
**SECTION 02940
FIXED KNOT FABRIC FENCE**

PART I: GENERAL

1.1 GENERAL REQUIREMENTS

- A. Furnishing and installation of Fixed Knot Fabric fence, galvanized steel posts, and gates plus all accessories incidentals and specials necessary for the proper erection and installation of the fence and gates.
- B. The Contractor shall construct Fixed Knot Fabric fencing including posts, and gates as shown on the Drawings and in accordance with this Specification.

1.2 MEASUREMENT AND PAYMENT

- A. Unit Prices:
 - 1. Payment for Fixed Knot Fabric Fence shall be on a per linear foot basis to include all necessary hardware, concrete, materials and labor.
 - 2. No separate payment shall be made for each gate. Gates shall be paid under Fixed Knot Fabric Fence as part of the linear footage.
 - 3. Refer to Section 01270 – Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum):
 - 1. If Contract is Stipulated Price Contract, payment for work in this Section is included in Total Stipulated Price.

1.3 REFERENCES

- A. AASHTO – American Association of State Highway and Transportation Officials.
 - 1. AASHTO M279 – Standard Specification for Metallic-Coated, Steel Woven Fence Fabric.
- B. ASTM – American Society for Testing and Materials.
 - 1. ASTM A116 – Standard Specification for Metallic-Coated, Steel Woven Wire Fence Fabric.
 - 2. ASTM A121 – Standard Specification for Metallic-Coated Carbon Steel Barbed Wire.
 - 3. ASTM A123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 4. ASTM A153 – Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.
 - 5. ASTM A500 – Standard Specifications for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - 6. ASTM A572 – Standard Specification for High-Strength Low-

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- Alloy Columbium-Vanadium Structural Steel.
- 7. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
- 8. ASTM A780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
- 9. ASTM A824 – Standard Specification for Metallic-Coated Steel Marcellled Tension Wire for Use With Chain Link Fence.
- 10. ASTM A1011 – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
- 11. ASTM F1043 – Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework.
- 12. ASTM F1083 – Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
- B. CTFS – City of Friendswood Specifications.
- C. FS – Federal Specifications.
 - 1. FS RR-F-191K/Gen – Fencing, Wire and Post Metal (and Gates, Chain-Link Fence Fabric, and Accessories).
 - 2. FS RR-W-410E – Wire Rope and Strand

1.4 SUBMITTALS

- A. Conform to requirements of Section 01330 – Submittal Procedures.
- B. Submit proposed design mix and test data for each type and strength of concrete.
- C. Submit manufacturer's data and details of following items for approval:
 - 1. Fixed Knot Fabric Mesh.
 - 2. Galvanized Posts.
 - 3. Materials to be used for installation.
 - 4. Latch and hinge hardware.
 - 5. Installation instructions for forms.
 - 6. Gates.

PART II: PRODUCTS

2.1 MANUFACTURERS

- A. Stay-Tuff Fence Manufacturing, Inc.
- B. Ranger Gate Company

2.2 FIXED KNOT FENCE WIRE FABRIC

- A. Fixed Knot Fabric Fence shall be High Tensile Fixed Knot Fence and shall be forty-nine inches (49 In) in vertical height. The horizontal openings starting from the bottom shall be:
 - 1. Two each (2 Ea) openings of five inches (5 In).
 - 2. Three each (3 Ea) openings of six inches (6 In).

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3. Three each (3 Ea) openings of seven inches (7 In).
The horizontal spacing of the Fixed Knot Fabric Fence shall be six inches (6 In) between vertical stay wires. The wire shall be heavily galvanized Class 3 coating eighty-five hundredths ounce (.85 Oz) to one and one tenth ounces (1.1 Oz) per square foot (Sf) and shall meet or exceed ASTM A116 and the requirements of Table 4.1 – Fixed Knot Fence Wire Fabric, in this Section. The fence knot shall be a minimum of thirteen gauge (13 Ga) “fixed-knot” that will reinforce the wire so that it stands up to impacts without sagging or breaking. No hinged joint knot shall be used.

- B. Barbed Wire for mounting on security arms shall be Zinc-coated, two (2) strand twisted fourteen gauge (14 Ga) galvanized steel wire with four point (4 Pt) barbs of fourteen gauge (14 Ga) steel wire spaced at five inches (5 In) apart. Three (3) strands of barbed wire shall be required. All wire shall conform to ASTM A121, Type Z.

2.3 WATER GAP MATERIALS

- A. Materials for the water gap fence shall be made of high quality, commercially available materials. The fence fabric for the water fence gap shall be a minimum six gauge (6 Ga) Class 3 galvanized steel wire in a four inch (4 In) mesh and shall meet the requirements of ASTM A116. Posts shall conform to the requirements of paragraph 2.4 of this Section. The steel tubing shall be a two inch by two inch (2 In x 2 In) fourteen gauge (14 Ga) hot dipped galvanized steel meeting the requirements of ASTM A500 Grade B. Wire rope shall be five-sixteenths inch (5/16 In) diameter galvanized cable meeting the requirements of Federal Specification RR-W-410E. Eye bolts and “D” shall be galvanized steel as recommended by the wire rope manufacturer for use with the wire rope specified.

