Preparing Activity: NAVFAC

Superseding
UFGS-08 34 16.10 (May 2017)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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SECTION 08 34 16.10

HORIZONTAL ROLLING STEEL DOORS

11/21

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HORIZONTAL ROLLING STEEL DOORS
11/21

NOTE: This guide specification covers the requirements for horizontal rolling steel door systems including their operators and controls.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

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

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

NOTE: Painting of hangar doors must be specifically mentioned in Section 09 97 13.27 HIGH PERFORMANCE COATING FOR STEEL STRUCTURES, along with a reference to this Section and with instructions not to paint operating parts, mechanisms, limit switches, or trolley ducts.

NOTE: Steel rails, top guides, head flashing, painting, and electrical work for these door systems are specified in other sections.

NOTE: On the design drawings, show:

1. Size and arrangement of doors including, if applicable, clearances in accordance with UFC 4-211-01 Paragraph 2.3 MINIMUM AIRCRAFT MAINTENANCE BAY CLEARANCES. Electrical and structural provisions for motor operators.

2. Location and type of weather stripping, exterior covering, interior lining, and flashing.

3. Location, spacing, size, and type of top guides and rails. Center-to-center dimension of leaves not less than 350 mm 14 inches, and not less than 115 mm 4 1/2 inches greater than total thickness of each leaf, including interior and exterior coverings. Where electrical trolley duct is required between leaves, provide additional 150 mm 6 inches of clearance. Where cable system is required between leaves, provide additional 25 mm 1 inch of clearance.

4. Location and type of personnel doors. Do not locate personnel doors between wheels and edge of door leaf. Exact location to be determined by structural design of door leaf.

5. Location of bumpers and pulls.

6. That wheels will be required. Size and weight of the doors will determine wheel type, size, and number and thus should not be shown on the drawings.

7. Appropriate design wind pressures based on the design wind velocity. See paragraph WIND LOADS for more detailed requirements. Appropriate seismic, blast or other loads must be considered in the design and construction of these door systems. Include positive and negative deflection of top guides due to all applicable loads other than dead load.

8. Details of expansion joints in rails and top guides where building expansion joints occur.

9. Electrical service for motor operators, preferably 460 volts, 3-phase, 60-hertz, and location of power supply disconnect.

10. Festooned or draped cables, cable reels or trolley duct.

11. Access for installation, maintenance, and replacement of top rollers if door system requires floating top rollers.

12. Door pockets: Minimum clearance of 450 mm 18 inches for doors up to 300 mm 12 inches thick, 800 mm 32 inches for doors more than 300 mm 12 inches thick, should be allowed from center line of power

leaf rail to farthest projection of interior wall of door pocket to accommodate operators and provide access. Consider clearance in the door pocket such that a person cannot be injured or trapped by closing doors.

13. Dimensions and details of tail doors or aperture doors, if required.

14. Minimum clearance of 100 mm 4 inches between extreme faces of adjacent leaves in vicinity of interconnecting cables to allow sufficient space for cable sheaves and cable pickup.

15. Minimum clearance of 100 mm 4 inches between extreme faces of adjacent leaves in vicinity of pick up brackets to allow sufficient space for brackets to engage.

16. Clearance of 100 mm 4 inches between metal parts on vertical edges of leaves and between leaves and jambs which are weather-stripped.

17. Pocket depth, equal to width of widest door leaf, plus 1 meter 3 feet net clearance for cable sheave brackets extending beyond trailing edge of leaves.

18. Rail drains for full length of bottom rails. This may be done with cross drains perpendicular to the rails spaced at a maximum of 3 meters 10 feet on center, emptying into continuous parallel floor drain. In cold areas it may be necessary to provide a means to prevent accumulation of ice at the rails to maintain door operation.

19. End of travel bumpers and bumper supports at end of door travel. Dimensions and locations should be in accordance with door manufacturer's approved drawings.

20. When this specification is used for a fuel cell maintenance hangar, paint hangar, or corrosion control hangar the hazardous classification may impact electrical components of the Horizontal Rolling Steel Door system - such as the electrical drive, limit switches, control panels, etc. All electrical devices within the hazardous classification areas must be specified to be rated for the hazardous location where electrical equipment is installed. Clearly indicate electrical classification.

