Preparing Activity: AFCEC Superseding
UFGS-32 31 13 (November 2016)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
****

SECTION TABLE OF CONTENTS

DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

11/21

PART 1 GENERAL

1.1 REFERENCES
1.2 SUBMITTALS
1.3 QUALITY CONTROL
1.3.1 Certificates of Compliance
1.4 DELIVERY, STORAGE, AND HANDLING

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION
2.2 FENCES
2.2.1 Fabric
2.2.1.1 Top and Bottom Selvages
2.2.2 Posts
2.2.2.1 Metal
2.2.2.1.1 Line Posts
2.2.2.1.2 End, Corner and Pull Posts
2.2.2.1.3 Steel Pipe, Class 1, Grade B Test Requirements
2.2.2.1.4 PVC Coating on Posts and Rails
2.2.2.2 Composite Posts
2.2.2.3 Post Tops
2.2.3 Braces[and Rails]
2.2.3.1 Top Rail
2.2.3.2 Center Rails Between Line Posts
2.2.3.3 Bottom Rail
2.2.3.4 Post-Brace Assembly
2.2.4 Wire Ties
2.2.5 Sleeves
2.2.6 Stretcher Bars
2.2.7 Stretcher Bar Bands
2.2.8 Tension Wire
2.2.9 Miscellaneous Hardware
2.3 GATES

2.3.1 Gate Posts
2.3.2 Gate Fabric
2.3.3 Gate Frame
2.3.4 Gate Bracing
2.3.5 Padlocks
2.3.6 Gate Hardware and Accessories
2.4 MATERIALS
2.4.1 Zinc Coating
2.4.2 Concrete
2.4.3 Grout

PART 3 EXECUTION

3.1 PREPARATION
3.1.1 Clearing and Grading
3.2 INSTALLATION
3.2.1 Security
3.2.2 Fence Installation
3.2.2.1 Post Spacing
3.2.2.2 Top and Bottom Tension Wire
3.2.3 Excavation
3.2.4 Setting Posts
3.2.4.1 Earth and Bedrock
3.2.4.2 Concrete Slabs and Walls
3.2.4.3 Bracing
3.2.4.4 Tolerances
3.2.5 Concrete Strength
3.2.6 Top Rails
3.2.7 Center Rails
3.2.8 Brace Assembly
3.2.9 Tension Wire Installation
3.2.10 Fabric Installation
3.2.11 Stretcher Bar Installation
3.2.12 Gate Installation
3.2.13 Tie Wires
3.2.14 Fasteners
3.2.15 Zinc-Coating Repair
3.2.16 Accessories Installation
3.2.16.1 Post Caps
3.2.16.2 Padlocks
3.2.17 Grounding
3.3 CLOSEOUT ACTIVITIES

-- End of Section Table of Contents --

****

USACE / NAVFAC / AFCEC / NASA | UFGS-32 31 13 (November 2021)

Preparing Activity: AFCEC | Superseding
UFGS-32 31 13 (November 2016)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
****

SECTION 32 31 13

CHAIN LINK FENCES AND GATES
11/21

****
NOTE: This guide specification covers the requirements for steel fencing, including posts, fabric, gates, and miscellaneous accessories. Colored fabric and accessories may be used if required. Edit specifications to suit the project scope.

Use Section 32 31 13.53 HIGH-SECURITY CHAIN LINK FENCES AND GATES when covering the requirements for chain link fence for high security applications.

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.

****

****

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.

****

PART 1 GENERAL

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 A392	(2011; R 2022a) Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A491	(2011; R 2022) Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric
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 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 F883	(2013; R 2022) Standard Performance Specification for Padlocks
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 F1183	(1996; R 2017) Standard Specification for Aluminum Alloy Chain Link Fence Fabric
ASTM F1345	(2010a; R 2019) Standard Specification for Zinc-5 percent Aluminum-Mischmetal Alloy-Coated Steel Chain-Link Fence Fabric
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 G152	(2013; R 2021) Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
ASTM G153	(2013; R 2021) Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
ASTM G154	(2023) Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Materials
ASTM G155	(2021) Standard Practice for Operating

