

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. This Section includes the following:
 - 1. Chain-Link Fences: [**Industrial**] [**Residential**].
 - 2. Gates: [**Motor operated,**] [**horizontal slide**] [**swing**].
- B. Related Sections include the following:
 - 1. Division 03 Section "[**Cast-in-Place Concrete**] [**Miscellaneous Cast-in-Place Concrete**]" for concrete [**equipment bases/pads for gate operators, drives, and controls**] [**post concrete fill**].
 - 2. Division 26 Sections for electrical service and connections for motor operators, controls, limit and disconnect switches, and safety features and for system disconnect switches.
 - 3. Division 31 Section "Earth Moving" for site excavation, fill, and backfill where chain-link fences and gates are located.
- C. Allowances: Furnish the following under the allowances indicated as specified in Division 01 Section "Allowances":
 - 1. **<Insert work to be included under an allowance.>**
- D. Alternates: Refer to Division 01 Section "Alternates" for description of Work in this Section affected by alternates.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide chain-link fences and gates capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Minimum Post Size and Maximum Spacing for Wind Velocity Pressure: Determine based on mesh size and pattern specified, and on the following minimum design wind pressures and according to CLFMI WLG 2445:
 - a. Wind Speed: [**80 mph (129 km/h)**] **<Insert speed>**.
 - b. Fence Height: [**10 feet (3 m)**] **<Insert height>**.
 - c. Line Post Group: [**IA, ASTM F 1043, Schedule 40 steel pipe**] **<Insert group>**.

- d. Wind Exposure Category: **[B]** <Insert category>.
 2. Determine minimum post size, group, and section according to ASTM F 1043 for framework up to **12 feet (3.66 m)** high, and post spacing not to exceed **10 feet (3 m)**.
- B. Lightning Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

1.4 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.
1. Fence and gate posts, rails, and fittings.
 2. Chain-link fabric, reinforcements, and attachments.
 3. Gates and hardware.
 4. Gate operators, including operating instructions.
 5. Accessories: **[Privacy slats]** **[Barbed wire]** **[Barbed tape]** <Insert accessory>.
 6. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.
- B. Shop Drawings: Show locations of fences, gates, posts, rails, tension wires, details of extended posts, extension arms, gate swing, or other operation, hardware, and accessories. Indicate materials, dimensions, sizes, weights, and finishes of components. Include plans, gate elevations, sections, details of post anchorage, attachment, bracing, and other required installation and operational clearances.
1. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
 2. Wiring Diagrams: Power and control wiring and **[communication]** **[access-control]** features.
 3. For installed products indicated to comply with design loads, include structural analysis data **[signed and sealed by the qualified professional engineer responsible for their preparation]**.
- C. Samples for Initial Selection: Manufacturer's color charts or **6-inch (150-mm)** lengths of actual units showing the full range of colors available for components with factory-applied color finishes.
- D. Samples for Verification: For each type of chain-link fence and gate indicated.
1. Polymer-coated steel wire (for fabric) in **6-inch (150-mm)** lengths.
 2. Polymer coating, in **6-inch (150-mm)** lengths on shapes for **[posts, rails, wires,]** **[and]** **[gate framing]** **[and on full-sized units for accessories]**.
- E. Product Certificates: For each type of chain-link fence, **[operator,]** and gate, signed by product manufacturer.
1. Strength test results for framing according to ASTM F 1043.

- F. Qualification Data: For Installer.
- G. Field quality-control test reports.
- H. Maintenance Data: For the following to include in maintenance manuals:
 - 1. Polymer finishes.
 - 2. Gate operator.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
 - 1. Engineering Responsibility: Preparation of data for chain-link fences and gates, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified according to NETA ETT, or the National Institute for Certification in Engineering Technologies, to supervise on-site testing specified in Part 3.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. UL Standard: Provide gate operators that comply with UL 325.
- E. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for automatic gate operators serving as a required means of access.
- F. Mockups: Build mockups to **[verify selections made under sample submittals and to demonstrate aesthetic effects] [and] [set quality standards for fabrication and installation]**.
 - 1. Include **[10 ft. (3 m)]** <Insert measurement> length of fence **[and gate]** complying with requirements.
 - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
 - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 PROJECT 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.
- B. Interruption of Existing Utility Service: Do not interrupt utility services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Architect no fewer than **[two]** **<Insert number>** days in advance of proposed interruption of utility services.
 - 2. Do not proceed with interruption of utility services without Architect's written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Chain-Link Fences and Gates:
 - a. **<Insert, in separate subparagraphs, manufacturer's name.>**
 - 2. Barbed **[Wire]** **[Tape]**:
 - a. **<Insert, in separate subparagraphs, manufacturer's name.>**
 - 3. Gate Operator:
 - a. **<Insert, in separate subparagraphs, manufacturer's name.>**
 - 4. **<Insert generic product name.>**
 - a. **<Insert, in separate subparagraph, manufacturer's name.>**

2.2 CHAIN-LINK FENCE FABRIC

- A. General: **[Height indicated on Drawings]** **<Insert height, limited to 12 feet (3.6 m)>**. Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage

knuckle or twist. Comply with ASTM A 392, CLFMI CLF 2445, and requirements indicated below:

1. Steel Wire Fabric: [Metallic] [Polymer]-coated wire with a diameter of [0.192 inch (4.88 mm)] [0.148 inch (3.76 mm)] [0.120 inches (3.05 mm)].
 - a. Mesh Size: [2-1/8 inches (54 mm)] [2 inches (50 mm)] [1-3/4 inches (44 mm)] [1 inch (25 mm)].
 - b. Weight of Aluminum Coating: ASTM A 491, Type I, [0.4 oz./sq. ft. (122 g/sq. m)] [0.35 oz./sq. ft. (107 g/sq. m)] [0.30 oz./sq. ft. (92 g/sq. m)].
 - c. Weight of Metallic (Zinc) Coating: ASTM A 392, Type II, Class [1, 1.2 oz./sq. ft. (366 g/sq. m)] [2, 2.0 oz./sq. ft. (610 g/sq. m)] with zinc coating applied [before] [after] weaving.
 - d. Weight of Zn-5-Al-MM Aluminum-Mischmetal Alloy Coating: ASTM F 1345, Type III, Class [1, 0.60 oz./sq. ft. (183 g/sq. m)] [2, 1.0 oz./sq. ft. (305 g/sq. m)].
 - e. Polymer Coating: ASTM F 668, Class [1] [2a] [2b] over metallic-coated steel wire.
 - 1) Color: [Dark green] [Olive green] [Brown] [Black] [As selected by Architect from manufacturer's full range], complying with ASTM F 934.
 - f. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.
2. Aluminum Wire Fabric: ASTM F 1183, with [mill] [caustic-cleaned] [etched] finish, and wire diameter of [0.148 inches (3.76 mm)] [0.192 inches (4.88 mm)].
 - a. Mesh Size: [2 inches (50 mm)] [1 inch (25 mm)].
3. Selvage: [Knuckled at both selvages] [Twisted top and knuckled bottom].

2.3 RESIDENTIAL FENCE AND GATE FRAMING

- A. Posts and Rails: [Round] [Square] cold-formed, electric-resistance-welded, steel pipe or tubing, with minimum yield strength of 45,000 psi (310 MPa) and with outside dimension, minimum wall thickness, and weight complying with ASTM F 761 or ASTM F 654 for the following fence height and strength and stiffness requirements:
 1. Fence Height: [4 feet (1.22 m)] [6 feet (1.83 m)] <Insert height>.
 2. Duty Rating: [Light] [Medium] [Heavy].
 3. Tube or Pipe Diameter and Thickness: [According to ASTM F 761.]
 4. Tube Size and Thickness: [According to ASTM F 654.]
 - a. Top Rail: [1.315 inches (33 mm)] [1.66 inches (42 mm)] <Insert square size>.
 - b. Line Post: [1.66 inches (42 mm)] [1.90 inches (48 mm)] <Insert square size>.
 - c. Terminal Post: [1.90 inches (48 mm)] [2.375 inches (60 mm)] <Insert square size>.
 - d. Gate Post: [1.90 inches (48 mm)] [2.375 inches (60 mm)] <Insert square size>.
 - e. Tube or Pipe Thickness: [0.065 inch (1.7 mm)] <Insert thickness>.

5. Gate: Comply with ASTM F 654 and the following:
 - a. Type: [I, single swing] [II, double swing] [Horizontal slide], [aluminum] [steel] frame tubing.
 - b. Fabric Height: [2 inches (50 mm) less than adjacent fence height] <Insert height>.
 - c. Leaf Width: [36 inches (914 mm)] [As indicated] <Insert width>.
6. Hardware: Latches permitting operation from both sides of gate, [hinges] [rolling gate mechanism] [center stops] [hold backs] <Insert other hardware items and accessories>.[Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.]
 - a. <Insert requirements for padlocks and chains if not Owner furnished.>
7. Metallic-Coated Steel: Posts, rails, and frames protected with an external coating of not less than 0.6 oz. of zinc/sq. ft. (183 g of zinc/sq. m), a chromate conversion coating, and a clear, verifiable polymer film; with an internal protective coating of not less than 0.6 oz. of zinc/sq. ft. (183 g of zinc/sq. m) or 81 percent, not less than 0.3-mil- (0.0076-mm-) thick, zinc pigmented coating.

2.4 INDUSTRIAL FENCE FRAMING

- A. Posts and Rails: Comply with ASTM F 1043 for framing, ASTM F 1083 for Group IC round pipe, and the following:
 1. Group: [IA, round steel pipe, Schedule 40] [IB, aluminum pipe, Alloy 6063] [IC, round steel pipe, yield strength 50,000 psi (345 MPa)] [II, roll-formed C section] [III, hot-rolled shapes] [IV, Alternative Design].
 2. Fence Height: [6 feet (1.83 m)] [8 feet (2.44 m)] <Insert height>.
 3. Strength Requirement: [Heavy] [Light] industrial according to ASTM F 1043.
 4. Post Diameter and Thickness: According to [ASTM F 1043] [ASTM F 1083].
 5. Post Size and Thickness: [According to ASTM F 1043.]
 - a. Top Rail: [1.66 inches (42 mm)] [1.25 by 1.63 inches (32 by 41 mm)] <Insert size>.
 - b. Line Post: [2.375 inches (60 mm)] [1.875 by 1.63 inches (48 by 41 mm)] <Insert size>.
 - c. End, Corner and Pull Post: [2.875 inches (73 mm)] [3.5 by 1.5 inches (89 by 38 mm)] <Insert size>.
 - d. Swing Gate Post: [According to ASTM F 900] [2.375-inch (60-mm) diameter, 3.11-lb/ft. (4.63-kg/m) weight] [4-inch (102-mm) diameter, 8.65-lb/ft. (12.88-kg/m) weight] <Insert size>.
 - e. Horizontal-Slide Gate Post: [According to ASTM F 1184.]
 - 1) Openings up to 12 Feet (3.7 m): Steel post, 2.875-inch (73-mm) diameter, and 4.64-lb/ft. (6.91-kg/m) weight.
 - 2) Openings Wider Than 12 Feet (3.7 m): Steel post, 4-inch (102-mm) diameter, and 8.65-lb/ft. (12.88-kg/m) weight.
 - 3) <Insert size and weight.>

