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UFGS-08 34 16.20 (October 2006)

Preparing Activity: NAVFAC

Superseding

UFGS-08 34 16.20 (April 2006)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated April 2009

SECTION TABLE OF CONTENTS

DIVISION 08 - OPENINGS

SECTION 08 34 16.20

VERTICAL LIFT FABRIC DOORS

10/06

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 DELIVERY, STORAGE AND HANDLING
- 1.4 DESIGN REQUIREMENTS
 - 1.4.1 Door Design
 - 1.4.1.1 Steel Door Hardware
 - 1.4.1.2 Aluminum Door Hardware
 - 1.4.2 Loads
 - 1.4.2.1 Wind
 - 1.4.2.2 Other Loads
 - 1.4.3 Door Speed
 - 1.4.4 Door Weight
- 1.5 QUALITY ASSURANCE
 - 1.5.1 Products
 - 1.5.2 Installers
 - 1.5.3 Warranty

PART 2 PRODUCTS

- 2.1 MATERIALS
 - 2.1.1 Steel Sheet
 - 2.1.2 Steel Shapes
 - 2.1.3 Aluminum Extrusions
 - 2.1.4 Aluminum Sheets and Strips
 - 2.1.5 Door Fabric
- 2.2 DOORS
 - 2.2.1 Fabric Door Panels
 - 2.2.2 Door Beams
 - 2.2.3 Door Guides
- 2.3 ELECTRIC OPERATORS
 - 2.3.1 Drive Units
 - 2.3.2 Belt/Cable System
 - 2.3.3 Safety Arrestors
 - 2.3.4 Slack Belt/Cable Breaker

- 2.3.5 Motors
- 2.3.6 Controls
- 2.3.7 Safety Device
- 2.3.8 Control Transformers
- 2.3.9 Electrical Components
- 2.3.10 [Diagnostic Panel]
- 2.4 HEADER BOX
- 2.5 BOTTOM BEAM
- 2.6 WIND LOCK
- 2.7 SWING-UP MULLION
 - 2.7.1 Mullion Pit Cover
- 2.8 PERSONNEL DOOR
- 2.9 OPERATION
 - 2.9.1 Door Operation
 - 2.9.2 Electrical Operation
- 2.10 FINISHES
 - 2.10.1 Galvanized and Shop Primed
 - 2.10.2 Aluminum

PART 3 EXECUTION

- 3.1 PROTECTIVE COATINGS
 - 3.1.1 Cleaning
 - 3.1.2 Shop Painting
- 3.2 ERECTION
 - 3.2.1 Assembly
 - 3.2.2 Cleaning
- 3.3 ELECTRICAL WORK
- 3.4 TESTING
 - 3.4.1 Safety Arrestors
- 3.5 TURNOVER
- 3.6 ELECTRICAL WORK

-- End of Section Table of Contents --

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SECTION 08 34 16.20

VERTICAL LIFT FABRIC DOORS

10/06

NOTE: This guide specification covers the requirements for vertical lift fabric doors.

Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

NOTE: These doors are an innovative application of new technology. The concept offers greater flexibility of aircraft movement and more efficient use of programmed space than the traditional horizontal steel sliding door. Contact the NAVFAC Engineering Innovation and Criteria Office for more information.

The designer needs to provide for alternate means of operating doors in the event of loss of power.

PART 1 GENERAL

1.1 REFERENCES

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a RID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 325 (2005) Manual of Steel Construction

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M (2008) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 36/A 36M (2008) Standard Specification for Carbon Structural Steel

ASTM A 653/A 653M (2008) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM B 209 (2007) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B 221 (2008) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

ASTM D 1790 (2008) Brittleness Temperature of Plastic Sheeting by Impact

ASTM E 84 (2009) Standard Test Method for Surface Burning Characteristics of Building Materials

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MFM (1988) Metal Finishes Manual

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	(2000; Errata 2002; R 2005; Errata 2006) Standard for Industrial Control and Systems: Controllers, Contractors, and Overload Relays Rated Not More than 2000 Volts AC or 750 Volts DC: Part 8 - Disconnect Devices for Use in Industrial Control Equipment
NEMA ICS 6	(1993; R 2006) Standard for Industrial Controls and Systems Enclosures
NEMA MG 1	(2007; Errata 2008) Standard for Motors and Generators
NEMA ST 20	(1992; R 1997) Standard for Dry-Type Transformers for General Applications

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2007; AMD 1 2008) National Electrical Code - 2008 Edition
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U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 1-200-01	(Notice 1) General Building Requirements
UFC 3-300-10N	Structural Engineering

1.2 SUBMITTALS

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes

following the "G" typically are not used for Navy,
Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force
and NASA projects, or choose the second bracketed
item for Army projects.

