SECTION 32 31 19

DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Decorative metallic coated steel tubular picket fences.
   2. Decorative steel fences.
   3. Decorative aluminum fences.
   4. Swing gates.
   5. Horizontal slide gates.
   6. Gate operators, including controls.

B. Related Work for Coordination:
   1. Refer to Section 11 12 00 Parking Control Equipment for control of automatic barrier gates, vehicle detection and access control units associated with Automatic Barrier Gates and other components controlled through Vehicle Detectors. Coordinate the Work of this Section with that of Section 11 12 00 Parking Control Equipment to allow site access control points and systems integrated with all Owner security systems to operate all vehicle gates, barrier gates and active vehicle barriers simultaneously to permit site access and egress.
   2. [Refer to Section 34 71 13 Active Vehicle Barriers for all wedge plate barrier systems. Coordinate the Work of this Section with that of Section 34 71 13 Active Vehicle Barriers to allow site access control points and systems integrated with all Owner security systems to operate all vehicle gates, barrier gates and active vehicle barriers simultaneously to permit site access and egress.]
   3. Functional Narrative: Refer to Part 2 of this Section; coordinate all functionality to coincide with the Owner’s Security Requirements.

1.2 ACTION SUBMITTALS

A. Product Data: Technical data including construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Submit plans, elevations, sections, gate locations, post spacing, and mounting attachment details, and grounding details.
   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: Include diagrams for power, signal, and control wiring.

C. Samples: Provide sample 12 inches (300 mm) in length for linear materials.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality control reports.

B. Product Test Reports: Submit reports for decorative metallic coated steel tubular picket fences, including finish, indicating compliance with referenced standard and specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: Submit data for gate operators to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer having minimum 5 years documented experience who is the fabricator of decorative metal fences and gates.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
   1. Include 10 foot (3 m) length of fence complying with requirements.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Preinstallation Conference: Conduct conference at site.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Wind Loading:
   1. Fence Height: 0 to 15 feet**.**
   2. Wind Exposure Category: As indicated on the Drawings**.**
   3. Design Wind Speed: As indicated on the Drawings**.**
   4. Design Wind Pressure: as indicated on the Drawings.

B. Lightning Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

2.2 DECORATIVE METALLIC COATED STEEL TUBULAR PICKET FENCES **(DMF-1)**

A. Decorative Metallic Coated Steel Tubular Picket Fences: Comply with ASTM F 2408 for industrial application (class) unless otherwise indicated.
   1. Basis of Design: Provide Montage II, Invincible Picket Style by Ameristar Fence Products. Subject to compliance with requirements, and determination of aesthetic

equivalence by the Architect products by one of the following may also be acceptable:

a. BetaFence USA LLC.
b. Builders Fence Company, Inc.
c. Fortress Iron.
d. Iron Eagle Industries, Inc.Iron World Manufacturing, LLC.
e. Xcel Fence.

B. Fence Description:

1. Material: Galvanized steel.
2. Height: As indicated on the Drawings.

C. Posts:

1. End and Corner Posts: Square tubes 3 inches by 3 inches (76 mm by 76 mm) formed from 0.108 inch (2.74 mm) nominal thickness, metallic coated steel sheet or formed from 0.105 inch (2.66 mm) nominal thickness steel sheet and hot dip galvanized after fabrication.
2. Posts at Swing Gate Openings: Square tubes 3 inches by 3 inches (76 mm by 76 mm) formed from 0.108 inch (2.74 mm) nominal thickness, metallic coated steel sheet or formed from 0.105 inch (2.66 mm) nominal thickness steel sheet and hot dip galvanized after fabrication.
3. Posts at Horizontal Slide Gate Openings: Square steel tubing 6 inches by 6 inches with 3/16 inch (4.76 mm) wall thickness, hot dip galvanized.
4. Guide Posts for Class III & IV Horizontal Slide Gates: Square steel tubing 6 inches by 6 inches with 3/16 inch (4.76 mm) wall thickness, hot dip galvanized; installed adjacent to gate post to permit gate to slide in space between.

D. Post Caps: Formed from steel sheet and hot dip galvanized after forming.

E. Rails: Double wall channels.

1. Size: 1-3/4 inches by 1-3/4 inches.
2. Metal and Thickness: 0.108 inches thickness minimum, metallic coated steel sheet or 0,105 inches thickness, uncoated steel sheet, hot dip galvanized after fabrication.

