
USACE / NAVFAC / AFCESA / NASA UFGS-32 31 13.53 (April 2008)

Preparing Activity: USACE Superseding
UFGS-32 31 13.53 (January 2008)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated October 2008

SECTION TABLE OF CONTENTS

DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 32 31 13.53

HIGH-SECURITY CHAIN LINK FENCES AND GATES

04/08

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 QUALITY ASSURANCE
 - 1.3.1 Required Report Data
 - 1.3.2 Assembly and Installation Drawings
- 1.4 DELIVERY, STORAGE, AND HANDLING

PART 2 PRODUCTS

- 2.1 FENCE FABRIC
 - 2.1.1 General
 - 2.1.2 Approval Of Polyvinyl Chloride-Coated Fence Materials
- 2.2 POSTS
 - 2.2.1 Metal Posts for Chain Link Fence
 - 2.2.2 Accessories
- 2.3 BRACES AND RAILS
- 2.4 WIRE
 - 2.4.1 Wire Ties
 - 2.4.2 Barbed Wire
 - 2.4.3 Tension Wire
- 2.5 BARBED TAPE
- 2.6 CONCRETE
- 2.7 GATES
 - 2.7.1 Gate Assembly
 - 2.7.2 Gate Leaves
 - 2.7.3 Gate Hardware and Accessories
- 2.8 Turnstiles
- 2.9 PADLOCKS
- 2.10 GATE OPERATOR
- 2.11 ELECTRO-MECHANICAL LOCKS

PART 3 EXECUTION

- 3.1 FENCE INSTALLATION

- 3.1.1 Line and Grade
- 3.1.2 Excavation
- 3.1.3 Concrete Slabs and Walls
- 3.2 POST INSTALLATION
 - 3.2.1 Earth and Bedrock
 - 3.2.2 Concrete Slabs and Walls
- 3.3 RAILS
- 3.4 FABRIC INSTALLATION
- 3.5 SUPPORTING ARMS
- 3.6 BARBED TAPE INSTALLATION
- 3.7 GATE INSTALLATION
- 3.8 GROUNDING
- 3.9 SECURITY
- 3.10 CLEANUP

-- End of Section Table of Contents --

USACE / NAVFAC / AFCEA / NASA UFGS-32 31 13.53 (April 2008)

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UFGS-32 31 13.53 (January 2008)

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SECTION 32 31 13.53

HIGH-SECURITY CHAIN LINK FENCES AND GATES 04/08

NOTE: This guide specification covers the requirements for chain link fence for high security applications..

Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

This guide specification includes tailoring options for NAVFAC and USACE. Selection or deselection of a tailoring option (select view-tailoring options) will include or exclude that option in the section. Specific project editing is still required for the resulting section.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR)

PART 1 GENERAL

NOTE: Where special fencing requirements exist, such as wolf-proofing, antiburrowing provisions, crossing drainage ditches, provisions for electrical installations, or special security installations, modify specifications and appropriate details included on the drawings. Modifications and details must afford security equal to that of the fence.

Where special entrance security requirements exist such as electronic locks, motor operated gates, closed circuit video; add details and modify the specification accordingly.

Use Section 32 31 13 for CHAIN LINK FENCES AND GATES.

Use Section 32 31 26 for WIRE FENCES AND GATES, formerly referred to as "Farm Style Fencing" within UFGS.

NOTE: Certain types of security fence must meet the requirements of an applicable OPNAVINST. Edit this specification as needed for the type of fencing required.

Standard drawings STD 872-90-02 through 872-90-13 of fence and gate types required will be included as part of the contract drawings; the standard drawings are available at <https://pdc.usace.army.mil/library/drawings/fence>.

Show layout of fence including types and locations of gates, and gate sizes. Indicate on drawings the extent of clearing required.

