPOSE AND USE OF PROCESS INDUSTRY PRACTICES

In an effort to minimize the cost of process industry facilities, this Practice has been prepared from the technical requirements in the existing standards of major industrial users, contractors, or standards organizations. By harmonizing these technical requirements into a single set of Practices, administrative, application, and engineering costs to both the purchaser and the manufacturer should be reduced. While this Practice is expected to incorporate the majority of requirements of most users, individual applications may involve requirements that will be appended to and take precedence over this Practice. Determinations concerning fitness for purpose and particular matters or application of the Practice to particular project or engineering situations should not be made solely on information contained in these materials. The use of trade names from time to time should not be viewed as an expression of preference but rather recognized as normal usage in the trade. Other brands having the same specifications are equally correct and may be substituted for those named. All Practices or guidelines are intended to be consistent with applicable laws and regulations including OSHA requirements. To the extent these Practices or guidelines should conflict with OSHA or other applicable laws or regulations, such laws or regulations must be followed. Consult an appropriate professional before applying or acting on any material contained in or suggested by the Practice.

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1. Scope

This Practice provides requirements for providing and installing heavy industrial chain link fences and gates.

This Practice covers materials, fabrication, and installation of heavy industrial chain link fencing using galvanized steel and polymer-coated steel.

2. References

Applicable parts of the following industry codes and standards shall be considered an integral part of this Practice. The edition in effect on the date of contract award shall be used, except as otherwise noted. Short titles are used herein where appropriate.

2.1 Process Industry Practices (PIP)

- PIP ELIGD000 - *Grounding Installation Details*

2.2 Industry Codes and Standards

ASTM International (ASTM)

- ASTM A121 - *Standard Specification for Metallic-Coated Carbon Steel Barbed Wire*
- ASTM A392 - *Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric*
- ASTM A824 - *Standard Specification for Metallic-Coated Steel Marcellled Tension Wire for Use With Chain Link Fence*
- ASTM C94/C94M - *Standard Specification for Ready-Mixed Concrete*
- ASTM F567 - *Standard Practice for Installation of Chain-Link Fence*
- ASTM F626 - *Standard Specification for Fence Fittings*
- ASTM F668 - *Standard Specification for Polyvinyl Chloride (PVC), Polyolefin and Other Polymer-Coated Steel Chain Link Fence Fabric*
- ASTM F900 - *Standard Specification for Industrial and Commercial Steel Swing Gates*
- ASTM F934 - *Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials*
- ASTM F1043 - *Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework*
- ASTM F1083 - *Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures*
- ASTM F1184 - *Standard Specification for Industrial and Commercial Horizontal Slide Gates*
- ASTM F1664 - *Standard Specification for Poly(Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Tension Wire Used with Chain-Link Fence*

- ASTM F1665 - *Standard Specification for Poly(Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Barbed Wire Used With Chain-Link Fence*
- ASTM F1910 - *Standard Specification for Long Barbed Tape Obstacles*
- ASTM F1911 - *Standard Practice for Installation of Barbed Tape*
- ASTM F2200 - *Standard Specification for Automated Vehicular Gate Construction*
- ASTM F2611 - *Standard Guide for Design and Construction of Chain Link Security Fencing*

3. Definitions

contract documents: Any and all documents, including codes, studies, design drawings, specifications, sketches, practices, and data sheets, that purchaser has transmitted or otherwise communicated, either by incorporation or reference, and made part of the legal contract agreement or purchase order between purchaser and supplier.

engineer of record: Purchaser's authorized representative with overall authority and responsibility for engineering design, quality, and performance of civil works, structures, foundations, materials, and appurtenances described in contract documents. Engineer of record shall be licensed as defined by laws of the locality in which the work is to be constructed, and be qualified to practice in the specialty discipline required for the work described in contract documents.

manufacturer: Party who produces and warrants the performance of materials provided in accordance with contract documents. Materials are manufactured in a controlled process using standard codes, specifications, tests and possibly include shop drawings to assist in proper application, installation and/or use. The term manufacturer shall apply also to manufacturer's subcontractor(s) and/or vendor(s).

owner: Party who has authority through ownership, lease, or other legal agreement over facility wherein fencing will be used.

purchaser: Party who awards contract to supplier. Purchaser may be owner or owner's authorized agent.

supplier: Party responsible for furnishing materials and performing fence installation in accordance with contract documents.

4. Requirements

4.1 General

- 4.1.1 Constructor shall furnish all equipment, tools, materials, labor, and supervision and shall perform all operations necessary for installation of fences and gates, where indicated by contract documents.
- 4.1.2 Any conflicts or inconsistencies between this Practice, design drawings, manufacturer's specifications and recommendations, and other contract

documents shall be brought to the attention of purchaser for resolution before the work begins.

- 4.1.3 Fences and gates designated in contract documents for high security applications shall also be in accordance with *ASTM F2611*.

4.2 Quality Control

- 4.2.1 Constructor shall be solely responsible for quality control of all constructor-provided materials, installations, and workmanship, including those items or installations provided by any of constructor's subcontractors or vendors.
- 4.2.2 Physical locations of features such as fence lines, gates, and terminal posts shall be in accordance with contract documents.

4.3 Quality Assurance

Purchaser reserves the right to make inspections at any time during receipt and installation of fencing materials.

4.4 Submittals

- 4.4.1 Before start of field installation, shop drawings of gates, bracing, and typical fence details shall be submitted to purchaser for approval.
- 4.4.2 Before start of installation, material data for fabrics, posts, rails, tension wire, and rods showing compliance with this Practice shall be submitted to purchaser.

4.5 Materials

4.5.1 Storage and Protection

- 4.5.1.1 Materials shall be stored a minimum of 4 inches (100 mm) above grade by using wood blocking or other approved materials. Avoid areas prone to flooding.
- 4.5.1.2 Materials shall be stored in areas of the job site designated and approved by purchaser.

4.5.2 Galvanized Chain Link Steel Fence

If galvanized fence is specified in contract documents, materials shall be uniform and consistent and shall be in accordance with the following requirements:

4.5.2.1 Fabric

Fabric shall consist of galvanized chain link material, in accordance with *ASTM A392*, Class 2, 2-inch (50-mm) mesh 9-gage (0.148 inches [3.76 mm] in diameter) steel wire, with top and bottom selvages twisted and barbed.

4.5.2.2 Line Posts

Line post size for chain link fence framework shall be in accordance with *ASTM F1043* for Heavy Industrial Fence.

1. For fabric less than or equal to 8 feet (2.4 m) high, line posts shall be NPS 2 (DN 50) Standard Weight (Schedule 40) galvanized steel pipe

(OD = 2.375 inches [60.3 mm]) in accordance with *ASTM F1083* unless otherwise specified in contract documents.