F. Pickets: Square tubes.

1. Extend pickets beyond top rail as indicated and press flat and trim to produce spear point shape; Provide Invincible pickets curved outward for an anti-climb application.
2. Picket Spacing: 4 inches (101.6 mm) clear, maximum.

G. Fasteners: Concealed fastening system.

H. Fasteners: Tamperproof, Corrosion resistant, color coated fasteners matching fence components with resilient polymer washers.

I. Metallic Coated Steel Sheet: Galvanized steel sheet.

J. Interior surface of tubes formed from uncoated steel sheet shall be hot dip zinc coated same as exterior or coated with zinc rich thermosetting coating to comply with ASTM F 2408.

K. Galvanizing: For components indicated to be galvanized and for which galvanized coating is not specified in ASTM F 2408, hot dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot dip galvanize to comply with ASTM A 153/A 153M.

L. Finish: Powder coating.

2.3 DECORATIVE STEEL FENCES **(DMF-2)**

A. Decorative Steel Fences: Fences made from steel tubing bars and shapes, hot dip galvanized and Factory Finished.

1. Basis of Design: Provide Aegis II, Invincible Picket Style by Ameristar Fence Products. Subject to compliance with requirements, and determination of aesthetic equivalence by the Architect products by one of the following may also be acceptable:
   a. A&T Iron Works, Inc.
   b. Ameristar Fence Products; an ASSA ABLOY company.
   c. Ametco Manufacturing Corporation.
   d. BarnettBates Corporation.
   e. Builders Fence Company, Inc.

B. Posts: Square steel tubing.

1. End, Line and Corner Posts: 3 inches by 3 inches (76 mm by 76 mm) with 1/8 inch (3.2 mm) wall thickness.
2. Swing Gate Posts: 3 inches by 3 inches (76 mm by 76 mm) with 3/16 inch (4.76 mm) wall thickness minimum. Posts shall be increased in size to meet all manufacturer recommendations for each specific configuration.
3. Horizontal Slide Gate Post: : 6 inches by 6 inches with 3/16 inch (4.76 mm) wall thickness.
4. Guide Posts for Class III & IV Horizontal Slide Gates: 6 inches by 6 inches with 3/16 inch (4.76 mm) wall thickness; installed adjacent to gate post to permit gate to slide in space between.

C. Post Caps: Formed from steel sheet and hot dip galvanized after forming.

D. Rails:

1. Steel Channel Rails: Steel channels double wall 2 inches by 2 inches nominal 0.80 inches thick each wall.
2. Provide 3 rail design unless otherwise indicated.

E. Pickets: 1 inch (25 mm) square by 0.083 inch (2.11 mm) steel tubes.

1. Extend pickets beyond top rail as indicated and press flat and trim to produce spear point shape for Invincible Style curved outward for anti-climb.

2. Picket Spacing: 4 inches (101.6 mm) clear, maximum.

F. Fasteners: Stainless steel tamperproof .

G. Fabrication: Assemble fences into sections by welding pickets to rails.

1. Steel material for fence framework shall be galvanized prior to forming in accordance with the requirements of ASTM A653/A653M, with minimum yield strength of 45,000 psi. Steel shall be hot-dip galvanized to meet the requirements of ASTM A653/A653M with a minimum zinc coating weight of 0.90 oz/ft2 , Coating Designation G-90 prior to finishing.
2. Fabricate sections with clips welded to rails for field fastening to posts.
3. Drill posts and clips for fasteners before finishing to maximum extent possible.

H. Finish exposed welds to comply with NOMMA Guideline 1, Finish #4 - good quality, uniform undressed weld with minimal splatter.

I. Galvanizing: For items other than hardware indicated to receive galvanizing, hot dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot dip galvanize to comply with ASTM A 153/A 153M.

1. Hot dip galvanize post, rail and picket assemblies after fabrication.

J. Finish: Factory applied polyester powder coat finish with a minimum thickness of 2 mils. Color as selected by Architect.

