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USACE / NAVFAC / AFCEA / NASA

UFGS-08371 (August 2004)

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Preparing Activity: NAVFAC

MasterFormat™ 2004 - 08 34 16.20

Superseding

UFGS-08371N (November 2002)

## UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 23 June 2005

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#### SECTION 08371

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08/04

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### SECTION 08371

#### VERTICAL LIFT FABRIC DOORS

08/04

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

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

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

Use of electronic communication is encouraged.

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

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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.

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## PART 1 GENERAL

### 1.1 REFERENCES

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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.

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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 (2001) LRFD Manual of Steel Construction

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M (2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 36/A 36M (2004) Carbon Structural Steel

ASTM A 653/A 653M (2004a) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM B 209 (2004) Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B 209M (2004) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

ASTM B 221 (2004a) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

ASTM B 221M (2004) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MFM (1988) Metal Finishes Manual

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2 (2000; R 2004) Industrial Controls and Systems: Controllers, Contactors, and Overload Relays Rated Not More than 2000

Volts AC or 750 Volts DC

NEMA ICS 6	(1993; R 2001) Industrial Control and Systems: Enclosures
NEMA MG 1	(2003; R 2004) Motors and Generators
NEMA ST 20	(1992; R 1997) Dry-Type Transformers for General Applications

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2005) National Electrical Code
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1.2 SUBMITTALS

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NOTE: Review submittal description (SD) definitions in Section 01330 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.

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

SD-02 Shop Drawings

Door Design[; G][; G, [\_\_\_\_\_]]

Show types, sizes, 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. Details for closing the space between bulkhead and doors. Details for supporting and bracing the door assembly from the structure.

#### SD-03 Product Data

DOORS[; G][; G, [\_\_\_\_\_]]

Controls[; G][; G, [\_\_\_\_\_]]

#### SD-10 Operation and Maintenance Data

Door Operation, Data Package 2.

Submit in accordance with Section 01781 OPERATION AND MAINTENANCE DATA. Include wiring diagrams.

### 1.3 DELIVERY, STORAGE AND HANDLING

Protect door and accessories from damage during delivery, storage, and handling. Clearly mark manufacturer's brand name. 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. Albany International Corporation  
High Performance Industrial Division  
975-A Old Norcross Road  
Lawrence, Georgia 30269  
Telephone: 800-252-2691
- b. MegaDoor  
665 Highway 74 South  
Peachtree City, Georgia 30269  
Telephone: 800-927-6342
- c. Or 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 05120 STRUCTURAL STEEL for requirements.

#### 1.4.2 Loads

##### 1.4.2.1 Wind

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**NOTE: Provide appropriate design wind pressure  
based on local design wind velocity. Refer to ASCE  
7 and UFC 1-200-01.**  
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Doors shall be designed to withstand a speed of [\_\_\_\_\_] km/hr ([\_\_\_\_\_] miles/hr [\_\_\_\_\_] miles/hr resulting in a wind pressure of [\_\_\_\_\_] kPa ([\_\_\_\_\_] psi [\_\_\_\_\_] psi acting inward and [\_\_\_\_\_] kPa ([\_\_\_\_\_] psi) [\_\_\_\_\_] psi acting outward. Door components with tributary areas less than 20 square meters (215 square feet) 215 square feet shall be designed to withstand a wind pressure of [\_\_\_\_\_] kPa ([\_\_\_\_\_] psi) [\_\_\_\_\_] psi acting inward.

##### 1.4.2.2 Other Loads

The door mullions must be of adequate strength to transmit the forces shown in the contract drawings, in addition to the other loads resulting from door operations or the doors's action as a tributary element, with no detrimental effect on the operation of the door.

##### 1.4.3 Door Speed

Door shall open fully in less than 60 seconds under all design conditions plus time for the swing-up mullion.

##### 1.4.4 Door Weight

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**NOTE: Careful coordination with the structural roof  
designer is required to ensure proper support of the  
vertical lift door system.**  
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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 10 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.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 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 221MASTM B 221, Alloy 6063-T5

#### 2.1.4 Aluminum Sheets and Strips

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

#### 2.1.5 Door Fabric

The fabric material shall be a heavy duty vinyl coated fabric weighing not less than 800 grams per square meter, capable of carrying 113.4 kg per 25.4 mm (250 pounds per 1 inch) 250 pounds per 1 inch 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 70 and -35 degrees C (158 and -31 degrees F) 150 and -31 degrees F. The fabric shall be attached to both sides of the intermediate beams, top beam and bottom beam with self-tapping screws through aluminum batten strips. Fabric color shall be as indicated. Color indicated shall be matched even if it is not a "standard" color by the manufacturer.

