SECTION 410

FENCES

410.1 GENERAL

This work shall consist of the construction of fences and gates in substantial compliance with the specifications, lines, and grades shown on the plans or established by the ENGINEER.

410.2 REFERENCES

410.2.1 ASTM:

A1	A 153
A 36	A 392
A 116	A 499
A 120	A 525
A 121	A 569
A 123	B 209

410.2.2 AASHTO:

M 111
M 133
M 181

410.2.3 COMMERCIAL STANDARD, U.S. DEPT. OF COMMERCE:

184
246

410.3 MATERIALS

410.3.1 GENERAL:

410.3.1.1 The CONTRACTOR shall submit the required number and type of test certificates to the ENGINEER certifying that the fencing materials conform with the requirements herein provided. When the locations of manufacturing plants allow, the plants will be inspected periodically for compliance with specified manufacturing methods, and material samples will be obtained for laboratory testing for compliance with materials quality requirements. This can be the basis for acceptance of manufacturing lots as to quality. All materials will be subject to inspection for acceptance as to condition at the latest practicable time the ENGINEER has the opportunity to check for compliance prior to or during incorporation of materials in the work.

410.3.1.2 All materials shall be new and without flaws or defects of any type.

410.3.2 WIRE FENCE

410.3.2.1 WIRE:

410.3.2.1.1 Barbed wire shall conform to ASTM A 121, Class 3, coating and shall consist of two strands of 12-1/2 gauge wire with 4-point 14-gauge round barbs spaced approximately 5 inches apart. In lieu of Class 3 galvanizing, the wire may be coated with aluminum alloy at the rate of not less than 0.30 ounce per square foot of wire surface and the barbs at the rate of not less than 0.25 ounce per square foot of wire surface.

410.3.2.1.2 Woven wire shall conform to ASTM A 116, design number 832-6-11 (shown in Appendix Table) or as shown on the plans, Class 3 coating or coated with aluminum alloy at the rate of not less than 0.25 ounce per square foot of wire surface. The height shall be 32 inches.

410.3.2.1.3 Staples for fastening fence wire to wood posts shall be galvanized 9 gauge, 1 1/2 inches long.

410.3.2.1.4 Brace wire shall be 9 gauge, galvanized and shall be used in the construction of braces and intermediate braces when wood posts are used.

410.3.2.1.5 Tie wires for fastening barbed wire or woven wire to steel posts shall be not less than 12-1/2 gauge and galvanized. Eleven gauge or heavier wire fasteners or metal clamps may be used in lieu of tie wires when approved by the ENGINEER. Aluminum tie wires will not be accepted.

410.3.2.1.6 Stays for barbed wire fences shall be not less than 9-1/2 gauge galvanized wire conforming with ASTM A 116 and of length and spacing shown on the plans.

410.3.2.2 POSTS: Corner, brace, intermediate brace, gate, and line posts shall be metal or wood and of the type, size, and length shown on the plans and as herein provided.

410.3.2.2.1 Metal posts and braces shall be fabricated from rail, billet, or commercial grade steel conforming with any of the following ASTM Designations: A 1, A 499, and ASTM A 120 (for pipe posts) or Commercial Standard 184, published by the U.S. Department of Commerce and shall be galvanized or painted as required. Galvanizing shall conform with ASTM A 123 and painting shall conform with the requirements shown on the plans. Corner, gate, and intermediate brace posts shall be tubular, section, or angles of the type and dimensions shown on the plans. Corner, gate and intermediate brace posts and braces shall be set in concrete as shown on the plans. Line posts shall have a minimum weight of 1.33 pounds per foot exclusive of anchor plates. A minus tolerance of not to exceed 5 percent of the minimum weight of each post will be permitted. A plus tolerance of 2 inches and a minus tolerance of 1 inch in the length of each post will be permitted. Line posts may be I-beam, T-beam, U-beam, Y-bar, or H-column section. Line posts shall be provided with corrugations, lugs, ribs, or notches spaced approxi- mately 1 inch on centers to engage the required fence wire in designated spaces. Posts with punched tabs intended to be crimped around the wire will not be accepted. Anchor plates shall have an area of not less than 19 square inches, shall weight not less than 0.64 pound each, and shall be securely welded, bradded, or riveted to each line post.

410.3.2.2.2 Wood corner, brace, intermediate brace, gate and line posts shall be southern yellow pine, lodgepole pine, or ponderosa pine and of the length and dimensions shown on the plans. Posts shall be cut from live trees and shall be straight and free from decay and other defects. Line posts may have a single crook in one direction but shall not vary more than 1 1/2 inches from a straight line connecting both ends of the post. All bark shall be peeled and the posts trimmed and smooth of all knots and projections, and both ends of the posts shall be sawed off perpendicular to the centerline.

410.3.2.2.3 Wood corner, brace, intermediate brace, and gate posts shall be of the length shown on the plans. The average nominal diameter of the top of each post shall be not less than 6 inches. The circumference of corner, brace, intermediate brace, and gate posts shall be measured 6 inches below the top of post and shall not be less than 19 inches. The average nominal diameter of the top of each line post shall be not less than 3 inches. The circumference of line posts shall be measured 6 inches below the top of the post and shall be not less than 9 1/2 inches.