1.1 REFERENCES

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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

ASTM INTERNATIONAL (ASTM)

ASTM A 116

(2005) Standard Specification for

	Metallic-Coated, Steel Woven Wire Fence Fabric
ASTM A 121	(2007) Standard Specification for Metallic-Coated Carbon Steel Barbed Wire
ASTM A 153/A 153M	(2005) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 176	(1999; R 2004) Standard Specification for Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
ASTM A 392	(2007) Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A 478	(1997; R 2008) Standard Specification for Chromium-Nickel Stainless Steel Weaving and Knitting Wire
ASTM A 491	(2007) Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric
ASTM A 666	(2003) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar
ASTM A 702	(1989; R 2006) Standard Specification for Steel Fence Posts and Assemblies, Hot Wrought
ASTM A 780	(2001; R 2006) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A 824	(2001; R 2007) Standard Specification for Metallic-Coated Steel Marcellled Tension Wire for Use With Chain Link Fence
ASTM B 117	(2007a) Standing Practice for Operating Salt Spray (Fog) Apparatus
ASTM C 94/C 94M	(2007) Standard Specification for Ready-Mixed Concrete
ASTM F 1043	(2008) Strength and Protective Coatings on Metal Industrial Chain-Link Fence Framework
ASTM F 1083	(2008) Standard Specification for Pipe, Steel, Hot-Dipped Zinc Coated (Galvanized) Welded, for Fence Structures
ASTM F 1184	(2005) Industrial and Commercial Horizontal Slide Gates
ASTM F 567	(2007) Standard Practice for Installation of Chain Link Fence

ASTM F 626	(2008) Standard Specification for Fence Fittings
ASTM F 668	(2007) Poly(Vinyl Chloride) (PVC) and other Organic Polymer-Coated Steel Chain-Link Fence Fabric
ASTM F 883	(2004) Padlocks
ASTM F 900	(2005) Industrial and Commercial Swing Gates

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS RR-F-191	(Rev K) Fencing, Wire and Post Metal (and Gates, Chain-Link Fence Fabric, and Accessories)
FS RR-F-191/1	(Rev D) Fencing, Wire and Post, Metal (Chain-Link Fence Fabric)
FS RR-F-191/2	(Rev D) Fencing, Wire and Post, Metal (Chain-Link Fence Gates)
FS RR-F-191/3	(Rev D) Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces)
FS RR-F-191/4	(Rev D) Fencing, Wire and Post, Metal (Chain-Link Fence Accessories)

1.2 SUBMITTALS

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for

Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.][information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fence Installation
Installation Drawings
Location of gate, corner, end, and pull posts
Gate Assembly
Turnstiles
Gate Hardware and Accessories

Installation drawings in accordance with paragraph titled, "ASSEMBLY AND INSTALLATION DRAWINGS" of this section.

SD-03 Product Data

Fence Installation
Gate Assembly
Gate Hardware and Accessories

Manufacturer's catalog data.

SD-04 Samples

Fabric
Posts
Post Caps
Braces
Line Posts
Sleeves
Top Rail
[Bottom Rail]
Tension Wire
Barbed Wire
Barbed Wire Supporting Arms
Barbed Tape
Stretcher Bars
Gate Posts
Gate Hardware and Accessories
Turnstiles
Padlocks
Wire Ties

Samples as described within this section.

SD-06 Test Reports

NOTE: Require test reports where closer product control is essential or where difficulty might be encountered determining quality of supplied materials.

Weight in grams ounces for zinc coating

Thickness of PVC coating

Chemical composition and thickness of aluminum alloy coating

SD-07 Certificates

Chain Link Fence

Submit reports, 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.

Zinc Coating

PVC coating

aluminum alloy coating

Fabric

Barbed Wire

Stretcher Bars

Gate Hardware and Accessories

Concrete

GATE OPERATOR

SD-08 Manufacturer's Instructions

Submit Manufacturer's instructions for the following items:

Fence Installation

Gate Assembly

Hardware Assembly

Accessories

SD-10 Operation and Maintenance Data

Electro-Mechanical Locks

Gate Operator

Submit operating and maintenance instructions

1.3 QUALITY ASSURANCE

1.3.1 Required Report Data

Submit reports of chain-link fencing listing and accessories regarding weight in grams ounces for zinc coating, thickness of PVC coating, and chemical composition and thickness of aluminum alloy coating. Submit reports demonstrating full compliance with the following standards: FS RR-F-191, FS RR-F-191/1, FS RR-F-191/2, FS RR-F-191/3, and FS RR-F-191/4

1.3.2 Assembly and Installation Drawings

Submit complete Fence Installation Drawings for review and approval by the Contracting Officer prior to shipment. Drawing details shall include, but are not limited to: Fence Installation, Location of gate, corner, end, and pull posts, Gate Assembly, Turnstiles, and Gate Hardware and Accessories.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in an undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact.