2.4 DECORATIVE STEEL FENCES **(DMF-3)**

A. Decorative Steel Fences: Fences made from steel tubing bars and shapes, hot dip galvanized and Factory Finished.

1. Basis of Design: Provide Impasse II, Gauntlet Picket Style by Ameristar Fence Products. Subject to compliance with requirements, and determination of aesthetic equivalence by the Architect products by one of the following may also be acceptable:
   a. A&T Iron Works, Inc.
   b. Ameristar Fence Products; an ASSA ABLOY company.
   c. Ametco Manufacturing Corporation.
   d. BarnettBates Corporation.
   e. Builders Fence Company, Inc.

B. Posts: I-Beram Posts and Square steel tubing.

1. End, Line and Corner Posts: 3 inches by 2.75 inches I-Beam Shape with 12 gauge minimum wall thickness.
2. Swing Gate Posts: 3 inches by 3 inches with 12 gauge minimum wall thickness.Posts shall be increased in size to meet all manufacturer recommendations for each specific configuration.
3. Horizontal Slide Gate Post: 6 inches by 6 inches with 0.25 inch wall thickness.

4. Guide Posts for Class III & IV Horizontal Slide Gates: 6 inches by 6 inches with 0.25 inch wall thickness; installed adjacent to gate post to permit gate to slide in space between.

C. Post Caps: Formed from steel sheet and hot dip galvanized after forming.

D. Rails:
1. Steel Channel Rails: Steel channels double wall 2 inches by 2 inches nominal 0.80 inches thick each wall.
2. Provide 3 rail design unless otherwise indicated.

E. Pickets: 1 inch (25 mm) square by 0.083 inch (2.11 mm) steel tubes.
1. Extend pickets beyond top rail as indicated and press flat and trim to produce spear point shape for Invincible Style curved outward for anti-climb.
2. Picket Spacing: 4 inches (101.6 mm) clear, maximum.

F. Fasteners: Stainless steel tamperproof .

G. Fabrication: Assemble fences into sections by welding pickets to rails.
1. Steel material for fence framework shall be galvanized prior to forming in accordance with the requirements of ASTM A653/A653M, with minimum yield strength of 45,000 psi. Steel shall be hot-dip galvanized to meet the requirements of ASTM A653/A653M with a minimum zinc coating weight of 0.90 oz/ft2 , Coating Designation G-90 prior to finishing.
2. Fabricate sections with clips welded to rails for field fastening to posts.
3. Drill posts and clips for fasteners before finishing to maximum extent possible.

H. Finish exposed welds to comply with NOMMA Guideline 1, Finish #4 - good quality, uniform undressed weld with minimal splatter.

I. Galvanizing: For items other than hardware indicated to receive galvanizing, hot dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot dip galvanize to comply with ASTM A 153/A 153M.
1. Hot dip galvanize post, rail and picket assemblies after fabrication.

J. Finish: Factory applied polyester powder coat finish with a minimum thickness of 2 mils. Color as selected by Architect.

2.5 SWING GATES

A. Gate Configuration: As indicated.

B. Gate Frame Height: As indicated.

C. Gate Opening Width: As indicated.

D. Additional Rails: Provide as indicated, complying with requirements for fence rails.

E. Infill: Comply with requirements for adjacent fence.

F. Automated vehicular gates shall comply with ASTM F 2200, Class III.

G. Steel Frames and Bracing: Fabricate members from square steel tubing with 1/8 inch (3.2 mm) wall thickness. Hot dip galvanize frames after fabrication.

H. Frame Corner Construction: Welded and 5/16 inch (7.9 mm) diameter, adjustable truss rods for panels 5 feet (1.52 m) wide or wider.

I. Additional Rails: Provide as indicated, complying with requirements for fence rails.

J. Infill: Comply with requirements for adjacent fence.

K. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf. Provide center gate stops and cane bolts for pairs of gates. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.
   1. All hardware shall meet or exceed Performance Requirements.
   2. Provide preparation and additional hardware as indicated in Section 08 71 00.
   3. All swinging gate hinges or pivots shall include mechanical stops to disallow a range of motion beyond 180 degrees.
   4. Positive mechanical stops shall be incorporated into all double gates and swinging gates with operators.

L. Electric Strikes: BHMA A156.31, Grade 1, of configuration required for use with lock specified, fail -secure, and suitable for exterior use.
   1. Mounting Plate: Configuration necessary for mounting electric strikes. Fabricate from 1/8-inch- (3.2-mm-) thick, steel plate; galvanized.
   2. Mounting: Mortise into post.

