Preparing Activity: USACE

Superseding
UFGS-32 31 13.53 (February 2020)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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SECTION 32 31 13.53

HIGH-SECURITY FENCES (CHAIN LINK AND ORNAMENTAL) AND GATES
11/21

NOTE: This guide specification covers the requirements for chain link and ornamental fencing for high security applications. Please review the UFC 4-022-03 "New Document Summary Sheet" that discusses Purpose, Application and Use, and Need. Document provides guidance and in some cases minimum requirements with the appropriate references.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. 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.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR)

NOTE: This Guide Specification and UFC 4-022-03 use the most generic term "zinc coating" in order not to conflict with requirements contained within referenced standards. The term "zinc coatings" encompasses a wide range of metallic and organic coatings including hot dip galvanizing, zinc plating, electroplating (sometimes called "electro-galvanizing"), metallizing, inorganic zinc paints and organic zinc paints. Detailed zinc coating requirements for fencing components are called out in various references such as ASTM

standards.

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NOTE: Select fencing materials throughout this Guide Specification as appropriate to protect against corrosion. Refer to the Corrosion Prevention & Control (CPC) Fencing Knowledge Area webpage on the Whole Building Design Guide website for additional information on making these selections (https://www.wbdg.org/ffc/dod/cpc-source/fencing-knowledge-area). This website contains a link to a Life Cycle Cost Analysis that was conducted for the DoD to identify the lowest cost materials over the service life of a fencing system.

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PART 1 GENERAL

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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, or closed circuit video, add details and modify the specification accordingly.

Standard drawings are incorporated into UFC 4-022-03 Security Fences and Gates, Appendix C Fence and Gate Design Details. The details in this appendix illustrate general layouts for each type of fence or gate. Use the drawings in the UFC corresponding to the fence required, on all DoD fence projects. Drawings were developed from all available DoD fence drawings including Army, Navy and Air Force. These illustrations are not intended to depict the importance or size of each element. Provide details and drawings meeting the minimum mandatory requirements and modify for the specific application, environmental conditions, and local/project constraints. See paragraph titled "Integration With Other Requirements" for additional directional direction. Sizes and dimensions indicated are the minimum requirement that must be modified in accordance with Service policy and for the specific application, environmental conditions, and local constraints.

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

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

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 Reference Identifier (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 A121	(2022) Standard Specification for Metallic-Coated Carbon Steel Barbed Wire
ASTM A153/A153M	(2023) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A240/A240M	(2023) Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A307	(2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A392	(2011; R 2022a) Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A478	(1997; R 2019) Standard Specification for Chromium-Nickel Stainless Steel Weaving and Knitting Wire
ASTM A491	(2011; R 2022) Standard Specification for Aluminum-Coated Steel Chain-Link Fence

	Fabric
ASTM A563	(2021; E 2022a) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A666	(2023) Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A824	(2001; R 2022) Standard Specification for Metallic-Coated Steel Marcelled Tension Wire for Use With Chain Link Fence
ASTM A1023/A1023M	(2021) Standard Specification for Stranded Carbon Steel Wire Ropes for General Purposes
ASTM C94/C94M	(2022a) Standard Specification for Ready-Mixed Concrete
ASTM F567	(2014a; R 2019) Standard Practice for Installation of Chain Link Fence
ASTM F626	(2014; R 2019) Standard Specification for Fence Fittings
ASTM F668	(2017; R 2022) Standard Specification for Polyvinyl Chloride (PVC) and Other Polymer-Coated Steel Chain Link Fence Fabric
ASTM F844	(2019) Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F883	(2013; R 2022) Standard Performance Specification for Padlocks
ASTM F900	(2011; R 2017) Standard Specification for Industrial and Commercial Swing Gates
ASTM F934	(2016; R 2022) Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials
ASTM F1043	(2018; R 2022) Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework
ASTM F1083	(2018; R 2022) Standard Specification for Pipe, Steel, Hot-Dipped Zinc Coated (Galvanized) Welded, for Fence Structures
ASTM F1145	(2005; R 2017) Standard Specification for Turnbuckles, Swaged, Welded, Forged