Xenon Arc Lamp Apparatus for Exposure of Materials

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS RR-F-191/1	(Rev F) Fencing, Wire and Post, Metal (Chain-Link Fence Fabric)
FS RR-F-191/2	(Rev E) Fencing, Wire and Post, Metal (Chain-Link Fence Gates)
FS RR-F-191/3	(2023; Rev F) Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces)
FS RR-F-191/4	(Rev F) 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, 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 Assembly; G[, [____]]

Location of Gate, Corner, End, and Pull Posts; G[, [____]]

Gate Assembly; G[, [____]]

Gate Hardware and Accessories; G[, [____]]

Erection/Installation Drawings; G[, [____]]

SD-03 Product Data

Fence Assembly; G[, [____]]

Gate Assembly; G[, [____]]

Gate Hardware and Accessories; G[, [____]]

Zinc Coating; G[, [____]]

PVC Coating; G[, [____]]

Aluminum Alloy Coating; G[, [____]]

Fabric; G[, [____]]

Stretcher Bars; G[, [____]]

Concrete; G[, [____]]

SD-04 Samples

Fabric; G[, [____]]

Posts; G[, [____]]

Braces; G[, [____]]

Line Posts; G[, [____]]

Sleeves; G[, [____]]

Top Rail; G[, [____]]

Bottom Rail; G[, [____]]

Tension Wire; G[, [____]]

Stretcher Bars; G[, [____]]

Gate Posts; G[, [____]]

Gate Hardware and Accessories; G[, [____]]

[Padlocks; G[, [____]]

] Wire Ties; G[, [____]]

SD-07 Certificates

Certificates of Compliance

SD-08 Manufacturer's Instructions

Fence Assembly

Gate Assembly

Hardware Assembly

Accessories

SD-11 Closeout Submittals

Recycled Material Content[; S]

1.3 QUALITY CONTROL

1.3.1 Certificates of Compliance

Submit certificates of compliance in accordance with the applicable reference standards and descriptions of this section for the following:

a. Zinc coating

b. PVC coating

c. Aluminum alloy coating

d. Fabric

e. Stretcher bars

f. Gate hardware and accessories

g. Concrete

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 SYSTEM DESCRIPTION

Submit reports of listing chain-link fencing and accessories regarding weight in grams ounces for zinc coating[, thickness of PVC coating][, and chemical composition and thickness of aluminum alloy coating].

Submit manufacturer's catalog data for complete fence assembly, gate assembly, hardware assembly and accessories.

2.2 FENCES

2.2.1 Fabric

****
NOTE: Coordinate type of fabric with project requirements. The five types of fabric are not necessarily equivalent. Standard selvage treatment for fabric 1.52 m 60 inches and less is knuckled at both selvages. Use either Type II aluminum-coated steel fabric or Type IV Class 2b (fused and adhered) PVC-coated over zinc- or aluminum-coated steel fabric for project locations with Environmental Severity Classifications (ESC) C3 thru C5; ESC C1 and C2 locations can use other options. Use Type IV Class 2b PVC-coated over zinc-coated steel fabric in areas where coatings are prone to abrasion from blowing sand. It should be noted that DoD research has shown Type I (zinc-coated steel) to have lower first costs but significantly higher life-cycle costs in corrosive environments; when using Type I in ESC C1 and C2 locations, use 610 grams per square meter (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.
****

****
NOTE: Choose core wire gauge and mesh size appropriate for the design. Gauges are not the same for all materials. Most common applications can utilize a 9 gauge wire with 50 mm 2 inch mesh. Thicker gauges and smaller mesh sizes may be required for higher or heightened security zones such as an installation perimeter or restricted area fence. Fences around recreational areas may require smaller mesh sizes, such as tennis courts requiring a 44 mm 1-3/4 inch mesh; swimming pool areas and playgrounds may also require a smaller mesh opening. The use of thicker gauges increase the difficulty of cutting the fabric, and smaller mesh fabric is more difficult to climb. PVC coating of fencing for certain security applications and grounded fencing requires detailed design and specifying.
****