M. Exit Hardware: BHMA A156.3, Grade 1, Type 1 (rim exit device), with push pad actuating bar, suitable for exterior use.
   1. Function: 01 - Exit only, no trim or blank escutcheon.
   2. Mounting Channel: Bent-plate channel formed from 1/8-inch- (3.2-mm-) thick, steel plate. Channel spans gate frame. Exit device is mounted on channel web, recessed between flanges, with flanges extending 1/8 inch (3.2 mm) beyond push pad surface.

N. Spring Hinges: BHMA A156.17, Grade 1, suitable for exterior use.
   1. Function: 320 - Gate spring pivot hinge. Adjustable tension.
   2. Material: Malleable iron; galvanized.

O. Cane Bolts: Provide for inactive leaf of pairs of gates. Fabricated from 3/4 inch (19 mm) diameter, round steel bars, hot dip galvanized after fabrication. Finish to match gates. Provide galvanized steel pipe strikes to receive cane bolts in both open and closed positions.

P. Finish exposed welds to comply with NOMMA Guideline 1, Finish #3 - partially dressed weld with splatter removed.

Q. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot dip galvanize to comply with ASTM A 153/A 153M.

R. Finish: Match adjacent fence.

2.6 HORIZONTAL SLIDE GATES

A. Basis of Design: Provide the Passport II Industrial Ornamental Design Series, Invincible Style and 3 rail frame configuration Transport II Ornamental Picket Cantilever, Invincible Style by Ameristar Fence Products. Subject to compliance with requirements, and determination of aesthetic equivalence by the Architect products by one of the following may also be acceptable:

1. BetaFence USA LLC.
2. Builders Fence Company, Inc.
3. Fortress Iron.
4. Iron Eagle Industries, Inc.
5. Iron World Manufacturing, LLC.
6. Xcel Fence.

B. Gate Configuration: As indicated.

1. Type: Cantilever slide, with internal roller assemblies.

C. Gate Frame Height: As indicated.

D. Gate Opening Width: As indicated.

E. Gate shall comply with ASTM F 2200, Class IV.

F. Steel Frames and Bracing: Fabricate members from square tubing. Hot dip galvanize frames after fabrication. Material shall be commercial steel with a minimum yield strength of 45,000 psi.

1. Frame Members: Steel tubing 5 inches by 2-1/2 inches with 3/16-inch wall thickness.
2. Bracing Members: Steel tubing 2-1/2 by 2-1/2 inches with 13/16-inch wall thickness.

G. Frame Corner Construction:

1. Welded frame

H. Additional Rails: Provide as indicated, complying with requirements for fence rails.

I. Infill: Comply with requirements for adjacent fence.

J. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.

K. Hardware: Latches permitting operation from both sides of gate, locking devices hangers roller assemblies and stops fabricated from galvanized steel.

1. Provide all hardware necessary for access control system and gate operator(s).

L. Finish exposed welds to comply with NOMMA Guideline 1, Finish #3 - partially dressed weld with splatter removed.

M. Galvanizing: For items other than hardware that are indicated to be galvanized, hot dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot dip galvanize to comply with ASTM A 153/A 153M.

N. Steel Finish: Powder coating or High performance coating.

2.7 GATE OPERATORS

A. Gate Operators:

B. General: Provide gate operators manufactured by or recommended by gate manufacturer for the specific applications inclusive to the Project.

C. 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 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.

D. Comply with NFPA 70.

E. UL Standard: Manufacturer and label gate operators to comply with UL 325.

F. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for automatic gate operators on gates that must provide emergency access.

G. 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: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
2. Horsepower: Not less than 3/4.
3. Enclosure: Totally enclosed.
4. Duty: Continuous duty at ambient temperature of 105 degrees F (40 degrees C) and at altitude of 3300 feet (1005 m) above sea level.
5. Service Factor: 1.0 for totally enclosed motors.
6. Phase: Selected to operate on nominal circuit voltage to which motor is connected.

7. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections.