****

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 Reference Identifier (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	(2017) Steel Construction Manual
AISC 360	(2016) Specification for Structural Steel Buildings

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI SG03-3	(2002; Suppl 2001-2004; R 2008) Cold-Formed Steel Design Manual Set

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ANSI/ASNT CP-189	(2020) ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-16	(2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2020; Errata 1 2021) Structural Welding Code - Steel
AWS D1.8/D1.8M	(2016) Structural Welding Code—Seismic Supplement

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2019) Standard Specification for Carbon

	Structural Steel
ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A325	(2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A449	(2014; R 2020) Standard Specification for Hex Cap Screws, Bolts, and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
ASTM A653/A653M	(2023) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A1008/A1008M	(2021a) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM A1011/A1011M	(2023) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM E84	(2023) Standard Test Method for Surface Burning Characteristics of Building Materials

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1	(2022) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures
NEMA MG 1	(2021) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2023) National Electrical Code
NFPA 220	(2024) Standard on Types of Building Construction

NFPA 409	(2022) Standard on Aircraft Hangars

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-R-5001	(1992, Rev B) Rubber Cellular Sheet, Molded And Hand-Built Shapes; Latex Foam
MIL-STD-889	(2021; Rev D) Galvanic Compatibility of Electrically Conductive Materials
UFC 1-200-01	(2022) DoD Building Code
UFC 3-101-01	(2020; with Change 1, 2021) Architecture
UFC 3-301-01	(2023) Structural Engineering
UFC 4-010-06	(2016; with Change 1, 2017) Cybersecurity of Facility-Related Control Systems

UNDERWRITERS LABORATORIES (UL)

UL 489	(2016; Rev 2019) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 506	(2017; Reprint Jan 2022) UL Standard for Safety Specialty Transformers

1.2 SUBMITTALS

****

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G". Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters 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.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding

Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

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" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Manufacturer's Qualifications; G[, [_____]]

Installer's Qualifications; G[, [_____]]

SD-02 Shop Drawings sealed by the Door Manufacturer's Registered Professional Engineer

Horizontal Rolling Steel Doors; G[, [_____]]

SD-05 Design Data sealed by the Door Manufacturer's Registered Professional Engineer

Horizontal Rolling Steel Doors; G[, [_____]]

Door Compliance Matrix; G[, [_____]]

SD-10 Operation and Maintenance Data

Horizontal Rolling Steel Doors, Data Package 2; G[, [_____]]

1.3 DESIGN REQUIREMENTS

1.3.1 Door Design and Components

The Horizontal Rolling Steel Door system described in the construction documents are representative of a commercially available door. Design and provide the door[, including tail doors,][, including aperture doors,] to fit within the space allocated and in accordance with the criteria specified herein. Design doors to operate properly without binding, interference, or damage to weather stripping or the adjacent structure. Door must be of limited combustible construction in accordance with NFPA 220 and NFPA 409.

Submit Calculations sealed by the door manufacturer's registered professional engineer for review.

Submit drawings showing details of construction, installation, and operation; size, shapes, and thickness of materials; joints and connections; reinforcing; hardware; mechanical devices; electrical devices; and design and detail data for work of other trades affected by these door system(s).

Submit a Door Compliance Matrix which references each specification requirement and the corresponding document and page number where compliance may be verified by the reviewer.

1.3.1.1 Steel Door Components

Design all supporting, steel bracing and framing steel members in accordance with the specified loads and the requirements of AISC 325 and AISC 360. Design all cold formed steel in accordance with AISI SG03-3. Weld steel in accordance with the AWS D1.1/D1.1M Standards.

1.3.2 Loads

Design the door for the loads in accordance with UFC 1-200-01, UFC 3-301-01 and all other applicable criteria.

1.3.2.1 Wind Loads

****

NOTE: In accordance with UFC 1-200-01 and, if applicable, UFC 3-301-01, the Engineer of Record must indicate the appropriate design wind pressure for the design of the door system on the drawings. Where conflicts exist between UFC and UFGS, the UFGS takes precedence.The simplified procedure/method may not be utilized to calculate these design wind pressures for these doorsystems, only the analytical procedure is allowed. The building volume accessed by these steel doors must be designed as a "Partially Enclosed" building in accordance with UFC 3-301-01 paragraph 2-4.6. The door system design pressure must be based on the specific project design criteria and on the design wind velocity for components and cladding based upon each structural element's associated tributary area. An example table of required design wind pressures is shown below and must be included in the drawings.

