

## SECTION 323113 - CHAIN LINK FENCES AND GATES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Chain-link fences.
  - 2. Swing, motor-operated gates.
  - 3. Horizontal-slide, motor-operated gates.
  - 4. Privacy slats.

- B. Related Requirements:

- 1. Section 033000 "Cast-in-Place Concrete" for cast-in-place concrete equipment bases/pads for gate operators and controls.
  - 2. Section 281500 "Access Control Hardware Devices" for gate controls.
  - 3. Section 321313 "Concrete Paving" for post footings.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

- 1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
  - 2. Review sequence of operation for each type of gate operator.
  - 3. Review coordination of interlocked equipment specified in this Section and elsewhere.
  - 4. Review required testing, inspecting, and certifying procedures.
  - 5. Review Construction Documents for fall protection requirements and coordinate with wall designer if required.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
    - a. Fence and gate posts, rails, and fittings.
    - b. Chain-link fabric, reinforcements, and attachments.
    - c. Accessories: Privacy slats Barbed wire Barbed tape.
    - d. Gates and hardware.

- e. Gate operators, including operating instructions and motor characteristics.
- B. Shop Drawings: For each type of fence and gate assembly.
  - 1. Include plans, elevations, sections, details, and attachments to other work.
  - 2. Include accessories, hardware, gate operation, and operational clearances.
  - 3. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
  - 4. Wiring Diagrams: For power, signal, and control wiring.
- C. Samples for Initial Selection: For each type of factory-applied finish.
- D. Samples for Verification: For each type of component with factory-applied finish, prepared on Samples of size indicated below:
  - 1. Polymer-Coated Components: In 6-inch lengths for components and on full-sized units for accessories.
- E. Delegated-Design Submittal: For structural performance of chain-link fence and gate frameworks, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency factory-authorized service representative.
- B. Product Certificates: For each type of chain-link fence, operator, and gate.
- C. Product Test Reports: For framework strength according to ASTM F 1043, for tests performed by a qualified testing agency.
- D. Field quality-control reports.
- E. Sample Warranty: For special warranty.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For gate operators to include in emergency, operation, and maintenance manuals.

#### 1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing fence grounding; member company of NETA or an NRTL.
  - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

- B. Emergency Access Requirements: According to requirements of authorities having jurisdiction for gates with automatic gate operators serving as a required means of access.
- C. Mockups: Build mockups to set quality standards for fabrication and installation.
  - 1. Build mockup for typical chain-link fence and gate, including accessories.
    - a. Size: Include 6 foot length of fence and one gate.

## 1.8 FIELD CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

## 1.9 WARRANTY

- A. Special Warranty: Manufacturer and Installer agree to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Failure to comply with performance requirements.
    - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    - c. Faulty operation of gate operators and controls.
  - 2. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design chain-link fence and gate operator frameworks.
- A. Structural Performance: Chain-link fence and gate frameworks shall withstand the effects of gravity loads and stresses within limits and under conditions indicated.
  - 1. Minimum Post Size: As indicated on drawings.
  - 2. Minimum Post Size and Maximum Spacing: As indicated on drawings.
- B. Lightning Protection System: Maximum resistance-to-ground value of 25 ohms at each grounding location along fence under normal dry conditions.

### 2.2 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to "CLFMI Product Manual" and requirements indicated below:

1. Fabric Height: As indicated on Drawings.
2. Steel Wire for Fabric: Wire diameter of 0.113 inch.
  - a. Mesh Size: 2 inches.
  - b. Aluminum-Coated Fabric: ASTM A 491, Type I, 0.35 oz./sq. ft.
  - c. Polymer-Coated Fabric: ASTM F 668, Class 1 over aluminum-coated steel wire.
    - 1) Color: As indicated on drawings and according to ASTM F 934.
  - d. Coat selvage ends of metallic-coated fabric before the weaving process with manufacturer's standard clear protective coating.
3. Aluminum Wire Fabric: ASTM F 1183, with mill finish, and wire diameter of 0.148 inch.
  - a. Mesh Size: 2 inches.
4. Selvage: Knuckled at both selvages.