2. For fabric greater than 8 feet (2.4 m) and up to 12 feet (3.6 m) high, line posts shall be NPS 2.5 (DN 65) Standard Weight (Schedule 40) galvanized steel pipe (OD = 2.875 inches [73.0 mm]), in accordance with *ASTM F1083* unless otherwise specified in contract documents.

4.5.2.3 Corner, Pull, and Terminal Posts

Corner, pull, and terminal posts shall be NPS (DN) Standard Weight (Schedule 40) galvanized steel pipe in accordance with *ASTM F1083* at least one size larger than line posts.

4.5.2.4 Rails

1. Top, brace, bottom, and intermediate rails shall be NPS 1.25 (DN 32) Standard Weight (Schedule 40) galvanized steel pipe (OD = 1.66 inches [42.2 mm]) in accordance with *ASTM F1083*.
2. Brace rails shall be provided with galvanized steel truss rods and truss tighteners.
3. Rail sleeves or couplings shall be in accordance with *ASTM F626*.

4.5.2.5 Tension Wire

Tension wire shall be 7-gage (0.177 inch [4.50 mm] in diameter) steel wire, Type II (galvanized), Class 5 coating, in accordance with *ASTM A824*.

4.5.2.6 Fittings

All chain link fence fittings shall be in accordance with *ASTM F626*.

4.5.2.7 Barbed Wire

1. Barbed wire shall consist of double 12.5-gage (0.099 inches [2.51 mm] in diameter) twisted steel wire with 14-gage (0.080 inches [2.03 mm] in diameter), 4-point round steel barbs spaced on 5-inch (127-mm) centers, Coating Type Z, Coating Class 3, in accordance with *ASTM A121*.
2. Top 1 foot (300 mm) of fence shall consist of three strands of barbed wire attached to Type I, pressed steel, galvanized barbed wire arms in accordance with *ASTM F626*.

4.5.2.8 Barbed Tape

When specified in contract documents, barbed tape materials shall be in accordance with *ASTM F1910*.

4.5.3 Polymer-Coated Chain Link Steel Fence

If polymer-coated fence is specified in contract documents, materials shall be in accordance with Section 4.5.2 and with the following requirements:

4.5.3.1 Fabric

1. Polymer-coated fabric shall be in accordance with *ASTM F668*.

2. Color shall be in accordance with *ASTM F934* (i.e., brown, green, or black) and as specified in contract documents.

4.5.3.2 Polymer-Coated Framework

Polymer-coated framework shall have a (PVC, Polyolefin, Polyester) coating fused and adhered to the exterior zinc coating of the post or rail. PVC and polyolefin minimum thickness shall be 10 mils (0.254 mm) and polyester coating minimum thickness shall be 3 mils (0.076 mm) in accordance with *ASTM F1043*. Color shall match fabric.

4.5.3.3 Tension Wire

Polymer-coated tension wire shall be 7-gage (0.177 inch [4.50 mm] in diameter) steel wire in accordance with *ASTM F1664*. Polymer coating, class, and color shall match fabric.

4.5.3.4 Fittings

Polymer-coated fittings shall be in accordance with *ASTM F626*. Minimum thickness of polymer coating shall be 0.006 inches (0.152 mm) fused and adhered to zinc coated fittings. Maximum thickness of polymer coating shall be 0.015 inches (0.381 mm). Color shall match fabric.

4.5.3.5 Barbed Wire

Polymer-coated barbed wire shall consist of double 12.5-gage (0.099 inches [2.51 mm] in diameter) twisted steel wire with 14-gage (0.080 inches [2.03 mm] in diameter), 4-point round steel barbs spaced on 5-inch (127-mm) centers, Coating Type Z, Coating Class 3, in accordance with *ASTM F1665*.

4.5.4 Gates

- 4.5.4.1 Gate materials such as fabric, bolts, nuts, tension bars, barbed wire, brace rail, truss rods, and tighteners shall be the same as fence materials and coating.
- 4.5.4.2 Gates shall be manually or electrically operated as specified in contract documents.
- 4.5.4.3 Swing gates and posts shall be in accordance with *ASTM F900*. Frames shall be NPS 1.5 (DN 40) Standard Weight (Schedule 40) pipe (OD = 1.9 inches [48.3 mm]) welded construction.
- 4.5.4.4 Slide gates shall be in accordance with *ASTM F1184*.
- 4.5.4.5 Automated vehicular gates shall be in accordance with *ASTM F2200*.

4.5.5 Concrete

- 4.5.5.1 Concrete shall have a minimum 28-day compressive strength of 2500 psi (17 MPa).
- 4.5.5.2 Concrete mix design shall be in accordance with *ASTM C94/C94M*.

4.6 Execution

4.6.1 Preparation

4.6.1.1 Clearing and grubbing shall be performed to a width necessary to permit a proper fence installation.

4.6.1.2 A smooth profile at the fence line shall be provided so that the bottom of fence will not be greater than 2 inches (50 mm) above finished ground line.

4.6.2 Installation

Fencing and gate installation shall be in accordance with *ASTM F567* except as otherwise specified below.

4.6.2.1 Post Spacing

Line posts and brace posts shall be set at intervals not exceeding 10 feet (3 m).

4.6.2.2 Foundation Sizes

Unless otherwise specified in contract documents, line, corner, pull, terminal, and gate posts shall be set vertically in cylindrical concrete foundations in accordance with Table 1.

Table 1 - Line, Corner, Pull, Terminal, and Gate Post Installation Schedule

| Post Size (OD) | Foundation Diameter | Foundation Depth | Post Embedment |
|----------------------|---------------------|------------------|-----------------|
| 2.375 in. (60.3 mm) | 0' - 10" (250 mm) | 3' - 3" (1 m) | 3' - 0" (0.9 m) |
| 2.875 in. (73.0 mm) | 1' - 0" (300 mm) | 3' - 3" (1 m) | 3' - 0" (0.9 m) |
| 4.0 in. (101.6 mm) | 1' - 0" (300 mm) | 3' - 3" (1 m) | 3' - 0" (0.9 m) |
| 6.625 in. (168.3 mm) | 1' - 8" (500 mm) | 4' - 0" (1.2 m) | 3' - 6" (1.1 m) |
| 8.625 in. (219.1 mm) | 2' - 2" (650 mm) | 4' - 6" (1.4 m) | 4' - 0" (1.2 m) |

4.6.2.3 Post Hole Preparation

1. Post holes shall be drilled or hand-augured.
2. Soil from excavations shall be spread uniformly adjacent to fence line or as directed by purchaser.