Zone	Effective Area (SF)	Max Positive Pressure (PSF)	Max Negative Pressure (PSF)
?	10	?	?
?	100	?	?
?	200	?	?
?	500	?	?
?	700	?	?

Components and Cladding elements with Effective Areas greater than 65.032 square meters 700 square feet must be permitted to be designed using the provisions for MWFRSs.

****

In the closed position, design the entire door system to withstand the component and cladding wind pressures as indicated by the Engineer of Record for a Partially Enclosed building, based upon the indicated design wind velocity, geometry and other factors. Design all elements of the door's components and cladding to withstand both the highest positive and negative pressures based upon the actual tributary area from the wind, as indicated.

In addition, design the entire door system to be both fully open and fully operational for wind velocities up to 124 km/h 77 mph. Calculate the applicable component and cladding wind pressures, including importance factor, and utilize the controlling wind pressures or utilize a positive and negative wind pressure of 0.718 kPa 15 psf on the surface of the door, whichever is greater.

Submit complete Calculations sealed by the door manufacturer's registered professional engineer for review.

1.3.3 Deflections

****

NOTE: Temperature effects have been noted to be an design issue on multiple cantilever truss structures. The structural engineer of record is responsible for providing a design, including appropriate camber, to accommodate anticipated deadloads and proper door operation.

****

For any door member, the deflection due to design wind load shall not exceed the member's length divided by 120.

Design Doors as a system to withstand a minimum of 150 percent of both the upward and downward deflections of the door header structure, or as recommended by the door manufacturer. The total anticipated service level maximum vertical deflections which may be experienced during the life of the door and building are [_____] [76 mm] [3 inches] upwards and [_____] [152 mm] [6 inches] downwards.

[For cantilevered truss structures, the camber to accommodate anticipated deadload is [_____] [152 mm] [6 inches] downward.

] Submit design drawings and structural including detail drawings to accommodate deflections described.

1.3.4 Door Structure and Connections

Design connections at top and bottom guide rails to withstand both the positive and negative design wind pressures[and seismic loads][and blast loads] as required by the construction documents. Utilize the governing design loads in accordance with ASCE 7-16 load combinations.

1.3.5 Primary and Secondary Door Members and Connections

Design primary door members and their connections with hot-rolled steel members only. Design complete vertical and lateral load paths, including interconnection system load path from pickup bracket or cable system through the door bracing, to both the top and bottom door leaf members.

[Pick Up Brackets for group doors: Connection of the bracket to the door will not use the torsion resistance of the frame to resist loading.

]1.3.6 Wind Girt Members and Connections

Cold-formed members are not permitted for use in primary or secondary (main) framing of the door leaf and bracing. In addition, face skin finish materials cannot be utilized as part of the lateral force resisting system, including diaphragm action.

Door manufacturer may utilize cold-formed steel infill members as wind girts to support the cladding. If utilized, cold-formed members may be not be thinner than 2 mm 14 GA in material thickness.

1.3.7 Cybersecurity

Design all control systems (including systems separate from a utility monitoring and control system) in accordance with UFC 4-010-06 and as required by Section 25 05 11 CYBERSECURITY OF FACILITY-RELATED CONTROL SYSTEMS [_____]. Implement cybersecurity requirements to mitigate vulnerabilities to all facility-related control systems.

1.4 QUALITY ASSURANCE

1.4.1 Manufacturer's Qualifications

Use a horizontal rolling steel door product from a manufacturer who is regularly engaged in the design, fabrication, erection, and service of horizontal rolling steel doors of type, complexity, and size required for this project. The manufacturer must have at least 5 years of similar horizontal rolling steel door design experience. Similar doors must have comparable function and design including size, configuration, type of use, retractable or moving elements, safety features, controls, and other key engineering elements as the door being specified. It is acceptable to show that a series of similar doors collectively meet all comparable elements to the door being specified, although not necessarily individually. Manufacturer must submit written evidence on similar past door designs and installations listing the name, location, contact information of owners, installation dates, overall sizes, features, and other relevant information for experience and qualifications evaluation. Only manufacturers who can submit this evidence of actual installations where the products have proven practical, durable, and require a minimum of maintenance, will be qualified under this specification.

1.4.2 Installer's Qualifications

A manufacturer's representative, skilled and experienced in the erection of horizontal rolling steel steel doors of the type specified herein, is required to supervise installation of the door system(s) in accordance with approved shop drawings. For each installer submit written evidence of similar past door installations listing the name, locations, contact information of owners, installation dates, overall sizes, features, and other relevant information for experience and qualifications evaluation.

