
USACE / NAVFAC / AFCEA UFGS-02821N (September 1999)

Preparing Activity: NAVFAC Replacing without revision
NFGS of same number and date

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 25 June 2004

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SECTION 02821N

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09/99

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SECTION 02821N

CHAIN LINK FENCES AND GATES 09/99

NOTE: This guide specification covers the requirements for chain-link fencing and is intended to be used in specifying chain-link fence for general-purpose and special-purpose use.

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).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

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.

NOTE: The following information shall be shown on the project drawings:

1. Fence alignment.
2. Posts: Minimum height to accommodate fabric and clearance.
3. Post Setting Dimensions: Not less than indicated in chain link manufacturer's installation standards. Assure that embedment length in concrete slabs and walls will be at least 300 mm 12 inches.

4. Chain-Link Fabric: Height.

5. As required: Top rail, bottom rail, top and bottom reinforcing wires, and where a higher degree of security is required other than provided by fabric, include barbed wire on supporting arms.

6. Sleeve-Type Expansion Couplings: 6.4 m 21 feet on centers, maximum, if used.

7. Gates: Location, size, and type.

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

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

10. Other information necessary to indicate layout and general configuration of the fence.

PART 1 GENERAL

1.1 REFERENCES

NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest guide specification. Use of SpecsIntact automated reference checking is recommended for projects based on older guide specifications.

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 B 117 | (2002) Operating Salt Spray (Fog) Apparatus |
| ASTM C 94 | (1994) Ready-Mixed Concrete |
| ASTM F 1043 | (2000) Strength and Protective Coatings on Metal Industrial Chain-Link Fence Framework |
| ASTM F 883 | (1997) Padlocks |

| | |
|-----------|---|
| ASTM G 23 | (1996) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials |
| ASTM G 26 | (1996) Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials |
| ASTM G 53 | (1996) Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials |

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 DEFINITION

- a. Year 2000 compliant - means computer controlled facility components that accurately process date and time data (including, but not limited to, calculating, comparing, and sequencing) from, into, and between the twentieth and twenty-first centuries, and the years 1999 and 2000 and leap year calculations.

1.3 SUBMITTALS

NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

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 projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.] [for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

NOTE: Omit this requirement when contract drawings are so detailed that additional drawings would serve no useful purpose or when there is no requirement for special items such as sliding gates or turnstiles.

Gates

Turnstiles

Post spacing

Location of gate, corner, end, and pull posts

SD-03 Product Data

Chain-link fencing components

Accessories

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 for zinc coating Weight in grams ounces for zinc coating

Thickness of PVC coating

Chemical composition and thickness of aluminum alloy coating

SD-07 Certificates

Fabric

Posts

Braces

Framing

Rails

Tension wires

Gates

Padlocks

Year 2000 (Y2K) Compliance Warranty; G

SD-08 Manufacturer's Instructions

Fence

Turnstiles

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.

1.5 WARRANTY

1.5.1 Year 2000 (Y2K) Compliance Warranty

For each product, component and system specified in this section as a "computer controlled facility component" provide a statement of Y2K compliance warranty for the specific equipment. The contractor warrants that each hardware, software, and firmware product delivered under this contract and listed below shall be able to accurately process date and time data (including, but not limited to, calculating, comparing, and sequencing) from, into, and between the twentieth and twenty-first centuries, and the years 1999 and 2000 and leap year calculations to the extent that other computer controlled components, used in combination with the computer controlled component being acquired, properly exchange data and time data with it. If the contract requires that specific listed products must perform as a system in accordance with the foregoing warranty, then that warranty shall apply to those listed products as a system. The duration of this warranty and the remedies available to the Government for breach of this warranty shall be defined in, and subject to, the terms and limitations of the contractor's standard commercial warranty or warranties contained in this contract, provided that, notwithstanding any provisions to the contrary, in such commercial warranty or warranties, the remedies available to the Government under this warranty shall include

repair or replacement of any listed product whose non-compliance is discovered and made known to the contractor in writing within one year (365 days) after acceptance. Nothing in this warranty shall be construed to limit any rights or remedies the Government may otherwise have under this contract, with respect to defects other than Year 2000 performance.

1.6 QUALITY ASSURANCE

1.6.1 Required Report Data

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

PART 2 PRODUCTS

2.1 Y2K COMPLIANT PRODUCTS

NOTE: To ensure that buildings' systems continue to function beyond Year 2000, the following paragraph must be included when this section is part of a construction contract. For more information on Y2K, see these web sites on the Internet.
<http://www.doncio.navy.mil/y2k/year2000.htm>, the Year 2000 homepage of the Department of the Navy Chief Information Officer (DONCIO);
<http://www.itpolicy.gsa.gov/mks/yr2000.legal.htm>, the General Services Administration (GSA) Chief Information Officer (CIO) homepage for Y2K procurement, contracting, and legal issues;
<http://y2k.lmi.org/gsa/y2kproducts> contains information on vendor product compliance.