PART 2 PRODUCTS

2.1 FENCE FABRIC

NOTE: In salt-laden or corrosive industrial atmosphere, either Class 2 fabric with 610 grams (2.0 ounces) of zinc coating per square meter (foot) or Type I, aluminum-coated fabric, will be specified. In other areas, Class 1 with 370 grams (1.2 ounces) of zinc coating per square meter (foot) or Type I will be specified. Class 2b polyvinyl chloride-coated steel fabric may be specified for other than security purposes when esthetics is of prime importance and the additional cost is justified. Fabric height must be as shown on the contract drawings. Minimum fabric height must be 1.83 m (6 feet) for controlled areas and 2.13 m (7 feet) for restricted areas. Certain security applications require fabric to be embedded into the ground or into a concrete curb.

2.1.1 General

Provide [ASTM A 392, [Class 1] [Class 2], zinc-coated steel wire with minimum coating weight of [370] [610] grams [1.2] [2.0] ounces of zinc per square meter foot of coated surface, [ASTM A 491, Type I, aluminum-coated steel wire.] [Class 2b polyvinyl chloride-coated steel fabric with 92 grams 0.3 ounces of zinc coating per square meter foot in accordance with ASTM F 668.] Fabricate fence fabric of 9 gauge wire woven in 50 mm 2 inch mesh conforming to ASTM A 116. [Polyvinyl chloride coating for fabric and all other fence components shall be manufacturer's standard [_____] in color.] Set fabric height [at [1.8] [2.1] m [6] [7] feet] [_____] [as shown]. Fabric shall be twisted and barbed on the top selvage and knuckled on the bottom selvage.] Secure fabric to posts using stretcher bars or ties spaced 375 mm 15 inches on center, or by integrally weaving to integral fastening loops of end, corner, pull, and gate posts for full length of each post. Install fabric on opposite side of posts from area being secured.

[2.1.2 Approval Of Polyvinyl Chloride-Coated Fence Materials

NOTE: Delete this paragraph if PVC Coated fencing is not within the project scope.

The Contracting Officer will thoroughly inspect polyvinyl chloride-coated fence materials for cracking, peeling, and conformance with the specifications prior to installation. Any fence materials rejected by the Contracting Officer shall be replaced by the Contractor with approved materials at no additional cost to the Government.

] 2.2 POSTS

2.2.1 Metal Posts for Chain Link Fence

NOTE: For high security fences that are to be
sensored, posts will be limited to Group IA or Group
IC steel pipe only. Certain security applications
using intrusion detection sensors, must use steel
pipe framework only.

- a. Provide posts conforming to 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 II, roll-formed steel sections, meeting the strength and coating requirements of ASTM F 1043 and ASTM A 702. 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. [Post shall be either Group IA steel pipe, Group IC, Group II, roll-formed steel sections, or Group III steel H-sections and be zinc coated (Type A) and polyvinyl chloride coated conforming to the requirements of ASTM F 1043.] Provide sizes as shown on the drawings. Line posts and terminal (corner, gate, and pull) posts selected shall be of the same designation throughout the fence. Provide gate post for the gate type specified subject to the limitation specified in ASTM F 900 and/or ASTM F 1184. Post spacing shall conform to the recommended guidelines as set forth in the CLFMI "Wind Load Guide for the Selection of Line Post Spacing and Size" unless specified to exceed those guidelines.
- b. FS RR-F-191/3 line posts; Class [1, steel pipe, Grade [A] [or] [B]] [2, aluminum pipe] [3, formed steel sections] [4, steel H sections] or [5, aluminum H sections]. End, corner, and pull posts; Class [1, steel pipe, Grade [A] [or] [B]], [2, aluminum pipe], [6, steel square sections] [or 7, aluminum square sections].