1.4.3 Warranty

Provide a three-year warranty for all mechanical and electrical components against defects in material and workmanship beginning on the date of

Project Acceptance.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials which are not shop installed on the doors in original rolls, packages, containers, boxes, or crates bearing the manufacturer's name, brand, and model number. Store materials and equipment in dry locations with adequate ventilation, free from dust and water, and so as to permit access for inspection and handling. Handle doors carefully to prevent damage. Remove damaged items that cannot be restored to like-new condition and provide new items.

PART 2 PRODUCTS

2.1 HORIZONTAL ROLLING STEEL DOORS

2.1.1 Structural Steel

****

NOTE: Specify stainless steel only if the project site is located in Environmental Severity Classification (ESC) C4 or greater or local experience indicates that steel guides will rust and interfere with door operation.

Include the following paragraphs in Section 05 12 00 STRUCTURAL STEEL.

".1 Top Guides and Bottom Rails for Horizontal Rolling Steel Doors:

.1.1 Top Guides: Maintain nominal elevation within plus or minus 6 mm 1/4 inch and nominal center-to-center dimension within plus or minus 3 mm 1/8 inch, with variation from nominal no greater than one mm in 2 meters 1/8 inch in 20 feet. Coordinate Guide Spacing with door manufacturer's design. Joints of head guides are not required to be welded, but shim and grind so adjoining guide surfaces are not out of line more than 2 mm 1/16 inch. Top guide tolerances must be met after dead load is imposed on building frame. [Provide stainless steel framing or structural members for top guide surfaces which will be in contact with rollers during door operation.]

.1.2 Head Flashing: Galvanized steel or galvalume, not thinner than 1.2 mm thick 18 gage, reinforced as required. Coordinate with door manufacturer. Show exact location and configuration on top guide shop drawings. Install head flashing after doors are in place.

.1.3 Bottom Rails: Standard A.S.C.E. or A.R.E.A. weighing not less than [_____] kilograms per meter pounds per yard. Coordinate rail spacing with door manufacturer's design and do not install rails until top guide system has been installed. Continuously support rails and anchor as indicated. Set rails to elevation within plus or minus 6 mm 1/4 inch, with

variations from elevation no greater rate than one mm in 2 meters 1/8 inch in 20 feet. Nominal design relationship between top guides and bottom rails to be maintained without exception. Center-to-center dimensions of bottom rails to be maintained within plus or minus 3 mm 1/8 inch with variation from nominal no greater than one mm in 2 meters 1/8 inch in 20 feet. Weld rail joints and grind smooth or provide with splice plate in accordance with ASCE standards."

****

AISC 360 and ASTM A36/A36M.

2.1.2 Formed Steel

AISI SG03-3.

2.1.3 Galvanized Steel

Hot dipped galvanized frames in accordance with ASTM A123/A123M.

2.1.4 Sheet Steel

ASTM A1011/A1011M hot-rolled steel sheet, commercial quality,
ASTM A1008/A1008M cold-rolled steel sheet, commercial quality.

2.1.5 Galvanized Sheet Steel

ASTM A653/A653M, coating designation G 90 galvanized steel sheet, commercial quality.

2.1.6 Exterior Covering

****

NOTE: Choose one of the following options.

****

****

NOTE: Designer's options.

Use the first paragraph if the doors are a part of a new or renovated building which will have the same exterior cladding as the rest of the facility (i.e., insulated metal wall panels, translucent wall panels, etc.). Include in the project specifications the appropriate referenced specification section and edit to include the exterior cladding for this door system.

Use the second paragraph if the door's cladding will not be provided by another specification. Examples of this condition may include a historical door replacement or a door in an existing facility which is being reskinned or replaced and must be thinner due to existing door clearances. In this example the door manufacturer will design the door to be a part of the exterior enclosure and will provide the entire door assembly, including cladding, insulation

and air barrier.
****

[Insulated Metal Wall Panels as specified in Section [07 42 63 FABRICATED WALL PANEL ASSEMBLIES][_____].

][Flat [sheet steel] [galvanized steel sheet], not thinner than 2.15 mm thick 13 gage[_____].