## 2.3 FENCE FRAMEWORK

- A. Posts and Rails: ASTM F 1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 or ASTM F 1083 based on the following:
1. Fence Height: As indicated on Drawings.
  2. Light-Industrial-Strength Material: Group IC-L, round steel pipe.
    - a. Line Post: As indicated on drawings.
    - b. End, Corner, and Pull Posts: As indicated on drawings.
  3. Heavy-Industrial-Strength Material: Group IA, round steel pipe, Schedule 40.
    - a. Line Post: As indicated on drawings.
    - b. End, Corner, and Pull Posts **As indicated on drawings.**
  4. Horizontal Framework Members: Top and bottom rails according to ASTM F 1043.
    - a. Top Rail: As indicated on drawings.
  5. Brace Rails: ASTM F 1043.
  6. Metallic Coating for Steel Framework:
    - a. Type A: Not less than minimum 2.0-oz./sq. ft. average zinc coating according to ASTM A 123/A 123M or 4.0-oz./sq. ft. zinc coating according to ASTM A 653/A 653M.
    - b. Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film.
    - c. External, Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil- thick, zinc-pigmented coating.
    - d. Type C: Zn-5-Al-MM alloy, consisting of not less than 1.8-oz./sq. ft. coating.
    - e. Coatings: Any coating above.
  7. Polymer coating over metallic coating.
    - a. Color: As indicated on drawings and according to ASTM F 934.

## 2.4 TENSION WIRE

- A. Metallic-Coated Steel Wire: 0.177-inch- diameter, marcelled tension wire according to ASTM A 817 or ASTM A 824, with the following metallic coating:

1. Type I: Aluminum coated (aluminized).
- B. Polymer-Coated Steel Wire: 0.177-inch- diameter, tension wire according to ASTM F 1664, Class 1 over aluminum-coated steel wire.
  1. Color: Match chain-link fabric as indicated on drawings and according to ASTM F 934.

## 2.5 SWING GATES

- A. General: ASTM F 900 for gate posts and swing gates. Provide automated vehicular gates according to ASTM F 2200.
  1. Gate Leaf Width: Minimum 36 inches or as indicated.
  2. Framework Member Sizes and Strength: Based on gate fabric height.
- B. Pipe and Tubing:
  1. Aluminum: ASTM B 429/B 429M; mill finish.
  2. Gate Posts: Round tubular aluminum.
  3. Gate Frames and Bracing: Round tubular aluminum.
- C. Frame Corner Construction: assembled with corner fittings.
- D. Extended Gate Posts and Frame Members: Fabricate gate posts and frame end members to extend 12 inches above top of chain-link fabric at both ends of gate frame to attach barbed wire or tape assemblies, if indicated.
- E. Hardware:
  1. Hinges: 360-degree inward and outward swing.
  2. Latch: Permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
  3. Lock: Manufacturer's standard internal device.
  4. Padlock and Chain: Owner furnished or Owner specified.
  5. Closer: Manufacturer's standard.

## 2.6 HORIZONTAL-SLIDE GATES

- A. General: ASTM F 1184 for gate posts and sliding gates. Provide automated vehicular gates according to ASTM F 2200.
  1. Classification: Type I Overhead Slide.
    - a. Gate Leaf Width: 36 inches or as indicated.
    - b. Framework Member Sizes and Strength: Based on gate fabric height.
  2. Classification: Type II Cantilever Slide, Class 1 with external roller assemblies.
    - a. Gate Frame Width and Height: As indicated on drawings.
- B. Pipe and Tubing:

1. Aluminum: ASTM B 429/B 429M; mill finish.
  2. Gate Posts: Round tubular aluminum.
  3. Gate Frames and Bracing: Round tubular aluminum.
- C. Frame Corner Construction: assembled with corner fittings.
- D. Extended Gate Posts and Frame Members: Fabricate gate posts and frame end members to extend 12 inches above top of chain-link fabric at both ends of gate frame to attach barbed wire or tape assemblies, if indicated.
- E. Overhead Track Assembly: Manufacturer's standard track, with overhead framework supports, bracing, and accessories, engineered to support size, weight, width, operation, and design of gate and roller assemblies.
- F. Hardware:
1. Hangers, Roller Assemblies, and Stops: Fabricated from mill-finished Grade 319 aluminum-alloy casting with stainless-steel fasteners.
  2. Latch: Permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.
  3. Lock: Manufacturer's standard internal device.
  4. Padlock and Chain: Owner furnished or Owner specified.

## 2.7 FITTINGS

- A. Provide fittings according to ASTM F 626.
- B. Post Caps: Provide for each post.
1. Provide line post caps with loop to receive tension wire or top rail.
- C. Rail and Brace Ends: For each gate, corner, pull, and end post.
- D. Rail Fittings: Provide the following:
1. Top Rail Sleeves: Aluminum Alloy 6063 not less than 6 inches long.
  2. Rail Clamps: Line and corner boulevard clamps for connecting bottom rails to posts.
- E. Tension and Brace Bands: Aluminum Alloy 6063.
- F. Tension Bars: Aluminum, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.
- G. Truss Rod Assemblies: Mill-finished aluminum rod and turnbuckle or other means of adjustment.
- H. Barbed Wire Arms: Aluminum, with clips, slots, or other means for attaching strands of barbed wire, and means for attaching to posts, integral with post cap, for each post unless otherwise indicated, and as follows:

1. Provide line posts with arms that accommodate top rail or tension wire.
2. Provide corner arms at fence corner posts unless extended posts are indicated.
3. Single-Arm Type: Type I, slanted arm.