Government approval is required for submittals with a "G" designation;
submittals not having a "G" designation are for information only. When
used, a designation following the "G" designation identifies the office
that will review the submittal for the Government. The following shall be
submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Door Design; G

Show types, sizes, fasteners, locations, metal gages, hardware
provisions, supporting and bracing steel, door guides at slabs,
installation details, and other details of construction. Include
supporting brackets for motors, location, type, and ratings of
motors, and safety devices. Provide details for the closure
between bulkhead and doors. Include details for supporting and
bracing the door assembly from the structure.

SD-03 Product Data

DOORS; G

Controls; G

Door Fabric; G

Submit fabric panel samples for color approval.

SD-05 Design Data

Calculations; G, A/E

SD-10 Operation and Maintenance Data

Door Operation, Data Package 2; G

Submit in accordance with Section 01 78 23 OPERATION AND
MAINTENANCE DATA. Including wiring diagrams and the complete
manufacturer's instructions for operation and maintenance of the
doors.

1.3 DELIVERY, STORAGE AND HANDLING

The door manufacturer shall provide shipment of all materials required for
door installation in protective packaging. Protect door and accessories
from damage during delivery, storage, and handling. Mark all packaging
clearly with manufacturer's brand name, door model and job site location.
Store in dry location with adequate ventilation, free from dust and water.
Storage shall permit easy access for inspection and handling. Remove
damaged items that cannot be restored to like new condition or provide new
items.

1.4 DESIGN REQUIREMENTS

1.4.1 Door Design

The overhead fabric doors indicated are representative of a typical commercially available door. Manufacturer shall design and fabricate the door to fit within the space allocated and in accordance with the criteria specified herein. Door shall operate properly without binding, interference, or damage to the adjacent structure. Door shall be as manufactured by one of the following:

- a. MegaDoor
665 Highway 74 South
Peachtree City, Georgia 30269
Telephone: 800-927-6342
- b. Mock Doors Ltd
c/o Finland Trade Center
1360 Post Oak Boulevard, Suite 1350
Houston, Texas 77056, USA
Telephone: 713-627-9700, ext. 204
- c. Or pre-approved equivalent.

1.4.1.1 Steel Door Hardware

All supporting, bracing and framing steel members shall be designed by a licensed professional engineer for the loads provided by the vertical lift fabric door manufacturer according to the requirements of AISC 325. Refer to Section 05 12 00 STRUCTURAL STEEL for requirements.

1.4.1.2 Aluminum Door Hardware

All supporting, bracing and framing aluminum members shall be designed by a licensed professional engineer for the loads provided by the vertical lift fabric door manufacturer according to the requirements of the Aluminum Design Manual.

1.4.2 Loads

1.4.2.1 Wind

**NOTE: Provide appropriate design wind pressure
based on local design wind velocity. Refer to ASCE
7 and UFC 1-200-01.**

Doors shall be designed to withstand the design wind speed in accordance with UFC 1-200-01 and UFC 3-300-10N (IBC 2003 & ASCE 7-02). The simplified procedure/method shall not be used to calculate the design wind loads for the door, only an analytical procedure is allowed. This building shall be considered "partially enclosed". It is the Structural Engineers of Record's responsibility to coordinate the wind load requirements with the door manufacturer. All door components shall be designed to withstand both the highest positive and negative "components and cladding" pressures based on actual tributary area from the wind load calculations. Calculations stamped by a registered professional engineer shall be submitted for review.

1.4.2.2 Other Loads

The door mullions must be of adequate strength to transmit the forces from design wind load, in addition to the other loads resulting from door operations or the door's action as a tributary element, with no detrimental effect on the operation of the door. It is the responsibility of the door manufacturer and structural engineer of record to coordinate loadings for door design.

1.4.3 Door Speed

NOTE: Time is a factor of door height divided by approximately 5-8 inches per second 125-200 mm per second for most doors plus time for the swing-up mullion if applicabl.

Door shall open fully in less than 60 [80] seconds under all design conditions plus time for the swing-up mullion. Each door leaf must have a minimum speed of 5 in/sec 127 mm/sec.