]2.1.7 Interior Covering

****
NOTE: Choose one of the following options.
****

****
NOTE: Designer's Options.

Use the first paragraph if the doors are a part of a new or renovated building which will have an interior metal liner panel. Include in the project specifications the appropriate referenced specification section and edit to include the liner panel for this door system.

Use the second paragraph if the door's interior liner panel will not be provided by another specification. Examples of this condition may include a historical door replacement or a door in an existing facility which is being reskinned or replaced and must be thinner due to existing door clearances. In this example the door manufacturer will design the door to be a part of the building's exterior enclosure and thus they will provide the entire door assembly, including cladding, insulation and air barrier.

Use the third paragraph if no interior liner panel is required.
****

[Preformed metal liner panel is specified in Section 07 42 13 METAL WALL PANELS with factory finish equal to Kynar 500 PVDF fluoropolymer. Provide interior panel[full height of door][for the bottom [_____] meters feet of door][as shown in the drawings].

][Flat [sheet steel] [galvanized steel] liner sheets, not thinner than 1.5 mm thick 16 gage. Provide interior panel[full height of door][for the bottom [_____] meters feet of door][as shown in the drawings].

][No interior liner panel required.

]2.1.8 Exterior Envelope

2.1.8.1 Insulation

****
NOTE: Choose one of the following options.

****

****

NOTE: Designer's Options.

Use the first paragraph if the doors are a part of a new or renovated building which will have insulated metal wall panels provided as a part of the rest of the facility (i.e., insulated metal wall panel assemblies, translucent wall panels, etc.). Include in the project specifications the appropriate referenced specification section and edit to include the insulated exterior cladding for this door system.

Use the second paragraph if the door's cladding will not be provided by another specification and insulation must be provided within the door. Examples of this condition may include a historical door replacement or a door in an existing facility which is being reskinned or replaced and must be thinner due to existing door clearances and thus not permit an insulated metal wall panel on the exterior. In this example the door manufacturer will design the door to be a part of the exterior enclosure and will provide the entire door assembly, including cladding, insulation and air barrier.

****

****

NOTE: Specify same U value as required for the walls of the building. Specify STC rating when required to limit sound transmission. Clearly list STC requirements in the Contract Documents while considering desired method and reason to achieve STC ratings. Particular attention should be paid to the perimeters of door panels. STC rating cannot be calculated empirically and are developed after field test of each installation including door flashing and weather stripping. If the STC rating is required for security, consider alternatives such as restricting how close people may be to the doors, based upon testing of the fully installed system. Coordinate STC rating and detailing with door manufacturers during design.

****

[Do not provide insulation if insulated metal panels are used.

][Provide insulation that:

a. Contains no asbestos;

b. Is permanently secured in place behind the exterior covering; and

c. Has a flame spread rating of 75 or less and a smoke-developed rating of 100 or less when tested in accordance with ASTM E84.

Do not use cellular plastics as exposed finish material. Design the doors to have an air-to-air U value of not more than [_____] and a sound

transmission class (STC) of not less than [_____].

][Batt or blanket insulation as specified in Section 07 21 16 MINERAL FIBER BLANKET INSULATION.

] Submit design drawings and U value calculations.

2.1.8.1.1 Air Barrier

****
NOTE: UFC 3-101-01 Architecture imposes air tightness requirements in accordance with ASHRAE 90.1 for all buildings and requires full design and inspection of the Air Barrier. In accordance with Section 3-6.3, testing of the air barrier is not required in hangar bays, maintenance bays, or similar areas. Section 01 91 19 BUILDING ENCLOSURE COMMISSIONING also notes this exception in the editor's notes in paragraph BUILDING ENVELOPE AIR TIGHTNESS REQUIREMENT. This acknowledges the inherent challenge in pressurizing a space of this volume, and the way these door systems seal, which inherently relieve this internal pressure. Indicate the delegated design responsibility to either the door manufacturer or the insulated metal panel provider, depending upon who is responsible for the envelope (Insulation and Air Barrier) design.
****

The [door manufacturer] [insulated metal panel provider] is responsible for the delegated requirement to design, provide and inspect the door cladding portion of the Air Barrier in accordance with UFC 3-101-01.

a. When the door system is fully open, all door system components will be outside of the required clearance area for the door opening.

b. When the door system is fully closed the door system will seal and form a portion of the building's exterior envelope.

The door manufacturer is responsible for the delegated requirement to design, provide and inspect the door flashings and weather stripping for their ability to seal to form a portion of the Air Barrier in accordance with UFC 3-101-01.

