

## SECTION 02831

## CHAIN LINK FENCE

07/92

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 121	(1992a) Zinc-Coated (Galvanized) Steel Barbed Wire
ASTM A 153	(1996) Zinc-Coated (Hot Dip) on Iron and Steel Hardware
ASTM A 176	(1994) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 392	(1991b) Zinc-Coated Chain-Link Fence Fabric
ASTM A 478	(1995a) Chromium-Nickel Stainless and Heat-Resisting Steel Weaving and Knitting Wire
ASTM A 491	(1994) Aluminum-Coated Steel Chain-Link Fence Fabric
ASTM A 585	(1992) Aluminum-Coated Steel Barbed Wire
ASTM A 666	(1994) Austenitic Stainless Steel Sheet, trip, Plate, and Flat Bar
ASTM A 824	(1992) Metallic-Coated Steel Marcellled Tension Wire for Use With Chain Link Fence
ASTM C 94	(1994) Ready-Mixed Concrete
ASTM F 626	(1994a) Fence Fittings
ASTM F 668	(1994) Poly(Vinyl Chloride) (PVC) Coated Steel Chain-Link Fence Fabric
ASTM F 883	(1990) Padlocks
ASTM F 900	(1994) Industrial and Commercial Swing Gates
ASTM F 1043	(1995) Strength and Protective Coatings on Metal Industrial Chain-Link Fence Framework

ASTM F 1083 (1993) Pipe, Steel, Hot-Dipped Zinc-Coated  
(Galvanized) Welded for Fence Structures

ASTM F 1184 (1994) Industrial and Commercial  
Horizontal Slide Gates

AMERICAN WELDING SOCIETY (AWS)

AWS WZC (1972) Welding Zinc-Coated Steels

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01300 SUBMITTAL PROCEDURES:

### SD-13 Certificates

Chain Link Fence; [\_\_\_\_\_].

Statement signed by an official authorized to certify on behalf of the manufacturer attesting that the chain link fence and component materials meet the specified requirements.

### SD-19 Operation and Maintenance Manuals

Electro-Mechanical Locks and Gate Operators; [\_\_\_\_\_].

[Six] [\_\_\_\_\_] copies of operating and maintenance instructions, a minimum of 2 weeks prior to field training. Operating instructions shall outline the step-by-step procedures required for system startup, operation, and shutdown. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Maintenance instructions shall include routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. The instructions shall include the general gate layout, equipment layout and simplified wiring and control diagrams of the system as installed.

## PART 2 PRODUCTS

### 2.1 MATERIALS

Materials shall conform to the following:

#### 2.1.1 Chain Link Fabric

ASTM A 392, [Class 1] [Class 2], zinc-coated steel wire with minimum coating weight of [370] [610] grams ([1.2] [2.0] ounces) [1.2] [2.0] ounces of zinc per square meter (foot) foot of coated surface, or ASTM A 491, Type I, aluminum-coated steel wire. [Polyvinyl chloride-coated steel fabric with 92 grams 0.3 ounces of zinc coating per square meter foot in accordance with ASTM F 668. Fabric shall be fabricated of 9 gauge wire woven in 50.8 mm (2 inch) 2 inch mesh. Fabric height shall be 1.83 m (6 feet) [6 feet] [[\_\_\_\_\_] meters (feet) feet] [as shown]. Fabric shall be twisted and barbed on the top selvage and knuckled on the bottom selvage.

### 2.1.2 Gates

ASTM F 900 and/or ASTM F 1184. Gate shall be the type and swing shown. Gate frames shall conform to strength and coating requirements of ASTM F 1083 for Group IA, steel pipe, with external coating Type A, nominal pipe size (NPS) 1-1/2. Gate frames shall conform to strength and coating requirements of ASTM F 1043, for Group IC, steel pipe with external coating Type A or Type B, pipe size (NPS) 1-1/2. Gate fabric shall be as specified for chain-link fabric. [Each end member of gate frames shall be extended sufficiently above the top member to carry three strands of barbed wire in horizontal alignment with barbed wire strands on the fence.] Gate leaves more than 2.44 m (8 feet) 8 feet wide shall have either intermediate members and diagonal truss rods or shall have tubular members as necessary to provide rigid construction, free from sag or twist. Gate leaves less than 2.44 m (8 feet) 8 feet wide shall have truss rods or intermediate braces. Intermediate braces shall be provided on all gate frames with an electro-mechanical lock. Gate fabric shall be attached to the gate frame by method standard with the manufacturer except that welding will not be permitted. Latches, hinges, stops, keepers, rollers, and other hardware items shall be furnished as required for the operation of the gate. Latches shall be arranged for padlocking so that the padlock will be accessible from both sides of the gate. Stops shall be provided for holding the gates in the open position.

