

SECTION 02830

CHAIN LINK FENCING AND GATES

The following comments are provided to aid the designer in the comparison of Types of Fence:

The all aluminum fence is most expensive. Aluminum fence is not as strong as other types. Maintenance is less for plastic coated and aluminum.

The vinyl coated steel fence may be the best choice with framework strength equal to galvanized, but there would be little need for future painting.

The attached diagrams show manufacturer's standard nomenclature for the various components, Diagram "A" for fence, and Diagram "B" for gates.

ESTIMATED RANKING OF TYPES OF FENCE

	First Cost	Service Life	Fabric Breaking Strength ⁽¹⁾	Frequency of Maintenance
Vinyl coated steel ⁽²⁾	1 (lowest)	1 (best)	1,800 lbs.	1 (least freq.)
Aluminum coated steel	2	5	2,170 lbs.	4
Galvanized steel (1.2 oz) ⁽³⁾	1 (lowest)	4	1,800 lbs.	5
Galvanized steel (2.0 oz)	3	3	2,170 lbs.	3
Aluminum	4	2	1,500 lbs.	2

⁽¹⁾ Per Federal Specification RR-F-191.

⁽²⁾ Thermal fusion applied.

⁽³⁾ 1.2 oz fabric not recommended.

NOTE: ACTUAL SPEC STARTS HERE.

NOTE: This spec has been written for (1) galvanized steel (2) aluminum (3) vinyl coated fences. Designer should select the type of fencing and delete any inappropriate items not required for the project.

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Requirements for providing and installing (aluminum) (galvanized steel) (vinyl coated galvanized steel) chain link fencing and gates.
- B. Related Work Specified in Other Sections Includes:
 - 1. Section 03311 – Concrete for Non-Plant Work
 - 2. Section 09900 – Painting and Coating

1.2 REFERENCES

- A. Codes and standards referred to in this Section are:
 - 1. ASTM 1043 - Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework
 - 2. ASME B36.10M - Welded and seamless wrought steel pipe
 - 3. FS RR-F-191 - Fencing, Wire and Post, Metal

1.3 DESIGN

NOTE: Determine height of fence.

- A. General: Provide fencing of the chain-link type and (_____) (seven) feet high with (_____) (six) feet of diamond mesh woven wire fabric topped by extension arms with a vertical height of approximately one foot above the top of the fabric. Design the extension arms slanted out at an angle of 45 degrees and provide the arms to carry three double strands of barbed wire. Locate the fence as shown.

NOTE: Delete item B or C depending on type of fences used and renumber as required.

- B. Fabric, Supports and Fittings: Provide (aluminum) (steel) fabric, supports and fittings except as specified.

NOTE: Color coated chain link fence consists of polyvinyl chloride (PVC) fused and bonded to a zinc coated steel wire fabric. Structural parts are galvanized steel, coated with thermoplastic or thermoset polyester resins and oven baked for complete fusion. An alternate method of color coating by extrusion is not acceptable, as it is subject to possible separation from the supporting element and to blistering.

- C. Fabric, Supports and Fittings: Provide (green) (black) color coated steel fabric, supports and fittings. Coat the framework, posts and hardware except hinges and latches to match the fabric with thermoplastic or thermoset resins and provide oven baked materials to a minimum dry coating of seven mils. Color coat all accessories except hinges and latches to match the fence. Provide aluminum hinges and latches.
- D. Pipe Sizes and Weights: Provide pipe sizes and weights meeting the requirements of ASME B 36.10, Table 2 and ASTM A 53, Table 1. All pipe sizes listed are nominal, unless otherwise indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.

NOTE: Manufacturers (a) and (c) are for galvanized steel and vinyl coated steel fences and (a) and (b) are for aluminum fences.

- 1. Fences
 - a. Chain Link Fence Co. of Pennsylvania
 - b. U.S. Steel-Cyclone

2.2 FABRIC

NOTE: Minimum breaking loads:

Vinyl Coated	1,800 lbs/ft
Aluminum	1,500 lbs/ft
Galvanized Steel	2,170 lbs/ft

Edit as required.

- A. Provide fabric that is a one piece woven 2inch mesh chain link of 6gauge (steel wire) (Type 6061 aluminum alloy) with a minimum breakload of (1800) (1500) (2170) lbs/ft. and which is interwoven to form a continuous fabric with no splices (and is hot-dip galvanized) (and is coated) after weaving. Provide the top selvage knuckled for fabric (60 inches) (____) high and under, and the bottom selvage twisted and barbed for fabric over (60 inches) (____) high. Clean the fabric of all grease and foreign matter before (coating and) (shipping). Stretch the fabric tightly approximately two

inches above grade level and attach the fabric to the terminal or gate posts using beveled tension bands and tension bars.

NOTE: Delete as required when vinyl coating is not specified.