1.4.4 Door Weight

NOTE: Careful coordination with the structural roof designer is required to ensure proper support of the vertical lift door system.

The door manufacturer shall provide load diagrams of the door in the closed and open positions. Details shall also be provided showing clearance and attachment requirements for coordination with the structural steel and miscellaneous steel shop drawings.

1.5 QUALITY ASSURANCE

1.5.1 Products

The overhead hoist-up fabric door shall be the product of a manufacturer who has had at least 20 years experience in design, fabrication, erection, and service, and who is regularly engaged in the manufacture of the type of door specified herein. Only manufacturers who can submit evidence of actual installations of comparable design and construction, and that the products have proven practical, durable, and require a minimum of maintenance, will be qualified under this specification.

1.5.2 Installers

Installation of the doors shall be by an authorized representative of the door manufacturer and shall be in accordance with approved shop drawings. Mechanics shall be skilled and experienced in the erection of large hangar doors of the type specified herein.

1.5.3 Warranty

The Door manufacturer shall provide a one-year warranty for all mechanical and electrical components against defects in material and workmanship

beginning from the date of Project Completion. The warranty for fabric shall be 5 years against defect in material.

PART 2 PRODUCTS

2.1 MATERIALS

Materials should be selected based on durability, low maintenance, weather resistance and strength (permanent deformation from loading not allowed).

2.1.1 Steel Sheet

ASTM A 653/A 653M

2.1.2 Steel Shapes

ASTM A 36/A 36M

2.1.3 Aluminum Extrusions

ASTM B 221, Alloy 6063-T6, Alloy 6005-T5 or 6000 Series Aluminum

2.1.4 Aluminum Sheets and Strips

ASTM B 209, alloy and temper best suited for the purpose.

2.1.5 Door Fabric

The fabric material shall be a one piece heavy-duty vinyl coated polyester fabric weighing not less than 2.1 oz/square foot to 2.4 oz/square foot 645 g/m² to 746 g/m², capable of carrying 250 lb/in 4.5 kg/mm per panel. Fabric shall be impervious and resistant to solvents, fuel, lubricants and other similar fluids commonly found in aircraft maintenance hangars. It shall be UV stabilized, self-extinguishing (0-75 flame spread), and suitable to withstand temperatures between +158 to -31 degrees F +70 to -35 degrees Celsius. [Use a translucent material in approximately the top 10 feet 3 m of the door to allow day lighting of the hangar high bay area. The translucent material shall also meet the same requirements and loadings as the standard door fabric.] Fabric color shall be as indicated. The door fabric shall be pulled tight between the intermediate beams when the door is fully closed and the wind locks engaged. [The fabric shall have been tested to meet the criteria of ASTM E 84-94 (flame spread - Class A interior wall and ceiling finish) and ASTM D 1790 (cold cracking, brittleness and temperature).]

2.2 DOORS

Doors shall consist of hoist up fabric doors with intermediate aluminum beams or trusses. Fabric shall be gathered above the head of the opening. Regardless of location, the minimum design wind load shall be 40 lb/square foot 201 kg/square meter. Maximum wind load deflection of steel structural members of the door shall not exceed the door height in inches divided by 3048 mm divided by 120 and the door width in inches divided by 3048 mm divided by 120. Maximum wind load deflection of extruded aluminum members of the door shall not exceed the door height in inches divided by 762 mm divided by 30 and the door width in inches divided by 762 mm divided by 30. Doors shall be fully operable during a wind load from a 60 mph 155 km/hr storm or below.

2.2.1 Fabric Door Panels

The fabric shall be attached to both sides of the intermediate beams, top beam, and bottom beam with self-tapping screws through corrosion resistant anodized aluminum batten strips. [Provide batten strip covers of PVC material to match the color of the Standard Door Fabric colors. The covers shall snap over the aluminum batten strips and be full width of the door fabric.]

2.2.2 Door Beams

The intermediate beams shall be corrosion resistant, extruded aluminum and have a suitable depth dependent on the door width and the wind load requirements. They shall be spaced 35 to 75 inches 890 to 1900 mm apart, dependent upon the wind load. At each end of the beams there shall be a guide block of self-lubricating nylon material or rollers that run along the guides. Built-up members meeting these requirements are acceptable. The intermediate door beams and guide block or rollers shall be designed to carry the full design wind load without failure or being pulled from the door guides.