4.6.2.4 Post Setting

1. Loose and foreign materials shall be removed from sides and bottoms of holes.
2. If posts are placed in sleeved holes, nonshrink Portland cement grout, approved by purchaser, shall be used to grout in posts.
3. Soil shall be moistened before placing concrete.
4. Concrete shall be placed continuously into hole around posts and tamped to consolidate.

5. Post shall be checked for vertical plumbness and horizontal alignment.
6. Exposed surface of concrete foundation shall be set 2 inches (50 mm) above surrounding grade.

4.6.2.5 Rails, Tension Wire, and Bracing

1. Unless otherwise specified in contract documents, fence shall be installed with a top rail and bottom tension wire.
2. Rails and tension wire shall be installed before installing chain link fabric.
3. Tension wire shall be stretched taut between posts independently and prior to installation of fabric. Tension wire shall be secured to terminal post using a brace band. Top tension wire shall be installed through the barb arm loop for fences having barbed wire and no top rail.
4. Rail sleeves or couplings shall be installed to allow for expansion and contraction.
5. Brace bands shall be used for attaching top rail or tension wire and braces to brace terminal and gateposts.

6. Bracing

- a. Corner, pull, terminal, and gate posts shall be braced and trussed.
- b. Two brace assemblies shall be used for each corner or pull post.
- c. One brace assembly shall be used for each terminal or gate post.
- d. Brace assemblies shall be installed in accordance with *ASTM F567*.

4.6.2.6 Fabric

1. Chain link fence fabric shall be installed on the outside of the secured area in accordance with *ASTM F567*.
2. Fabric shall be installed not more than 2 inches (50 mm) above the ground, and fastened securely to posts, rails, and tension wires in accordance with *ASTM F567*.
3. Fabric tie wire shall be spaced at 2-feet (600-mm) intervals on centers for rails and line posts.
4. Chain link fabric shall be secured to tension wire with hog rings 18 inches (450 mm) on center.

4.6.2.7 Barbed Wire

1. Barbed wire strands shall be spaced uniformly and attached to frame with brace bands.
2. Extension arms on line posts and corner posts shall be inclined at approximately 45 degrees away from property enclosed unless otherwise specified in contract documents.

3. Strands of barbed wire shall be stretched to remove sag and be anchored firmly to extension arms.
4. Each strand of barbed wire shall be attached to terminal post using a brace band.
5. Barbed wire on gates shall be attached to vertical members of gates.

4.6.2.8 Barbed Tape

Barbed tape shall be installed in accordance with *ASTM F1911*.

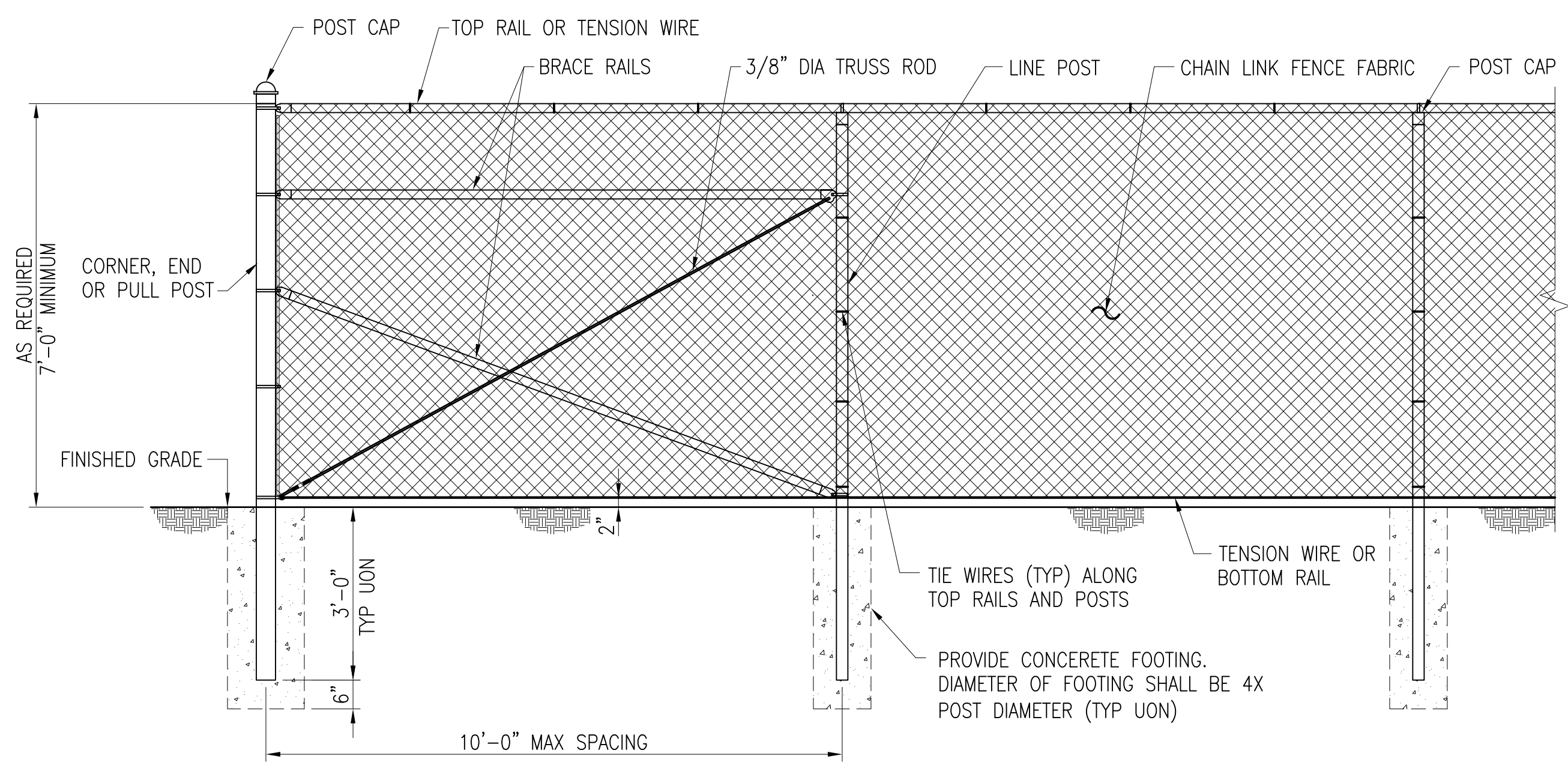
4.6.2.9 Gates

1. Gates shall be installed in accordance with *ASTM F567*.
2. Gates shall be braced and trussed to prevent sagging, buckling, and warping.