- 4) Guide posts for Class 1 horizontal-slide gates equal the gate post height, 1 size smaller, but weight is not less than **3.11 lb/ft. (4.63 kg/m)**; installed adjacent to gate post to permit gate to slide in space between.
6. Coating for Steel Framing:
- a. Metallic Coating:
 - 1) Type A, consisting of not less than minimum **2.0-oz./sq. ft. (0.61-kg/sq. m)** average zinc coating per ASTM A 123/A 123M or **4.0-oz./sq. ft. (1.22-kg/sq. m)** zinc coating per ASTM A 653/A 653M.
 - 2) Type B, zinc with organic overcoat, consisting of a minimum of **0.9 oz./sq. ft. (0.27 kg/sq. m)** of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film.
 - 3) External, Type B, zinc with organic overcoat, consisting of a minimum of **0.9 oz./sq. ft. (0.27 kg/sq. m)** 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- (0.0076-mm-)** thick, zinc pigmented coating.
 - 4) Type C, Zn-5-Al-MM alloy, consisting of not less than **1.8-oz./sq. ft. (0.55-kg/sq. m)** coating.
 - 5) Coatings: Any coating above.
 - b. Polymer coating over metallic coating.
7. Aluminum Finish: Mill finish complying with ASTM B 429.

2.5 TENSION WIRE

- A. General: Provide horizontal tension wire at the following locations:
1. Location: Extended along **[top]** **[and]** **[bottom]** of fence fabric.
 2. Location: Extended along top of **[barbed wire arms]** **[extended posts]** and top of fence fabric for supporting barbed tape.
 3. Location: **[As indicated]** **<Insert requirements>**.
- B. Metallic-Coated Steel Wire: **0.177-inch- (4.5-mm-)** diameter, marcelled tension wire complying with ASTM A 817, ASTM A 824, and the following:
1. Metallic Coating: Type **[I, aluminum coated (aluminized)]** **[II, zinc coated (galvanized)]** by **[hot-dip]** **[electrolytic]** process, with the following minimum coating weight:
 - a. Class 1: Not less than **0.8 oz./sq. ft. (244 g/sq. m)** of uncoated wire surface.
 - b. Class 2: Not less than **1.2 oz./sq. ft. (366 g/sq. m)** of uncoated wire surface.
 - c. Class 3: Not less than **2 oz./sq. ft. (610 g/sq. m)** of uncoated wire surface.
 - d. Matching chain-link fabric coating weight.
 2. Metallic Coating: Type III, Zn-5-Al-MM alloy with the following minimum coating weight:

- a. Class 1: Not less than **0.6 oz./sq. ft. (183 g/sq. m)** of uncoated wire surface.
 - b. Class 2: Not less than **1 oz./sq. ft. (305 g/sq. m)** of uncoated wire surface.
 - c. Matching chain-link fabric coating weight.
- C. Aluminum Wire: **0.192-inch- (4.88-mm-)** diameter tension wire, mill finished, complying with **ASTM B 211 (ASTM B211M)**, Alloy 6061-T94 with **50,000-psi (344-MPa)** minimum tensile strength.

2.6 INDUSTRIAL SWING GATES

- A. General: Comply with ASTM F 900 for [**single**] [**double**] swing gate types.
1. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1043 and ASTM F 1083 for materials and protective coatings.
 2. Metal Pipe and Tubing: Aluminum. Comply with ASTM B 429 and ASTM F 1043 for materials and protective coatings.
- B. Frames and Bracing: Fabricate members from [**round**] [**square**], [**galvanized steel**] [**aluminum**] tubing with outside dimension and weight according to ASTM F 900 and the following:
1. Gate Fabric Height: [**2 inches (50 mm) less than adjacent fence height**] [**As indicated**] **<Insert height>**.
 2. Leaf Width: [**36 inches (914 mm)**] [**As indicated**] **<Insert width>**.
 3. Frame Members:
 - a. Tubular [**Steel**] [**Aluminum**]: [**1.66 inches (42 mm) round**] [**1.90 inches (48 mm) round**] [**2 inches (50 mm) rectangular**] **<Insert size>**.
- C. Frame Corner Construction:
1. [**Welded**] [**or**] [**assembled with corner fittings**] [**and 5/16-inch- (7.9-mm-) diameter, adjustable truss rods for panels 5 feet (1.52 m) wide or wider**].
- D. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame [**12 inches (300 mm)**] [**as indicated**] **<Insert dimension>** as required to attach barbed [**wire**] [**tape**] assemblies.
- E. Hardware: Latches permitting operation from both sides of gate, hinges, [**center gate stops**] and keepers for each gate leaf more than **5 feet (1.52 m)** wide. **<Insert hardware items and accessories.>**[**Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.**]
1. **<Insert requirements for padlocks and chains if not Owner furnished.>**

2.7 INDUSTRIAL HORIZONTAL-SLIDE GATES

- A. General: Comply with ASTM F 1184 for [**single**] [**double**] slide gate types.
1. Classification: Type I Overhead Slide.