410.3.2.2.4 Wood posts shall be pressure treated with standard creosote oil or petroleum-pentachlorophenol consisting of not more than 95 parts by weight of petroleum and not less than 5 parts by weight of pentachlorophenol. The empty cell process shall be used. The amount of creosote oil retained shall be not less than 6 pounds per cubic foot of wood, and the amount of pentachlorophenol retained shall be not less than 0.3 pound of dry salt per cubic foot of wood. Wood preservatives shall conform with AASHTO M 133.

410.3.2.2.5 Braces for wood posts shall be coast region Douglas fir, New Mexico red spruce or fir and shall conform with dimensions shown on the plans.

410.3.2.3 GATES: Gates shall be only tubular steel frame or tubular steel frame with filters of wire fabric, metal panel, chain link, or barbed wire, conforming with the dimensions and details shown on the panels. Materials and galvanizing shall be in conformity with the requirements of ASTM A 116 Class 3, A 120, A 392, A 525, and A 123 where applicable. Aluminum panel gates shall conform to ASTM B 209, and shall be installed if specifically required by the construction plans. Aluminum gates will not be arbitrarily substituted for tubular steel frame gates.

410.3.2.4 FITTINGS: All fittings, hardware, and appurtenances for fences and gates shall be commercial quality steel, malleable iron or wrought iron and shall be galvanized in accordance with the requirements of ASTM A 153.

410.3.3 CHAIN LINK FENCE:

410.3.3.1 Post shall be galvanized steel, tubular or H-column, conforming with the

lengths, dimensions and weights shown on the plans. Tubular posts, braces, and top rails shall conform with the requirements of ASTM A 120 for galvanized standard weight pipe, except that the pipe shall not be threaded nor subjected to hydrostatic test. H-column posts shall conform to ASTM A 36. The galvanizing shall conform to the requirements of AASHTO M 111 (ASTM A 123).

410.3.3.2 Post tops, stretcher bars, hardware and other required fittings shall be of commercial quality steel or malleable iron, and the galvanizing shall conform with the requirements of ASTM A 153.

410.3.3.3 Tie wires for fastening chain link fence to posts and rails shall be 9 gauge and galvanized. Galvanized steel or non-corrosive metal bands or fasteners may be used in lieu of tie wires when approved by the ENGINEER. Aluminum tie wires will not be accepted.

410.3.3.4 Compression braces shall conform with the same requirements as top rails. Tension truss rods shall be not less than 3/8 inch round galvanized rods with drop-forged turnbuckles or other approved tension device.

410.3.3.5 Chain link fabric shall conform to the requirements of AASHTO M 181 or Commercial Standard 246 published by the U.S. Department of Commerce. Unless otherwise provided, the wire shall be No. 9 gauge galvanized wire and the fabric shall be 2 inch mesh.

410.3.3.6 Gates may be double drive, single drive, or single walk and shall conform with the dimensions and details shown on the plans. Gate frames shall be fabricated from galvanized steel pipe conforming with ASTM A 120 and A 123. Chain fabric filler shall conform to the requirements herein provided for chain link fabric.

410.3.3.7 Corner posts shall be 3 inches O.D. with a minimum weight of 5.8 lb. per ft. Line posts shall be 2-1/2 inches O.D. with a minimum weight of 3.66 lb. per ft. Top rail and braces shall be 1-5/8 inches O.D. with a minimum weight of 2.27 lb. per ft.

410.3.3.8 At the option of the CONTRACTOR, posts, rails, braces, and gate framing members may be pipe conforming to ASTM A 120, and coated with a minimum or 1.8 ounces of zinc per square foot or vinyl- bonded pre-galvanized steel chain link fabric and fence components according to U.S. Government Specifications RR-F-191J/GEN. (See Table 410.3.3.8 for Fence Piping Dimensions and Weights.)

410.3.3.9 When outriggers with barbed-wire are installed the lowest strand shall not be less than 8 feet high measured from ground level. The same clearance distance will be required for coiled security wire.

410.4 CONSTRUCTION REQUIREMENTS

410.4.1 CONSTRUCTION METHODS: The CONTRACTOR shall perform such clearing and grubbing as may be necessary to construct the fence to the required grade and alignment. At locations where breaks in a run of fencing are required or at intersections with existing fences, appropriate adjustment in post spacing shall be made to conform to the requirements for the type of closure indicated. When the plans require that posts, braces, or anchors be embedded in concrete, the CONTRACTOR shall install temporary guys or braces as may be required to hold the posts in proper position until such time as the concrete has set sufficiently to hold the posts. Unless otherwise permitted by the ENGINEER, no materials shall be installed on posts or strain placed on guys and bracing set in concrete until 4 days have elapsed from the time of placing of the concrete. The tops of all posts shall be set to the required depth and alignment. Cutting of the tops of posts shall be allowed only with the approval of the ENGINEER and under the conditions specified by him. Wire or fencing of the size and type required shall be firmly attached to the posts and braced in the manner indicated. All wire shall be stretched taut and be installed to the required elevations. At each location where an electric transmission, distribution, or secondary line crosses any of the types of fences covered by these specifications, the CONTRACTOR shall furnish and install a ground conforming to the drawings shown on the plans.

