

SECTION 02810 CHAIN LINK FENCING AND GATES

1.0 General

1.1 Scope

The work covered by this specification includes furnishing of all labor, equipment, and materials required for installation of chain link fencing and gates as shown on the drawings and specified herein.

1.2 Related Work

02121	General Excavation and Backfill
03100	Reinforced Concrete

1.3 Codes and Standards

Comply with the provisions of the following codes, specifications and standards, except as otherwise shown or specified. The latest edition of the code or standard shall govern.

American Society of Testing and Materials (ASTM)

ASTM A 121	Standard Specification for Metallic-Coated Carbon Steel Barbed Wire
ASTM A 123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products
ASTM A 392	Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A 641	Standard Specification for Zinc Coated (Galvanized) Carbon Steel Wire
ASTM A 780	Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A 817	Standard Specification for Metallic-Coated Steel Wire for Chain-Link Fence Fabric and Marcellled Tension Wire
ASTM A 824	Standard Specification for Metallic-Coated Steel Marcellled Tension Wire for Use with Chain Link Fence
ASTM F 567	Standard Practice for Installation of Chain-Link Fence
ASTM F 626	Standard Specification for Fence Fittings

ASTM F 1043	Standard Specification for Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework
ASTM F 1083	Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
ASTM F 2611	Standard Guide for Design and Construction of Chain Link Security Fencing

2.0 Materials

2.1 General

All materials shall conform to the following specifications unless otherwise approved by the Company.

2.2 Height

The total installed fence height shall be eight (8) feet above subgrade, with the bottom seven (7) feet being chain link fabric and the top one (1) foot consisting of three strands security wire installed on brackets slanting outward at 45°.

2.3 Chain Link Fabric

Fabric shall conform to ASTM A 392, made from #9-gage galvanized wire (0.148 inch nominal diameter), spirally wound and interwoven into a two (2) inch diamond mesh, with twisted and barbed selvage on top and bottom.

Minimum breaking strength of the fabric wire shall be 1,290 pounds after galvanizing. Fabric wire shall be galvanized to Class 1, with a minimum weight of 1.20 ounces of zinc per square foot of uncoated wire surface. Galvanized fabric wire shall be tested in accordance with ASTM A 370.

2.4 Fence Framework

Fence line posts and terminal posts (end, corner, and pull posts) are to be selected and spaced to meet the specific site geographic location and weather conditions with due consideration to additives to the fence such as windscreen, inserts or signage. The Chain Link Fence Manufacturers Institute's, *Chain Link Fence Wind Load Guide for the Selection of Line Post and Line Post Spacing, WLG 2445* may be used as a guide to select the post diameter and spacing if not specified on the drawings.

Line, terminal posts and rails shall conform to ASTM F 1043 and Specification ASTM F 1083.

Line and terminal posts shall be per Table 3 of ASTM F 1043, Material Group IA. Weight shall not vary more than $\pm 10\%$ from that prescribed. Lengths shall be sufficient for depth of required concrete embedment and security wire attachment.

All fence framework shall be hot-dipped galvanized per ASTM A123 and shall have a minimum of 1.8 ounces hot-dipped zinc per square foot of surface.

The use of re-rolled, re-galvanized, or open-seam posts or rails is not allowed.

Minimum pipe sizes and Regular Strength Grade shall be as follows for the various fence and gate posts and framing. Larger sizes or Grades may be required by site-specific design and will be shown on the drawing and notes.

Group IA: Steel pipe shall be Schedule 40 pipe and shall conform to ASTM F 1083:

Regular Grade 30,000 psi minimum yield strength (minimum tensile strength = 48,000 psi)

Intermediate Strength Grade 50,000 psi minimum yield strength (minimum tensile strength = 60,000 psi)

Available in 5.563 inch outside diameter and larger

High Strength Grade 83,000 psi minimum yield strength (minimum tensile strength = 85,000 psi)

Line Post

Nominal	2" Schedule 40
Diameter	2.375"
Thickness	0.154"

Terminal Post

Nominal	3.5" Schedule 40
Diameter	4.0"
Thickness	0.226"