Provide computer controlled facility components, specified in this section, that are Year 2000 compliant (Y2K). Computer controlled facility components refers to software driven technology and embedded microchip technology. This includes, but is not limited to, telecommunications switches, alarms, security systems, and other facilities control systems utilizing microcomputer, minicomputer, or programmable logic controllers.

2.2 CHAIN-LINK FENCING AND ACCESSORIES

FS RR-F-191 and detailed specifications as referenced and other requirements as specified.

2.2.1 Fabric

NOTE: Coordinate type of fabric with project requirements. The four types of fabric are not necessarily equivalent. Certain security applications may require use of steel fabric only. Standard selvage treatment for fabric 1.52 m 60 inches and less is knuckled at both selvages. Fabric with heavier zinc or aluminum coating or polyvinyl chloride (PVC) coatings may be useful in

highly corrosive environments.

NOTE: Choose core wire gage appropriate for the design. Gages will not be the same for all materials. Polyvinyl chloride (PVC) coating may be specified for other than security purposes when aesthetics are of prime importance and the additional cost is justified. There are different PVC-coated fabrics on the market. Some ways in which they may vary are: The methods of applying PVC coating, wall thickness of PVC coating, adhesion of PVC coating to wire, and cost. Take these factors into consideration when selecting a fence fabric for different environmental applications. PVC coating of fencing for certain security applications and fencing requiring grounding must be designed and specified very carefully.

NOTE: For projects located on the Naval Base Complex, Norfolk, Virginia, fencing which is not adequately screened by landscaping shall be PVC coated. PVC coating shall be dark brown in color.

FS RR-F-191/1; Type [I, zinc-coated steel, [] gage] [II, aluminum-coated steel, [] gage] [III, aluminum alloy, [] gage] [or] [IV, polyvinyl chloride (PVC) coated over zinc- or aluminum-coated steel, []-gage core wire size]. Mesh size, 50 mm 2 inches. 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.

2.2.2 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 shall require special design consideration.

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] or [square] of [steel] [or] [aluminum alloy]. [Steel member finish, [zinc-coated] [or] [PVC-coated over zinc- or aluminum-coated steel].] Gate frames and braces of minimum sizes listed in FS RR-F-191/3 for each Class and Grade except that steel pipe frames shall be 48 mm 1.90 inches od, 3 mm 0.120 inches minimum wall thickness and aluminum pipe frames and intermediate braces shall be 47.5 mm 1.869 inches od, 1.4 kg per meter 0.940 lb/ft of length. Gate fabric, as specified for fencing fabric. [Barbed wire top on gate, as specified herein.] Coating

for steel latches, stops, hinges, keepers, and accessories, [galvanized] [PVC, minimum thickness of 0.25 mm 0.010 inch.] Gate latches, [fork] [plunger bar] type. [Special gate frames, [as indicated] [____].] [Gate leaves more than 2.4 m 8 feet wide shall have intermediate members as necessary to provide rigid construction, free from sag or twist.] [Gate leaves less than 2.4 m 8 feet wide shall have truss rods or intermediate braces.] Attach gate fabric to gate frame in accordance with manufacturer's standards, except that welding will not be permitted. Arrange padlocking latches to be accessible from both sides of gate, regardless of latching arrangement.

2.2.3 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.

2.2.4 Posts [, Top Rails] [, Bottom Rails] and Braces

NOTE: Use as many of the options as possible consistent with functional requirements. Allow Class 3, formed steel sections as an alternative if no other requirements prohibit their use on a particular job. Certain security applications using intrusion detection sensors, must use steel pipe framework only. 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.

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. Grade A pipe which has the heavier zinc-coated interior may be desired in some coastal regions located in highly corrosive salt-laden environments to prevent rust caused by condensation inside the pipe. Grade A or Grade B pipe may be used in inland and desert areas, provided Grade B pipe meets the salt spray test.

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]. Braces [and rails]; 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:

- a. Exterior [_____] 1,000 hours with maximum 5 percent red rust.
- b. Interior [_____] 650 hours with maximum 5 percent red rust.]

2.2.4.1 Composite Posts

NOTE: For High Security or for taut wire system use steel post. Provide as alternative to PVC coated fence posts, and use where corrosion is a problem. Since posts are non-conductive, fence grounding procedures need to be detailed where grounding of the fence is required.

Polyester resin reinforced posts shall be produced from polyester or epoxy resin, reinforced with E-glass and filler material. Posts shall meet the ASTM F 1043 bending strength for heavy industrial fencing, and shall be filled with 20 MPa 2,500 psi concrete. Posts shall be protected from UV degradation by a veil of polyester cloth impregnated with resin and an acrylic based 0.037 mm 1.5 mil DFT coating system. The post will exhibit no structural failure (less than 10 percent loss of strength) as a result of exposure to moisture and UV lamps per ASTM G 23, ASTM G 26, and ASTM G 53, (3600 hours). Posts shall be provided [green], [black], [brown] in color to match fabric. [Provide outside diameter as specified in FS RR-F-191/3 for round steel pipe.]

2.2.5 Fencing Accessories

NOTE: Polyvinyl chloride (PVC) coated ties shall be specified when PVC-coated fence fabric is required.

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.]