2.2.3 Door Guides

The vertical guides shall be an integral part of the door, made of extruded aluminum with a suitable depth and width dependent on the size of the intermediate beams and wind load requirements. The guides shall be designed to provide weather sealing on the inside and outside faces. There shall also be a space inside the guides for the polyester belt or steel cable of the drive unit and safety arrestors. The installer shall furnish jamb anchorage of size and type required for attachment of the guide rails as shown on the approved shop drawings. The jamb anchorage and door guides shall be designed to carry the full design wind load without failure or permanent deformation.

2.3 ELECTRIC OPERATORS

2.3.1 Drive Units

The door leaves shall have a single or dual motor drive system with horsepower sized as appropriate for the weight of the door leaf. The gear motor shall be equipped with a drum on which the polyester belt or steel cables are wound. If a single motor drive is used, the belts/cables shall be wound on the same drum. The belts/cables shall be attached to the bottom beam via the safety arrestors. A chain operation device or other manual means shall be supplied on the motor for manual operation of the door in the event of a power failure. The gear motor shall be removable without disturbing limit switch adjustment.

2.3.2 Belt/Cable System

A maximum of two belts/cables per door, running inside the door guides, shall be used to transmit motive force to the door unit. Similarly, the quantity of sheaves used to guide the belts/cables shall be minimized to reduce maintenance requirements and spare parts inventories. Belts/cables shall be installed free of any kinks and the system design and sheave diameter shall be such to prevent the occurrence of any kinks or abnormal stress in the operating belts/cables. Where belts/cables pass through openings of the building structure, the openings shall be constructed so as to prevent abrasion, wear, or damage to the belts and cables. Sheave units

shall be installed in accessible locations that allow inspection and preventive maintenance. Sheaves shall not be located in enclosed locations, which are not readily accessible for visual inspection.

2.3.3 Safety Arrestors

Each door leaf shall be supplied with two safety arrestors that activate and support the door in the event a belt or cable breaks. Each different type of safety arrestor shall be tested to withstand the door leaf weight. The moveable mullions, when provided, shall be provided with a lifting motor that includes a backup arresting system to prevent the mullion from falling in case of motor or primary brake failure.

2.3.4 Slack Belt/Cable Breaker

A safety device shall be used on all door leaf belts/cables that will send a slack belt/cable condition and cut power to the appropriate drive unit to prevent an unsafe condition.

2.3.5 Motors

NEMA MG 1, high-starting torque, reversible type with sufficient horsepower and torque output to move the door in either direction from any position. Motor shall produce a door travel speed of not less than **5 inches 125 mm** or more than **12 inches per second 300 mm per second** without exceeding the rated capacity. Motors shall operate on current of the characteristics indicated at not more than 3600 rpm. Motor enclosures shall be drip-proof type or NEMA totally-enclosed, fan-cooled (TEFC) type. A hand crank shall be supplied which fits the motor for manual operation of the door in the event of a power failure. Install motors in approved locations.

2.3.6 Controls

Each door motor shall have an enclosed, across-the-line type, magnetic reversing contactor, and thermal overload and under voltage protection, brake, limit switches, and control switches. Locate the bottom of the control panel 48 inches above the floor so the operator will have complete visibility of the door at all times. Control equipment shall conform to **NEMA ICS 2**. Control enclosures shall be **NEMA ICS 6**, Type 12 or Type 4. The "OPEN" and "STOP" buttons shall require only momentary pressure to operate. The "CLOSE" button shall require constant pressure to maintain the closing motion of the door. If the door is in motion and the "STOP" button is pressed or the "CLOSE" button is released, the door shall stop instantly and remain in the stop position; from the stop position, the door may be operated in either direction by the "OPEN" or "CLOSE" buttons. Pushbuttons shall be full-guarded to prevent accidental operation. Provide limit switches to automatically stop doors at the fully open and fully closed positions. Limit switch positions shall be readily adjustable. Proximity switches for the wind lock shall be provided with indicator lights installed on the control panel for each door leaf. The indicator shall notify the door operator that the wind locks are engaged for all door leaves. The control panel shall contain devices to control the logic and sequence of door and mullion operation to insure safe operation. The control panel shall also contain interlocks to preclude personnel injury, including an interlock between the power supply system and use of the hand crank for manual operation of the door. Emergency power hook up shall be provided at the control panel and coordinated with base activity emergency power provisions.