2. Classification: Type II Cantilever Slide, Class [**1 with external**] [**2 with internal**] roller assemblies.
 3. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1184 for materials and protective coatings.
 4. Metal Pipe and Tubing: Aluminum. Comply with ASTM F 699 for materials and protective coatings.
- B. Frames and Bracing: Fabricate members from [**round**] [**square**], [**galvanized steel**] [**aluminum**] tubing with outside dimension and weight according to ASTM F 1184 and the following:
1. Gate Fabric Height: [**6 feet (1.83 m)**] [**As indicated**] <Insert height>.
 2. Gate Opening Width: [**4 feet (1.22 m)**] [**As indicated**] <Insert width>.
 3. Frame Members:
 - a. Tubular [**Steel**] [**Aluminum**]: [**1.66 inches (42 mm) round**] [**1.90 inches (48 mm) round**] [**2 inches (50 mm) rectangular**] <Insert size>.
 4. Bracing Members:
 - a. Tubular [**Steel**] [**Aluminum**]: [**1.66 inches (42 mm) round**] [**1.90 inches (48 mm) round**] [**2 inches (50 mm) rectangular**] <Insert size>.
- C. Frame Corner Construction:
1. Welded frame [**with panels assembled with bolted or riveted corner fittings**] [**and 5/16-inch- (7.9-mm-) diameter, adjustable truss rods for panels 5 feet (1.52 m) wide or wider**].
 2. Type I Overhead Slide Gates: Assembled with corner fittings[**including 5/16-inch- (7.9-mm-) diameter, adjustable truss rods for panels 5 feet (1.52 m) wide or wider**].
 3. Type I Overhead Slide Gates: Welded or assembled with corner fittings[**including 5/16-inch- (7.9-mm-) diameter, adjustable truss rods for panels 5 feet (1.52 m) wide or wider**].
- D. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame [**12 inches (300 mm)**] [**as indicated**] <Insert dimension> as required to attach barbed [**wire**] [**tape**] assemblies.
- E. Overhead Track Assembly: Manufacturer's standard track, with overhead framing supports, bracing, and accessories, engineered to support size, weight, width, operation, and design of gate and roller assemblies.
- F. Roller Guards: As required per ASTM F 1184 for Type II, Class 1 gates.
- G. Hardware: Latches permitting operation from both sides of gate, [**locking devices**] [**hangers**] [**roller assemblies**] <Insert hardware items and accessories> and stops fabricated from [**galvanized steel**] [**galvanized malleable iron**] [**mill-finished Grade 319 aluminum-alloy casting with stainless-steel fasteners**]. [**Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.**]
1. <Insert requirements for padlocks and chains if not Owner furnished.>

2.8 FITTINGS

- A. General: Comply with ASTM F 626.
- B. Post and Line Caps: Provide for each post.
 - 1. Line post caps with loop to receive tension wire or top rail.
- C. Rail and Brace Ends: Attach rails securely to each gate, corner, pull, and end post.
- D. Rail Fittings: Provide the following:
 - 1. Top Rail Sleeves: [**Pressed-steel or round-steel tubing**] [**Aluminum Alloy 6063**] not less than **6 inches (152 mm)** long.
 - 2. Rail Clamps: Line and corner boulevard clamps for connecting [**intermediate**] [**and**] [**bottom**] rails in the fence line-to-line posts.
- E. Tension and Brace Bands: [**Pressed steel**] [**Aluminum Alloy 6063**].
- F. Tension Bars: [**Steel**] [**Aluminum**] [**Fiberglass**], length not less than **2 inches (50 mm)** 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: [**Steel, hot-dip galvanized after threading**] [**Mill-finished aluminum**] rod and turnbuckle or other means of adjustment.
- H. Barbed Wire Arms: [**Pressed steel or cast iron**] [**Aluminum Alloy 360**], 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. Line posts with arms that accommodate top rail or tension wire.
 - 2. Corner arms at fence corner posts, unless extended posts are indicated.
 - 3. Type I, single slanted arm.
 - 4. Type II, single vertical arm.
 - 5. Type III, V-shaped arm.
 - 6. Type IV, A-shaped 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, complying with the following:
 - a. Hot-Dip Galvanized Steel: [**0.106-inch- (2.69-mm-)**] [**0.148-inch- (3.76-mm-)**] diameter wire[; **galvanized coating thickness matching coating thickness of chain-link fence fabric**].
 - b. Aluminum: **ASTM B 211 (ASTM B 211M)**; Alloy 1350-H19; [**0.148-inch- (3.76-mm-)**] [**0.192-inch- (4.88-mm-)**] diameter, mill-finished wire.
- J. Finish:
 - 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than **1.2 oz. /sq. ft. (366 g /sq. m)** zinc.