2.2.2 Accessories

- a. Provide accessories conforming to ASTM F 626. Ferrous accessories shall [be zinc or aluminum coated.] [also be polyvinyl chloride-coated, minimum thickness of 0.152 mm 0.006 inch, maximum thickness of 0.381 mm 0.015 inch. Match color coating of fittings to color coating of the fabric.]
- b. Furnish truss rods for each terminal post. Provide truss rods with turnbuckles or other equivalent provisions for adjustment.
- c. Provide Barbed wire supporting arms of the [single] [45 degree outward angle 3-strand] [V 6 strand] arm type and of the design required for the post furnished. Secure arms by [top tension wire] [top rail] [bolting] [riveting].

d. Furnish **post caps** in accordance with manufacturer's standard accessories.

e. Provide 9 gauge steel tie wire for attaching fabric to rails, braces, and posts and match the coating of the fence fabric. [Tie wires for attaching fabric to **tension wire** on high security fences shall be **1.6 mm 16 gage** stainless steel. Provide double loop tie wires **165 mm 6.5 inches** in length.] Miscellaneous hardware coatings shall conform to **ASTM A 153/A 153M** unless modified.

2.3 **BRACES AND RAILS**

NOTE: Normally rails will not be specified except where appearance is important and the added cost is justified. When top rails are not specified, top tension wire will be used. Bottom tension wire will be specified unless a bottom rail is required for high security fence.

NOTE: Use a single diagonal truss rod for fences less than **3.7 m 12 feet** high. Use two diagonal truss rods on fences **3.7 m 12 feet** and higher.

a. **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**. [Braces and rails shall be [Group IA] [Group IC], steel pipe, size NPS 1-1/4 or Group II, formed steel sections, size **42 mm 1-21/32 inch** and be zinc coated (Type A) and polyvinyl chloride-coated conforming to the requirements of **ASTM F 1043**.] Group II, formed steel sections, size **42 mm 1-21/32 inch**, conforming to **ASTM F 1043**, may be used as braces and rails if Group II line posts are furnished.

b. Braces [, **top rail**][and **bottom rail**]; Class [1, steel pipe, Grade [A] [or] [B]] [2, aluminum pipe] or [3, formed steel sections], in [minimum sizes listed in **FS RR-F-191/3** for each class and grade] [size [____]]. [Provide PVC color coating, minimum thickness, **2.5 mm 0.10 inch**.] [Steel pipe, Class 1, Grade B shall meet the following performance criteria when subjected to salt spray testing in accordance with **ASTM B 117**: Exterior [____] 1,000 hours with maximum 5 percent red rust; Interior [____] 650 hours with maximum 5 percent red rust.]

2.4 **WIRE**

2.4.1 **Wire Ties**

FS RR-F-191/4. Provide wire ties constructed of the same material as the fencing fabric. [Provide accessories with polyvinyl (PVC) coatings similar to that specified for chain-link fabric or framework.]

2.4.2 **Barbed Wire**

Provide barbed wire conforming to **ASTM A 121** zinc-coated, Type Z, Class 3, or aluminum-coated, Type A, with 12.5 gauge wire with 14 gauge, round, 4-point barbs spaced no more than **125 mm 5 inches** apart.

2.4.3 Tension Wire

Provide Type I or Type II tension wire, Class 4 coating, in accordance with [ASTM A 824](#). [Provide 7 gauge coil spring wire for top wire.]

2.5 BARBED TAPE

Provide reinforced barbed tape, [double coil] [single coil], for fence toppings fabricated from 430 series stainless steel with a hardness range of Rockwell (30N) 37-45 conforming to the requirements of [ASTM A 176](#). Provide stainless steel strip [0.6 mm thick by 25 mm 0.025 inch thick by 1 inch](#) wide before fabrication. Each barb shall be a minimum of [30.5 mm 1.2 inch](#) in length, in groups of 4, spaced on [102 mm 4 inch](#) centers. The stainless steel core wire shall have a [2.5 mm 0.098 inch](#) diameter with a minimum tensile strength of [9.68 MPa 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 [0.6 mm thick by 31 mm 0.025 inch thick by 1.21 inches](#) wide before fabrication. Each barb shall be a minimum of [30.5 mm 1.2 inch](#) in length, in groups of 4, spaced on [102 mm 4 inch](#) centers.] Use sixteen gauge stainless steel twistable wire ties for attaching the barbed tape to the barbed wire [and to the fence for ground application].