Each Module Door shall be provided with the following operators:

Master Control Panel

- 1 Remote Push Button Station - at opposite end of hangar door
- 2 Emergency Stop Button located outside at the end of each hangar bay
- 1 "Open" operator located on the exterior of each bay door keyed for use by Fire Department personnel to allow entry in the event of an emergency

The Contractor shall provide all conduit and control wiring between master, slave and emergency stop controls and each door motor drive unit. Power wiring and conduit shall be provided in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.3.7 Safety Device

A bottom edge safety device is not required.

2.3.8 Control Transformers

NEMA ST 20. Provide transformers in power circuits as necessary to reduce the voltage on the control circuits to 120 volts or less.

2.3.9 Electrical Components

NFPA 70. The door manufacturer shall provide automatic control and safety devices, including extra flexible TYPE SO cable and spring-loaded automatic take-up reel or equivalent device, if required for operation of the doors. Control wiring shall be in accordance with NFPA 70. The Contractor shall provide conduit, wiring, and mounting of controls in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.3.10 [Diagnostic Panel]

[The door manufacturer shall supply a diagnostic panel on the face of the Main Control Panel for multiple doors. The function of the diagnostic panel is to provide information on the status of electrical components in the door system. It shall state the status of a malfunction and identify the component to investigate.]

2.4 HEADER BOX

Header boxes shall be constructed of carbon steel and factory primed with rust inhibitive paint.

2.5 BOTTOM BEAM

The bottom beam shall be provided with a suitable width and depth to carry the load of the intermediate beams when the door is open, and to ensure full closing and a tight floor seal in heavy winds. A heavy U-shaped bottom rubber seal shall be provided to form a tight seal with the floor, even on uneven surfaces.

2.6 WIND LOCK

Each door leaf shall have two wind locks, which activate and lock the bottom beam into place when the door reaches its closed position. This locking action shall act to maintain a tight floor seal and intermediate beam stability even under design wind conditions. A proximity switch, with indicator shall be provided to notify the door operator that all wind locks are engaged properly.

2.7 SWING-UP MULLION

The swing-up mullions shall be designed to swing up under the door leaf in the raised position. They shall be constructed of steel and coated with corrosion resistant paint primer. The mullion hinge pivot shall be of a maintenance-free bearing design. The swing-up mullion shall include a backup arresting system should the primary lifting wire fail. The electrical control panel shall provide an interlock function to coordinate door leaf and mullion operation and mullion constant-pressure type, push buttons for both up and down operation.

2.7.1 Mullion Pit Cover

A mullion pit guide plate cover shall be provided for each mullion, with hinged cover plates, to be welded to the mullion pit frame. Mullion pit covers shall be designed to support a 35,000 pounds force 155.7 kN single wheel load with a tire pressure of 200 psi 1379 kPa and contact area 1.2 sqft 0.1 square meters.

2.8 PERSONNEL DOOR

Personnel doors are not required in Hangar doors.

[Hangar door manufacturer shall provide exit doors in hangar doors as indicated. Personnel doors shall be insulated steel or aluminum doors and as specified in Section 08 11 13 STEEL DOORS AND FRAMES. Door shall come complete with all hardware including, hinges, lockset, stop, weather stripping, emergency exit sign, and interlock.]

2.9 OPERATION

2.9.1 Door Operation

The overhead hoist-up fabric door shall guide up and down in the weather sealing vertical guides attached to the structure. The door shall operate by lifting the bottom beam upwards, thereby stacking the intermediate beams one on top of the other, with the fabric panel folding in pleats. The fabric panel shall go over the top beam, covering both sides of the door, and shall be attached to the intermediate beams by screws and batten strips. When the door is fully closed, the intermediate beams shall hang between the two fabric door panels thus pulling the fabric tight. The tension created in the fabric panels shall stabilize the intermediate beams. The safety arrestors shall be attached to each end of the bottom beam and shall travel in the vertical guide tracks. The safety arrestors shall immediately stop the downward movement of the door in case of belt/cable failure.