2. Aluminum: Mill finish.

2.9 PRIVACY SLATS

- A. Material: PVC, UV-light stabilized, [**flame resistant, 4 ply,**] not less than [**0.006 inch (0.15 mm)**] [**0.023 inch (0.58 mm)**] thick; [**attached to not less than 0.0475-inch- (1.21-mm-) diameter, twisted galvanized wire; hedge-type lattice;**] sized to fit mesh specified for direction indicated.
- B. Material: Polyethylene tubular slats, not less than **0.023 inch (0.58 mm)** thick, manufactured for chain-link fences from virgin polyethylene containing UV inhibitor, sized to fit mesh specified for direction indicated; with [**vandal-resistant fasteners and lock strips**] [**fins for increased privacy factor**].
- C. Material: Fiber-glass-reinforced plastic, UV-light stabilized, not less than **0.06 inch (1.5 mm)** thick, sized to fit mesh specified for direction indicated; [**with vandal-resistant fasteners and lock strips**].
- D. Material: Aluminum, not less than **0.01 inch (0.25 mm)** thick, sized to fit mesh specified for direction indicated.
- E. Material: Redwood, **5/16 inch (7.9 mm)** thick, sized to fit mesh specified for direction indicated.
- F. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**] [**As indicated on Drawings**] <Insert color>.

2.10 BARBED WIRE

- A. Zinc-Coated Steel Barbed Wire: Comply with ASTM A 121, [**Standard**] [**Chain-Link Fence**] grade for the following two-strand barbed wire:
 1. Standard Size and Construction: **0.099-inch- (2.51-mm-)** diameter line wire with **0.080-inch- (2.03-mm-)** diameter, 2-point round barbs spaced not more than [**4 inches (102 mm)**] [**5 inches (127 mm)**] o.c. <Insert line wire diameter, barbed wire diameter, and other characteristics.>
- B. Aluminum-Coated Steel Barbed Wire: 2-strand, **0.099-inch- (2.51-mm-)** diameter line wire with **0.080-inch- (2.03-mm-)** diameter, 4-point barbs spaced not more than **5 inches (127 mm)** o.c.
- C. Aluminum Barbed Wire: Mill finished, **ASTM B 211 (ASTM B 211M)**. 2-strand, **0.099-inch- (2.51-mm-)** diameter line wire with **0.080-inch- (2.03-mm-)** diameter, 4-point barbs spaced not more than **5 inches (127 mm)** o.c., for the following alloys:
 1. Line Wire: [**Alloy 5056-H32**] [**Manufacturer's standard alloy**] <Insert alloy>.
 2. Barb Wire: Alloy 5000-H38 or Alloy 6061-T94.

2.11 BARBED TAPE

- A. Unreinforced Tape: 301 Series stainless steel hardened to Rockwell (30N) [45 to 50] [50 to 55], 0.025 inch (0.64 mm) thick by 1.2 inch (30.7 mm) wide before fabrication; with 4-point, needle-sharp barbs.
- B. Wire-Reinforced Tape: 430 Series stainless steel hardened to Rockwell (30N) [35 to 40] [40 to 45], 0.025 inch (0.64 mm) thick by 1 inch (25 mm) wide before fabrication; with 4-point, needle-sharp barbs permanently cold clenched to a minimum of 230 deg F (110 deg C) around a core wire.
1. Core wire: 0.098-inch- (2.5-mm-) diameter, high-tensile-strength, [zinc-coated steel complying with ASTM A 764] [stainless steel complying with ASTM A 313/A 313M] [zinc-coated steel complying with ASTM A 764 or stainless steel complying with ASTM A 313/A 313M].
- C. Clips: Stainless steel, 0.065 inch (1.7 mm) thick by 0.375 inch (9.5 mm) wide, capable of withstanding a minimum 150-lbf (667-N) pull load to limit extension of coil, resulting in a concertina pattern when deployed.
- D. Tie Wires: Stainless steel, 0.065 inch (1.7 mm) diameter.
- E. Fabrication: Continuous coils of barbed tape as defined in ASTM F 1379 for the following characteristics:
1. Configuration: [Single] [Double] coil.
 2. Style: [Helical] [Concertina] pattern.
 3. Coil Diameter(s): [18 inches (457 mm)] [24 inches (610 mm)] [24-inch (610-mm) inner coil and 30-inch (762-mm) outer coil] [As indicated on Drawings] <Insert dimensions>.
 4. Coil Loop Spacing(s): [12 inches (300 mm)] [Manufacturer's standard] [As indicated on Drawings] <Insert dimensions>.
 5. Barb Length Classification: [Long, 1.2-inch (30.5-mm)] [Medium, 0.4-inch (10.2-mm)] [Short, 0.1875-inch (4.76-mm)] barb.
 6. Barb Spacing: [4 inches (102 mm)] <Insert dimension> o.c.
 7. Barb Set: [Straight] [Offset] [Manufacturer's standard].