2.4 BRACE POSTS, LINE POSTS, T-POSTS AND ACCESSORIES

- A. These items, when specified, shall conform to the requirements of Federal Specification RR-F-191 or ASTM F1043 as amended by ASTM F1083 as follows:
1. Galvanized tubular steel pipe shall conform to the requirements of Group 1A, (Schedule 40) coatings conforming to Type A or Group IC (High Tensile Strength Pipe), External coating Type B, and internal coating Type B or D.
 2. Posts and braces, with the exception of galvanized steel conforming to ASTM F1043 or ASTM F1083, Group 1A, Type A, or aluminum alloy, shall demonstrate the ability to withstand testing in salt spray in accordance with ASTM B117 as follows:
 - a. External: One thousand hours (1,000 Hr) with a maximum of five percent (5%) red Rust.
 - b. Internal: Six hundred fifty hours (650 Hr) with a maximum of five percent (5%) red Rust.

3. The dimensions of the posts and braces in accordance with Table I through VI of Federal Specification RR-F-191/3D, as amended.
4. All posts and braces used for the fence shall be zinc-coated or galvanized. T-posts for the fence shall be a minimum of seventy-eight inches (78 In) in length with a weight of one and five-tenths pounds per linear foot (1.5 Lb/Lf). T-Post clips shall be made of 0.115 galvanized wire, or thicker, or as recommended by the manufacturer, whichever is sturdier.

2.5 GATES

- A. Gates shall be manufactured by Ranger Gates or City approved equal. Gate frames shall consist of galvanized tubular steel pipe or square tubing meeting the dimensions stated in this paragraph and on the plans and shall conform to the same materials as list in paragraph 2.4 of this Section.
- B. Pasture Tube Gates shall be five (5) - one and five-eighths inch (1 5/8 In) diameter horizontal bars and two (2) one and five-eighths inch (1 5/8 In) diameter horizontal bars. Bars shall be saddled and fitted before welding and made of nineteen gauge (19 Ga) galvanized tubing. Gate shall be forty-eight inches (48 In) in height overall. Gate shall have two (2) – five-eighths inch by six inch (5/8 In x 6 In) screw hooks and adjustable hinges.
- C. Wire Mesh Gates shall be three (3) - one and five-eighths inch (1 5/8 In) diameter horizontal bars and two (2) one and five-eighths inch (1 5/8 In) diameter horizontal bars. Bars shall be flattened before welding and made of nineteen gauge (19 Ga) galvanized tubing. Gate shall be forty-eight inches (48 In) in height overall. Wire Mesh Panel shall be thirty-six inches (36 In) tall, mesh opening shall be four inch by four inch (4 In x 4 In) openings. Gate shall have two (2) – five-eighths inch by six inch (5/8 In x 6 In) screw hooks and adjustable hinges.

2.6 WIRE TIES AND TENSION WIRES

- A. Wire ties for use in conjunction with a given type of fabric shall be of the same material and coating weight identified with the fabric type with a minimum seven gauge (7 Ga) thickness or as recommended by the manufacturer. Tension wires are to be a minimum seven gauge (7 Ga) marcelled steel tension wire conforming to ASTM A824. All material shall conform to Federal Specification RR-4-191/4D, as amended.

2.7 MISCELLANEOUS HARDWARE AND FITTINGS

- A. Miscellaneous steel hardware and fittings for use with zinc-coated steel fabric shall be of commercial grade steel or better quality, wrought or cast as appropriate to the article, and sufficient in strength to provide balanced design when used in conjunction with fabric posts and wires of the quality specified herein. All steel hardware and fittings shall be protected with a zinc coating applied in conformance with ASTM A153.

2.8 CONCRETE

- A. All concrete shall conform to Technical Specification 03300 – Structural Concrete and have a minimum twenty-eight day (28 Dy) strength of three thousand pounds per square inch (3,000 PSI).

2.9 MARKING

- A. Each roll of fabric shall carry a tag showing the kind of base metal (steel, aluminum, or aluminum alloy number), type of coating, the gauge of wire, the length of fencing on the roll, and the name of the manufacturer. Posts, wire, and other fittings shall be identified as to manufacturer, kind of base metal (steel, aluminum, or aluminum alloy number), and type of coating.

2.10 PAINT

- A. Paint for repair of damaged hot dipped galvanized coating shall be zinc rich paint with organic binders meeting the requirements of ASTM A780. Paint to be Galv Match Plus as manufactured by NuWave Solutions or City approved equal.

PART III: EXECUTION

3.1 INSTALLATION

- A. The fence shall be installed by skilled and experienced fence erectors, and on lines and grades indicated on the Drawings. The finished fence shall be plumb, taut, true to line and ground contour and complete in every detail.