2.1.9 Hardware

Provide door hardware to accommodate all design loads specified. Provide top guide rollers, bottom wheels, interleaf bumpers, tractor pulls, track cleaners, and top bumpers as required for a complete and operational installation.

2.1.9.1 Wheel Assemblies

Provide steel plate bottom wheels having a minimum tread diameter as required for the actual wheel loading. Construct wheel assemblies to permit removal of the wheel without removing the door leaf from its position on the rail.

a. Treads: Machine wheel treads concentric with bearing seats. The

clear distance between flanges not exceeding the width of the rail by more than 3 mm 1/8 inch at the tread nor more than 6 mm 1/4 inch at the edge of the flange. Machine internal bearing seats accurately for a press fit. Heat treat wheels 450 mm 18 inches or greater in diameter to obtain a rim hardness of 320 Brinnel.

b. Wheel bearings: Provide tapered roller or spherical bearings, either internal or cartridge type, arranged so that both horizontal and vertical loads are transferred to the rail only through the bearing. Provide bearings tightly sealed and equipped with high-pressure grease fittings.

2.1.9.2 Top Guide Rollers

****
NOTE: Select one type of top guide roller and delete other types. In Environmental Severity Classification (ESC) C4 or greater or, in circumstances as indicated by the DoD, specify stainless steel rollers only if local experience indicates that steel rollers will rust and interfere with door operation. Consider both cost and softness of stainless steel rollers and thus shorter lifespan versus benefits.
****

Provide top guide rollers of suitable size and capacity for satisfactory performance under the design load conditions. In addition, provide the top guide roller type matching the top guide system to be used.

2.1.9.2.1 Fixed Pancake Top Guide Rollers

Horizontal type; to be used between two vertical steel surfaces formed by the top guide system. Provide adequate clearance for vertical deflection of top guide system. Provide rollers not allowing more than 6 mm 1/4 inch of side to side movement of the door. Provide guide heads each with single or double steel rollers of a suitable diameter and thickness for satisfactory performance under the designated load conditions and top guide system used. Provide permanently lubricated bearings. Design doors to use no less than two top guide heads. Use fixed type head flashing when providing fixed pancake top guide rollers.[Provide stainless steel rollers.]

2.1.9.2.2 Vertical Floating Head Top Guide Rollers

Provide top-roller assemblies to:

a. Move up and down within the specified positive and negative deflection of the roof in the vicinity of the door opening;

b. Allow easy removal through the top of the guide system; and

c. Include both horizontal and vertical [stainless steel] rollers built into a frame which is connected in such a manner as to transmit the specified wind loads from the door to the building structure and to prevent disengagement of the door from the top guide; and

[d. Provide vertical floating head top guide rollers that use floating type head.

]2.1.10 Personnel Doors

****

NOTE: Emergency Exit/Egress doors are no longer permitted to be located in hangar doors in accordance with UFC 4-211-01. Personnel doors for convenient access to the flightline are permitted if provided in accordance with the second paragraph.

****

[Personnel doors are not required within these Hangar doors.

][Provide personnel doors in door leaves as indicated in the drawings. Provide insulated steel or aluminum personnel doors as specified in Section [08 11 13 STEEL DOORS AND FRAMES][08 11 16 ALUMINUM DOORS AND FRAMES]. Provide complete personnel door with all hardware including, hinges, lockset, stop, weatherstripping, and interlock.

] **********

NOTE: Personnel doors, their frames, and hardware are specified in the respective sections of the project specification. Provide self-closing door hardware. Personnel doors in hangar doors are often part of the flight line security perimeter locking behind someone exiting through the hangar door and may, or may not, have exterior door hardware pulls. Specifier must address getting back into the hangar from the flight line when the hangar doors are all closed.

****

The door manufacturer is responsible for providing structural frames and electrical interlock for personnel doors.

2.1.10.1 Doors and Frames

Specified in Section 08 11 13 STEEL DOORS AND FRAMES.

2.1.10.2 Hardware for Personnel Doors

Specified in Section 08 71 00 DOOR HARDWARE.

2.1.10.3 Electrical Interlock

Provide each personnel door with an electrical interlock switch to prevent motor operation of the leaf or group in which it is located when the personnel door is open. Provide an identified indicator light at each door leaf control station indicating when the personnel door is in the open position. The intent of this requirement is to prevent any other door leaf from bypassing the door leaf with an open personnel door.