2.6 CONCRETE

[ASTM C 94/C 94M](#), 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.

2.7 GATES

NOTE: Show type of gates on the drawings, including degree of swing required. In heavy use conditions overhead slide gates should be considered if clearances permit, because these gates require less maintenance and repair than cantilever gates. Ground level track and roller systems should be avoided in climates where snow and ice may accumulate. Recessed tracks should never be used in climates where the recess may fill with ice and snow. Where gates are to receive electric locks, the gate post foundations should be lowered to frost depth to help prevent misalignment of the lock components.

2.7.1 Gate Assembly

Provide [gate assembly](#) conforming to [ASTM F 900](#) and/or [ASTM F 1184](#) of the type and swing shown. Provide gate frames conforming 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. Provide gate frames conforming to strength and coating requirements of [ASTM F 1043](#), for Group IC, steel pipe with external coating Type A or Type B, nominal pipe size

(NPS) 1-1/2. [Gate frames shall be polyvinyl chloride-coated steel pipe (Group IA) (Group IC) with external coating Type A, a nominal pipe size (NPS) 1-1/2, conforming to ASTM F 1043.] Gate fabric shall be as specified for chain link fabric.

2.7.2 Gate Leaves

For gate leaves, more than 2.44 m 8 feet wide, provide either intermediate members and diagonal truss rods or tubular members as necessary to provide rigid construction, free from sag or twist. Gate leaves less than 2.44 m 8 feet wide shall have truss rods or intermediate braces. Provide intermediate braces on all gate frames with an electro-mechanical lock. Attach fabric to the gate frame by method standard with the manufacturer except that welding will not be permitted.

2.7.3 Gate Hardware and Accessories

Furnish and install latches, hinges, stops, keepers, rollers, and other hardware items as required for the operation of the gate. Arrange latches for padlocking so that the padlock will be accessible from both sides of the gate. Provide stops for holding the gates in the open position. For high security applications, 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.

2.8 Turnstiles

Provide [galvanized steel] [metal], three wing turnstile consisting of a rotor, cage, ceiling plate, and bottom bearing plate. [Provide electronic opening and closing [by card key] [____].] Provide [continuous turn] [one way continuous turn] [one-third turn and stop] motion.

2.9 PADLOCKS

NOTE: Type P01 is key operated. Grade 6 is the top grade commercial lock; in Option A the key is captive in cylinder when padlock is unlocked; in Option B the cylinder is removable; Option 6 is environmentally resistant. For combination locks or other options and grades see ASTM F 883.

Provide padlocks conforming to ASTM F 883, Type [P01] [____], Option[s] [A, B, and G] [____] [and] [____], Grade [6] [____]. Size 44 mm 1-3/4 inch. [Key all padlocks alike]. [Key all padlocks into master key system as specified in Section 08 71 00 DOOR HARDWARE].

2.10 GATE OPERATOR

Provide electric gate operators for sliding gates 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 are not allowed. Equip gate operators 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. Provide positive stops on the gate tracks as a backup to the limit switches.

2.11 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. Provide continuous duty type solenoid, rated for 120V ac, 60Hz operation. The locking device shall be unlockable by key and 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 monitor the locking tongue.

PART 3 EXECUTION

3.1 FENCE INSTALLATION

Perform complete installation conforming to ASTM F 567.

3.1.1 Line and Grade

Install fence to the lines and grades indicated. Clear the area on either side of the fence line to the extent indicated. Space line posts equidistant at intervals not exceeding 3 m 10 feet. Terminal (corner, gate, and pull) posts shall be set at abrupt changes in vertical and horizontal alignment. Provide fabric continuous between terminal posts; however, runs between terminal posts shall not exceed 152.4 m 500 feet. Repair any damage to galvanized surfaces, including welding, with paint containing zinc dust in accordance with ASTM A 780.

3.1.2 Excavation

Clear all post holes of loose material. Spread waste material where directed. Eliminate ground surface irregularities along the fence line to the extent necessary to maintain a [25] [50] mm [1] [2] inch clearance between the bottom of the fabric and finish grade.