ASTM F1184	(2023; E 2023) Standard Specification for Industrial and Commercial Horizontal Slide Gates
ASTM F1664	(2008; R 2022) Standard Specification for Poly(Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Tension Wire Used with Chain-Link Fence
ASTM F1665	(2008; R 2022) Standard Specification for Poly(Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Barbed Wire Used With Chain-Link Fence
ASTM F1910	(1998; R 2018) Standard Specification for Long Barbed Tape Obstacles
ASTM F1911	(2005; R 2019) Standard Practice for Installation of Barbed Tape
ASTM F2408	(2016) Standard Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets
ASTM F2814	(2009; R 2015) Standard Guide for Design and Construction of Ornamental Steel Picket Fence Systems for Security Purposes

1.2 SUBMITTALS

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NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a “G” to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters 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.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding

Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

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" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification 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 Drawings; G[, [_____]]

SD-03 Product Data

Fabric

Posts

Post Caps

Chain Link Braces

Line Posts

Sleeves

Rails

Tension Wire

Barbed Wire

Barbed Wire Supporting Arms

Barbed Tape

Latches

Hinges

Stops

Keepers

Rollers

Turnstiles

Padlocks

Wire Ties

Ornamental Fence Systems

Swing Gates

Slide Gates

Fence Fabric Reinforcement

SD-07 Certificates

Chain Link Fence

Fabric

Barbed Wire

Gate Hardware and Accessories

Concrete

Gate Operator

SD-10 Operation and Maintenance Data

Electro-Mechanical Locks

Gate Operator

Operating and maintenance instructions

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in an undamaged condition. Store materials elevated off of the ground to protect against oxidation caused by ground contact.

PART 2 PRODUCTS

2.1 COMPONENTS

2.1.1 Chain Link Fence Fabric

****

NOTE: Use either aluminum-coated steel fabric or Class 2b (fused and adhered) PVC-coated over zinc-coated steel fabric for project locations with Environmental Severity Classifications (ESC) C3 thru C5; ESC C1 and C2 locations can use other options. Use Class 2b PVC-coated over zinc-coated steel fabric when fabric is being buried in soils and in areas where coatings are prone to abrasion from blowing sand. It should be noted that DoD research has shown zinc-coated steel fabric to have lower first costs but significantly higher life-cycle costs in corrosive environments; when using zinc-coated steel in ESC C1 and C2 locations, use Class 2 with 2.0 ounces per square foot of zinc coating for C2 project locations or where localized

corrosive conditions are present or have been observed. See UFC 1-200-01 for determination of ESC for project locations. Fabric height must be as shown on the contract drawings. Minimum fabric height must be 1.9 m 6 feet for controlled areas and 2.13 m 7 feet for restricted areas. Minimum fabric height requirement for security fences and gates is 2.13 m7 feet per UFC 4-022-03 - Unless otherwise directed all security and perimeter fencing must have a minimum fence fabric height of 2.13 m7 feet, excluding the top guard. Fence height including outriggers must be a minimum of 2.44 m8 feet. Modifications to existing fences are not required to meet this new UFC. Consult with current Service policies on specific requirements regarding fence height and assets that may require a higher level of protection. Certain security applications require fabric to be embedded into the ground or into a concrete curb.

****

2.1.1.1 General

Provide [ASTM A491, 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 F668. Provide manufacturer's standard [dark green][olive green][brown][black] in color for polyvinyl chloride coating for fabric and all other fence components complying with ASTM F934.][ASTM A392, [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.]Fabricate fence fabric of 9 gauge wire woven in 50 mm 2 inch diamond mesh.[Provide twisted and barbed fabric on the top selvage and knuckled on the bottom selvage.]

[2.1.1.2 Approval Of Polyvinyl Chloride-Coated Fence Materials

****

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

****

Inspect polyvinyl chloride-coated fence materials for cracking, peeling, and conformance with the specifications prior to installation. Replace any fence materials rejected by the Contracting Officer with approved materials at no additional cost to the Government.