Corner Post

Nominal	3.5" Schedule 40
Diameter	4.0"
Thickness	0.226"

Rails: Top, Brace

Nominal	1¼" Schedule 40
Diameter	1.660"
Thickness	0.140"

Vehicle Gate Posts

Leaf less than 12 Feet

Nominal	4.0" Schedule 40
Diameter	4.50"
Thickness	0.237"

Leaf 12 Feet to 18 Feet

Nominal	6.0" Schedule 40
Diameter	6.625"
Thickness	0.280"

Vehicle Gate Frames

Nominal	1½" Schedule 40
Diameter	1.90"
Thickness	0.145"

Personnel Gate Post

Nominal	3.5" Schedule 40
Diameter	4.0"
Thickness	0.226"

Personnel Gate Frames

Nominal	1¼" Schedule 40
Diameter	1.66"
Thickness	0.140"

2.5 Fittings

All fence fittings shall comply with ASTM F 626. Fittings shall be from malleable or pressed steel and shall be hot dipped galvanized with a minimum 1.20 oz./ft² of zinc coating, per ASTM A 817 unless noted otherwise. No aluminum fittings are allowed.

- A. Post Tops: All intermediate or line posts shall be fitted with 45 degree security wire extension arms with wire positioned outside the fence. Arms shall be, at a minimum, made from 14-gage pressed steel designed to hold the top rail and three strands of security wire with the top strand located 12 inches above the fabric. Arms having projections that bent down over security wire may not be used. Arms shall withstand 250 pounds downward pull at end of arm without failure. Tubular posts shall be equipped with tops designed to exclude moisture from the posts center. Post and line caps shall be fabricated from pressed steel or cast iron.
- B. Rail and Brace Ends shall be provided where top and brace rails are required. Rail and brace ends shall be fabricated from pressed steel or cast iron.
- C. Top Rail Sleeves shall be fabricated from pressed steel or round steel tubing; 0.051" wall thickness. Sleeves shall be not less than six (6) inches long with expansion sleeves provided at every fifth sleeve.
- D. Round Wire Ties that are power fastened shall be #6-gage steel and twisted with one and a half (1½) full twists machine turns, which is equivalent to three (3) full twists, thereby drawing up tightly around the rail or post and the chain-link fabric. #6-gage wire shall have a minimum zinc coating of 2.00 ounces per square foot in accordance with ASTM A641, Class B coating. Manually fastened round wire ties can be either #6- or #9-gage galvanized steel, and twisted with three (3) full twists. After twisting, the protruding wire ends shall be cut off to prevent untwisting by hand. Manually fastened #6-gage or #9-gage wire shall have a minimum zinc coating of 1.2 ounces per square foot in accordance with ASTM A817, Type 2, Class 1.
- E. Hog Rings (Tension Wire Clip) shall be #9-gage galvanized steel.
- F. Fabric Tension (Stretcher) Bars shall be galvanized steel, one piece length equal to two (2) inches less than full height of fabric, with a minimum cross-section of 3/16" x 3/4" per ASTM F626.
- G. Tension and Brace Bands used to connect ends of tension wire and top rails shall be a minimum of 3/4" wide x 12-gage thickness, secured using 3/8" galvanized steel carriage bolts and nuts.
- H. Bolts, Nuts, and Turnbuckles shall be minimum 3/8", galvanized or stainless steel.
- I. Gate Fittings shall be included for each gate as specified below.

Hinges for vehicle and personnel gates shall be adjustable arm type, with a 180-degree swing, fabricated from pressed galvanized steel.

Gate Latches for vehicle and personal swing gates shall be a fulcrum type, fabricated from pressed steel, bolted to the gate frame. Latch shall be pad-lockable. After installation U-bolt nuts shall be tack welded.

Drop Rod shall be 1" Schedule 40 (minimum size), have a hand grip welded to the top of the rod and a stopper welded six (6) inches from the bottom to prevent removal. Drop rods shall be attached to the gate frame at a minimum of two (2) points with a full loop guide, bolted to the gate frame. After installation U-bolt nuts shall be tack welded. Drop rod shall be inserted into a chamber assembly cast into the gate curb. See fabrication detail in the fence drawings.