4.6.3 Grounding

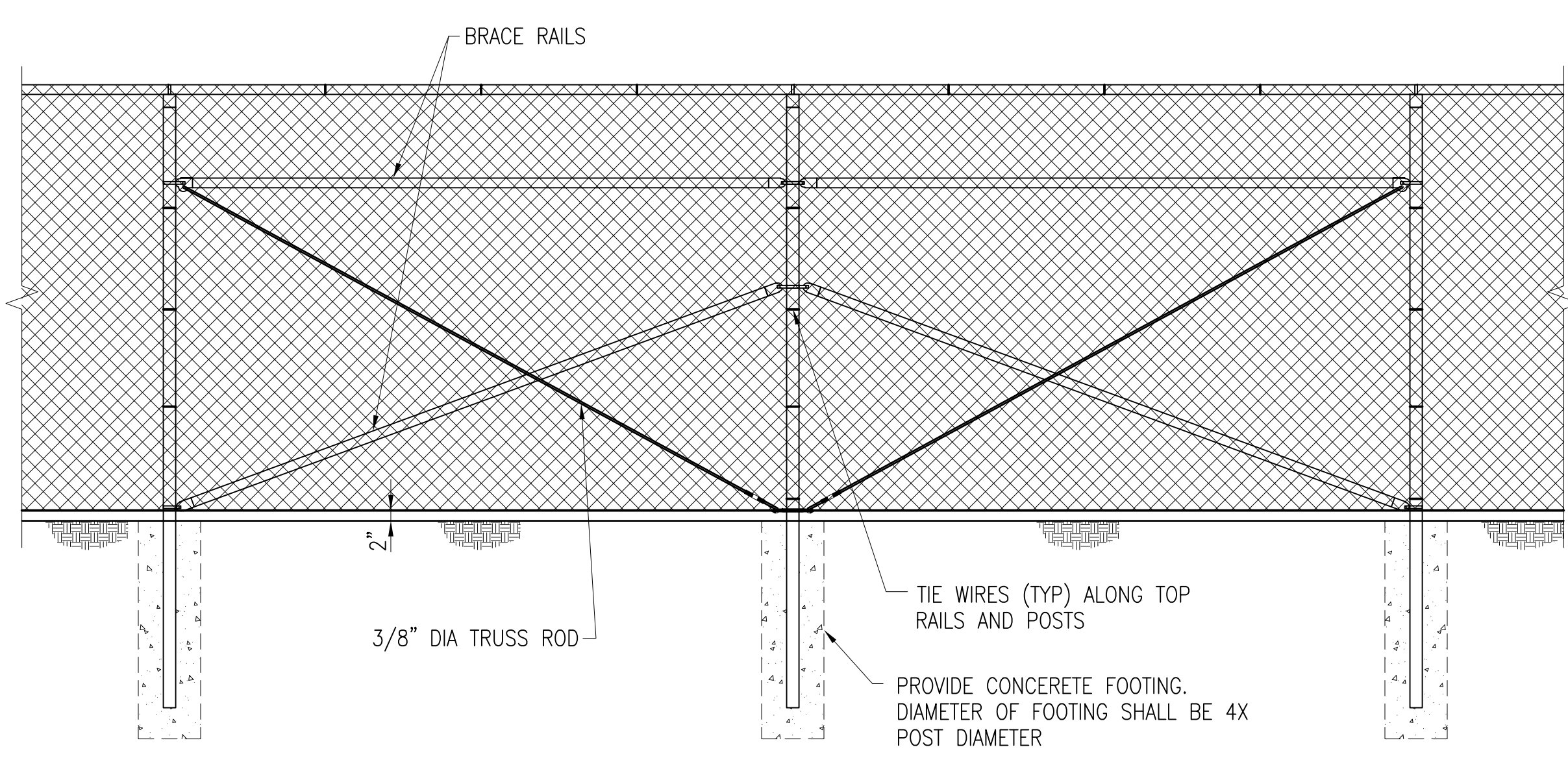
Unless otherwise noted in contract documents, grounding of fence, fence posts, and gates shall be in accordance with *PIP ELIGD000*, and shall be performed by a licensed electrical contractor.

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TYPICAL FENCE AND CORNER PANEL ELEVATION

SCALE: 1" = 1'-0"

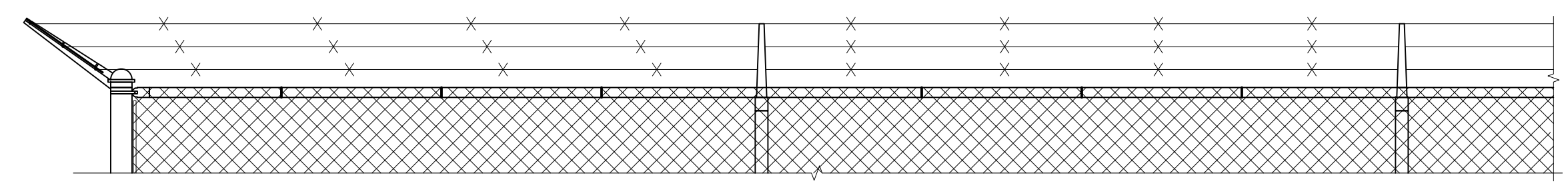


TYPICAL FENCE AND BRACED PANEL ELEVATION

SCALE: 1" = 1'-0"

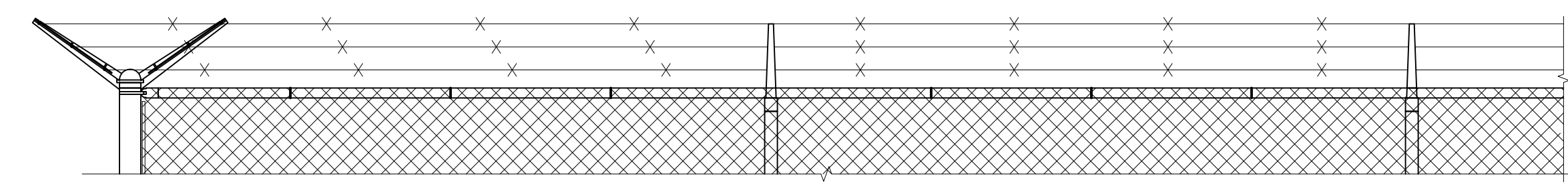
NOTE (1): A BOTTOM RAIL CAN BE ADDED FOR SECURITY, IT SHALL BE INSTALLED APPROX 3" ABOVE GRADE (A MINIMUM OF 2" AND A MAXIMUM OF 4"). HARDWARE SHALL BE WELDED OR SHOT NAILED TO POSTS AND RAILS IN ORDER TO SECURE IN PLACE. ATTACH FABRIC TO NEW BOTTOM RAIL TO ELIMINATE POSSIBILITY OF PEELING UP FABRIC.