2.12 GATE OPERATORS

- A. General: Provide factory-assembled automatic operating system designed for gate size, type, weight, and operation frequency. Provide operation control system with characteristics suitable for Project conditions, with remote-control stations, safety devices, and weatherproof enclosures; coordinate electrical requirements with building electrical system.
1. Provide operator designed so motor may be removed without disturbing limit-switch adjustment and without affecting auxiliary emergency operator.
 2. Provide operator with UL [approval] [-approved components].
 3. Provide electronic components with built-in troubleshooting diagnostic feature.
 4. Provide unit designed and wired for both right-hand/left-hand opening, permitting universal installation.

- B. Comply with NFPA 70.
- C. Motor Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, within installed environment, with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG-1 and the following:
1. Voltage: [12 V dc] [120 V] [208-220 V] [NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.] <Insert voltage>.
 2. Horsepower: [1/4] [1/3] [3/4] <Insert horsepower>.
 3. Enclosure: [Open dripproof] [Totally enclosed] [Manufacturer's standard].
 4. Duty: Continuous duty at ambient temperature of 105 deg F (40 deg C) and at altitude of 3300 feet (1005 m) above sea level.
 5. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
 6. Phase: [One] [Polyphase].
- D. Gate Operators: [Gate] [Concrete base/pad] [Pedestal post] [In ground] mounted and as follows:
1. Hydraulic [Swing] [Slide] Gate Operators:
 - a. Duty: [Light] [Medium] [Heavy] duty, [residential] [commercial/industrial].
 - b. Gate Speed: Minimum [45 feet (13.7 m)] [60 feet (18.2 m)] per minute.
 - c. Maximum Gate Weight: [300 lb (137 kg)] <Insert weight>.
 - d. Frequency of Use: [10 cycles per hour] [25 cycles per hour] [Continuous duty] <Insert cycles>.
 - e. Locking: Hydraulic in both directions.
 - f. Heater: Manufacturer's standard track and roller heater with thermostatic control.
 - g. <Insert feature.>
 - h. Operating Type: [Crank arm] [Wheel and rail drive] [Roller chain] [with manual release].
 - i. <Insert feature.>
 2. Mechanical [Swing] [Slide] Gate Operators:
 - a. Duty: [Light] [Medium] [Heavy] duty, [residential] [commercial/industrial].
 - b. Gate Speed: Minimum [45 feet (13.7 m) per minute] [60 feet (18.2 m) per minute] [variable speed] <Insert speed>.
 - c. Maximum Gate Weight: [600 lb (272 kg)] [800 lb (363 kg)] <Insert weight>.
 - d. Frequency of Use: [10 cycles per hour] [25 cycles per hour] [60 cycles per hour] [Continuous duty] <Insert cycles>.
 - e. Operating Type: [Crank arm] [Wheel and rail drive] [Roller chain], [with manual release].
 - f. Drive Type: Enclosed worm gear[and chain-and-sprocket] reducers, roller-chain drive.
 - g. Drive Type: V-belt and [worm gear] [chain-and-sprocket] reducers, roller-chain drive.
 - h. <Insert feature.>
- E. Remote Controls: Electric controls separated from gate and motor and drive mechanism, with [NEMA ICS 6, Type 1] [NEMA ICS 6, Type 4] <Insert type of enclosure> enclosure for [surface] [recessed or flush] [concrete base/pad] [pedestal] <Insert mounting> mounting,

and with space for additional optional equipment. Provide the following remote-control device(s):

1. Control Station: Keyed, [**two**] [**three**]-position switch, located remotely from gate. Provide two keys per station.
2. Control Station: Momentary-contact, [**single**] [**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**] [**single**]-code system[, **permitting four different access time periods**] [**;** **face-lighted unit fully visible at night**].
 - a. Reader Type: [**Touch plate**] [**Swipe**] [**Insertion**] [**Proximity**].
 - b. Features: [**Timed anti-passback**] [**Limited-time usage**] [**Capable of monitoring and auditing gate activity**].
4. Digital Keypad Entry Unit: Multiple-[**programmable,**] code capability of not less than [**5**] [**500**] [**2500**] <Insert number> possible individual codes, consisting of [**1- to 7**] [**4**] [**5**]-digit codes[, **and permitting 4 different access time periods**].
 - a. Features: [**Timed anti-passback**] [**Limited-time usage**] [**Capable of monitoring and auditing gate activity**].
 - b. Face-lighted unit with [**metal-keyed**] [**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 [**1**] [**2**] <Insert number> of programmable transmitter(s) with multiple-code capability permitting validating or voiding of not less than [**1000**] [**10,000**] <Insert number> codes per channel configured for the following functions:
 - a. Transmitters: [**Single**] [**Three**]-button operated, with open [**and close**] function.
 - b. Channel Settings: [**Two**] [**Three**] [**Four**] <Insert number> 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**] [**100**] <Insert number> telephones[, **and with electronic directory**].
7. Vehicle Loop Detector: System including automatic closing timer with adjustable time delay before closing[, **timer cut-off switch,**] and loop detector designed to [**open and close gate**] [**hold gate open until traffic clears**] [**reverse gate**] <Insert functions>.

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, as recommended in writing by detection system manufacturer for function indicated.