H. Gate Operators: Concrete base mounted and as follows:
   1. Hydraulic Slide Gate Operators:
      a. Duty: Medium or Heavy duty, commercial/industrial.
      b. Gate Speed: Minimum 60 feet (18.2 m) per minute.
      c. Sized for weight of gate in application.
      d. Frequency of Use: Continuous duty.
      e. Operating Type: Wheel and rail drive 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: Track and roller heater with thermostatic control.
   2. Mechanical Swing Gate Operators:
      a. Duty: Medium or Heavy duty, commercial/industrial.
      b. Gate Speed: Minimum variable speed up to 60 feet per minute.
      c. Maximum Gate Weight: to suit application.
      d. Frequency of Use: Continuous duty.
      e. Operating Type: Crank arm, with manual release.
   3. Gate operators for swinging gates shall be mounted on the secure side of the fence and be capable of gate operation from the secure side regardless of gate swing, configuration and gate loads. The Contractor shall coordinate operator selections to ensure the requirements of this Section are met.

I. Remote Controls: Electric controls separated from gate and motor and drive mechanism, with NEMA ICS 6, Type 4 enclosure for pedestal mounting unless otherwise indicated on the Drawings, and with space for additional optional equipment. Provide the following remote control device(s):
   1. Control Station: Keyed, three position switch with open, stop, and close function; located remotely from gate. Provide two keys per station.
   2. Card Reader: Functions only when authorized card is presented. Programmable, multiple code system; face lighted unit fully visible at night.
      a. Reader Type: Proximity.
      b. Features: Timed antipassback Capable of monitoring and auditing gate activity.
   3. 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 programmable transmitter(s) with multiple code capability permitting validating or voiding of not less than 10,000 codes per channel configured for the following functions:
      a. Transmitters: Three button operated, with open and close function.
      b. Channel Settings: up to Four independent channel settings controlling separate receivers for operating more than one gate from each transmitter.

J. Vehicle Loop Detector: System includes automatic closing timer with adjustable time delay, timer cutoff switch, and loop detector designed to hold gate open until traffic clears. System includes 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. System includes number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement, as recommended in writing by detection system manufacturer for function indicated, at location indicated on Drawings.

K. 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 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.
5. Photoelectric/Infrared Sensor System: Designed to detect an obstruction in gate's path when infrared beam in the zone pattern is interrupted.

L. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully retracted and fully extended positions.

M. Emergency Release Mechanism: Quick disconnect release of operator drive system of the following type, 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.

N. 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 cutoff 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.

O. Accessories:

1. Warning Module: Audio and Visual, strobe light alarm sounding three to five seconds in advance of gate operation and continuing until gate stops moving; compliant with the United States Access Board's ADA-ABA Accessibility Guidelines.
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. Fire box.
4. Instructional, Safety, and Warning Labels and Signs: According to UL 325.
5. Equipment Bases/Pads: Precast concrete, depth not less than 12 inches (305 mm), dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.

2.8 MATERIALS

A. Aluminum: Provide alloys and tempers with not less than the strength and durability properties of alloy and temper designated in paragraphs below for each aluminum form required.

1. Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
2. Tubing: ASTM B 429/B 429M, Alloy 6063-T6.
3. Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.
4. Die and Hand Forgings: ASTM B 247 (ASTM B 247M), Alloy 6061-T6.
5. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

B. Steel and Iron:

1. Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Bars (Pickets): Hot rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.
3. Tubing: ASTM A 500/A 500M, cold formed steel tubing.
4. Bar Grating: NAAMM MBG 531.
   a. Bars: Hot rolled steel strip, ASTM A 1011/A 1011M, Commercial Steel, Type B.
   b. Wire Rods: ASTM A 510/A 510M.

5. Uncoated Steel Sheet: Hot rolled steel sheet, ASTM A 1011/A 1011M, Structural Steel, Grade 45 (Grade 310) or cold rolled steel sheet, ASTM A 1008/A 1008M, Structural Steel, Grade 50 (Grade 340).
6. Galvanized Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 50 (Grade 340), with G90 (Z275) coating.
7. Aluminum Zinc, Alloy Coated Steel Sheet: ASTM A 792/A 792M, structural quality, Grade 50 (Grade 340), with AZ60 (AZM180) coating.
8. Castings: Either gray or malleable iron unless otherwise indicated.
   a. Gray Iron: ASTM A 48/A 48M, Class 30.
   b. Malleable Iron: ASTM A 47/A 47M.