I. Tie Wires, Clips, and Fasteners: According to ASTM F 626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:
  - a. Hot-Dip Galvanized Steel: 0.148-inch- diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.
  - b. Aluminum: ASTM B 211; Alloy 1350-H19; 0.148-inch-diameter, mill-finished wire.

J. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. of zinc.
  - a. Polymer coating over metallic coating.
2. Aluminum: Mill finish.

## 2.8 PRIVACY SLATS

- A. Fiber-Glass-Reinforced Plastic Slats: UV-light-stabilized fiber-glass-reinforced plastic, not less than 0.06 inch thick, sized to fit mesh specified for direction indicated with vandal-resistant fasteners and lock strips.
- B. Tubular Polyethylene Slats: Minimum 0.023-inch-thick tubular polyethylene, manufactured for chain-link fences from virgin polyethylene with UV inhibitor, sized to fit mesh specified for direction indicated, with vandal-resistant fasteners and lock strips and fins for increased privacy factor.
- C. Aluminum Slats: Minimum 0.01-inch-thick aluminum, sized to fit mesh specified for direction indicated.
- D. Redwood Slats: 5/16-inch-thick redwood, sized to fit mesh specified for direction indicated.
- E. Hedge-Type Slats: UV-light-stabilized, flame-resistant, PVC "needles" woven into braided, galvanized wire core, sized to fit mesh specified for direction indicated.
- F. Color: As indicated on Drawings.

## 2.9 BARBED WIRE

- A. Steel Barbed Wire: ASTM A 121, two-strand barbed wire, 0.099-inch- diameter line wire with 0.080-inch- diameter, four-point round barbs spaced not more than 5 inches o.c.
  1. Aluminum Coating: Type A.

## 2.10 GATE OPERATORS

- A. Operators: Factory-assembled, automatic, gate-operating system designed for gate size, type, weight, and frequency of use. Control system shall have characteristics suitable for Project conditions, with control stations, safety devices, and weatherproof enclosures.
  - 1. Operator design shall allow for removal of cover or motor without disturbing limit-switch adjustment and without affecting auxiliary emergency operation.
  - 2. Electronic components shall have built-in troubleshooting diagnostic feature.
  - 3. Unit shall be designed and wired for both right-hand/left-hand opening, permitting universal installation.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. UL Standard: Manufacture and label gate operators according to UL 325.
- D. Motors: Comply with NEMA MG 1.
  - 1. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
  - 2. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
  - 3. Service Factor: 1.15.
  - 4. Electrical Characteristics:
    - a. Horsepower: Per manufacturer.
    - b. Voltage: Single phase or three phase as required per manufacturer's requirement.
- E. Gate Operators: Equipment base/pad mounted and as follows:
  - 1. Hydraulic Gate Operators:
    - a. Duty: Commercial/industrial.
    - b. Gate Speed: Minimum **60 feet** per minute.
    - c. Maximum Gate Weight: 300 lb.
    - d. Frequency of Use: Continuous duty.
    - e. Operating Type: Crank arm, Wheel and rail drive, or Roller chain, with manual release.
    - f. Hydraulic Fluid: Of viscosity required for gate operation at ambient temperature range for Project.
    - g. Locking: Hydraulic in both directions.
    - h. Heater: Manufacturer's standard track and roller heater with thermostatic control.
  - 2. Mechanical Gate Operators:
    - a. Duty: Commercial/industrial.
    - b. Gate Speed: Minimum **60 feet** per minute.
    - c. Maximum Gate Weight: Per manufacturer.
    - d. Frequency of Use: Continuous duty.
    - e. Operating Type: Crank arm, Wheel and rail drive, Roller chain, with manual release.
    - f. Drive Type: Per manufacturer.