- a. Loop: Wire, in size indicated for field assembly, for [**pave-over**] [**saw-cut with epoxy-grouted**] installation.
 - b. Loop: Factory preformed in size indicated; style for [**pave-over**] [**saw-cut with epoxy-grouted**] installation.
8. Vehicle Presence Detector: System including automatic closing timer with adjustable time delay before closing[, **timer cut-off switch**,] and presence detector designed to [**open and close gate**] [**hold gate open until traffic clears**] [**reverse gate**] <**Insert functions**>. Provide [**retroreflective**] [**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.
- F. 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: Reverse gate in both opening and closing cycles and hold until clear of obstruction.
 2. Action: Stop gate in opening cycle and reverse gate in closing cycle and hold until clear of obstruction.
 3. Internal Sensor: Built-in torque or current monitor senses gate is obstructed.
 4. 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 [**take-up cable reel**] [**self-coiling cable**] [**gate edge transmitter and operator receiver system**].
 - a. Along entire gate leaf leading edge.
 - b. Along entire gate leaf trailing edge.
 - c. Across entire gate leaf bottom edge.
 - d. Along entire length of gate posts.
 - e. Along entire length of gate guide posts.
 - f. Where indicated on Drawings.
 - g. <**Insert extent and location.**>
 5. Photoelectric/Infrared Sensor System: Designed to detect an obstruction in gate's path when infrared beam in the zone pattern is interrupted.
- G. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully retracted and fully extended positions.
- H. Emergency Release Mechanism: Quick-disconnect release of operator drive system of the following type of mechanism, permitting manual operation if operator fails. Design system so 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.
2. Type: Mechanical device, key, or crank-activated release.

I. 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] [Seven-day] <Insert time period> programmable for regular events.

J. Accessories:

1. Warning Module: [Audio] [Visual], ADA-compliant, [constant] [strobe]-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] [magnetic] lock with delay timer allowing time for lock to release before gate operates.
4. [Fire] [Postal] box.
5. Fire [strobe] [siren] alarm.
6. Intercom System: <Insert requirements.>
7. Instructional, Safety, and Warning Labels and Signs: [According to UL 325] [Manufacturer's standard for components and features specified] [As indicated on Drawings] <Insert requirements>.

2.13 CAST-IN-PLACE CONCRETE

- A. Materials: Portland cement complying with ASTM C 150, Type I aggregates complying with ASTM C 33, and potable water[**for ready-mixed concrete complying with ASTM C 94/C 94M**].[**Measure, batch, and mix Project-site-mixed concrete according to ASTM C 94/C 94M.**]

1. Concrete Mixes: Normal-weight concrete[**air entrained**] with not less than **3000-psi (20.7- MPa)** compressive strength (28 days), **3-inch (75-mm)** slump, and **1-inch (25-mm)** maximum size aggregate.
- B. Materials: Dry-packaged concrete mix complying with ASTM C 387 for normal-weight concrete mixed with potable water according to manufacturer's written instructions.

2.14 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.
- B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable 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.

2.15 FENCE GROUNDING

- A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
 1. Material above Finished Grade: [**Copper**] [**Aluminum**].
 2. Material on or below Finished Grade: Copper.
 3. Bonding Jumpers: Braided copper tape, **1 inch (25 mm)** wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.
- B. Connectors and Grounding Rods: Comply with UL 467.
 1. Connectors for Below-Grade Use: Exothermic welded type.
 2. Grounding Rods: Copper-clad steel.
 - a. Size: **5/8 by 96 inches (16 by 2440 mm)**.

2.16 POLYMER FINISHES

- A. Supplemental Color Coating: [**In addition to specified metallic coatings for steel,**] provide fence components with polymer coating.
- B. Metallic-Coated Steel Tension Wire: PVC-coated wire complying with ASTM F 1664, Class [**1**] [**2a**] [**2b**].
- C. [**Metallic-Coated Steel**] [**Aluminum**] Barbed Wire: PVC-coated wire complying with ASTM F 1665, Class [**1**] [**2a**] [**2b**].

- D. **[Metallic-Coated Steel] [Aluminum]** Framing and Fittings: Comply with ASTM F 626 and ASTM F 1043 for polymer coating applied to exterior surfaces and, except inside cap shapes, to exposed interior surfaces.
1. Polymer Coating: Not less than **[10-mil- (0.254-mm-) thick PVC] [or] [3-mil- (0.076-mm-) thick polyester]** finish.
- E. Color: **[Match chain-link fabric] [Dark green] [Olive green] [Brown] [Black] [As selected by Architect from manufacturer's full range]**, complying with ASTM F 934.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for **[a verified survey of property lines and legal boundaries,]** site clearing, earthwork, pavement work, and other conditions affecting performance.
1. Do not begin installation before final grading is completed, unless otherwise permitted by Architect.
 2. 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 (152.5 m)** or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

- A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements specified.
1. Install fencing on established boundary lines inside property line.