FS RR-F-191/1; Type [II, aluminum-coated steel, [9][_____] gauge, conforming to ASTM A491] [IV, Class 2b polyvinyl chloride (PVC) coated over zinc- or aluminum-coated steel, [9][_____]-gauge core wire size, conforming to ASTM F668. Color to be [dark green][olive green][brown][black] complying with ASTM F934.][I, zinc-coated steel, [9][_____] gauge conforming to ASTM A392, with [610] [370] gram per square meter [2.0] [1.20] ounces per square foot of coated surface] [III,

aluminum alloy, [9][_____] gauge, conforming to ASTM F1183, alloy 6061-T94] [or] [V, Zinc-5% aluminum-mischmetal alloy coated steel wire, [9][____] gauge, conforming to ASTM F1345, with [183] [305] gram per square meter [0.6] [1.0] ounces per square foot alloy coating]. Provide selvage [knuckled at one selvage and twisted and barbed at the other] [twisted and barbed at both selvages] [knuckled at both selvages]. Height of fabric, as indicated.

Provide fabric consisting of wires woven into a [25] [45] [50] millimeter [1 inch] [1-3/4 inch] [2 inch] diamond mesh. Provide one-piece fabric widths for fence heights up to[3658 millimeter 12 feet][_____].

2.2.1.1 Top and Bottom Selvages

Provide knuckled selvages at top and bottom for fabric with 51 millimeter 2 inch mesh and up to 1524 millimeter 60 inches high, and if over 1524 millimeter 60 inches high, provide twisted and barbed top selvage and knuckled bottom selvage.

Knuckle top and bottom selvages for 45 millimeter and 25 millimeter 1-3/4 inch and 1 inch mesh fabric.

2.2.2 Posts

****

NOTE: Use either Class 2 aluminum pipe or include PVC coating on zinc-coated steel pipe posts and railings in locations with ESC C3 thru C5, and high humidity locations. When specifying steel pipe posts, use Grade A pipe which has the heavier zinc-coated interior in locations with ESC C3 thru C5, and high humidity locations. Also use Grade A steel pipe where steel posts are buried in direct contact with soil, regardless of the ESC of the project location. Grade A or Grade B steel pipe may be used in locations with ESC C1 or C2 and in low humidity locations, provided Grade B pipe meets the salt spray test. 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. Where aluminum-coated steel fabric is used, use Class 2 aluminum pipe. In areas where coatings are prone to abrasion from blowing sand, use PVC coating on zinc-coated steel pipe posts and railings. Allow as many of the pipe type options as possible consistent with functional requirements, ESC location requirements, and other local corrosion conditions. Allow Class 3, formed steel sections as an alternative if no other requirements prohibit their use on a particular job; however, formed steel sections may prohibit the use of PVC coatings. Certain security applications using intrusion detection sensors use steel pipe framework only.

****

****

NOTE: Steel pipe is available in two grades: A or B. Grade A is zinc-coated with 0.54 kg per square

meter 1.8 ounces per square foot of zinc. Grade B consists of a zinc-coating with 0.27 kg per square meter 0.9 ounce per square foot, a chromate conversion coating, followed by a clear acrylic or polyester coating. The acrylic or polyester coatings used on Grade B pipe should not be confused with optional polyvinyl chloride (PVC) coatings available for framework.

****

2.2.2.1 Metal

2.2.2.1.1 Line Posts

****

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 line posts complying with FS RR-F-191/3. Provide [Class 1, steel pipe, Grade [A [Regular Strength][High Strength]] [or] [B]][Class 2, aluminum pipe] [Class 3, formed steel sections] [Class 4, steel H sections] or [Class 5, aluminum H sections], in [minimum sizes listed in FS RR-F-191/3 for each class and grade] [size [_____]].

2.2.2.1.2 End, Corner and Pull Posts

Provide end, corner, and pull posts in [minimum sizes listed in FS RR-F-191/3 for each class and grade] [size [_____]]. Provide [Class 1, steel pipe, Grade [A [Regular Strength][High Strength]] [or] [B]], [Class 2, aluminum pipe], [Class 6, steel square sections] [or Class 7, aluminum square sections].

[2.2.2.1.3 Steel Pipe, Class 1, Grade B Test Requirements

****

NOTE: Include this subparagraph when Class 1, Grade B pipe is included, or allowed for use, in the project.