410.4.2 WIRE FENCE:

410.4.2.1 Wire fences shall be constructed in conformity with the details and at locations shown on the plans or staked by the ENGINEER. All posts shall be set plumb and to the depth and spacing shown on the plans. Excavations for footings and anchors shall be to dimensions shown on plans or established by the ENGINEER. Metal line posts may be driven. Post hole backfill shall be placed in thin layers and each layer solidly compacted. Posts set in rock shall be placed as per construction plans.

410.4.2.2 Fence wire shall be stretched by mechanical stretcher or other device designated for such use. Stretching by motor vehicle will not be permitted. The length between pull posts shall not exceed 995 feet for barbed wire and 660 feet for woven wire.

410.4.2.3 Intermediate braces shall be placed at intervals not to exceed 1000 feet and shall be spaced evenly between corner and gate posts or cattle guards.

410.4.2.4 A corner post and brace shall be placed at the intersection of cross fences with the right-of-way fence. Cross fence wires shall be stretched and firmly attached to the corner posts.

410.4.2.5 Right-of-way fences shall be attached to roadway structures when shown on the plans.

410.4.2.6 Fence materials of the same manufacture, type or process, conforming with the details shown on the plans shall be used throughout the Work unless otherwise authorized in writing by the ENGINEER.

410.4.3 CHAIN LINK FENCE:

410.4.3.1 Chain link fences shall be constructed in conformity with the details and at locations shown on the plans or staked by the ENGINEER. Posts shall be spaced at not more than 10 foot intervals. The intervals shall be measured from center to center of post. All posts shall be set in concrete footings conforming with the dimensions and details shown on the plans. Posts set in rock shall be approved by the ENGINEER. Chain link fabric shall not be attached to posts until the concrete footings have completely set. Pull posts shall be line posts braced to adjacent line posts as shown on the plans. Pull posts shall be spaced at intervals not to exceed 500 feet. End posts shall be not less than 2.875 inches in outside diameter and braced in the same manner as corner posts. Braced tension rods or cables, hardware, and appurtenances shall be installed as shown on the plans.

410.4.3.2 Chain link fabric shall be stretched by mechanical stretcher or other device designed for such use. Stretching by motor vehicle will not be permitted.

TABLE 410.3.3.8

FENCE PIPING DIMENSIONS AND WEIGHTS

Error! Bookmark not defined. Fence Industry O.D. (in)	Nominal Pipe Size I.D. (in)	Decimal Equivalent O.D. (in)	Minimum Wall Thickness (in)	Minimum Weight lbs per foot
1-5/8	1-1/4	1.660	0.111	1.836
2-1/2	2	2.375	0.130	3.117
3	2-1/2	2.875	0.160	4.640

410.5 REMOVING AND REBUILDING FENCE

As shown on the construction plans or directed by the ENGINEER existing fences may require removal and re-erected. Such fences shall be reconstructed to the same condition as the original fence or better. The materials in existing fences to be removed and rebuilt shall be salvaged and incorporated in the rebuilt fences. Fence materials damaged beyond reuse during removal or rehandling shall be replaced by the CONTRACTOR at his expense. Posts shall be firmly reset to the line shown on the plans. The spacing of the posts and the material to be strung and secured to the posts shall be the same as the original fence. New tie material or staples shall be used to fasten the fence material to the posts and shall be furnished by the CONTRACTOR at his expense.

410.6 MEASUREMENT AND PAYMENT

410.6.1 For new fences the measurement and payment will be by one of the following methods:

410.6.1.1 By the linear foot. Measurement will be along the top of the fence from outside to outside of end posts for each continuous run of fence. The accepted quantities of fence will be paid for at the Bid Proposal's unit price per linear foot complete in place for the specified type of fence.

410.6.1.2 By the square foot. Measurement will be the horizontal distance of the fence from outside to outside of end posts for each continuous run multiplied by the vertical measurement of the material; the product area shall be designated in square feet. Payment will be made on the Bid Proposal's unit price per square foot complete in place for the specified type of fence.

410.6.1.3 Regardless of which method is used, payment shall include the cutting, removal, and replacement of any concrete or asphalt surfacing associated with the fence installation.

410.6.2 Removal and rebuilding of a fence shall be measured by the linear foot of fence removed and rebuilt and payment will be made on the unit price per linear foot for the type of fence as specified in the Bid Proposal.

410.6.3 Removal and disposal of a fence shall be measured by the linear foot of fence removed and disposed of by the CONTRACTOR. Payment will be made on the unit price per linear foot for the type of fence as indicated in the Bid Proposal.

410.6.4 Measurement and payment for gates will be the unit price per each for the type of fencing material specified in the Bid Proposal.