1. Provide galvanized fabric that is fusion coated with a minimum seven mil coating of polyvinyl chloride (PVC) applied over a thermoset plastic bonding agent. Conform the PVC to Federal Specification RR-F-191.
2. Vinyl coat all cut ends.
3. Conform aluminum fabric to Fed. Spec. RR-F-191.

2.3 BARBED WIRE

NOTE: Five-inch spacing is standard construction for barbs on fencing. If greater security is required, the following changes can be made:

- a. Change barb spacing to three inches.
- b. Delete the top tension rail and add top tension wire which will be more flexible and make climbing the fence more difficult.
Change Subsection 2.05 to read as follows:

2.5 TOP TENSION WIRE AND BRACE RAILS

A. General: Run a top tension wire of minimum 7-gauge (aluminum) (galvanized coil spring steel), (fusion color coated as specified for fabric,) continuously for each run of fence, and within the top six inches of the fence fabric. Provide brace rails at all terminal posts, located midway between the top and bottom of the fabric extend from the terminal post to the first adjacent line post. Securely fasten rails at both ends. Provide brace rails that are galvanized steel, (fusion color coated as specified for framework in Subsection 1.03 C).

B. Pipe Type: Provide brace rails that are 1-1/4-inch Schedule 40 pipe or a 1.625- by 1.25-inch roll-formed section with a minimum bending strength of 192 pounds in a 10-foot span.

- A. Provide barbed wire consisting of two strands of (0.110-inch diameter wire with 0.080-inch diameter) (12-1/2 gauge galvanized steel wire with 14 gauge) 4point round barbs spaced not more than five inches apart.

NOTE: Delete as required.

1. Provide barbed wire for vinyl coated fence, finished with color coating as specified for the fabric. Provide uncoated barbs.
2. Use Alloy 5052-H38 for aluminum wire.

2.4 TENSION WIRE

- A. For the tension wire for the fence bottom use (minimum 6-gauge galvanized coil spring steel) (fusion color coated as specified for the fabric) (6-gauge alloy 6061) (minimum 7-gauge galvanized coil spring steel).

2.5 TOP AND BRACE RAILS

- A. General: Furnish the top rail in approximately 20-foot lengths with couplings approximately 6 inches long for each joint. Provide one coupling in each 5 with an expansion spring. Provide the rail continuous from end-to-end for each run of fence. Provide brace rails at all terminal posts, locate the rails midway between the top and bottom of the fabric and extend from the terminal post to the first adjacent line post. Securely fasten rails at both ends. Provide top and brace rails that are (galvanized steel fusion color coated as specified for framework in Subsection 1.03 C) (galvanized steel) (aluminum alloy Type 6063-T6).
- B. Pipe Type: (For galvanized steel top and brace rails, use 1-1/4-inch, Schedule 40 pipe or a 1.625- by 1.25-inch roll-formed section with minimum bending strength of 192 pounds on 10-foot span.) (For aluminum top and brace rails, use 1-1/4-inch, Schedule 40 pipe.)

2.6 POSTS

NOTE: Several manufacturers size gate posts according to the following schedule:		
Width of Gate Leaf	Nominal Minimum Post Size	Minimum Depth into Concrete
up to 6'-0"	2-1/2-inch Schedule 40	36"
over 6'-0" to 12'-0"	3-1/2-inch Schedule 40	36"
over 12'-0" to 18'-0"	6-inch Schedule 40	48"
over 18'-0" to 23'-0"	8-inch Schedule 30	48"
over 23'-0" to 30'-0"	10-inch Schedule 30	48"

- A. General: Provide all posts that are (aluminum alloy 6063-T6 conforming to Fed. Spec. RR-F-191) (galvanized steel pipe or roll-formed section) (coated as specified for vinyl coated framework, posts and hardware in Subsection 1.03 C).

NOTE: Item B for galvanized steel fences, both coated and uncoated.

- B. Pipe Posts: Provide pipe posts as follows:
 1. For end, corner and pull posts use 2-1/2-inch, Schedule 40 pipe
 2. For line posts use 2-inch, Schedule 40 pipe
 3. For gate posts use the following pipes for different leaves:

- a. For leaves up to 6 feet wide, use 2-1/2-inch Schedule 40 pipe
- b. For leaves over 6 feet to 12 feet wide, use 3-1/2-inch Schedule 40 pipe
- c. For leaves over 12 feet to 18 feet wide, use 6-inch Schedule 40 pipe

NOTE: Delete as necessary either the columns and line items for the steel or aluminum.