****

Steel pipe, Class 1, Grade B meeting the following performance criteria when subjected to salt spray testing in accordance with ASTM B117:

a. Exterior: 1,000 hours with maximum 5 percent red rust.

b. Interior: 650 hours with maximum 5 percent red rust.

][2.2.2.1.4 PVC Coating on Posts and Rails

****

NOTE: Include this subparagraph when PVC Coating is required on zinc-coated posts. Include PVC coating where zinc-coated steel pipe posts and railings are used in locations with ESC C3 thru C5, and high humidity locations. Additionally, in areas where

coatings are prone to abrasion from blowing sand, use PVC coating on zinc-coated steel pipe posts and railings.
****

Provide PVC color coating, minimum thickness, 0.25 mm 0.01 inch fused and adhered to the exterior coating of the posts and rails in accordance with ASTM F1043; color to match fabric in accordance with ASTM F934.

][2.2.2.2 Composite Posts

****
NOTE: Consider as alternative to PVC coated fence posts in project locations with ESC C4 or C5. See UFC 1-200-01 for determination of ESC for project locations. Designer must ensure these are readily available in the local area in the sizes needed for the project before specifying. Since posts are non-conductive, fence grounding procedures need to be detailed where grounding of the fence is required.
****

Produce resin reinforced posts from polyester or epoxy resin, reinforced with E-glass and filler material. Provide posts that meet the ASTM F1043 bending strength for heavy industrial fencing, and filled with 20 MPa 3,000 psi concrete. Protect posts from UV degradation by a veil of polyester cloth impregnated with resin and an acrylic based 1.46 mm 1.5 mil DFT coating system. The post can exhibit no structural failure (less than 10 percent loss of strength) as a result of exposure to moisture and UV lamps per ASTM G152, ASTM G153, ASTM G155, and ASTM G154, (3600 hours). Provide posts in color to match fabric. [Provide outside diameter as specified in FS RR-F-191/3 for round steel pipe.]

]2.2.2.3 Post Tops

****
NOTE: Use aluminum top where posts are aluminum. Include steel requirements where used. Include PVC coating where posts and rails are coated.
****

Provide [steel, wrought iron, or malleable iron][aluminum] tops [with PVC coating of minimum thickness of 0.152 mm 0.006 in] and designed as a weathertight closure cap. Post top to have finish and coating matching rails and posts.[Steel type to be pressed steel galvanized after fabrication having a minimum zinc coating of 366 grams per square meter 1.20 ounces per square foot.][Provide resin reinforced tops for resin reinforced posts.] Provide one cap for each post, unless equal protection is provided by a combination post-cap and wire supporting arm. Provide caps with an opening to permit through passage of the top rail.

2.2.3 Braces[and Rails]

****
NOTE: For rails and braces, use minimum sizes specified in FS RR-F-191/3 for each class and grade unless members are to be oversized. Use the same materials for braces and rails. For fences, use a top tension wire or a top rail, and a bottom tension

wire or a bottom rail; where rails are utilized, include the "and rails" phrasing in the title of this paragraph.
****

****
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.
****

Class [1, steel pipe, Grade [A [Regular Strength][High Strength]] [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, 0.25 mm 0.01 inch in accordance with ASTM F1043; color to match fabric in accordance with ASTM F934.]

2.2.3.1 Top Rail

Provide top rail conforming to minimum sizes specified in FS RR-F-191/3 for each class and grade unless members are to be oversized. Provide expansion couplings 150 millimeter 6 inches long at each joint in top rails.

[2.2.3.2 Center Rails Between Line Posts

****
NOTE: Center rails are not normally required for fencing less than 1829 millimeter 6 feet high. Edit as required.
****

Provide center rail conforming to minimum sizes specified in FS RR-F-191/3 for each class and grade unless members are to be oversized.

][2.2.3.3 Bottom Rail

****
NOTE: Fence design includes either a bottom tension wire or a bottom rail. Delete this paragraph if fence design does not include a bottom rail.
****

Provide bottom rail conforming to minimum sizes specified in FS RR-F-191/3 for each class and grade unless members are to be oversized.