NOTE (2): SOME LOCATIONS MAY REQUIRE 8' OF FABRIC.



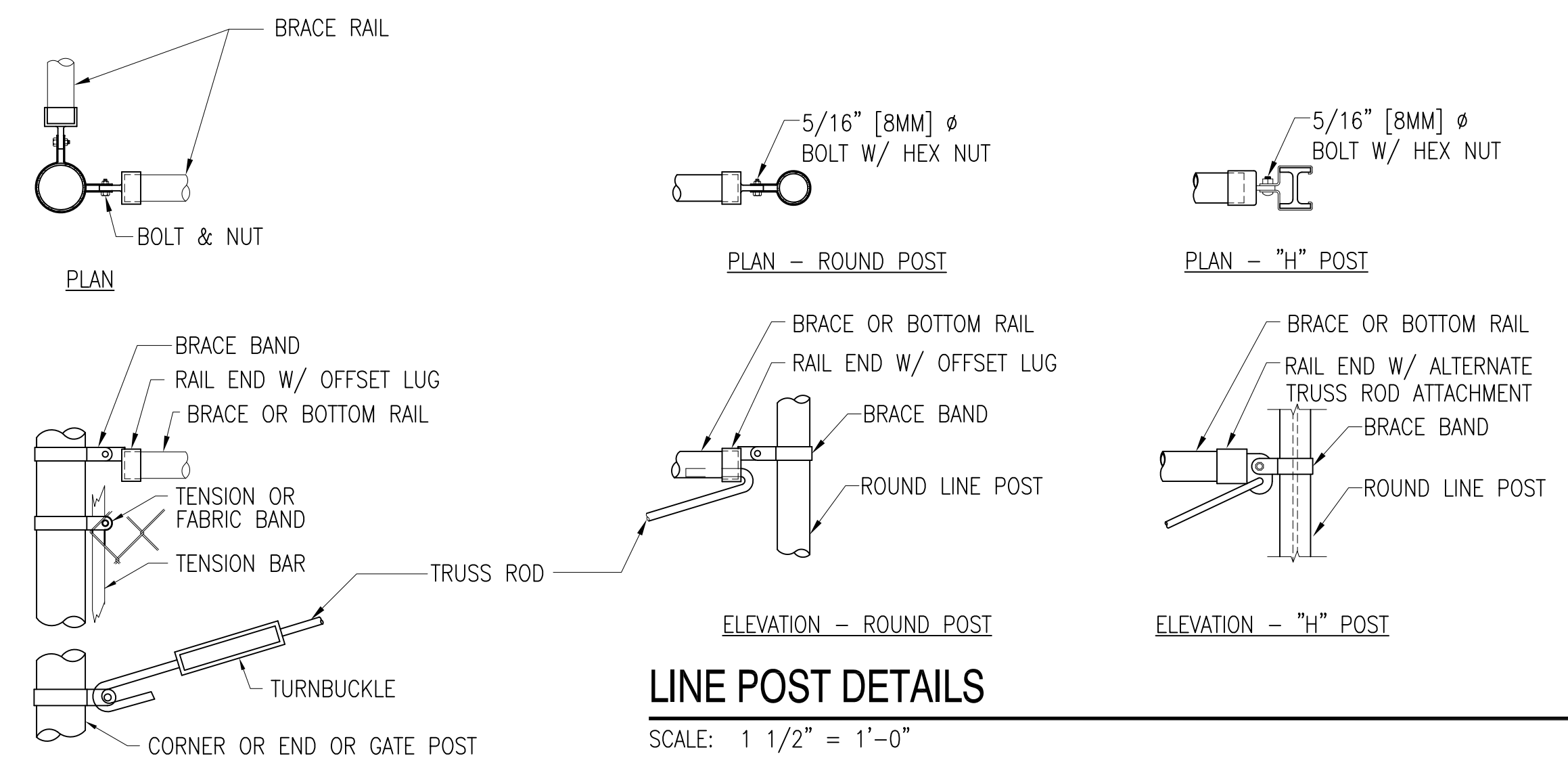
TYPICAL 3 STRAND BARBED WIRE AND SINGLE EXTENSION ARM CONFIGURATION

SCALE: 1" = 1'-0"



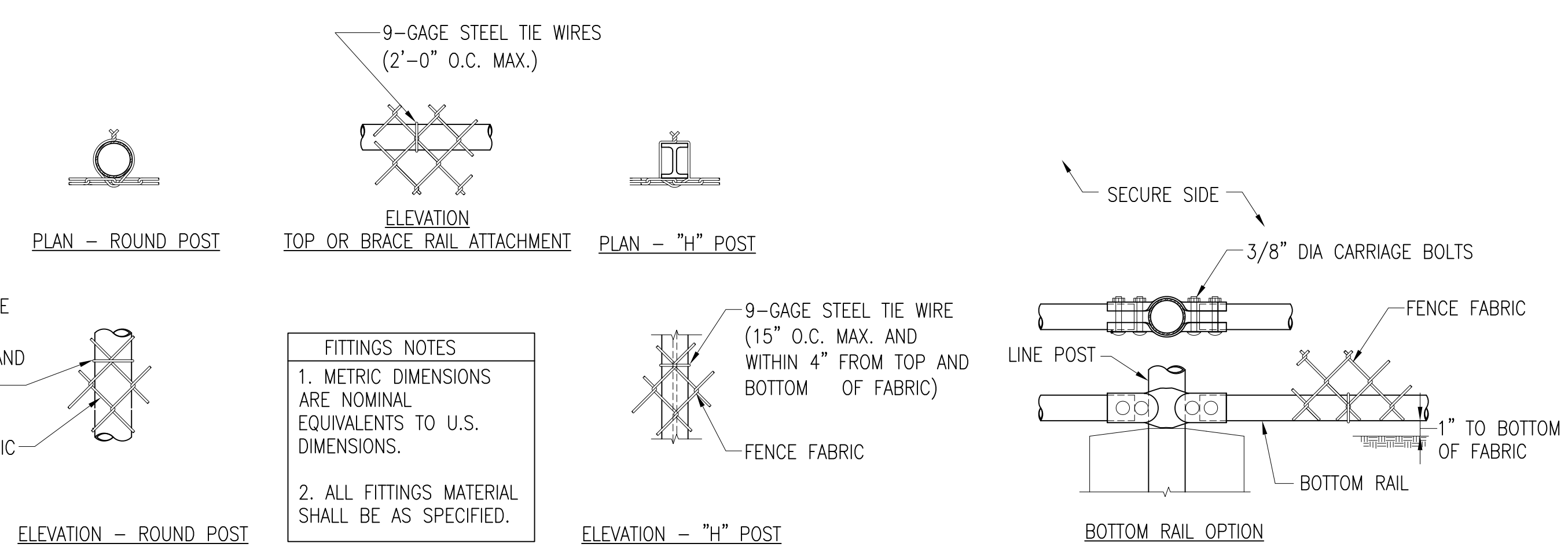
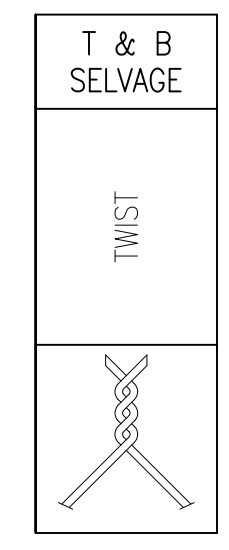
TYPICAL 6 STRAND BARBED WIRE AND DOUBLE EXTENSION ARM CONFIGURATION