C. Bending Strength (and Weight): Provide materials with the minimum bending strength (and weights for aluminum posts) based on a 6-foot cantilever for rolled formed or tube posts as follows:

		Minimum Bending Strength, lbs		Minimum Weight, lbs/ft
		Galvanized Steel	Aluminum	Aluminum
1.	End, Corner and Pull Posts:			
	2.875" O.D. roll formed or	444		
	2-1/2-inch square tube	547		
	2-1/2-inch square, heavy wall extrusion		646	2.90
2.	Line Posts:			
	For fences 8 feet maximum height 1.875- by 1.625-inch C-Section	245		
	For fabric height to 6 feet 1.875-inch by 1.625-inch H-Section		202	0.913
	For fences over 8 feet high 2.25- by 1.703-inch C-Section	347		
	For fabric height to 7 feet and more 2.25-inch by 1.875-inch H-Section		325	1.22
3.	Gate Posts:			
	For leaves up to 6 feet wide (2.875-inch O.D. roll formed or	444		
	2-1/2-inch square tube	645		

For leaves to 6 feet wide 2-1/2-inch square, heavy wall extrusion	646	2.90
For leaves over 6 feet wide to 12 feet wide 3-1/2- inch Schedule 40 pipe		3.15
For leaves over 12 feet to 18 feet wide 6-inch Schedule 40 pipe		6.56

2.7 GATES

- A. General: For the perimeter construction of gates with leaves up to 6 feet wide, use 1-1/2-inch (Schedule 40) (Schedule 40 aluminum) pipe or 1-1/2-inch square (steel tube) (aluminum tube or extrusion), and for gates with leaves greater than 6 feet wide, use 2-inch (Schedule 40) (Schedule 40 aluminum) pipe or 2-inch square (steel tube) (aluminum tube or extrusion).
- B. Braces: Provide the gates with sufficient horizontal and vertical members and bracing to ensure structural stability to prevent sagging and to provide for the attachment of fabric, hardware and accessories. Provide gates with diagonal cross bracing consisting of 3/8-inch diameter adjustable length truss rods where necessary to provide frame rigidity without sag or twist.

NOTE: Delete if not required.

- C. Cantilever Sliding Gates: Furnish cantilever overhang as follows:

<u>Gate Leaf Size</u>	<u>Overhang</u>
6'-0" to 10'-0"	6'-6"
11'-0" to 14'-0"	7'-6"
15'-0" to 22'-0"	10'-0"
12'-0" to 30'-0"	12'-0"

- For gates leaf sizes 23'-0" to 30'-0", add one additional 2-inch square lateral support rail welded adjacent to the top horizontal rail. Make the bottom rail of 2" x 4" tubing weighing 1.71 pounds per foot.
- Provide all cantilever overhang frames having 3/8-inch (galvanized steel) (aluminum) brace rods.
- Provide the enclosed track made of a combined track and rail aluminum extrusion having a total weight of 3.72 pounds per foot and designed to withstand a reaction load of 2,000 pounds.

4. Provide each gate leaf with two swivel type zinc die cast trucks having four sealed lubricant ball-bearing wheels, 2-inch in diameter by 9/16-inch in width, with two side rolling wheels to insure alignment of the truck in the track. Hold trucks to post brackets by 7/8-inch diameter ball bolts with 1/2-inch shank. Design truck assemblies to take the same reaction load as the track.
5. Install gates on 4-inch OD Schedule 40 (galvanized) (aluminum) posts weighing 9.1 pounds per foot. Use three posts for single slide gate and four posts for double slide gate.
6. Provide guide wheel assemblies for each supporting post. Provide each assembly consisting of two rubber wheels 4 inches in diameter attached to a post so that the bottom horizontal member will roll between the wheels which can be adjusted to maintain gate frames plumb and in proper alignment.

NOTE: Use aluminum accessories for both aluminum and vinyl coated gates.

- D. Gate Accessories: Equip gates with hinges, latches, center stops, hasps, holdbacks, and padlocks. Provide hinges, latches, center stops, hasps, and holdbacks that are (aluminum) (cast iron, malleable iron, or pressed steel hot-dip galvanized after fabrication). Provide double gates with a center drop bar and gate holdbacks.
- E. Latches: Provide gate latches that are positive locking, pivoting type with the padlocking arrangement accessible from either side of the gate.
- F. Hinges: Hang all gates on offset hinges to permit swinging the gate through a 180-degree arc to lie, when not obstructed, along and parallel to the line of the fence.
- G. Barbed Wire: Top gates with barbed wire on extension arms the same as specified for the fence.

2.8 ATTACHMENTS

- A. General: Provide all attachments fabricated of (aluminum) (galvanized carbon steel) (coated to match the fabric as specified for framework, posts and hardware in Subsection 1.03, except provide aluminum hinges and latches).
- B. Tension Bars: Provide 3/16-inch by 3/4-inch (galvanized carbon steel) (aluminum) tension bars attached to the terminal posts by means of beveled edge bands.
- C. Truss Rods: Provide 3/8-inch diameter (aluminum) (galvanized carbon steel) truss rods. Securely mount truss rods between the line post end of the brace rail and the base of the terminal post.
- D. Post Tops: Provide post tops of (aluminum alloy 6063-T6) (galvanized pressed steel or malleable iron) to form weathertight caps for (pipe) (post or tube posts). Make provisions for installation or passage of the top rail.