]2.2.3.4 Post-Brace Assembly

Provide bracing conforming to minimum sizes specified in FS RR-F-191/3 for each class and grade, and 10 millimeter 3/8 inch adjustable truss rods and turnbuckles.

2.2.4 Wire Ties

****
NOTE: Choose the same size for wire ties as the

fabric wire.
****

Provide[2.9 millimeter 9-gauge][2.3 millimeter 11-gauge][_____] wire for tying fabric to line posts,spaced 300 millimeter 12 inches on center. For tying fabric to rails and braces, space wire ties 600 millimeter 24 inches on center. For tying fabric to tension wire, space 2.7 millimeter 0.105-inch hog rings 600 millimeter 24 inches on center. Manufacturer's standard procedure will be accepted if of equal strength and durability.

FS RR-F-191/4. Provide wire ties constructed of the same material and coating as the fencing fabric.

2.2.5 Sleeves

Provide sleeves for setting into concrete construction of the same material as post sections, sized 25 millimeter 1 inch greater than the diameter or dimension of the post. Weld flat plates to each sleeve base to provide anchorage and prevent intrusion of concrete.

2.2.6 Stretcher Bars

Provide bars that have one-piece lengths equal to the full height of the fabric with a minimum cross section of 5 by 20 millimeter 3/16 by 3/4 inch, in accordance with ASTM F626.

2.2.7 Stretcher Bar Bands

Provide bar bands for securing stretcher bars to posts that are steel, wrought iron, or malleable iron spaced not over 381 millimeter 15 inches on center. Bands may also be used in conjunction with special fittings for securing rails to posts. Provide bands with projecting edges chamfered or eased.

2.2.8 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 PVC-coated tension wire of the same class and color as the fencing fabric complying with ASTM F1664.] [Provide zinc-coated steel wire with zinc coating that weighs not less than [370] [610] gram per square meter [1.2] [2.0] ounces per square foot.][Provide zinc-5% aluminum-mischmetal alloy coated steel wire, with [183] [305] gram per square meter [0.6] [1.0] ounces per square foot alloy coating.]

2.2.9 Miscellaneous Hardware

Provide miscellaneous hot-dip galvanized hardware as required.

2.3 GATES

****
NOTE: The gate frames and intermediate braces indicated are adequate for gate sizes less than or equal to 2.4 m 8 feet high and 4.3 m 14 feet wide. Gate configurations larger than 2.4 m 8 feet high and 4.3 m 14 feet wide require special design consideration. Edit to provide gate framing and bracing member material and finish, to match those previously used for posts, rails and braces. Include PVC coating on steel latches, stops, hinges, keepers, and accessories where fence posts are also PVC coated; otherwise, use zinc coating (galvanized).
****

FS RR-F-191/2; Type [I, single swing] [II, double swing] [III, single cantilever sliding, wheel sliding gate] [IV, double cantilever sliding] [V, single overhead sliding] [VI, double overhead sliding] [VII, vertical lift] [VIII, special]. Shape and size of gate frame, [as indicated] [_____]. Framing and bracing members, [round][square] of [steel][aluminum] alloy. [Steel member finish, [zinc-coated] [or] [PVC-coated over zinc- or aluminum-coated steel].] Provide gate frames and braces of minimum sizes listed in FS RR-F-191/3 for each Class and Grade, except that steel pipe frames are a minimum of 48 mm 1.90 inches o.d., 3 mm 0.120 inches minimum wall thickness and aluminum pipe frames and intermediate braces are 47.5 mm 1.869 inches o.d. minimum, 1.4 kg per meter 0.940 lb/ft of length. [Provide intermediate members as necessary for gate leaves more than 2.4 m 8 feet wide, to provide rigid construction, free from sag or twist.] [Provide truss rods or intermediate braces for gate leaves less than 2.4 m 8 feet wide.]

2.3.1 Gate Posts

Provide gate posts for supporting each gate leaf in [minimum sizes listed in FS RR-F-191/3 for each material class and grade] [size [_____]]. Gate post material class, grade and finish to match other fence posts.