3.2 CONSTRUCTION

- A. The Contractor shall perform all clearing of brush and debris, which may be necessary for the installation of the fencing.
- B. The fencing panels between corner, brace and line posts shall generally follow the finished ground elevations. The Contractor shall grade off minor irregularities in the path of the fencing as necessary to limit the variation of grade under bottom edge of fence fabric to a distance of not more than three inches (3 In) and not less than two inches (2 In) from the ground at any point along the fencing. Care shall be taken not to stretch the wire fabric so tight that it will break in cold weather or pull up the brace posts.
- C. Post Spacing:
 - 1. T-Posts shall have a maximum spacing of no more than twenty-five feet (25 Ft).
 - 2. Line Posts shall have a maximum spacing of no more than one hundred twenty-five feet (125 Ft).

3. Bracing of fencing shall be a maximum of one thousand three hundred twenty feet (1,320 Ft).
 4. Line Fence Post, Line Brace Posts, and End Brace Posts shall be set in concrete as specified in Paragraph 3.2.D of this Section.
- D. Holes
1. Holes for concrete footings for all posts shall be drilled to the dimension as specified in TABLE 4.2 – HOLES FOR LINE, LINE BRACE AND BRACE POSTS.
 2. Concrete footings shall be Class A Concrete, NO EXCEPTIONS. Concrete shall be in accordance with Section 03300 – Structural Concrete. All concrete footings shall be cast up to finished grade and crowned one inch (1 In) to shed water. Excess concrete and other material shall be removed and disposed of in accordance with Section 01580 – Waste Material Disposal. Embedded posts shall have a minimum of three inches (3 In) of clearance from the sides and bottom of the post.
 3. No material shall be set on posts line and brace posts for a minimum of seven days (7 Dy) after individual concrete footing has been placed.
- E. Fence fabric shall generally follow the finished contour of the site with the bottom edge of the fabric located two inches (2 In) above the grade.
- F. Erect fencing to generally follow ground surface and adjust irregularities in grade. Where depressions or swales are crossed by the fencing, provide galvanized pipe and ire fabric laced to main fabric to prevent entrance of small animals but permit natural drainage flow.
- G. Splicing
1. The splice shall be made with approved wire splice with a rated holding capacity higher that the breaking strength of the wire as recommended by the wire manufacturer and using an approved crimping tools as recommended by the wire manufacturer. The splice shall be made in accordance with industry standards and wire manufacturers recommendations. Any splices that fail to meet these requirements shall not be accepted and shall be redone at the Contractor’s expense.
- H. Gates
1. Install gates at the proper dimensions and alignments as shown on the drawings. Contractor shall grade the area in the vicinity of the gate to provide a level area for gate opening.
- I. Existing Connections
1. Wherever the new fixed knot wire fabric fence or water gap joins an existing fence, either at the corner or at the intersection of straight fence lines, a corner or anchor post shall be set at the junction and braced as shown in the detail drawings. If the connection is made at other than an intersection or junction, then the last span of the existing fence shall contain a brace span.
- J. Electrical Grounds

1. Electrical grounding shall be installed where a power line passes over the fence and shall be installed directly below the point of crossing. The grounding shall be accomplished with an eight foot (8 Ft) copper clad rod a minimum of five-eighths inch (5/8 In) in diameter driven vertically until the top is six inches (6" In) below natural grade. A number six (#6) solid copper conductor shall be clamped to the rod and to the fence in such a manner that each element in the fence is grounded and per current NEC requirements and inspected by City’s Electrical Inspector. All work described in this paragraph is incidental to the work.

PART IV: TABLES

TABLE 4.1 FIXED KNOT FABRIC FENCE REQUIREMENTS

WIRE	GAUGE	TENSILE STRENGTH	BREAKING LOAD
Top & Bottom	12	Hi-Tensile: 185K – 215K	1,512 Lbs. – 1,689 Lbs.
Line Wires	12 ½	Hi-Tensile: 185K – 215K	1,339 Lbs. – 1,492 Lbs.
Stay Wires	12 ½	Med-Tensile: 130K – 150K	940 Lbs. – 1,041 Lbs.
Knot Wires	13	Low-Tensile: 60K – 85K	356 Lbs. – 482 Lbs.

TABLE 4.2 LINE, LINE BRACE, AND BRACE POST REQUIREMENTS

POST	HEIGHT	WIDTH	EMBED	HOLE DEPTH	HOLE WIDTH
Brace Post	8' - 0"	2.875"	3' – 6"	3' – 9"	9"
Fence Pull	8' - 0"	2.875"	3' – 6"	3' – 9"	9"
Angle Brace	4' – 6"	2.875"	3' – 6"	3' – 9"	9"
Line Post	7' – 0"	2.375"	2' – 6"	2' – 9"	9"
T-Post	6' – 6"	N/A	2' – 6"	N/A	N/A

END OF SECTION