[3.1.3 Concrete Slabs and Walls

NOTE: Use the following paragraph where required by the design, otherwise delete. Sleeve joints for nonremovable fence sections are usually filled with lead or nonshrink grout. Removable fence sections may be useful as an economical means for providing access to equipment. Sleeve joints in removable fence sections may be a tight sliding type, or where moisture entry could be a problem, filled with pipe sulphur jointing compound.

Set posts into zinc-coated sleeves, set in concrete slab or wall, to a minimum depth of 300 mm 12 inches. Fill sleeve joint with lead, nonshrink grout, or other approved material. Set posts for support of removable fence sections into sleeves that provide a tight sliding joint and hold posts aligned and plumb without use of lead or setting material.

] 3.2 POST INSTALLATION

NOTE: For fences over 1.83 m (6 feet) tall in areas of frequent high winds (113 kph (70 mph) or greater), specify hole diameters of 406 mm (16 inches) for terminal posts and 305 mm (12 inches) for line posts.

3.2.1 Earth and Bedrock

a. Set posts plumb and in alignment. Except where solid rock is encountered, set posts in concrete to the depth indicated on the drawings. Where solid rock is encountered with no overburden, set posts to a minimum depth of 457 mm 18 inches in rock. Where solid rock is covered with an overburden of soil or loose rock, set posts to the minimum depth indicated on the drawing unless a penetration of 457 mm 18 inches in solid rock is achieved before reaching the indicated depth, in which case terminate depth of penetration. Grout all portions of posts set in rock.

b. 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. Make diameters of holes in solid rock at least 25 mm 1 inch greater than the largest cross section of the post. Thoroughly consolidate concrete and grout around each post, free of voids and finished to form a dome. Allow concrete and grout to cure for 72 hours prior to attachment of any item to the posts. Group II line posts may be mechanically driven, for temporary fence construction only, if rock is not encountered. Set driven posts to a minimum depth of 914 mm 3 feet and protect with drive caps when setting.

Test fence post rigidity by applying a 222.4 newtons 50 pound force on the post, perpendicular to the fabric, at 1.52 m 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 from the relaxed position. Test every tenth post for rigidity. When a post fails this test, make further tests on the next four posts on either side of the failed post. All failed posts shall be removed, replaced, and retested at the Contractor's expense.

[3.2.2 Concrete Slabs and Walls

NOTE: Use the following paragraph where required by the design, otherwise delete. Sleeve joints for nonremovable fence sections are usually filled with lead or nonshrink grout. Removable fence sections may be useful as an economical means for providing access to equipment. Sleeve joints in removable fence sections may be a tight sliding type, or where moisture entry could be a problem, filled with pipe sulphur jointing compound.

Set posts into zinc-coated sleeves, set in concrete slab or wall, to a minimum depth of 300 mm 12 inches. Fill sleeve joint with lead, nonshrink

grout, or other approved material. Set posts for support of removable fence sections into sleeves that provide a tight sliding joint and hold posts aligned and plumb without use of lead or setting material.

] 3.3 RAILS

NOTE: Top Rails are normally not applicable to High Security Installations

Bolt bottom rail to double rail ends and securely fasten double rail ends to the posts. Peen bolts to prevent easy removal. Install bottom rail before chain link fabric. [Provide 3/8" diameter eye hook anchored into concrete footing at midpoint.]

3.4 FABRIC INSTALLATION

NOTE: Normally the bottom of fence fabric will be installed no higher than 50.8 mm (2 inches) from the ground. For Air Force projects, high security fence fabric will be installed no higher than 25 mm (1 inch) from the ground. The height requirement for fence fabric will be verified with the user.

In areas where the soil along the fence line is prone to erosion, measures should be taken to maintain the level of security for which the fence is designed.