Gate Hold Back Catches shall be of the duck-bill type that will lock the gate as it passes over the lever. Disengaging the lock shall be by lifting the lever to free the gate. The hold back shall be fabricated from malleable steel, attached to a steel pipe with end cap that will be cast in concrete.

Gate Stop shall be installed to the curb for all leaves of vehicle gates to restrict gate opening to the direction shown on the drawings. See fabrication detail in the fence drawings.

- J. Security Wire shall be made of two strands of galvanized, Coating Type Z, twisted 12-½ gauge carbon steel wire per ASTM 121, Design Number 12-4-5-14H. Barbs shall be four-point pattern on approximately five (5) inch centers. Barbs shall be 14-gage carbon steel wire.
- K. Truss Rods shall be ¾" diameter galvanized steel with a truss tightener or turnbuckle. Truss rod assembly shall be capable of withstanding a tension of 2,000 pounds.
- L. Tension Wire shall be a minimum 7-gage (0.177 inch) marcelled spring coil wire, with Type II, Class 4 galvanized coating per ASTM A 824, with a tensile strength of 75,000 psi.
- M. Slats shall be pre-woven into the chain link fabric and self-locked when manufactured. Slats shall be extruded from High Density Polyethylene (HDPE) with color pigments and ultra violet (UV) inhibitors added that are specifically formulated to retard the harmful effects of the sun and lengthen the life of the slat for 25-year warranty. See drawing notes for color to be provided.

Note: Wind load on slated fence is approximately 80% solidity ratio. Chain link fence is usually installed with ten (10) foot maximum post spacing. Engineering shall specify reduced post spacing and heavier wall/diameter posts and footings for the local wind loads as shown on the drawings.

3.0 Execution

3.1 General

The chain link fence shall be installed in compliance with the drawings and this specification. Installation crew shall be experienced in the erection of this type of fence. The fence shall be erected on the lines and to the grades as specified on the drawings.

3.2 Post Spacing

Posts shall be spaced equidistant not more than ten (10) feet on centers in the line of the fence. Posts shall be plumb, with tops properly graded and aligned. Corner or terminal posts shall be located at all angles of 20° or greater. Terminal posts shall be placed when a grade change of more than 20° in slope or a ratio of ten to three and one half (10:3½) occurs. Terminal posts shall not be placed more than 1,500 feet apart within any fence line or as indicated on the drawings.

3.3 Excavation and Concrete Work

Excavations shall be in accordance with specification 02121, *General Excavation and Backfill*. Excavate post foundations with a power auger to the diameter and depth shown on the drawings. Post hole shall be clear of debris or standing water and shall not be left open more than 24 hours prior to placing concrete. All excavated materials shall be removed from the site or disposed as directed by the Company.

Fence posts and gate catches shall be embedded in the augured holes with concrete, in a vertical position, plumb and in line. The top six (6) inches shall be formed if ground is not firm enough to permit excavation of the post hole to neat lines to prevent a mushroom top that are susceptible to frost heave.

Curbs, if specified on the drawings, shall be placed with forms. Post and curbs may be poured at the same time.

Ready-mix concrete shall have a minimum 28-day compressive strength of 3,000 psi, maximum slump of five (5) inches, air content of 5% +/- 1%, and water-cement weight ratio not exceeding 0.53 at time of placement. Site-mixed concrete shall be 1:2:3 mix (one-cement, two-sand, and three-gravel). Concrete for gate aprons shall be per the structural concrete specification 03100, *Reinforced Concrete*.

The top exposed surface of the concrete shall be crowned to shed water and troweled smooth. Top of concrete shall be formed in line with the sides of hole to avoid "mushrooming" of the concrete.

Where solid rock is encountered a hole shall be cored or air hammered into the rock that is ½ inch larger than the post diameter. Minimum depth of holes in solid rock shall be 12 inches for line posts and 18 inches for end, corner, gate, and terminal posts, but not less than three times the post diameter or depth as shown on the drawings. Clear the hole of all loose debris and water, then half-fill the void with non-shrink grout approved by the Company. Then force the post to the bottom of the hole and plumb. Thoroughly work additional grout into the hole so as to leave no voids. Crown the grout to shed water.