### 2.1.3 Posts

ASTM F 1083, zinc-coated. Group IA, with external coating Type A steel pipe. Group IC steel pipe, zinc-coated with external coating Type A or Type B and Group IIA, formed steel sections, shall meet the strength and coating requirements of ASTM F 1043. Group III, ASTM F 1043 steel H-section may be used for line posts in lieu of line post shapes specified for the other classes. Sizes shall be as shown on the drawings. Line posts and terminal (corner, gate, and pull) posts selected shall be of the same designation throughout the fence. Gate post shall be for the gate type specified subject to the limitation specified in ASTM F 900 and/or ASTM F 1184.

### 2.1.4 Braces

ASTM F 1083, zinc-coated, Group IA, steel pipe, size NPS 1-1/4. Group IC steel pipe, zinc-coated, shall meet the strength and coating requirements of ASTM F 1043. Group IIA, formed steel sections, size 42.16 mm (1.66 inch), 1.66 inch, conforming to ASTM F 1043, may be used as braces if Group IIA line posts are furnished.

### 2.1.5 Tension Wire

Tension wire shall be Type I or Type II, Class 2 coating, in accordance with ASTM A 824.

### 2.1.6 Accessories

ASTM F 626. Ferrous accessories shall be zinc or aluminum coated. Truss rods shall be furnished for each terminal post. Truss rods shall be provided with turnbuckles or other equivalent provisions for adjustment. Barbed wire shall be zinc-coated, Class 3 in accordance with ASTM A 121 or aluminum coated Type I in accordance with ASTM A 585. Barbed wire shall be four-point barbed type steel wire. Barbed wire support arms shall be the

[single] [V] arm type and of the design required for the post furnished. Tie wire for attaching fabric to rails, braces, and posts shall be 9 gauge steel wire and match the coating of the chain link fabric. Miscellaneous hardware coatings shall conform to ASTM A 153 unless modified herein.

#### 2.1.1.7 Barbed Tape

Reinforced barbed tape, [double coil] [single coil], for fence toppings shall be fabricated from 430 series stainless steel with a hardness range of Rockwell (30N) 37-45 conforming to the requirements of ASTM A 176. The stainless steel strip shall be 0.64 mm (0.025 inch) 0.025 inchthick by 25.4 mm (1.0 inch) 1.0 inch wide before fabrication. Each barb shall be a minimum of 30.5 mm (1.2 inch) 1.2 inch in length, in groups of 4, spaced on 101.6 mm (4.0 inch) 4.0 inch centers. The stainless steel core wire shall have a 2.5 mm (0.098 inch) 0.098 inch diameter with a minimum tensile strength of 9.68 MPa (140 psi)140 psi and be in accordance with ASTM A 478.

[Reinforced barbed tape, single coil, for ground application shall meet the above requirements.] [Non-reinforced barbed tape, single coil, for ground applications shall be fabricated from 301 series stainless steel, with a hardness range of Rockwell (30N) 50-55, in accordance with ASTM A 666.

The stainless steel strip shall be 0.64 mm (0.025 inch) 0.025 inchthick by 30.73 mm (1.21 inches) 1.21 inches wide before fabrication. Each barb shall be a minimum of 30.5 mm (1.2 inch) 1.2 inchin length, in groups of 4, spaced on 101.6 mm (4.0 inch) 4.0 inchcenters.] Sixteen gauge stainless steel twistable wire ties shall be used for attaching the barbed tape to the barbed wire [and to the fence for ground application].

#### 2.1.1.8 Concrete

ASTM C 94, using 19 mm 3/4 inch maximum size aggregate, and having minimum compressive strength of 21 MPa 3000 psi at 28 days. Grout shall consist of one part portland cement to three parts clean, well-graded sand and the minimum amount of water to produce a workable mix.

#### 2.1.1.9 Padlocks

ASTM F 883, Type PO1, Grade 2, Size 44.4 mm (1-3/4 inch). 1-3/4 inch. Padlocks shall be keyed alike and each lock shall be furnished with two keys.

#### 2.1.1.10 Gate Operator

Electric gate operators for sliding gates shall be as follows: Electrical gate operators shall have a right angle gearhead instantly reversing motor with magnetic drum-type brake, friction disc clutch, reversing starter with thermal overload protection, and a chain-driven geared rotary-type automatic limit switch. Gears shall consist of a hardened steel machine cut worm and mating bronze gear. All gears and bearings shall operate in a bath of oil. Gate operators with V-belt pulleys will not be allowed. Gate operators shall be equipped with an emergency release to allow the gate to be operated manually. The emergency release mechanism shall be capable of being locked in the engaged or disengaged position. Positive stops shall be provided on the gate tracks as a backup to the limit switches.