3.4 CHAIN-LINK FENCE INSTALLATION

- A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- B. 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 (50 mm)** above grade; shape and smooth to shed water.
 - b. Concealed Concrete: Top [**2 inches (50 mm)**] <Insert dimension> below grade [as indicated on Drawings] to allow covering with surface material.
 - c. Posts Set into Concrete in Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with [**nonshrink, nonmetallic grout**] [**anchoring cement**], mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.
 - d. Posts Set into Voids in Concrete: Form or core drill holes not less than **5 inches (125 mm)** deep and **3/4 inch (20 mm)** larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with [**nonshrink, nonmetallic grout**] [**anchoring cement**], mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.
3. Mechanically Driven Posts: Drive into soil to depth of [**30 inches (762 mm)**] [**36 inches (914 mm)**] <Insert depth>. Protect post top to prevent distortion.
- C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of [**15 degrees or more**] [**30 degrees or more**] [as indicated on Drawings] <Insert requirement>.
- D. Line Posts: Space line posts uniformly at [**8 feet (2.44 m)**] [**10 feet (3 m)**] <Insert dimension> o.c.
- E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Install braces at end and gate posts and at both sides of corner and pull posts.
1. Locate horizontal braces at midheight of fabric **6 feet (1.83 m)** or higher, on fences with top rail and at 2/3 fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- F. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with **0.120-inch- (3.05-mm-)** diameter hog rings of same material and finish as fabric wire, spaced a maximum of **24 inches (610 mm)** o.c. Install tension wire in locations indicated before stretching fabric.
1. Top Tension Wire: Install tension wire through post cap loops.
 2. Bottom Tension Wire: Install tension wire within **6 inches (150 mm)** of bottom of fabric and tie to each post with not less than same diameter and type of wire.
- G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. 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.
- H. Bottom Rails: Install, spanning between posts.

- I. Chain-Link Fabric: Apply fabric to **[outside]** **[inside]** of enclosing framework. Leave **[1 inch (25.4 mm)] [2 inches (50 mm)]** 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.
- J. 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 (380 mm)** o.c.
- K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at 1 end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per 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 (300 mm)** o.c. and to braces at **24 inches (610 mm)** o.c.
- L. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side.**[Peen ends of bolts or score threads to prevent removal of nuts.]**
- M. Privacy Slats: Install slats in direction indicated, securely locked in place.
 - 1. **[Vertically]** **[Horizontally]**, **[for privacy factor of 70 to 75]** **<Insert privacy factor range>**.
 - 2. Diagonally, **[for privacy factor of 80 to 85]** **<Insert privacy factor range>**.
 - 3. Direction **[and privacy factor]** as indicated.
- N. Barbed Wire: Install barbed wire uniformly spaced **[, angled toward security side of fence]** **[as indicated on Drawings]**. Pull wire taut and install securely to extension arms and secure to end post or terminal arms.
- O. Barbed Tape: Install barbed tape uniformly in configurations indicated and fasten securely to prevent movement or displacement.
- P. Tennis Court Fencing: Construct tennis court fence according to ASTM F 969.

3.5 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 and lubricate where necessary.

3.6 GATE OPERATOR INSTALLATION

- A. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.
- B. Excavation for **[Support Posts]** **[Pedestals]** **[Concrete Bases/Pads]**: Hand-excavate holes for bases/pads, in firm, undisturbed soil to dimensions and depths and at locations as required by gate-operator component manufacturer's written instructions and as indicated.

- C. Concrete Bases/Pads: Cast-in-place or precast concrete, [**depth not less than 12 inches (300 mm)**] <Insert **depth 6 to 12 inches (150 to 300 mm)** below frost line or detail on **Drawings**>, dimensioned and reinforced according to gate-operator component manufacturer's written instructions and as indicated on Drawings.
- D. Vehicle Loop Detector System: [**Cut grooves in pavement and**] bury and seal wire loop according to manufacturer's written instructions. Connect to equipment operated by detector.
- E. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.

3.7 GROUNDING AND BONDING

- A. Fence Grounding: Install at maximum intervals of [**1500 feet (450 m)**] <Insert a lesser **distance if grounding resistance is high**> except as follows:
 - 1. Fences within **100 Feet (30 m)** of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of [**750 feet (225 m)**] <Insert a lesser **distance if grounding resistance is high**>.
 - a. Gates and Other Fence Openings: Ground fence on each side of opening.
 - 1) Bond metal gates to gate posts.
 - 2) Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least **18 inches (460 mm)** below finished grade.
 - B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of **150 feet (45 m)** on each side of crossing.
 - C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2, unless otherwise indicated.
 - D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is **6 inches (150 mm)** below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location, including the following:
 - 1. Each Barbed Wire Strand. Make grounding connections to barbed wire with wire-to-wire connectors designed for this purpose.
 - 2. Each Barbed Tape Coil: Make grounding connections to barbed tape with connectors designed for this purpose.
 - E. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.
 - F. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.

2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

G. Bonding to Lightning Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor complying with NFPA 780.

3.8 FIELD QUALITY CONTROL

A. Grounding-Resistance Testing: [**Owner will engage**] [**Engage**] a qualified independent testing and inspecting agency to perform field quality-control testing.

1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
3. Report: Prepare test reports certified by a testing agency of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.

3.9 ADJUSTING

A. Gate: Adjust gate 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. Adjust operators, controls, safety devices,[**alarms,**] and limit switches.

1. Hydraulic Operator: Purge operating system, adjust pressure and fluid levels, and check for leaks.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls[**, alarms,**] and safeties. Replace damaged and malfunctioning controls and equipment.

C. Lubricate hardware[**, gate operator,**] and other moving parts.

3.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain gates. Refer to Division 01 Section "[**Closeout Procedures**] [**Demonstration and Training**]."

END OF SECTION 323113