2.3.2 Gate Fabric

Gate fabric, is as specified for fencing fabric. Attach gate fabric to gate frame in accordance with manufacturer's standards, except that welding is not permitted.

2.3.3 Gate Frame

Provide gate frame assembly that is welded or assembled with special malleable or pressed-steel fittings and rivets to provide rigid connections. Install fabric with stretcher bars at vertical edges; stretcher bars may also be used at top and bottom edges. Attach stretcher bars and fabric to gate frames on all sides at intervals not exceeding 381 millimeter 15 inches. Attach hardware with rivets or by other means which provides equal security against breakage or removal.

[Provide special gate frames, [as indicated][_____].

]2.3.4 Gate Bracing

Provide diagonal cross-bracing, consisting of 10 millimeter 3/8 inch

diameter adjustable-length truss rods on welded gate frames, where necessary to obtain frame rigidity without sag or twist. Provide nonwelded gate frames with diagonal bracing.

2.3.5 Padlocks

****

NOTE: Consult station regarding padlocks. Most stations will provide padlocks. If Contractor-furnished padlocks are required for certain security applications, a padlock conforming to an appropriate Military or Agency Specification may need to be specified. See referenced specification for types, grades, and options available.

****

Provide padlocks conforming to ASTM F883, with chain.

2.3.6 Gate Hardware and Accessories

Provide gate hardware and accessories that conforms to ASTM A392 and ASTM F626, and as specified. Coating for steel latches, stops, hinges, keepers, and accessories, is [galvanized] [PVC, minimum thickness of 0.25 mm 0.01 inch.]

a. Provide [malleable iron] [forged steel] [pressed steel] hinges to suit gate size, non-lift-off type, offset to permit 180-degree opening. Provide hinge with stainless steel pin.

b. Provide latch that permits accessibility and operation from either side of the gate regardless of the latching arrangement, and with a padlock eye provided as an integral part of the latch. Provide [fork] [plunger bar] type gate latches.

c. Provide stops and holders of malleable iron for vehicular gates. Provide stops that automatically engage the gate and hold it in the open position until manually released.

****

NOTE: Specify polyvinyl chloride (PVC) coated accessories when PVC-coated fence fabric is required. Specify aluminum alloy accessories with aluminum coated fabric and aluminum posts.

****

d. [Provide accessories with polyvinyl (PVC) coatings matching that specified for chain-link fabric or framework.][Provide accessories constructed of aluminum alloy in conformance with ASTM F626.]

****

NOTE: Delete the following paragraph when double gates are not required.

****

[e. Provide double gates with a cane bolt and ground-set keeper, with latch or locking device and padlock eye designed as an integral part.]

****

NOTE: Delete the following paragraph if manual sliding gates are not required.
****

[f. Provide manufacturer's standard heavy-duty track ball bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, and accessories as required for easy operation of manual sliding gates.

]2.4 MATERIALS

2.4.1 Zinc Coating

Provide zinc-coated ferrous metal components and accessories that are factory coated after fabrication, except as otherwise specified.

For galvanizing field repairs, provide material that is cold-applied zinc-rich coating conforming to ASTM A780/A780M.

2.4.2 Concrete

Provide concrete conforming to ASTM C94/C94M, and obtaining a minimum 28-day compressive strength of 20,685 kilopascal 3,000 psi.

2.4.3 Grout

Provide grout of proportions one part portland cement to three parts clean, well-graded sand and a minimum amount of water to produce a workable mix.

PART 3 EXECUTION

Submit manufacturer's erection/installation drawings and instructions that detail proper assembly and materials in the design for fence, gate, hardware and accessories.

Provide complete installation conforming to ASTM F567.

3.1 PREPARATION

Ensure final grading and established elevations are complete prior to commencing fence installation.

3.1.1 Clearing and Grading

Clear fence line of trees, brush, and other obstacles to install fencing for a distance of [_____] meters feet inside; and [_____] meters feet outside the fence. Establish a graded, compacted fence line prior to fencing installation.

3.2 INSTALLATION

[3.2.1 Security

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

****

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

]3.2.2 Fence Installation

****

NOTE: Certain security applications require conformance to an applicable OPNAVINST. Use bracketed sentences as required by the applicable OPNAVINST.