Where solid rock is covered with an overburden of soil, the post shall be set in the solid rock and grouted to the depth as listed above, and the portion around the post to the depth of the overburden shall be completed as a standard concrete footing. The sides of this concrete footing shall be formed (or sleeved).

3.4 Top Rail

The top rail shall pass through the base of the line post tops and shall be securely fastened to terminal posts. Every fifth coupling, in 100-foot sections or longer, shall have a sleeve to compensate for contraction and expansion.

3.5 Bracing

Braces shall be installed midway between the finished grade line and the top rail on all corner, pull, terminal, and gate posts. Bracing shall extend from these designated posts to the adjacent line posts, and be diagonally trussed from the line posts back to the base of these designated posts. The angle of the brace to the ground shall be no more than 50 degrees. The three-eighth inch ($\frac{3}{8}$ ") diameter truss rod shall be placed in tension by adjusting the truss tightener or turnbuckle.

3.6 Tension Wire

The tension wire shall be installed with sufficient tension to maintain tautness during temperature changes and installed at two inches above finished grade. The tension wire shall be secured to the fabric and each line post, and shall be terminated at each corner, gate, terminal, and pull post.

3.7 Fabric

Only after the concrete or grout has sufficiently cured, (minimum seven [7] days after placing), and after all framework and braces have been installed the chain link fabric may be installed. The fabric shall be placed on the outside of the secured area, stretched taut, with its lower edge one (1) inch above rough grade or subgrade. Panels of fabric shall be stretched between all terminal posts and terminated on tension bars, which are held by fabric bands spaced not to exceed 15 inches.

The chain link fabric shall be sufficiently stretched taut so as not to deflect more than two (2) inches in the center of the fence panel in between the two line posts when subjected to a 30 pound horizontal force.

Fabric shall be tied to line posts, top, mid rails and tension wire at the maximum spacing listed below:

Top of Fabric to Top Rail —18-Inch Spacing

Center of Fabric to Bracing —18-Inch Spacing

Width of Fabric to Line Posts —12-Inch Spacing

Bottom of Fabric to Tension Wire using hog rings —18-Inch Spacing

Excess tie wire shall be cut off and bent over to prevent injury. Care must be taken to ensure that the ends of the ties do not protrude beyond the vertical plane on either side of the chain link fence to avoid injury to personnel in contact with the fence.

3.8 Extension Arms and Security Wire

All extension arms shall be firmly seated on the top of the posts with the blade portion of the arm slanting outward at forty-five degrees (45°). Anchor extension arms to posts with screws or spot welds to prevent rotation and removal. Field welded areas shall be cleaned and protected with zinc rich paint per ASTM A780 ("Cold Galvanizing Compound" as manufactured by ZRC Corporation is an

acceptable product for this application). Three strands of security wire shall be installed with sufficient tension to maintain tautness during temperature changes and shall be securely fastened to the slots in the extension arms. Attach each strand of security wire to terminal post using a brace band.

3.9 Gates

Vehicle and personnel entry gates shall be installed as shown on the drawings.

Gates shall be erected to provide easy operation. Direction of gate swing shall be as indicated on the drawings. Gateposts shall not be located closer than ten feet to a corner, unless indicated otherwise on the drawings. Braces shall be installed on each side of all gates. Top of gate frame and security wire shall be aligned vertically. Horizontal brackets and three strands of barbed security wire shall be installed, as shown on the drawings; to clear the gate posts. The lower edge of bottom rail above top of concrete curb at gate shall not exceed two (2) inches, and the gap between the gate posts and gate frame shall not exceed two (2) inches.

Each gate leaf shall have vertical interior bracing at maximum intervals of eight (8) feet and shall have a horizontal interior member. A diagonal truss rod will be provided for each gate leaf. Gate corners shall be fabricated from pressed steel or may be welded. If welded corners are used, welded areas shall be painted with zinc-rich paint per ASTM A780.