][2.1.2 Ornamental Fence Systems

****

NOTE: Delete this paragraph if ornamental fencing is not within the project scope. Use powder-coat finish in locations with ESC C3 thru C5, and high humidity locations. High humidity locations are those in ASHRAE climate zones 0A, 1A, 2A, 3A, 3C, 4C, and 5C (as identified in ASHRAE 90.1). See UFC 1-200-01 for determination of ESC for project locations. In other ESC and humidity locations, a painted finish is allowed.

****

Submit manufacturer's catalog data. Provide ASTM F2814 structural components consisting of tubular steel ornamental pickets and rails. Provide ASTM F2408 industrial class pickets with a minimum cross-sectional area of 2.5 sq cm 1 sq in and a minimum wall thickness of 6 mm 14 gauge. Provide pickets with spear-pointed tips extending a minimum of 15 cm 6 in above the top rail of the fence. Mount pickets to a top and bottom rail spaced a maximum of 2 m 80 inches apart. Space pickets along rails with a maximum gap not to exceed 5.5 cm 2.25 inches. Secure pickets to rails by [welding] [inaccessible, tamper-proof fasteners]. Provide all items and accessories finished by [PVC powder-coating][painting][_____] in [black][dark bronze][white][_____].

[Add the following accessories to further harden the Ornamental Fence System: [barbed wire on top of fence] [barbed wire along bottom of fence] [barbed wire along side of fence] [spiked railing along the top rail] [chain-link security mesh welded to the pickets and rails]. Accessories are specified separately in this section.

]]2.1.3 Posts

2.1.3.1 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 - see UFC 4-022-03 for additional information. Use last bracketed option that includes PVC coating on steel pipe posts in locations with ESC C3 thru C5, and high humidity locations; also use PVC coating on zinc-coated steel pipe posts in areas prone to metal loss caused by blowing sand. When specifying pipe-type posts, use Group IA pipe with additional PVC coating in locations with ESC C3 thru C5, and high humidity locations. Also use Group IA steel pipe where steel posts are buried in direct contact with soil, regardless of the ESC of the project location. Group IA or IC steel pipe may be used in locations with ESC C1 or C2 and in low humidity locations. High humidity locations are those in ASHRAE climate zones 0A, 1A, 2A, 3A, 3C, 4C, and 5C (as identified in ASHRAE 90.1). See UFC 1-200-01 for determination of ESC for project locations.
****

****
NOTE: For Group IA zinc-coated steel pipe, select "Regular Strength" when standard schedule 40 steel with a 207 MPa 30,000 psi yield strength is sufficient; select "High Strength" when the fence posts require 345 MPa 50,000 psi yield strength.
****

[Provide posts conforming to ASTM F1083, zinc-coated.[Group IA[Regular Strength][High Strength] steel pipe.][Group IC steel pipe, zinc-coated with PVC polymer overcoat[and Group II, roll-formed steel sections, with

zinc [and PVC] coating meeting the strength and coating requirements of ASTM F1043.]] [Provide either Group IA steel pipe posts, Group IC, with PVC polymer overcoat, or Group II, roll-formed steel sections, and be coated conforming to the requirements of ASTM F1043.][Provide posts with polyvinyl chloride coating, minimum thickness, 0.25 mm 0.01 inch conforming to ASTM F1043; color of PVC coating to match that of fabric.]] Provide sizes as shown on the drawings. Use line posts and terminal (corner, gate, and pull) posts of the same designation throughout the fence. Provide gate post for the gate type specified subject to the limitation specified in ASTM F900 or ASTM F1184.

2.1.3.2 Accessories

****

NOTE: Use PVC coating for accessories and post caps to match fence fabric/posts in locations with ESC C3 thru C5, and high humidity locations. High humidity locations are those in ASHRAE climate zones 0A, 1A, 2A, 3A, 3C, 4C, and 5C (as identified in ASHRAE 90.1). See UFC 1-200-01 for determination of ESC for project locations. In areas where coatings are prone to abrasion from blowing sand, use PVC-coated accessories. Use zinc-coated accessories where zinc-coated steel fence posts (with no PVC coatings) are being used.