- F. Controls: Electric controls separated from gate and motor and drive mechanism, with NEMA 250, Type 3R or NEMA 250, Type 4 enclosure for equipment base/pad mounting and with space for additional optional equipment.
- G. Control Devices:
1. Control Station: Keyed, three-position switch, located remotely from gate. Provide two keys per station.
    - a. Function: Open, stop, and close.
  2. Control Station: Momentary contact, three-button operated; located remotely from gate. Key switch to lock out open and close buttons.
    - a. Function: Open, stop, and close.
  3. Card Reader: Functions only when authorized card is presented. Programmable, magnetic multiple -code system; face-lighted unit fully visible at night.
    - a. Reader Type: Touch plate or Proximity.
    - b. Features: Capable of monitoring and auditing gate activity.
  4. Digital Keypad Entry Unit: Multiple- programmable-code capability of not less than 500 possible individual codes, consisting of one- to seven -digit codes.
    - a. Features: Capable of monitoring and auditing gate activity.
    - b. Face-lighted unit with metal-keyed or keyless-membrane keypad fully visible at night.
  5. Radio Control: Digital system consisting of code-compatible universal receiver for each gate, located where indicated, with remote antenna with coaxial cable and mounting brackets designed to operate gates. Provide two programmable transmitter(s) with multiple-code capability, permitting validating or voiding of not less than 1000 codes per channel configured for the following functions:
    - a. Transmitters: Three-button operated, with open and close function.
    - b. Channel Settings: Three independent channel settings controlling separate receivers for operating more than one gate from each transmitter.
  6. Telephone Entry System: Hands-free voice-communication system for connection to building telephone system, with digital-entry code activation of gate operator and auxiliary keypad entry.
    - a. Residential System: Designed to be wired to same line with telephone.
    - b. Multiunit System: Designed to be wired to a dedicated telephone line, with capacity to access 20 telephones and with electronic directory.
  7. Vehicle Loop Detector: System that includes automatic closing timer with adjustable time delay before closing, timer cut-off switch, and loop detector designed to open and close gate and hold gate open until traffic clears. Provide electronic detector with adjustable detection patterns, adjustable sensitivity and frequency settings, and panel indicator light designed to detect presence or transit of a vehicle over an embedded loop of wire and to emit a signal activating the gate operator. Provide number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement at location shown on Drawings, and as recommended in writing by detection system manufacturer for function indicated.
    - a. Loop: Field-assembled wire, in size indicated, for pave-over or saw-cut and epoxy-grouted installation.
  8. Vehicle Presence Detector: System that includes automatic closing timer with adjustable time delay before closing, timer cut-off switch, and presence detector designed to open and close gate and hold gate open until traffic clears.
    - a. Provide retroreflective or emitter/receiver detector with adjustable detection zone pattern and sensitivity, designed to detect the presence or transit of a vehicle in gate

pathway when infrared beam in zone pattern is interrupted, and to emit a signal activating the gate operator.

- H. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately function as follows:
  - 1. Action: Stop gate in opening cycle and reverse gate in closing cycle and hold until clear of obstruction.
  - 2. Internal Sensor: Built-in torque or current monitor senses gate is obstructed.
  - 3. Sensor Edge: Contact-pressure-sensitive safety edge, profile, and sensitivity designed for type of gate and component indicated, in locations as follows. Connect to control circuit using gate edge transmitter and operator receiver system.
    - a. Along entire gate leaf leading edge.
    - b. Across entire gate leaf bottom edge.
    - c. Along entire length of gate posts.
    - d. Along entire length of gate guide posts.
    - e. Where indicated on Drawings.
  - 4. Photoelectric/Infrared Sensor: Designed to detect an obstruction in gate's path when infrared beam in the zone pattern is interrupted.
- I. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully open and fully closed positions.
- J. Emergency Release Mechanism: Quick-disconnect release of operator drive system, permitting manual operation if operator fails. Control circuit power is disconnected during manual operation.
  - 1. Type: Integral fail-safe release, allowing gate to be pushed open without mechanical devices, keys, cranks, or special knowledge.
- K. Operating Features:
  - 1. Digital Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features with capability for monitoring and auditing gate activity. Provide unit that is isolated from voltage spikes and surges.
  - 2. System Integration: With controlling circuit board capable of accepting any type of input from external devices.
  - 3. Master/Slave Capability: Control stations designed and wired for gate pair operation.
  - 4. Automatic Closing Timer: With adjustable time delay before closing and timer cut-off switch.
  - 5. Open Override Circuit: Designed to override closing commands.
  - 6. Reversal Time Delay: Designed to protect gate system from shock load on reversal in both directions.
  - 7. Maximum Run Timer: Designed to prevent damage to gate system by shutting down system if normal time to open gate is exceeded.
  - 8. Clock Timer: 24 hour, programmable for regular events.
- L. Accessories:
  - 1. Warning Module: Audio, -light alarm sounding three to five seconds in advance of gate operation and continuing until gate stops moving.