****

Install fence on prepared surfaces to line and grade indicated. [Secure fastening and hinge hardware in place to fence framework by peening or welding. Allow for proper operation of components. Coat peened or welded areas with a repair coating matching original coating.] Install fence in accordance with fence manufacturer's written installation instructions except as modified herein.

3.2.2.1 Post Spacing

Provide line posts spaced equidistantly apart, not exceeding 3.048 m 10 feet on center. Provide gate posts spaced as necessary for size of gate openings. Do not exceed 152.4 m 500 feet on straight runs between braced posts. Provide corner or pull posts, with bracing in both directions, for changes in direction of 0.26 rad 15 degrees or more, or for abrupt changes in grade. Submit drawings showing location of gate, corner, end, and pull posts.

3.2.2.2 Top and Bottom Tension Wire

****

NOTE: Coordinate with requirements for top and bottom rails. Specify bottom tension wire to maintain fence alignment, except for designs requiring bottom rail.

****

Install [top] [and] [bottom] tension wires before installing chain-link fabric, and pull wires taut. Place top and bottom tension wires within 203 mm 8 inches of respective fabric line.

3.2.3 Excavation

Provide excavations for post footings which are [drilled holes] in virgin or compacted soil, of minimum sizes as indicated. Space footings for line posts 3048 millimeter 10 feet on center maximum and at closer intervals when indicated, with bottoms of the holes approximately 75 millimeter 3 inches below the bottoms of the posts. Set bottom of each post not less than 915 millimeter 36 inches below finished grade when in firm, undisturbed soil. Set posts deeper, as required, in soft and problem soils and for heavy, lateral loads.[Uniformly spread soil from excavations adjacent to the fence line or on areas of Government property, as directed.][Remove excavated soil from Government property.]

When solid rock is encountered near the surface, drill into the rock at least 305 millimeter 12 inches for line posts and at least 457 millimeter 18 inches for end, pull, corner, and gate posts. Drill holes at least 25.4 millimeter 1 inch greater in diameter than the largest dimension of the placed post. If solid rock is below the soil overburden, drill to the full depth required except that penetration into rock need not exceed the minimum depths specified above.

3.2.4 Setting Posts

Remove loose and foreign materials from holes and moisten the soil prior to placing concrete. Provide tops of footings that are trowel finished and sloped or domed to shed water away from posts. Set hold-open devices, sleeves, and other accessories in concrete.

Keep exposed concrete moist for at least 7 calendar days after placement or cured with a membrane curing material, as approved.[Grout all posts set into sleeved holes in concrete with an approved grouting material.] Maintain vertical alignment of posts in concrete construction until concrete has set.

3.2.4.1 Earth and Bedrock

****
NOTE: Alternate drive anchor method may be specified as an option where evidence indicates that optional method under similar ground conditions has satisfactory and proven performance record.
****

Provide concrete bases of dimensions indicated on the manufactures installation drawings[, except in bedrock]. Compact concrete to eliminate voids, and finish to a dome shape. [In bedrock, set posts with a minimum of 25.4 mm 1 inch of grout around each post. Work grout into hole to eliminate voids, and finish to a dome shape.]

[3.2.4.2 Concrete Slabs and Walls

****
NOTE: Use the following paragraph where required by the design, otherwise delete. Sleeve joints for non-removable 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 305 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.

]3.2.4.3 Bracing

****

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.
****

Brace gate, corner, end, and pull posts to nearest post with a horizontal brace used as a compression member, placed at least 305 mm 12 inches below top of fence, and [a diagonal tension rod] [two diagonal tension rods].

3.2.4.4 Tolerances

Provide posts that are straight and plumb within a vertical tolerance of 6.35 millimeter 1/4 inch after the fabric has been stretched. Provide fencing and gates that are true to line with no more than 12.7 millimeter 1/2 inch deviation from the established centerline between line posts. Repair defects as directed.

3.2.5 Concrete Strength

Provide concrete that has attained at least 75 percent of its minimum 28-day compressive strength, but in no case sooner than 7 calendar days after placement, before rails, tension wire, or fabric are installed. Do not stretch fabric and wires or hang gates until the concrete has attained its full design strength.