****

a. Provide accessories conforming to ASTM F626. Coat ferrous accessories with [zinc coating.] [polyvinyl chloride-coated, minimum thickness of 0.25 mm 0.01 inch. Match color coating of fittings to color coating of the fabric.]

b. Provide truss rods (with turnbuckles or other means of adjustment)for each terminal post.

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 [with coating matching that of fence posts].

e. Provide 9 gauge tie wire for attaching fabric to rails, braces, and posts and match the material and coating of the fence fabric. [Use tie wires for attaching fabric to tension wire on high security fences made from 1.6 mm 16 gauge stainless steel. Provide double loop tie wires 165 mm 6.5 inches in length.] Provide miscellaneous hardware coatings which conform to ASTM A153/A153M unless modified.

2.1.4 Chain Link 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. Where rails are utilized,

include the "and rails" phrasing in the title of this paragraph.

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.
****

****
NOTE: Include PVC coating on zinc-coated steel pipe railings in locations with ESC C3 thru C5, and high humidity locations; also use PVC coating on zinc-coated steel pipe railings in areas where coatings are prone to abrasion from blowing sand. When specifying pipe-type braces and rails, use Group IA pipe with additional PVC coating in locations with ESC C3 thru C5, and high humidity locations. Group IA or IC steel pipe may be used in locations with ESC C1 or C2 and in low humidity locations. High humidity locations are those in ASHRAE climate zones 0A, 1A, 2A, 3A, 3C, 4C, and 5C (as identified in ASHRAE 90.1). See UFC 1-200-01 for determination of ESC for project locations.
****

****
NOTE: For Group IA zinc-coated steel pipe, select "Regular Strength" when standard schedule 40 steel with a 207 MPa 30,000 psi yield strength is sufficient; select "High Strength" when 345 MPa 50,000 psi yield strength is required.
****

[ASTM F1083, zinc-coated, Group IA[Regular Strength][High Strength], steel pipe, size NPS 1-1/4.][Provide Group IC steel pipe, zinc-coated, with PVC polymer overcoat that meets the strength and coating requirements of ASTM F1043.][Use braces and rails that are [Group IA[Regular Strength][High Strength]] [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 and polyvinyl chloride-coated, minimum thickness, 0.25 mm 0.01 inch conforming to the requirements of ASTM F1043. Group II, formed steel sections, size 42 mm 1-21/32 inch, conforming to ASTM F1043, may be used as braces and rails if Group II line posts are furnished.][Provide rails and braces with polyvinyl chloride coating, minimum thickness, 0.25 mm 0.01 inch conforming to ASTM F1043; color of PVC coating to match that of fabric.]

2.1.5 Chain Link 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.
****

2.1.5.1 Gate Assembly

****
NOTE: Edit to provide gate framing and bracing member material and finish to match those previously used for posts, rails and braces.
****

Provide gate assembly conforming to ASTM F900 and/or ASTM F1184 of the type and swing shown. [Provide gate frames conforming to strength and coating requirements of ASTM F1083 for Group IA[Regular Strength][High Strength], steel pipe, nominal pipe size (NPS) 1-1/2.][Provide gate frames conforming to strength and coating requirements of ASTM F1043, for Group IC, steel pipe with PVC polymer overcoat, nominal pipe size (NPS) 1-1/2.] [Provide gate frames made of polyvinyl chloride-coated steel pipe (Group IA)(Group IC) a nominal pipe size (NPS) 1-1/2, conforming to ASTM F1043.] Use gate fabric that matches the specified chain link fabric.

2.1.5.2 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. For gate leaves less than 2.44 m 8 feet wide, provide 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. Welding is not an acceptable method for attaching fabric to gate frames.