2.2.6 Concrete

[ASTM C 94, using 19 mm 3/4 inch maximum-size aggregate, and having minimum compressive strength of 20 MPa 3000 psi at 28 days.] [Provide as specified in Section 03300N CAST-IN-PLACE CONCRETE.]

2.2.7 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.

2.2.8 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 Specification may need to be specified.
See referenced specification for types, grades, and
options available.**

ASTM F 883, with chain.

PART 3 EXECUTION

3.1 SITE PREPARATION

3.1.1 Clearing and Grading

Clear fence line of trees, brush, and other obstacles to install fencing. Establish a graded, compacted fence line prior to fencing installation. Compact fill used to establish fence line.

3.1.2 Excavation

Excavate to dimensions indicated for concrete-embedded items, except in bedrock. If bedrock is encountered, continue excavation to depth indicated or 450 mm 18 inches into bedrock, whichever is less, with a diameter in bedrock a minimum of 50 mm 2 inches larger than outside diameter of post. Clear post holes of loose material. Dispose of waste material [outside limits of station] [on station, as directed].

3.2 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.

3.2.1 Post Spacing

Provide line posts spaced equidistantly apart, not exceeding 3 m 10 feet on center. Provide gate posts spaced as necessary for size of gate openings. Do not exceed 152 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. Provide drawings showing location of gate, corner, end, and pull posts.

3.2.2 Post Setting

Set posts plumb. Allow concrete [and grout] to cure a minimum of 72 hours before performing other work on posts.

3.2.2.1 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 [except in bedrock]. Compact concrete to eliminate voids, and finish to a dome shape. [In bedrock, set posts with a minimum of 25 mm one inch of grout around each post. Work grout into hole to eliminate voids, and finish to a dome shape.]

3.2.2.2 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.

3.2.3 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 300 mm 12 inches below top of fence, and [a diagonal truss rod and truss tightener used as a tension member] [two diagonal truss rods and truss tighteners used as tension members].

3.2.4 [Top] [and] [Bottom] Rails

NOTE: Top rails offer a handhold to climbers, therefore do not specify where security is of utmost importance. A top rail may be specified on fences where appearance is an important factor and the added cost is justified. Specify bottom rails only when required by the design.

Install [top] [and] [bottom] rails before installing chain-link fabric. Pass top rail through intermediate post caps. Provide expansion coupling spaced as indicated.

3.2.5 Top and Bottom Tension Wires

NOTE: Coordinate with requirements for top and bottom rails. Bottom tension wire is desirable to maintain fence alignment and will be retained 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 200 mm 8 inches of respective fabric line.

3.2.6 Fabric

NOTE: Coordinate with requirements for reinforcing wire and top and bottom rails. Certain security applications require fabric to be embedded into the ground or into a concrete curb. When security fencing with intrusion detection sensors is required, include bracketed sentence dealing with deflection of fabric.

Pull fabric taut and secure fabric to [top rail] [and] [bottom rail] [and] [top wire] [and] [bottom wire], close to both sides of each post and at maximum intervals of 600 mm 24 inches on center. Secure fabric to posts using stretcher bars, ties or clips 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. Install fabric so that bottom of fabric is 50 mm 2 inches above ground level [embedded as indicated]. [Install fence fabric to provide approximately 50 mm 2 inch deflection at center of fabric span between two posts, when a force of approximately 133 N 30 pounds is applied perpendicular to fabric. Fabric should return to its original position when force is removed.]

3.3 ACCESSORIES INSTALLATION

3.3.1 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.

3.3.2 Supporting Arms

NOTE: Coordinate with requirements for top rails.
Use supporting arms and barbed wire only when

required by applicable OPNAVINST or by Station.

Design supporting arms to accommodate top rail. Install supporting arms as recommended by manufacturer. In addition to manufacturer's standard connections, permanently secure supporting arms to posts. Studs driven by low-velocity powder-actuated tools may be used with steel, wrought iron, ductile iron, or malleable iron. Do not use studs driven by powder-actuated tools with gray iron or other material that will fracture.

3.3.3 Barbed Wire

Install barbed wire on supporting arms above fence posts. Extend each end member of gate frames sufficiently above top member to carry three strands of barbed wire in horizontal alignment with barbed wire strands on the fence. Pull each strand taut and securely fasten each strand to each supporting arm or extended member. Secure wires in accordance with fence manufacturer's recommendations.

3.3.4 Gates

NOTE: Special items, such as sliding gates complete with rollers and roller tracks, should be shown and specified. Consideration should be given to the need for detail drawings for these items.

Install swing gates to swing through [1.57] [3.14] rad [90] [180] degrees from closed to open.

3.3.5 Turnstiles

Install in accordance with manufacturer's instructions.

3.3.6 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.

3.4 GROUNDING

NOTE: Grounding requirements may be indicated on the drawings, specified in a separate section in Division 16, or included in this section. Specify polyvinyl chloride coated fencing with care when grounding is a project requirement.

Ground fencing as [indicated] [specified in Division 16].

3.5 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.

3.6 CLEANUP

Remove waste fencing materials and other debris from the station.
-- End of Section --