2.9 FUNCTIONAL NARRATIVE FOR SITE SECURITY

A. Functional Operational Narrative: Upon vehicle detection together with valid security credentials presented, the following shall occur:
   1. Vehicle Entry to Site: Valid access control credentials presented shall open vehicle barrier gates at the respective location, open the vehicle gates at the respective location and lower all active vehicle barriers at the respective location to allow unobstructed site entry. Upon vehicle entry, all items shall close, reset and continue site entry protection.
   2. Vehicle Exit from Site: Upon detection of a vehicle in the exit lane within one half car length of the exit gate, open vehicle barrier gates at the respective location, open the vehicle gates at the respective location and lower the active vehicle barriers at the respective location to allow unobstructed vehicle exit. Upon vehicle exit, all items shall close, reset and continue site entry protection.
      a. Should the Owner's security protocol require the presentation of valid security identification, vehicle exit from each lane shall be adjusted to require valid security identification for exit from the site.

B. Compliance with functional narrative
   1. Upon the completion of the Work, energize the access control circuits to test all related items and intended functionality, simultaneous operation of the following systems for both site entry and site egress.
      a. Scope of Work as specified in Section 11 12 00 for control of vehicle barrier gates, vehicle detection and access control units. Test and confirm compliance with the functional narrative for site entry and egress.
      b. Scope of Work as specified in Section 34 71 13 Active Vehicle Barriers for all wedge plate barrier systems. Test and confirm compliance with the functional narrative for site entry and egress.
      c. Test and confirm all integrated Owner security systems and components for intended operation and unobstructed site entry and egress when valid credentials are presented.

C. Refer to Section 11 12 00 Parking Control Equipment for mounting pedestals, access control and other requirements. Coordinate all Work to comply with Owner's security requirements.

D. Refer to Section 34 71 13 Active Vehicle Barriers for all wedge plate barrier systems.

2.10 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.

B. Concrete: Normal weight, air entrained, ready mix concrete complying with requirements in Section 03 30 00 with a minimum 28 day compressive strength of 3000 psi (20 MPa), 3 inch (75 mm) slump, and 1 inch (25 mm) maximum aggregate size.

C. Nonshrink Grout: Factory packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M and specifically recommended by manufacturer for exterior applications.

2.11 GROUNDING MATERIALS

A. Comply with requirements of Section 26 05 26.

B. Grounding Conductors: Size as indicated on Drawings. Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Aluminum.
2. Material on or below Finished Grade: Copper.
3. Bonding Jumpers: Braided copper tape, 1-5/8 inch (41 mm) wide and 1/16 inch (1.6 mm) thick, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

C. Grounding 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).

2.12 FINISHES

A. Steel Finishes:

1. Surface Preparation: Clean surfaces according to SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning. After cleaning, apply a conversion coating compatible with the organic coating to be applied over it.
2. Powder Coating: Immediately after cleaning, apply two coat finish consisting of epoxy primer and TGIC polyester topcoat to a minimum total dry film thickness of not less than 8 mils (0.20 mm). Comply with coating manufacturer's written instructions.
   a. Color and Gloss: Selected by Architect.
3. Primer Application: Apply zinc rich epoxy primer immediately after cleaning, to provide a minimum dry film thickness of 2 mils (0.05 mm) per applied coat, to surfaces that are exposed after assembly and installation, and to concealed surfaces.

4. High Performance Coating: Apply intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1 Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel for shop painting. Apply at spreading rates recommended by coating manufacturer.

B. Metallic Coated Steel Finishes:

1. Galvanized Finish: Clean welds, mechanical connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.
2. Surface Preparation: Clean surfaces of oil and other contaminants. Use cleaning methods that do not leave residue. After cleaning, apply a zinc phosphate conversion coating compatible with the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint, complying with SSPC-Paint 20, to comply with ASTM A 780/A 780M.
3. Powder Coating: Immediately after cleaning and pretreating, apply two coat finish consisting of zinc-rich epoxy prime coat and TGIC polyester topcoat to a minimum dry film thickness of 2 mils (0.05 mm). Comply with coating manufacturer's written instructions to achieve a minimum total dry film thickness of 4 mils (0.10 mm).
   a. Color and Gloss: Selected by Architect.
   b. Comply with surface finish testing requirements in ASTM F 2408[except change corrosion resistance requirement to 3000 hours without failure].
4. High Performance Coating: Apply epoxy primer, polyurethane intermediate coat, and polyurethane topcoat to prepared surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1 Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel, for shop painting. Apply at spreading rates recommended by coating manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and conditions affecting performance of the work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

C. Proceed with installation after correcting unsatisfactory conditions.

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.