SCALE: 1" = 1'-0"



LINE POST DETAILS

SCALE: 1 1/2" = 1'-0"



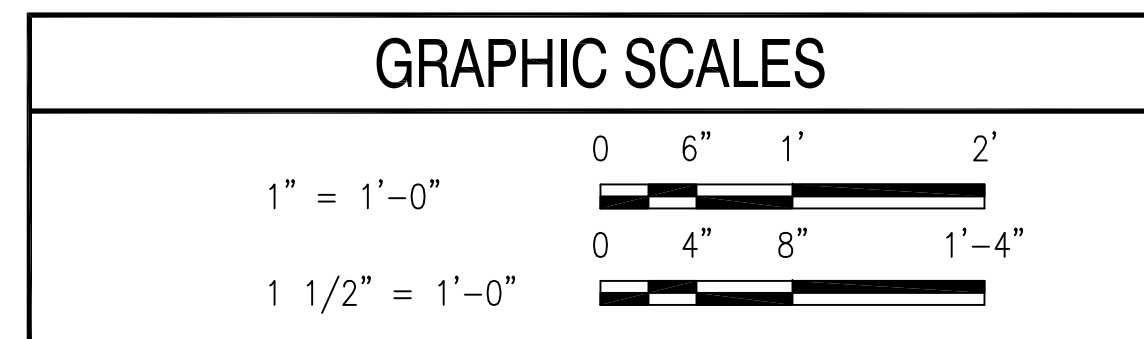
FITTINGS NOTES

1. METRIC DIMENSIONS ARE NOMINAL EQUIVALENTS TO U.S. DIMENSIONS.

2. ALL FITTINGS MATERIAL SHALL BE AS SPECIFIED.

CORNER OR END POSTS

SCALE: 1 1/2" = 1'-0"



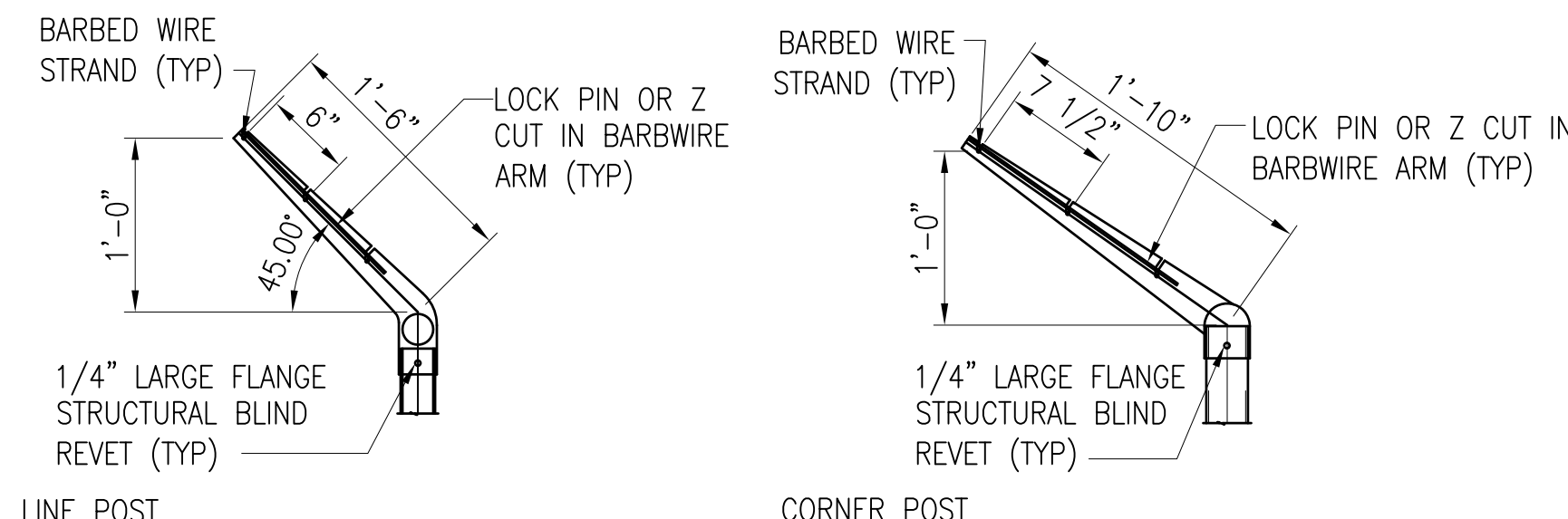
UNIFIED FACILITIES CRITERIA 4-022-03 SECURITY ENGINEERING: FENCES, GATES AND GUARD FACILITIES