- E. Brace and Tension Bands: Provide (aluminum alloy 6063-T6) (galvanized steel) brace bands and tension bands, of the "unclimbable" beveled edge type with 3/8-inch diameter square shouldered aluminum carriage bolts, nonremovable from outside of the fence.
- F. Rail Couplings: Provide rail couplings of the outside sleeve type, not less than six inches long, self-centering, which allows for expansion and contraction. Provide (aluminum) (galvanized steel) rail couplings.
- G. Fabric Ties: Provide (9-gauge alloy 1100-H18) (11-gauge galvanized steel) (or equal aluminum wire) fabric ties.
- H. Hog Rings: Provide 11-gauge wire, aluminum alloy, Type 6061-T6 hog rings.

NOTE: Use a force of 200 pounds for aluminum wires and 250 pounds for galvanized steel arms.

- I. Extension Arms: Provide (galvanized pressed steel) (aluminum alloy 6063-T6) extension arms for supporting the barbed wire. Design the arms with an adequate cross section to withstand without failure or permanent deflection a perpendicular force of (200) (250) pounds applied at the end of the arm when the arm is securely attached to the post. Construct extension arms to be slanted out.

NOTE: Delete if not appropriate.

- 1. Provide aluminum arms conforming to Fed. Specs. RR-F-191.
- 2. Provide Vee-type arm at 45 degrees to vertical with a vertical height approximately one foot above the top of the fabric, one for each post.

PART 3 EXECUTION

3.1 INSTALLATION

- A. General: Install all fencing and accessories according to the manufacturer's recommendations. Do not begin installation and erection before final grading is completed, unless otherwise approved.
- B. Excavation: Drill or hand excavate (using post hole digger) holes for posts to the diameter and spacing indicated, in firm, undisturbed or compacted soil.
 - 1. If not indicated, excavate holes for each post to the minimum diameter recommended by the fence manufacturer, but not less than four times the largest cross-section of the post.

2. Unless otherwise indicated excavate the hole depths approximately 3 inches lower than the post bottom, with the bottom of posts set not less than 36 inches below the finished grade surface.
- C. Barbed Wire: Firmly install the barbed wire in slots in the extension arms, anchored to the terminal extension arms after removal of all sag from the wire.
- D. Tension Wire: Attach the tension wire to the bottom of the fabric by hog rings spaced at 24-inch intervals and to terminal posts by brace bands.
- E. Posts: Set posts plumb in concrete encasement at not more than 10-foot centers in the line of the fence with the tops properly aligned. Extend concrete encasement for line posts a minimum of three feet below finish grade with a minimum diameter of ten inches. Extend concrete encasement for terminal, corner and gate posts 40 inches below finished grade, except gate posts for leaves greater than 6 feet, for which extend the encasement 54 inches below grade. Provide the minimum diameter of encasement for terminal, corner and gate posts to be sufficient to provide not less than four inches between any part of the post and the face of the concrete and in no case provide the diameter to be less than 12 inches. Set line posts 32 inches into the concrete and set all other posts 36 inches, except gate posts for leaves greater than 6 feet wide, which are to be set 48 inches into the concrete. Slope the top exposed surface of the concrete to shed water and provide a neat appearance.
1. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment and hold posts in position during placement and finishing operations.
 - a. Unless otherwise indicated, extend the concrete footing 2 inches above grade and trowel to a crown to shed water.
 2. Where aluminum is in contact with concrete, coat the aluminum as specified in Section 09900.
- F. Fabric Ties: Space fabric ties approximately 14 inches apart on the line posts and 24 inches apart on the rails. (For clips used with C-section posts, use galvanized 11-gauge steel wire.)
- G. Fabric: Leave approximately 2 inches between finished grade and the bottom selvage, unless otherwise indicated. Pull the fabric taut and tie to posts, rails, and tension wires. Install the fabric on the security side of the fence, and anchor the fabric to the framework so that the fabric remains in tension after the pulling force is released.
- H. Fasteners: Install nuts for tensions bands and hardware bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent nut removal.

NOTE: Use barbed tape only for high security enclosures.

- I. Barbed Tape: Install barbed tape in configurations indicated in accordance with manufacturer's recommendations and securely fasten to fencing to prevent movement or displacement.

NOTE: Delete Subsection 3.2 if not needed.

3.2 GALVANIZING

- A. Provide galvanizing meeting the requirements of Section 05035.

END OF SECTION

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