### 2.2 DOORS

Doors shall consist of hoist up fabric doors with intermediate aluminum or steel beams or trusses. Fabric shall be gathered above the head of the opening. Minimum design wind load shall be 2.2 kPa (0.32 psi) 0.32 psi. Maximum wind load deflection of steel structural members of the door shall not exceed the door height in mm divided by 120 and the door width in mm divided by 120. Doors shall be operable during design wind load. Maximum wind load deflection of extruded aluminum members of the door shall not exceed the door height in mm divided by 30 and the door width in mm divided by 30.

#### 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 aluminum batten strips.



### 2.2.2 Door Beams

The intermediate beams shall be aluminum or steel and have a suitable depth dependent on the door width and the wind load requirements. They shall be spaced 900 to 1900 mm (35 to 75 inches) 35 to 75 inches 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.

### 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. 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.

## 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 space 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 adjacent structure. Sheave units shall be installed in accessible locations which 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 shall be supplied with two safety arrestors which activate and support the door in the event a belt or cable breaks. The moveable mullions, when provided, shall be provided with a lifting motor which has an internal safety device 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 which 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 200 mm (8 inches) 8 inches or more than 300 mm (12 inches) 12 inches per second without exceeding the rated capacity. Motors shall operate on current of the characteristics indicated at not more than 377 rad/s (3600 rpm) 3600 rpm. Motor enclosures shall be drip-proof type or NEMA totally-enclosed, non-ventilated (TENV) type. Install motors in approved locations.

#### 2.3.6 Controls

Each door motor shall have an enclosed, across-the-line type, magnetic reversing contactor, thermal overload and undervoltage protection, solenoid-operated brake, limit switches, and control switches. Locate control switches at least 1500 mm (60 inches) 60 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, except that contractor enclosures may be Type 1. Each control switch station shall be of the three-button type; buttons shall be marked "OPEN", "CLOSE", and "STOP". 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. 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. The control panel shall contain an interlock function to prevent door operation when personnel door in hangar doors are not secured.

Doors shall be provided with the following operators:

Master Control Panel

1 Slave Unit - [at opposite end of hangar] [\_\_\_\_\_]

1 Emergency Stop Button located [\_\_\_\_\_]

Hangar door manufacturer 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 16402 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 manual or automatic control and safety devices, including extra flexible TYPE SO cable and spring-loaded automatic takeup reel or equivalent device, as required for operation of the doors. Provide conduit, wiring, and mounting of controls in accordance with Section 16402 INTERIOR DISTRIBUTION SYSTEM.

#### 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 be provided with two wind locks which activate and lock the bottom beam when the door reaches its closed position. This locking action shall act to maintain a tight floor seal and intermediate beam stability even under heavy wind conditions.

#### 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 paint primer. The mullion hinge pivot shall be of a maintenance-free bearing design. Mullion push buttons for both up and down operation shall be of the constant-pressure type.

##### 2.7.1 Mullion Pit Cover

A mullion pit cover shall be provided for each mullion, with hinged cover plates, to be welded to the mullion pit frame. The electrical control panel shall provide an interlock function to coordinate door leaf and mullion operation to prevent equipment damage. Mullion pit covers shall be designed to support a 156kN (35 pounds force) 35 pounds force single wheel load with a tire pressure of 1378 kPa (200 psi) 200 psi or contact area (0.1136 sqm (1.2 sqft)) (1.2 sqft).

#### 2.8 PERSONNEL DOOR

Hangar door manufacturer shall provide exit doors in hangar doors as indicated. Personnel doors shall be insulated steel door and as specified

in Section 08110 STEEL DOORS AND FRAMES. Door shall come complete with all hardware including, hinges, lockset, stop, weather stripping 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. The slack breakers shall be activated by weight or springs. 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. The mullion operation shall be controlled by two buttons marked "Horizontal Position" and "Vertical Position". 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 which is factory-wired and equipped with instantaneous overload relays. 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 and ship primed.

### 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 slats before forming in lieu of prime coat specified.

#### 2.10.2 Aluminum

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 steep 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 plum, 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 doors after erection on both interior and exterior.

#### 3.3 ELECTRICAL WORK

NFPA 70. Conduit, wiring, and mounting controls are specified in Section 16402 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. Final adjustment shall be made by

manufacturer's authorized representative. 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. Drop door from its highest limit.

#### 3.5 TURNOVER

A door fabric patch kit shall be supplied with approximately 4 square meters (45 square ft) 45 square feet of fabric for each hangar and all other materials required for door panel repair.

#### 3.6 ELECTRICAL WORK

NFPA 70. Provide all conduit, wiring, and mounting of controls in accordance with Section 16402 INTERIOR DISTRIBUTION SYSTEM.

-- End of Section --