2.1.5.3 Gate Hardware and Accessories

****
NOTE: Include PVC coating on steel latches, stops, hinges, keepers, and accessories where fence posts are also PVC coated; otherwise, use galvanized coating.
****

Submit manufacturer's catalog data. Furnish and install latches, hinges, stops, keepers, rollers, and other hardware items as required for the operation of the gate. All items are required to match the material characteristics of the fence system being installed. Provide hinge with stainless steel pin. 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, extend each end member of gate frames sufficiently above the top member to carry three strands of barbed wire in horizontal alignment with barbed wire strands on the fence. Coating for steel latches, stops, hinges, keepers, and accessories, must be [galvanized] [PVC, minimum thickness of 0.25 mm 0.01 inch.]

2.1.6 Ornamental Fence Gates

2.1.6.1 Swing Gates

Submit manufacturer's catalog data. Fabricate swing gates by welding 5 sq cm 2 sq in tubular steel ends and rails. Use pickets that match the

adjacent fence construction. Reinforce gates to ensure assembly sags no more than 1% of the gate leaf width or 5 cm 2 in, whichever is less. Size gate posts to accommodate the weight and width of each gate leaf. Mount gates to posts with weldable steel plates or blocks, pressed steel, or malleable iron hinges. Hot-dip galvanize all hinges with a minimum zinc weight of 66 g/sq m 1.20 oz/sq ft. Provide hinge with stainless steel pin. Secure all tamper points by welding or peening the threads. Use swing gate latches and drop bar guides manufactured of pressed steel, hot-dipped galvanized with a minimum zinc weight of 366 g/sq m 1.20 oz/sq ft. Finish all gate hardware in the same color/coating as the fence system.

2.1.6.2 Slide Gates

Submit manufacturer's catalog data. Fabricate slide gates by welding 5 sq cm 2 sq in tubular steel ends and rails. Use pickets that match the adjacent fence construction. Select the type and class of slide gate to comply with ASTM F1184. Size gate posts to accommodate the weight and width of each gate leaf in accordance with ASTM F1184, or per manufacturer's recommendations. [Specify Type II, Class 2, interior roller design for cantilever slide gates.]

2.1.7 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.

2.1.8 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 F883.

****

Provide padlocks conforming to ASTM F883, Type [PO1] [_____], 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].

2.1.9 Gate Operator

Provide electric gate operators for sliding gates as follows: Provide electric gate operators with 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. Use only hardened steel machine cut worm and mating bronze gears that 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 that is also capable of being locked in the engaged or disengaged position. Provide positive stops on the gate tracks as a backup to the limit switches.

2.1.10 Electro-Mechanical Locks

Provide electro-mechanical locking devices for sliding gates and personnel gates that are 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. Ensure the locking device is unlockable by key and keyed on both sides. Monitor status of the electro-mechanical lock by two limit switches (integral to the locking device) wired in series. Ensure one switch monitors the deadlock lever and the other monitors the locking tongue.

2.2 MATERIALS

2.2.1 Wire

2.2.1.1 Wire Ties

Submit samples as specified. Provide wire ties constructed of the same material and finish as the fencing fabric.

2.2.1.2 Barbed Wire

****
NOTE: Use barbed wire material and coating to match fence fabric.
****

Provide barbed wire conforming to [ASTM A121 aluminum-coated, Type A][ASTM F1665, PVC-coated, Class 2b][ASTM A121 zinc-coated, Type Z, Class 3], with 12.5 gauge wire with 14 gauge, round, 4-point barbs spaced no more than 125 mm 5 inches apart.

2.2.1.3 Tension Wire

****
NOTE: Use tension wire material and coating to match fence fabric. Specify polyvinyl chloride (PVC) coated tension wire when PVC-coated fence fabric is used above.
****

Provide metallic coated steel marcelled tension wire (No. 7-gauge), complying with ASTM A824. [Provide aluminum-coated (aluminized) steel wire with coating that weighs not less than 122 gram per square meter 0.4 ounces per square foot.][Provide zinc-coated steel wire with coating that weighs not less than [370] [610] gram per square meter [1.2] [2.0] ounces per square foot.][Provide PVC-coated tension wire of the same class and color as the fencing fabric complying with ASTM F1664.]