DEFINITIVE DRAWINGS FOR SECURITY FENCING, GATES AND CABLING

CHAIN LINK FENCE AND DETAILS

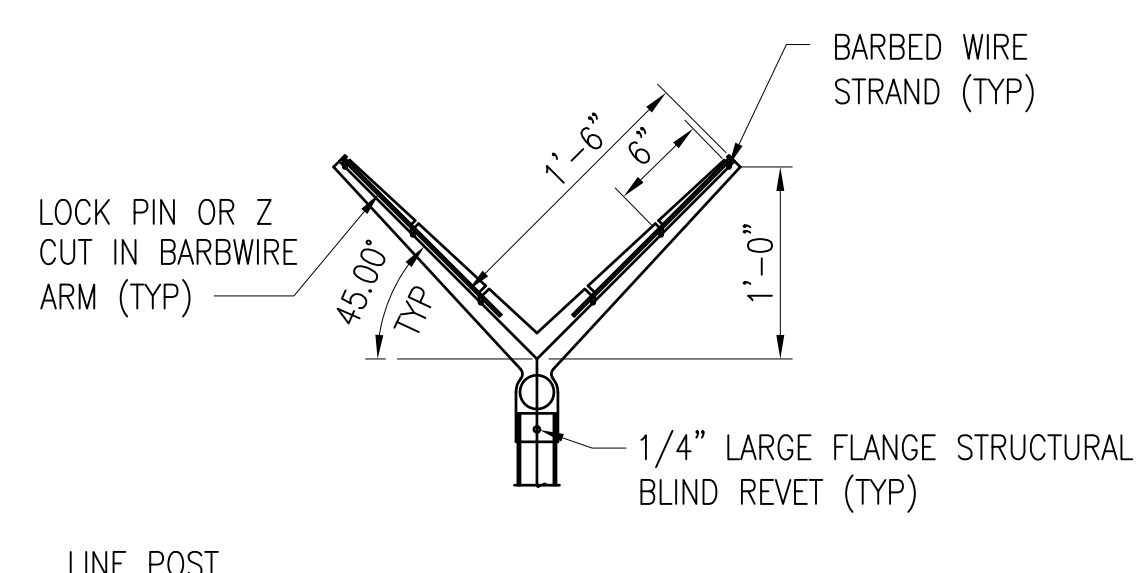
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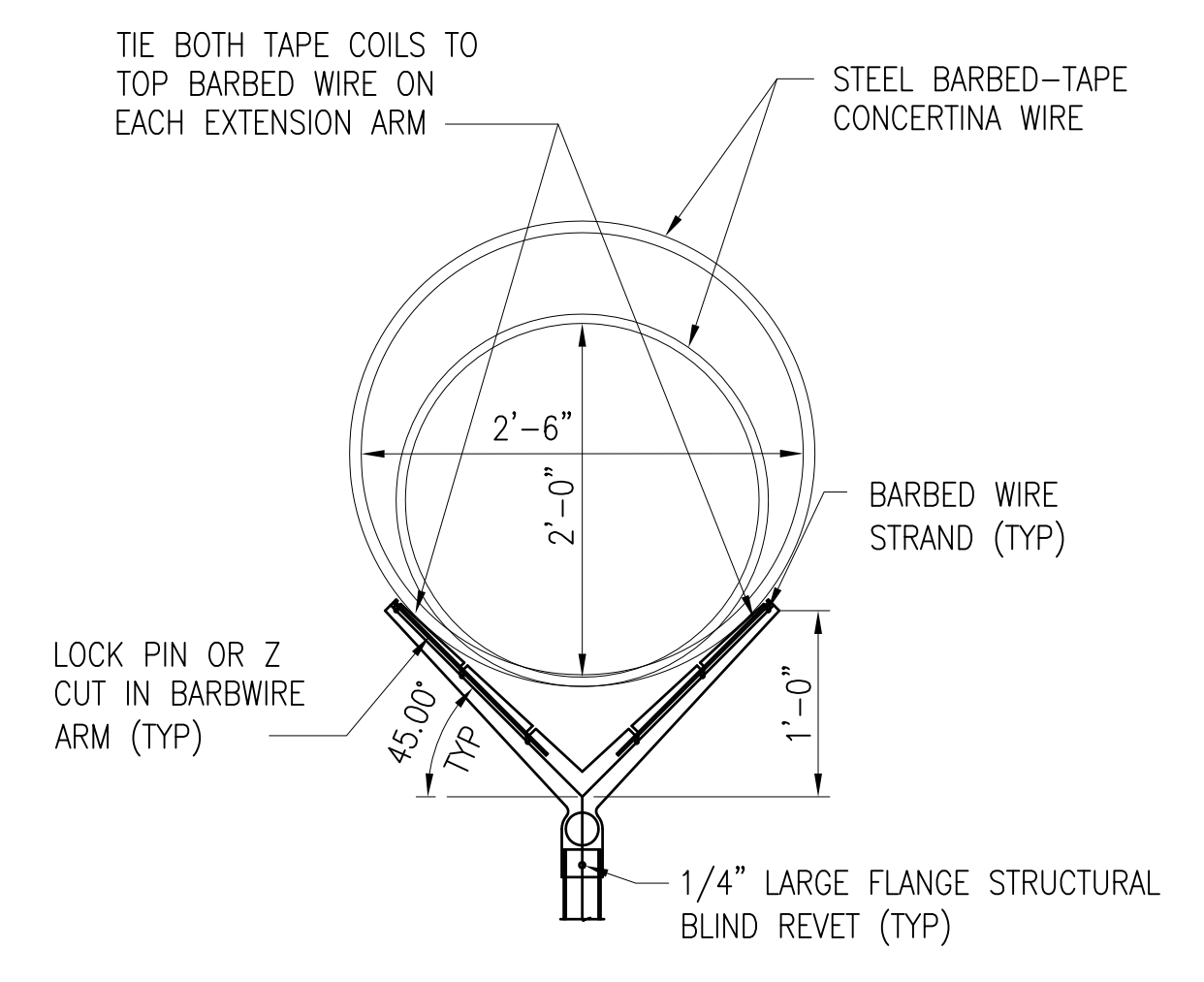
SINGLE EXTENSION ARM DETAILS

SCALE: 1" = 1'-0"