1. Construction layout and field engineering are specified in Section 01 73 00.

3.3 DECORATIVE FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Install fences by setting posts as indicated and fastening rails to posts. Peen threads of bolts after assembly to prevent removal.

C. Post Excavation: Drill or hand excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches (600 mm) plus 3 inches (75 mm) for each foot (300 mm) or fraction of a foot (300 mm) that fence height exceeds 4 feet (1.2 m).

D. Post Setting: Set posts in concrete 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 and sleeves and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
      a. Exposed Concrete: Extend 2 inches (51 mm) above grade. Finish and slope top surface to drain water away from post.
      b. Concealed Concrete: Top 2 inches (51 mm) below grade to allow covering with surface material. Slope top surface of concrete to drain water away from post.
   3. Posts Set in Concrete: Extend post to within 6 inches (150 mm) of specified excavation depth, but not closer than 3 inches (75 mm) to bottom of concrete.
   4. Posts Set into Concrete in Sleeves: Use galvanized steel pipe sleeves with inside diameter at least 3/4 inch (20 mm) larger than outside diagonal dimension of post, preset and anchored into concrete for installing posts.
      a. Extend posts at least 5 inches (125 mm) into sleeve.
      b. After posts have been inserted in sleeves, fill annular space between post and sleeve with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions; shape and smooth to shed water. Finish and slope top surface of grout to drain water away from post.
   5. Posts Set into Voids in Concrete: Form or core drill holes not less than 3/4 inch (20 mm) larger than outside diagonal dimension of post.
      a. Extend posts at least 5 inches (125 mm) into concrete.
      b. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions. Finish and slope top surface of grout to drain water away from post.
   6. Space posts uniformly at 8 feet (2.44 m) o.c. unless otherwise indicated.

3.4 GATE INSTALLATION

A. Coordinate all gate operators with vehicle detection, access control and security system components shared with vehicle barrier gates as specified in Section 11 12 00 Parking Control Equipment.

B. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. 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.

3.5 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: Hand excavate holes for bases 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: Cast in place or precast concrete,, dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.

D. Vehicle Loop Detector System: 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.

3.6 GROUNDING AND BONDING

A. Comply with Division 26 for additional requirements for grounding and bonding.

B. Fence Grounding: Install at maximum intervals of 1500 feet (450 m) 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).
      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 at openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches (460 mm) below finished grade.

C. 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.

D. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.

E. 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 grounding location.

F. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

G. 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 are 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.

H. 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.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

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 of grounding resistance at each test location certified by a testing agency. Include observations of weather and other phenomena that may affect test results.

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 Operators: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, alarms, and limit switches.

1. Hydraulic Operators: 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. Compliance with functional narrative
1. Upon the completion of the Work, energize the access control circuits to confirm activation of all obstructions to site access and confirm simultaneous operation of the following systems for both site entry and site egress.
a. Scope of Work as specified in Section 11 12 00 Parking Control Equipment for control of automatic barrier gates, vehicle detection and access control units. Test and confirm compliance with the functional narrative for site entry and egress.
b. [Scope of Work as specified in Section 34 71 13 Active Vehicle Barriers for all wedge plate barrier systems. Test and confirm compliance with the functional narrative for site entry and egress.]
c. Test and confirm all integrated Owner security systems and components for intended operation and unobstructed site entry and egress when valid credentials are presented.
2. Functional Narrative: Valid access control credentials presented shall open vehicle barrier gates at the respective location, open the vehicle gates at the respective location and lower the active vehicle barriers at the respective location to allow unobstructed site entry. Unobstructed vehicle exit from the site shall be permitted to all vehicles existing the secure site.

D. Lubricate hardware, gate operators, and other moving parts.

3.9 DEMONSTRATION

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

END OF SECTION

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