****
NOTE: Include the following paragraph if Section 03 30 00 CAST-IN-PLACE CONCRETE is included in the project specifications.
****

[Sample and test concrete in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE.

]3.2.6 Top Rails

Provide top rails that run continuously through post caps or extension arms, bending to radius for curved runs. Provide expansion couplings as recommended by the fencing manufacturer.

[3.2.7 Center Rails

Provide single piece center rails between posts set flush with posts on the fabric side, using special offset fittings where necessary.

]3.2.8 Brace Assembly

Provide bracing assemblies at end and gate posts and at both sides of corner and pull posts, with the horizontal brace located at midheight of the fabric.

Install brace assemblies so posts are plumb when the diagonal rod is under proper tension. Provide two complete brace assemblies at corner and pull posts where required for stiffness and as indicated.

3.2.9 Tension Wire Installation

Install tension wire by weaving them through the fabric and tying them to each post with not less than 3.9 millimeter 7-gauge galvanized wire or by

securing the wire to the fabric with 3.5 millimeter 10-gauge ties or clips spaced 610 millimeter 24 inches on center.

3.2.10 Fabric Installation

Provide fabric in single lengths between stretch bars with bottom barbs placed approximately 38 millimeter 1-1/2 inches above the ground line. Pull fabric taut and tied to posts, rails, and tension wire with wire ties and bands.

Install fabric on the security side of fence, unless otherwise directed. Ensure fabric remains under tension after the pulling force is released.

3.2.11 Stretcher Bar Installation

Thread stretcher bars through or clamped to fabric 102 millimeter 4 inches on center and secured to posts with metal bands spaced 381 millimeter 15 inches on center.

3.2.12 Gate Installation

Install gates plumb, level, and secure, with full opening without interference. Install ground set items in concrete for anchorage as recommended by the fence manufacturer. Adjust hardware for smooth operation and lubricated where necessary.

3.2.13 Tie Wires

Provide tie wires that are U-shaped to the pipe diameters to which attached. Twist ends of tie wires not less than two full turns and bent so as not to present a hazard.

3.2.14 Fasteners

Install nuts for tension bands and hardware on the side of the fence opposite the fabric side. Peen ends of bolts to prevent removal of nuts.

3.2.15 Zinc-Coating Repair

Clean and repair galvanized surfaces damaged by welding or abrasion, and cut ends of fabric, or other cut sections with specified galvanizing repair material applied in strict conformance with the manufacturer's printed instructions.

3.2.16 Accessories Installation

3.2.16.1 Post Caps

****

NOTE: Coordinate with requirements for top rails or supporting arms.

****

[Design post caps to accommodate top rail.] Install post caps as recommended by the manufacturer.

3.2.16.2 Padlocks

Provide padlocks for gate openings and provide chains that are securely

attached to gate or gate posts. Provide padlocks keyed alike, and provide two keys for each padlock.

[3.2.17 Grounding

****
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 paragraph in lieu of those in the first paragraph.

Provide fence grounding details when composite type posts are specified where grounding of the fence is required. Grounding requirements may be indicated on the drawings or included in this section.

When PVC coated fencing is a project requirement, take this into account when detailing the fence grounding system.
****

****
NOTE: Specify solid copper rod for project locations with soil resistivity less than 1,500 ohm-cm. Specify copper-clad steel rods for other locations.
****

Ground fencing as [indicated on drawings][and specified].

[Ground all fences crossed by overhead power lines in excess of 600 volts, and all electrical equipment attached to the fence.][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 can not exceed 198 m 650 feet. Bond each gate panel with a flexible bond strap to its gate post. Ground fences crossed by power lines 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. Provide ground conductor consisting of No. 6 AWG solid copper wire. Provide [copper-clad steel][solid copper] rod grounding electrodes 19 mm 3/4 inch by 3.05 m 10 foot long. 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, with top of the electrode not 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 cannot exceed 25 ohms.]

]3.3 CLOSEOUT ACTIVITIES

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

Submit manufacturer's data indicating percentage of recycled material content in protective fence materials, including chain link fence, fabric, and gates to verify affirmative procurement compliance.

-- End of Section --