Tension requirements are for high security fence applications. Fabric fastening requirement of 305 mm (12 inch) spacing to top tension wire and bottom rail is a high security fence requirement.

a. Install chain link fabric on the side of the post indicated. Attach fabric to terminal posts with stretcher bars and tension bands. Space bands at approximately 381 mm 15 inch intervals. Install fabric and pull taut to provide a smooth and uniform appearance free from sag, without permanently distorting the fabric diamond or reducing the fabric height. Fasten fabric to line posts at approximately 381 mm 15 inch intervals and fastened to all rails and tension wires at approximately [610] [305] mm [24] [12] inch intervals.

b. Cut fabric by untwisting and removing pickets. Accomplish splicing by weaving a single picket into the ends of the rolls to be joined. The bottom of the installed fabric shall be [50] [25] mm plus or minus 13 mm [2] [1] plus or minus 1/2 inch above the ground.

c. After the fabric installation is complete, exercise the fabric by applying a 222 newtons 50 pound push-pull force at the center of the fabric between posts; the use of a 133 newtons 30 pound pull at the center of the panel shall cause fabric deflection of not more than 63.5 mm 2.5 inches when pulling fabric from the post side of the fence; every second fence panel shall meet this requirement; resecure and retest all failed panels at the Contractor's expense.

3.5 SUPPORTING ARMS

Install barbed wire supporting arms and barbed wire as indicated on the drawings and as recommended by the manufacturer. Anchor supporting arms [to the posts in a manner to prevent easy removal with hand tools] [with 9.5 mm 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. Use a minimum of two studs per support arm.] Pull barbed wire taut and attach to the arms with clips or other means that will prevent easy removal.

[3.6 BARBED TAPE INSTALLATION

**NOTE: Barbed tape is a high security fence option
when required.**

Install stainless steel reinforced barbed tape as detailed on the drawings. Stretch out barbed tape to its manufacturer's recommended length, set on top of the barbed wire and "V" shaped support arms, then secure it to the barbed wire. Secure the barbed tape to the barbed wire at the two points and at every spiral turn of both coils as shown on the drawings. Install stainless steel [reinforced] [non-reinforced] barbed tape for ground applications [in accordance with manufacturer's recommendations] [as shown on the drawings].

]3.7 GATE INSTALLATION

- a. Install gates at the locations shown. Mount gates to swing as indicated. Install latches, stops, and keepers as required. Install [Slide] [Lift] gates as recommended by the manufacturer.
- b. Attach padlocks to gates or gate posts with chains. Weld or otherwise secure hinge pins, and hardware assembly to prevent removal.
- c. Submit [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. Include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Include in the maintenance instructions routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. Also include the general gate layout, equipment layout and simplified wiring and control diagrams of the system as installed.

3.8 GROUNDING

**NOTE: Delete this paragraph if grounding is not
required. If grounding is required and lightning
protection is not part of project design, the
requirements in the second set of brackets will be
used in lieu of those in the first set of brackets.
Provide fence grounding details when composite type
posts are specified where grounding of the fence is**

required.

- a. Ground fencing as [indicated on drawings] [and] [specified].
- b. [Ground fences crossed by overhead powerlines in excess of 600 volts. Electrical equipment attached to the fence shall be grounded.]
- c. [Ground fences on each side of all gates, at each corner, at the closest approach to each building located within 15 m 50 feet of the fence, and where the fence alignment changes more than 15 degrees. Grounding locations shall not exceed 198 m 650 feet. Bond each gate panel with a flexible bond strap to its gate post. Ground fences crossed by powerlines of 600 volts or more at or near the point of crossing and at distances not exceeding 45 m 150 feet on each side of crossing.]
- d. [Provide ground conductor consisting of No. 8 AWG solid copper wire. Grounding electrodes shall be 19 mm 3/4 inch by 3.05 m 10 foot long copper-clad steel rod. Drive electrodes into the earth so that the top of the electrode is at least 152 mm 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 not be less than 610 mm 2 feet or more than 2.4 m 8 feet from the fence. Clamp ground conductor to the fence and electrodes with bronze grounding clamps to create electrical continuity between fence posts, fence fabric, and ground rods. Total resistance of the fence to ground shall not be greater than 25 ohms.]

[3.9 SECURITY

NOTE: Delete this paragraph if new fencing does not involve relocation or replacement of existing security fencing. Depending on nature of fence work, paragraph may need further elaboration regarding necessary construction to maintain perimeter.

Install new security fencing, remove existing security fencing, and perform related work to provide continuous security for facility. Schedule and fully coordinate work with Contracting Officer and cognizant Security Officer.

] 3.10 CLEANUP

Remove waste fencing materials and other debris from the work site each workday.