2.2.2 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 A240/A240M. Provide stainless steel strip 0.6 mm thick by 25 mm 0.025 inch thick by 1 inch wide before fabrication. Provide barbs that are a minimum of 30.5 mm 1.2 inch in length, in groups of 4, spaced on 102 mm 4 inch centers. Use stainless steel core wire with a 2.5 mm 0.098 inch diameter and a minimum tensile strength of 9.68 MPa 140 psi and conforming to ASTM A478. [The above requirements also apply to reinforced barbed tape, single coil, for

ground application.] [Fabricate non-reinforced barbed tape, single coil, for ground applications from 301 series stainless steel, with a hardness range of Rockwell (30N) 50-55, in accordance with ASTM A666. Provide stainless steel strips 0.6 mm thick by 31 mm 0.025 inch thick by 1.21 inches wide before fabrication. Use barbs with a minimum of 30.5 mm 1.2 inch in length, in groups of 4, spaced on 102 mm 4 inch centers.] Use 1.3 mm No. 16 AWG stainless steel twistable wire ties for attaching the barbed tape to the barbed wire[and to the fence for ground application].

Ensure long barbed tape obstacles conform to ASTM F1910.

2.2.3 Concrete

ASTM C94/C94M, using 19 mm 3/4 inch maximum size aggregate, and having minimum compressive strength of 21 MPa 3000 psi at 28 days. Use grout consisting of one part portland cement to three parts clean, well-graded sand and the minimum amount of water to produce a workable mix.

[2.3 FENCE FABRIC REINFORCEMENT

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NOTE: Reinforcement for chain link and ornamental fencing is typically constructed with wire rope and concrete deadman anchor. Refer to UFC 4-022-02, Security Engineering: Design and Selection of Vehicle Barriers and UFC 4-022-03 Security Fences and Gates for guidance and details.

NOTE: Include PVC coating on structural wire rope in locations with ESC C3 thru C5, and high humidity locations. High humidity locations are those in ASHRAE climate zones 0A, 1A, 2A, 3A, 3C, 4C, and 5C (as identified in ASHRAE 90.1). See UFC 1-200-01 for determination of ESC for project locations.

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Provide galvanized [PVC-coated]structural wire rope as indicated and in accordance with ASTM A1023/A1023M, 20mm 3/4 inch nominal diameter of strand, 19 wire strand, regular lay, extra improved plow steel (EIPS), independent wire rope core (IWRC) and with a minimum breaking strength of 9,175 Newtons40,800 pound-force. Galvanize cable, Class A, in accordance with ASTM A1023/A1023M.

2.3.1 Wire Rope Accessories

Use hot-dipped galvanized structural steel members in cable anchoring system. Provide hot-dipped galvanized clamps, U-bolts, and associated hardware in accordance with ASTM A153/A153M.

2.3.2 Turnbuckles

Provide turnbuckles that are 30mm x 300mm x 300mm1-1/4 inches x 12 inches x inches Type I, Grade 1 galvanized, in accordance with ASTM F1145.

2.3.3 Rope Clamps

Provide hot-dipped galvanized rope clamps in accordance with ASTM A153/A153M.

2.3.4 Threaded Rods, U-Bolts, and Bolts

Provide all threaded rods, U-bolts conforming to ASTM A307 and install with ASTM F844 and ASTM A563 nuts. Galvanize the entire bolt assembly.

]PART 3 EXECUTION

3.1 PREPARATION

Perform complete installation conforming to ASTM F567.

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. Set terminal (corner, gate, and pull) posts whenever abrupt changes in vertical and horizontal alignment are encountered. Provide continuous fabric between terminal posts; however, ensure runs between terminal posts do not exceed 152.4 m 500 feet. Repair any damage to galvanized surfaces, including welding, with paint containing zinc dust in accordance with ASTM A780/A780M.

3.1.2 Excavation

Excavate holes to depths indicated. Clear all post holes of loose material and 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.

3.2 INSTALLATION

3.2.1 Installation Drawings

Submit complete Fence Installation Drawings for review and approval by the Contracting Officer prior to shipment. Submit drawing details that include, but are not limited to the following information: Fence Installation Drawings, Location of gate, corner, end, and pull posts, Gate Assembly, Turnstiles, and Gate Hardware and Accessories. Install fence system per approved drawings.