#### 2.1.1.11 Electro-Mechanical Locks

Electro-mechanical locking devices for sliding gates and personnel gates shall be solenoid actuated such that the deadbolt retracts when the solenoid is energized and remains electrically retracted until the gate is

closed. The solenoid shall be the continuous duty type, rated for 120V ac, 60Hz operation. The locking device shall be unlockable by key and shall be keyed on both sides. Status of the electro-mechanical lock shall be monitored by two limit switches (integral to the locking device) wired in series. One switch shall monitor the deadlock lever and the other switch shall monitor the locking tongue.

### PART 3 EXECUTION

#### 3.1 GENERAL

Fence shall be installed to the lines and grades indicated. The area on either side of the fence line shall be cleared to the extent indicated. Line posts shall be spaced equidistant at intervals not exceeding 3.05 m (10 feet). 10 feet. Terminal (corner, gate, and pull) posts shall be set at abrupt changes in vertical and horizontal alignment. Chain link fabric shall be continuous between terminal posts; however, runs between terminal posts shall not exceed 152.4 m (500 feet). 500 feet. Damage to the galvanized surface due to welding shall be repaired with "repair sticks" of zinc-cadmium alloys or zinc-tin-lead alloys per AWS WZC.

#### 3.2 EXCAVATION

Post holes shall be cleared of loose material. Waste material shall be spread where directed. The ground surface irregularities along the fence line shall be eliminated to the extent necessary to maintain a [25.4 mm (1 inch)] [1 inch] [50.8 mm (2 inch)] [2 inch] clearance between the bottom of the chain link fabric and finish grade.

#### 3.3 POSTS

Posts shall be set plumb and in alignment. Except where solid rock is encountered, posts shall be set in concrete to the depth indicated on the drawings. Where solid rock is encountered with no overburden, posts shall be set to a minimum depth of 457 mm (18 inches) 18 inches in rock. Where solid rock is covered with an overburden of soil or loose rock, posts shall be set to the minimum depth indicated on the drawing unless a penetration of 457 mm (18 inches) 18 inches if solid rock is achieved before reaching the indicated depth, in which case depth of penetration shall terminate. All portions of posts set in rock shall be grouted. Portions of posts not set in rock shall be set in concrete from the rock to ground level. Posts set in concrete shall be set in holes not less than the diameter shown on the drawings. Diameters of holes in solid rock shall be at least 25.4 mm (1 inch) 1 inch greater than the largest cross section of the post. Concrete and grout shall be thoroughly consolidated around each post, shall be free of voids and finished to form a dome. Concrete and grout shall be allowed to cure for 72 hours prior to attachment of any item to the posts. Class 3 line posts may be mechanically driven, for temporary fence construction only, if rock is not encountered. Driven posts shall be set to a minimum depth of 914 mm (3 feet) 3 feet and shall be protected with drive caps when being set. Fence post rigidity shall be tested by applying a 222.4 newtons (50 pound) 50 pound force on the post, perpendicular to the fabric, at 1.52 m (5 feet) 5 feet above ground. Post movement measured at the point where the force is applied shall be less than or equal to 19 mm (3/4 inch) 3/4 inch from the relaxed position. Every tenth post shall be tested for rigidity. When a post fails this test, further tests on the next four posts on either side of the failed post shall be made. All failed posts shall be removed, replaced, and retested at the Contractor's expense.

### 3.4 RAILS

#### 3.4.1 Top Rail

Top rail shall be supported at each post to form a continuous brace between terminal posts. Where required, sections of top rail shall be joined using sleeves or couplings that will allow expansion or contraction of the rail. Bottom rail, if required for high security fence, shall be installed as indicated on the drawings.

#### 3.4.2 Bottom Rail

The bottom rail shall be bolted to double rail ends and double rail ends shall be securely fastened to the posts. Bolts shall be peened to prevent easy removal. Bottom rail shall be installed before chain link fabric.

### 3.5 BRACE RAILS AND TRUSS RODS

Brace rails and truss rods shall be installed as indicated and in conformance with the standard practice for the fence furnished. Horizontal (compression) brace rails and diagonal truss (tension) rods shall be installed on fences over 1.83 m (6 feet) 6 feet in height. A center brace or 2 diagonal truss rods shall be installed on 3.66 m (12 foot) 12 foot fences. Brace rails and truss rods shall extend from terminal posts to line posts. Diagonal braces shall form an angle of approximately 40 to 50 degrees with the horizontal. No bracing is required on fences 1.83 m (6 feet) 6 feet high or less if a top rail is installed.