2.9.2 Electrical Operation

When the door is completely opened it shall stop on the primary top limit

switch. In case of over travel, a secondary limit switch shall cut off the drive units' motor current to prevent damage. These two limit switches shall be activated by the uppermost intermediate beam. The drive unit shall be stopped by the slack belt/cable breakers when the door is closed. The slack breakers shall also stop the door in case of belt/cable rupture or if an obstruction should prevent the door from being closed. Weight or springs shall activate the slack breakers. The control panel station(s) (remote push button station located at the opposite side of the hangar is optional) shall be of the pushbutton type. Door operation shall be controlled by three buttons marked "OPEN", "CLOSE", and "STOP". These buttons shall be controlled by momentary pressure to open and constant pressure to close. Removing the pressure from the "CLOSE" button shall stop the motor drive and set the brake. Two buttons marked "Horizontal Position and Vertical Position" shall control the mullion operation. Both buttons shall be controlled by constant pressure to open and to close. Removing the pressure from either button shall stop the motor drive and set the brake. The door manufacturer shall provide a NEMA enclosure that is factory-wired and equipped with instantaneous overload relays. Emergency power hook up shall be provided at the control panel connecting the drive units to a portable emergency generator. The Contractor shall demonstrate the operability of all limit switches prior to the Government accepting ownership.

2.10 FINISHES

Concealed ferrous metal surfaces shall be hot-dip galvanized. Exposed ferrous metal surfaces shall be hot-dip galvanized or shop primed with a marine grade industrial primer.

2.10.1 Galvanized and Shop Primed

Surfaces specified shall have a zinc coating, a phosphate treatment, and a shop prime coat of rust-inhibitive paint. The galvanized coating shall conform to [ASTM A 653/A 653M](#), coating designation Z275, for steel sheets, and [ASTM A 123/A 123M](#) for assembled steel products. The weight of coatings for assembled products shall be as designated in Table I of [ASTM A 123/A 123M](#) for the class of material to be coated. The prime coat shall be a type especially developed for materials treated by phosphates and adapted to application by dipping or spraying. Repair damaged zinc-coated surfaces by the application of galvanizing repair paint and spot prime. At the Contractor's option, a two-part system including bonderizing, baked-on epoxy primer, and baked-on enamel topcoat may be applied to assembled products in lieu of prime coat specified.

2.10.2 Aluminum

Batten strip surfaces shall receive a clear anodized finish, AA-M10-C22-A41, in accordance with [NAAMM MFM](#).

PART 3 EXECUTION

3.1 PROTECTIVE COATINGS

3.1.1 Cleaning

After fabrication, clean all metal surfaces thoroughly of all mil scale, rust, oil, grease and other foreign substances. Apply rust-preventive primer to all steel parts immediately after cleaning.

3.1.2 Shop Painting

After cleaning, coat with primer all steel surfaces other than machine-finished parts. Keep paint off finished bearing surfaces. Before assembly, prime surfaces that will be inaccessible after assembly. Handle painted materials with care to avoid scraping or breaking the protective film.

3.2 ERECTION

Coordinate the erection of the doors with the work of other trades. Ensure that all steel support, bracing and framing members are provided and accurately installed for the proper installation of the door hardware.

3.2.1 Assembly

Assemble and install the doors and accessories in accordance with the manufacturer's recommendations and installation manual. Secure guides to the walls plumb, level and in-line. Anchor guides at spacing indicated on installation drawings. Provide additional supports as necessary for attachment of guides, brackets, doors, and operation mechanisms. After erection is complete and before field painting is applied, thoroughly clean all abraded surfaces, field welds, and field bolts; coat with primer paint.

3.2.2 Cleaning

Clean both the interior and exterior of doors after erection.

3.3 ELECTRICAL WORK

NFPA 70. Conduit, wiring, and mounting controls are specified in Section **26 20 00** INTERIOR DISTRIBUTION SYSTEM.

3.4 TESTING

Upon completion of installation, including work by other trades, lubricate, adjust, and test doors to verify operation on accordance with manufacturer's product data. Manufacturer's authorized representative shall make final adjustment. Adjust and re-test the doors until the entire installation is fully operational and acceptable.

3.4.1 Safety Arrestors

Demonstrate performance of door safety arrestors by disengaging the lifting motor clutch. Demonstrate safety arrestor performance by dropping door from **3 feet 1 m** above closed position.

3.5 TURNOVER

A door fabric patch kit shall be supplied with approximately **45 square feet 4.2 square meters** of fabric for each hangar door and all other materials required for door panel repair.

The door manufacturer shall provide a training session for the door operating personnel and maintenance department. The training shall outline door operation, troubleshooting and repair guidelines.

3.6 ELECTRICAL WORK

NFPA 70. Provide all conduit, wiring, and mounting of controls in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

-- End of Section --