3.2.2 Security Fencing

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.

3.2.3 Posts

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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.

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3.2.3.1 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. Set portions of posts not set in rock in concrete from the rock to ground level. Set posts 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.

c. 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. Ensure post movement measured at the point where the force is applied is 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. Remove, replace, and retest all failed parts at the Contractor's expense.

[3.2.3.2 Concrete Slabs and Walls

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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.

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When installed in concrete slabs or walls, set posts in zinc-coated sleeves, 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 in sleeves that provide a tight sliding joint and hold posts aligned and plumb without use of lead or setting material.

]3.2.4 Rails

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

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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.]

3.2.5 Fabric

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NOTE: Normally the bottom of fence fabric will be installed no higher than 50 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 300 mm 12 inch spacing to top tension wire and bottom rail is a high security fence requirement.

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a. Set fabric height [at [1.8][2.1] m [6][7] feet] [_____] [as shown].

b. 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.

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

d. After the fabric installation is complete, exercise the fabric by applying a 222 newton 50 pound push-pull force at the center of the fabric between posts; use a 133 newton 30 pound pull at the center of the panel to ensure 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 is required to meet this requirement. Resecure and retest all failed panels at the Contractor's expense.

3.2.6 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. Do not use explosive-actuated tool to drive studs into 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.

[3.2.7 Barbed Tape Installation

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NOTE: Barbed tape is a high security fence option when required.
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Install stainless steel reinforced barbed tape per ASTM F1911 and 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].

]3.2.8 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 [6][_____] copies of operating and maintenance instructions. 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.

3.2.9 Grounding

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NOTE: Delete this paragraph if grounding is not required. If grounding is required and lightning protection is not part of project design, use the requirements in the second set of brackets 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.
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NOTE: Specify solid copper rod for project locations with soil resistivity less than 1,500 ohm-cm. Specify copper clad steel rods for other conditions.
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a. Ground fencing as [indicated on drawings][and][specified].

b. [Ground fences crossed by overhead powerlines in excess of 600 volts and ground all electrical equipment attached to the fence.]

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. Ensure grounding locations are located no more than 198 m 650 feet apart. 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 3.3 mmNo. 8 AWG solid copper wire. Use grounding electrodes that measures 19 mm 3/4 inch by 3.05 m 10 foot long and are a [copper-clad steel][solid copper] 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, bury electrodes a minimum of 305 mm 12 inches deep and radially from the fence. Install the top of the electrode to 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. Measure total resistance of the fence to ground and ensure it is not greater than 25 ohms.]

[3.2.10 Cable Reinforcement Installation

Comply with the contract drawings. Install [1][2][___] strands of [1.9][2.5] cm [3/4][1] in steel aircraft cables mounted to the [chain link fence] [ornamental fence system] posts utilizing u-bolts and nuts. Peen the ends of the U-bolts to prevent removal. Tighten cables with galvanized steel turnbuckles with swaged fittings to the point there is no visible sag. Install [1 m x 1 m x .5 m][1.3 m x 1.3 m x 0.66 m][_____] [3 ft x 3 ft x 1.5 ft][4ft x 4 ft x 2ft][_____] concrete deadman anchors which are a minimum of [1][1.3][___] m [3][4][___] ft underground and installed in undisturbed surrounding soils. Space dead man anchors no more than 61 m 200 ft apart and on each side of gate openings. Connect steel aircraft cables to dead man anchors using swaged end fittings and turnbuckles attached to 3.2 cm 1.25 in galvanized threaded rod which is embedded into concrete anchor and held in place with two 10 cm x 10 cm x 0.66 cm 4 in x 4 in x ¼ in thick steel plates welded to the threaded rod. Place deadman anchors within 3 m 10 feet of last post and on each side of gate openings.

]3.3 CLOSEOUT ACTIVITIES

3.3.1 Cleanup

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

-- End of Section --