2. Battery Backup System: Battery-powered drive and access-control system, independent of primary drive system.
  - a. Fail Safe: Gate opens and remains open until power is restored.
  - b. Fail Secure: Gate cycles on battery power, then fail safe when battery is discharged.
3. External electric-powered solenoid or magnetic lock with delay timer allowing time for lock to release before gate operates.
4. Fire box.
5. Fire siren alarm.
6. Intercom System.
7. Instructional, Safety, and Warning Labels and Signs: According to UL 325 and per Manufacturer's standard for components and features specified.
8. Equipment Bases/Pads: Cast-in-place or precast concrete, depth not less than 12 inches, dimensioned and reinforced according to gate-operator component manufacturer's written instructions and as indicated on Drawings.

## 2.11 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating, and that is recommended in writing by manufacturer for exterior applications.

## 2.12 GROUNDING MATERIALS

- A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Connectors and Grounding Rods: Listed and labeled for complying with UL 467.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for a certified survey of property lines and legal boundaries, site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
  1. Do not begin installation before final grading is completed unless otherwise permitted by Design Professional.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

### 3.3 CHAIN-LINK FENCE INSTALLATION

- A. Install chain-link fencing according to ASTM F 567 or more stringent requirements specified.
  - 1. Install fencing on established boundary lines inside property line.
- B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- C. Post Setting: Set posts in concrete with mechanical anchors by mechanically driving into soil at indicated spacing into firm, undisturbed soil.
  - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
  - 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
    - a. Exposed Concrete: Extend 2 inches above grade; shape and smooth to shed water.
    - b. Concealed Concrete: Place top of concrete 2 inches below grade as indicated on Drawings to allow covering with surface material.
    - c. Posts Set into Sleeves in Concrete: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.
    - d. Posts Set into Holes in Concrete: Form or core drill holes not less than 5 inches deep and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.
  - 3. Mechanically Driven Posts: Drive into soil to depth as indicated on drawings. Protect post top to prevent distortion.
- D. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment as indicated on Drawings. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.
- E. Line Posts: Space line posts uniformly at 10 feet or as indicated on drawings.
- F. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail, and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- G. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:
1. Extended along top and bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.
  2. Extended along top of barbed wire arms and top of fence fabric to support barbed tape.
  3. As indicated on Drawings.
- H. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- I. Intermediate and Bottom Rails: Secure to posts with fittings.
- J. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2-inch bottom clearance between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- K. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches o.c.
- L. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.
- M. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.
- N. Privacy Slats: Install slats in direction indicated, securely locked in place.
1. privacy factor of 70 to 75.
  2. Direction and privacy factor as indicated on Drawings.
- O. Barbed Wire: Install barbed wire uniformly spaced as indicated on Drawings. Pull wire taut, install securely to extension arms, and secure to end post or terminal arms.
- P. Barbed Tape: Install according to ASTM F 1911. Install barbed tape uniformly in configurations indicated and fasten securely to prevent movement or displacement.

### 3.4 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

### 3.5 GATE-OPERATOR INSTALLATION

- A. Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.
- B. Excavation: Hand-excavate holes for posts, pedestals, and equipment bases/pads, in firm, undisturbed soil to dimensions and depths and at locations according to gate-operator component manufacturer's written instructions and as indicated.
- C. Vehicle Loop Detector System: Cut grooves in pavement, bury, and seal wire loop according to manufacturer's written instructions. Connect to equipment operated by detector.
- D. Ground electric-powered motors, controls, and other devices according to NFPA 70 and manufacturer's written instructions.

### 3.6 GROUNDING AND BONDING

- A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Fence and Gate Grounding:
  - 1. Ground for fence and fence posts shall be a separate system from ground for gate and gate posts.
- C. Fences Enclosing Electrical Power Distribution Equipment: Ground according to IEEE C2 unless otherwise indicated.
- D. Bonding to Lightning Protection System: Ground fence and bond fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor according to NFPA 780.
- E. Comply with requirements in Section 264113 "Lightning Protection for Structures."

### 3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests.
- B. Grounding Tests: Comply with requirements in Section 264113 "Lightning Protection for Structures."
- C. Provide test reports.

### 3.8 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Automatic Gate Operator: Energize circuits to electrical equipment and devices, start units, and verify proper motor rotation and unit operation.
  - 1. Hydraulic Operator: Purge operating system, adjust pressure and fluid levels, and check for leaks.
  - 2. Test and adjust operators, controls, alarms, and safety devices. Replace damaged and malfunctioning controls and equipment.
  - 3. Lubricate operator and related components.
- C. Lubricate hardware and other moving parts.

### 3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 323113