Gates shall be secured with a fulcrum latch and a $\frac{3}{8}$ " hardened steel security chain joining each leaf of a double-swing gate or the leaf and gate post of a single leaf gate frame. The chain shall be secured by a Company provided lock appropriate for the station class. Hand holes shall be provided to make training the chain through the fabric easier.

3.10 Warning & Station Signs

The "Warning! Hazardous Voltage Inside, Keep Out" signs shall be supplied by Company and installed by Contractor as shown on the drawings. Signs shall be placed on each fence run starting five (5) feet from the corner and then at 65-foot maximum spacing and at the gates. Signs shall be attached to the fence fabric five (5) feet six (6) inches from bottom of sign to finished grade. The "No Trespassing" sign shall be placed at the same five (5) foot, six (6) inch level and immediately to the right or left.

Station sign shall be supplied by the Company and installed on the main entry gate only.

Warning! Hazardous Voltage Inside Keep Out (RMP)
SI# 7999852

Warning! Hazardous Voltage Inside Keep Out (PP)
SI# 7999851

No Trespassing
SI# 8252306

Mounting Hardware
SI# 7999092

The mounting hardware is comprised of aluminum brackets with one-inch tamper-proof bolts and locking nuts. The bolts are installed through the sign's front, and screw into the aluminum brackets located on the interior of the fence. Four sets of mounting hardware are needed for each sign.

3.11 Gate Catch

Install one center gate drop rod catch block (keeper) and two gate-catches with each vehicle as shown on the drawings.

3.12 Attachments

Field welding or drilling of tapped holes for attachments to the gate posts must be prepared and repainted with zinc rich paint prior to installation of the attachment. Zinc rich paint shall conform to ASTM A780 ("Cold Galvanizing Compound" as manufactured by ZRC Corporation is an acceptable product for this application).

3.13 Fence Relocation

When so specified in the contract documents, portions of an existing fence shall be removed and relocated (only if existing fence fabric and overall height meets current 8'-0" overall height requirements), in accordance with these specifications and drawings furnished. The following fence materials may be reused is in good condition: Fabric, brace, rail, top rail, stretcher bars, truss rods, truss bands, security wire, gate frames, and gate hardware. Reused fence materials shall be removed and handled with care so as not to damage them. New bottom tension wire and hog ties must be installed and fence posts shall not be reused. All fence materials that are not reinstalled shall be returned to the nearest PacifiCorp warehouse unless stated differently in contract.

When relocating an existing fence, the contractor shall coordinate the work so that security is maintained at all times.

Warning signs not compliant with current standards/specifications must be removed and new standard signs installed per section 3.10.

3.14 Fence Isolation Panel

When a PacifiCorp substation fence is adjacent to or abuts to any neighboring metallic or wire fence with wood posts, the intermediate section of fence must be isolated electrically by installing an Isolation Panel as shown in the drawings. If the adjacent metallic or wire fence is more than eight (8) feet apart then the panel is not required as both cannot be touched at the same time.

A section of the adjacent metallic or wire fence shall be removed and a new corner/terminal post shall be installed. If the metallic fence is chain link with security wire over the top, then a new corner/terminal post shall match the height of the Company's isolation panel. A security wire barrier may need to be constructed to ensure that security wire extends to the top of the corner/terminal post. A wood post wire fence need not have the post height match.

The isolation panel shall be completely insulated from the grounding system. The support posts shall be grouted in the appropriate diameter schedule 40 PVC pipe placed in the concrete footings with the adjacent fence posts. PVC end caps shall be placed at the bottom of the PVC pipe.

Under the isolation panel a concrete curb shall be installed to prevent the fence metallic fabric from touching the ground.

3.15 New Fence to Existing Fence

When enlarging a substation by installing a new fence to an existing substation fence, the new fence shall meet the current fence overall height standard of 8'-0" (including security wire). Refer to the drawings for joining the unequal height fence sections.

3.16 Cleanup

Pieces of fencing or other scrap materials shall be removed. Dirt from excavations and left over concrete shall be removed or deposited as instructed by Company and the area shall be left clean and orderly.

END OF SECTION