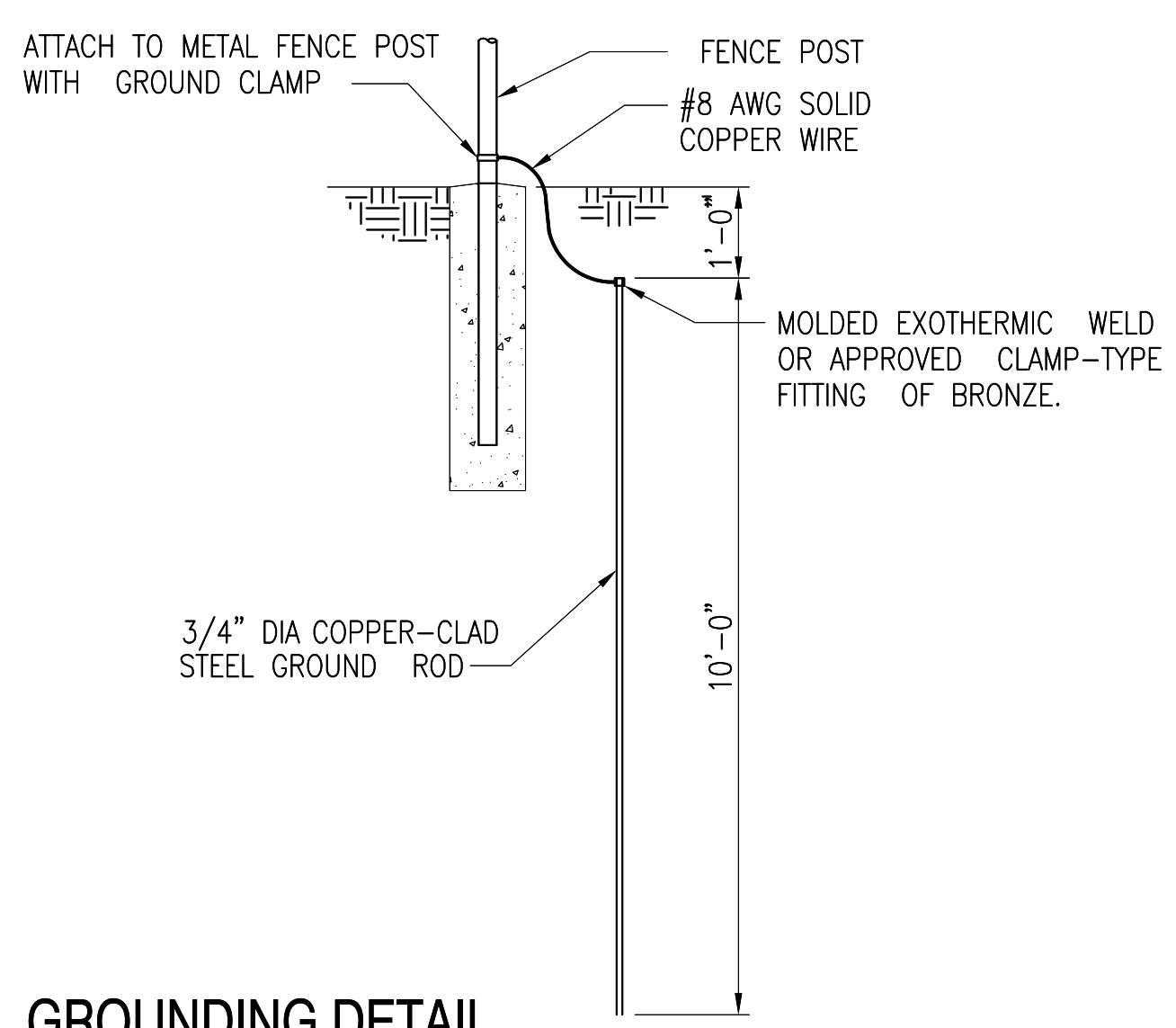
DOUBLE EXTENSION ARM DETAILS

SCALE: 1" = 1'-0"



CONCERTNA WIRE MOUNTING

SCALE: 1" = 1'-0"



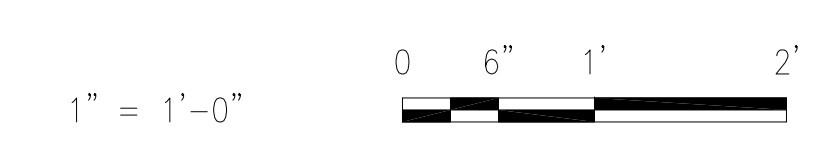
GROUNDING DETAIL

NO SCALE

CHAIN LINK FENCING NOTES

- FABRIC:** THE STANDARD FENCE FABRIC SHALL BE VINYL, ZINC OR ALUMINUM-COATED STEEL WIRE CHAIN LINK WITH MESH OPENINGS NOT LARGER THAN TWO INCHES PER SIDE AND A TWISTED AND BARBED SELVAGE AT TOP AND BOTTOM IN ACCORDANCE WITH THE SPECIFICATIONS. UTILIZE 6-GAUGE FOR BASE PERIMETER OR HEIGHTENED SECURITY ZONES AND 9-GAUGE FOR BASE INTERIOR OR WHEN JOINING AN EXISTING FENCE WHICH IS ALREADY 9-GAUGE.
- FABRIC TIES:** ONLY 12-GAUGE STEEL TIES SHALL BE USED. COATING OR PLATING WILL BE ELECTROLYTICALLY COMPATIBLE WITH THE FENCE FABRIC TO INHIBIT CORROSION.
- REINFORCEMENT:** TENSION WIRES SHALL BE INSTALLED AND INTERWOVEN (OR AFFIXED WITH FABRIC TIES) ALONG THE TOP & BOTTOM OF THE FENCE FOR STABILIZATION OF THE FENCE FABRIC.
- FENCE HEIGHT:** CHAIN LINK FABRIC SHALL BE 7' HIGH WITH AN ADDITIONAL 1' IN HEIGHT COMPOSED OF 3 STRANDS OF BARBED WIRE AS REQUIRED. THE TOTAL FENCE HEIGHT SHALL BE 8'.
- GROUND CLEARANCE:** BOTTOM OF THE FENCE FABRIC SHALL BE WITHIN TWO INCHES OF FIRM SOIL.
- TOP GUARDS:** A TOP GUARD IS AN OVERHANG OF BARBED WIRED ALONG THE TOP OF A FENCE, FACING OUTWARD (AWAY FROM PROTECTED SITE) AND UPWARD AT APPROX. 45° ANGLE. TOP GUARD SUPPORTING ARMS WILL BE PERMANENTLY AFFIXED TO THE TOP OF FENCE POSTS TO INCREASE THE OVERALL HEIGHT OF THE FENCE AT LEAST 1 FOOT. THREE STRANDS OF 12-GAUGE BARBED WIRE, EQUALLY SPACED, SHALL BE INSTALLED ON THE SUPPORTING ARMS.
- FENCE POSTS:** SHALL BE ASTM F1043 OR F1083 ROUND PIPE OR SQUARE TUBE AND SHALL BE GALVANIZED IN ACCORDANCE WITH THE SPECIFICATIONS. FENCE POST SPACING AND SIZE (DIAMETER) SHALL BE DETERMINED IN ACCORDANCE WITH CHAIN LINK FENCE MANUFACTURERS' INSTITUTE (WLG 2445). SPACING SHALL NOT EXCEED 10'-0" OC. SIZE (DIAMETER) SHALL NOT BE LESS THAN THAT SPECIFIED.

GRAPHIC SCALES



UNIFIED FACILITIES CRITERIA 4-022-03 SECURITY ENGINEERING: FENCES, GATES AND GUARD FACILITIES
DEFINITIVE DRAWINGS FOR SECURITY FENCING, GATES AND CABLING

UFC-701

FILE NAME: J:\CIVIL\FENCE DRAWINGS\452009-UFC-701.dwg LAYOUT NAME: #-### PLOTTED: Monday, April 29, 2013 1:03pm

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