### 3.6 TENSION WIRES

Tension wires shall be installed along the [top and] bottom of the fence line and attached to the terminal posts of each stretch of the fence. [Top tension wires shall be installed within the top [305 mm (1 foot)] [1 foot] [102 mm (4 inches)] [4 inches] of the installed fabric.] Bottom tension wire shall be installed within the bottom 152 mm (6 inches) 6 inches of the installed fabric. Tension wire shall be pulled taut and shall be free of sag.

### 3.7 CHAIN LINK FABRIC

Chain link fabric shall be installed on the side of the post indicated. Fabric shall be attached to terminal posts with stretcher bars and tension bands. Bands shall be spaced at approximately 381 mm (15 inch) 15 inch intervals. The fabric shall be installed and pulled taut to provide a smooth and uniform appearance free from sag, without permanently distorting the fabric diamond or reducing the fabric height. Fabric shall be fastened to line posts at approximately 381 mm (15 inch) 15 inch intervals and fastened to all brace rails and tension wires at approximately [610 mm (24 inch)] [24 inch] [305 mm (12 inch)] [12 inch] intervals. Fabric shall be cut by untwisting and removing pickets. Splicing shall be accomplished by weaving a single picket into the ends of the rolls to be joined. The bottom of the installed fabric shall be [50.8 mm (2 inches)] [2 inches] [25.4 mm (1 inch)] [1 inch] (plus or minus 12.7 mm (1/2 inch) 1/2 inch) above the ground. [After the fabric installation is complete, the fabric shall be exercised by applying a 222 newtons (50 pound) 50 pound push-pull force at the center of the fabric between posts. The use of a 133 newtons (30 pound) 30 pound pull at the center of the panel shall cause fabric deflection of not more than 63.5 mm (2.5 inches) 2.5 inches when pulling

fabric from the post side of the fence. Every second fence panel shall meet this requirement. All failed panels shall be resecured and retested at the Contractor's expense.]

### 3.8 BARBED WIRE SUPPORTING ARMS AND BARBED WIRE

Barbed wire supporting arms and barbed wire shall be installed as indicated and as recommended by the manufacturer. Supporting arms shall be anchored to the posts in a manner to prevent easy removal with hand tools.

[Supporting arms shall be anchored with 9.5 mm (3/8 inch) 3/8 inch diameter plain pin rivets or, at the Contractor's option, with studs driven by low-velocity explosive-actuated tools for steel, wrought iron, ductile iron, or malleable iron. Studs driven by an explosive-actuated tool shall not be used with gray iron or other material that can be fractured. A minimum of two studs per support arm shall be used.] Barbed wire shall be pulled taut and attached to the arms with clips or other means that will prevent easy removal.

### 3.9 GATES

Gates shall be installed at the locations shown. Hinged gates shall be mounted to swing as indicated. Latches, stops, and keepers shall be installed as required. [[Slide] [Lift] gates shall be installed as recommended by the manufacturer.] Padlocks shall be attached to gates or gate posts with chains. Hinge pins, and hardware shall be welded or otherwise secured to prevent removal.

### 3.10 BARBED TAPE

Stainless steel reinforced barbed tape shall be installed as detailed on the drawings. Barbed tape shall be stretched out to its manufacturer's recommended length, set on top of the barbed wire and "V" shaped support arms, and then secured to the barbed wire. The barbed tape shall be secured to the barbed wire at the two points and at every spiral turn of both coils as shown on the drawings. [Stainless steel reinforced [and/or non-reinforced] barbed tape for ground applications shall be installed [per manufacturer's recommended] [as shown on the drawings].]

### 3.11 GROUNDING

[Fences crossed by overhead powerlines in excess of 600 volts shall be grounded as specified in Section 16670 LIGHTNING PROTECTION SYSTEM. Electrical equipment attached to the fence shall be grounded as specified in [Section 16370 ELECTRICAL DISTRIBUTION SYSTEM, AERIAL] [Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND].] [Fences crossed by powerlines of 600 volts or more shall be grounded at or near the point of crossing and at distances not exceeding 45 m 150 feet on each side of crossing. Ground conductor shall consist of No. 8 AWG solid copper wire. Grounding electrodes shall be 19 mm (3/4 inch) 3/4 inch by 2.4 m (8 foot) 10 foot long copper-clad steel rod. Electrodes shall be driven into the earth so that the top of the electrode is at least 152 mm (6 inches) 6 inches below the grade. Where driving is impracticable, electrodes shall be buried a minimum of 305 mm 12 inches deep and radially from the fence. The top of the electrode shall be not less than 0.6 m 2 feet or more than 2.4 m 8 feet from the fence. Ground conductor shall be clamped to the fence and electrodes with bronze grounding clamps to create electrical continuity between fence posts, fence fabric, and ground rods. After installation the total resistance of fence to ground shall not be greater than 25 ohms.]

-- End of Section --