2.1.11 Weather Stripping

Provide adjustable and readily replaceable material. Provide [as indicated] [on vertical edges, sills, and heads] to afford a weathertight installation. Weather stripping is [flap] [bulb] type.

****

NOTE: Designers Option. Select either single or double edge flashing between door leaf panels. It is recommended that double edge flashing be provided when door panels are 300 mm 12 inches wide or greater.
****

Provide minimum [single] [double] edge weather stripping between door leaf panels.

****
NOTE: Clearly list STC requirements in the Construction Drawings while carefully considering desired method and reason to achieve STC ratings. Particular attention should be paid to the perimeters of door panels (flashing and weather stripping). If the STC rating is required for security, consider alternatives such as restricting how close people may be to the doors, based upon testing of the fully installed system. Coordinate STC rating and detailing with door manufacturers during design.
****

[Design and provide the door's weather stripping and flashing to meet or exceed a sound transmission class (STC) of not less than [_____].

]2.1.11.1 Rubber

Provide flexible weather stripping on vertical edges and sills. Provide clearance between metal parts on vertical edges of leaves and between leaves and jambs which are to be weather-stripped as indicated, or a minimum of 50 mm 2 inches whichever is greater. Use either flap-type, two-ply, EPDM or double flap, single or dual opposed solid neoprene material.

For flap-type weather stripping, provide a two-ply cloth-inserted EPDM material with a minimum thickness of 3 mm 1/8 inch and retained continuously for its full length and secured with rust-resistant fasteners spaced no more than 300 mm 12 inches on center.

For double flap weather stripping, provide extruded neoprene with heavy center section attached at 300 mm 12 inches on center.

2.1.11.2 Metallic

Form head weather stripping material between each leaf and the top guide system of not thinner than 1.2 mm thick 18 gage galvanized sheet steel or flap-type, cloth-inserted neoprene, as indicated.

2.1.11.3 Head Flashing

****
NOTE: Select one of the following options for different head flashing designs. Coordinate with the top guide structure and top guide head design. Hanging head flashing must be designed and fabricated to accommodate total positive and negative deflection of roof in vicinity of door

opening. Design stiffened hanging head flashing to fasten to top guides; Provide 2.15 mm 13 gage galvanized or galvannealed steel material stiffened by supporting frames to adequately withstand specified wind loads without permanent deformation. Material must be furnished and installed by same trade that furnishes top guide system, so preparation for fasteners can be done at fabrication shop. However, to minimize possibility of damage to the material, installation must be done after doors are in final position on rails.

****

Provide with the top guide system specified in Section 05 12 00 STRUCTURAL STEEL. Provide cloth-inserted neoprene weathering fastened to top of door leaves to engage the head flashing when doors are closed. Head flashing type is dictated by top guide system and top guide head type.

2.1.11.3.1 Hanging Head Flashing

Provide head flashing secured to top guide structure so as not to obstruct path of door movement.

2.1.11.3.2 Floating Head Flashing

Provide head flashing secured to top guide heads and travel with the guide heads as the guide system deflects under live load. Provide adequate clearance such that when the floating flashing moves, it does not crash into the door structure.

2.1.11.3.3 Fixed Head Flashing

Provide head flashing secured to the door structure and extending vertically upward until it creates an overlapping seal with the top guide structure. Select dimensions such that the top guide roller will contact the guide structure before the head flashing so that it does not drag during operation.

2.1.12 Fasteners

Fasteners are selected by the hangar door manufacturer in order to develop the full strength of the connection required. Bolted structural connections require ASTM A325 or ASTM A449 bolts. Bolt finish is [zinc plated][black oxide][Hot dipped galvanized].

2.1.13 Sealant

Single-component or multicomponent elastomeric type conforming to ASTM C920, Type S or M, Grade NS, Class 12.5, Use NT. Provide a sealant that has been tested on the types of substrate to which it will be applied.

2.1.14 Primer

Zinc-Rich Epoxy Primer in accordance with Section 09 97 13.27 HIGH PERFORMANCE COATING FOR STEEL STRUCTURES.

2.1.15 Variable Frequency Drives

Provide a variable frequency drive (VFD) in NEMA ICS 1, Type [4][12]

enclosures equipped with access door-controlled, UL 489 Molded Case Circuit Breaker (MCCB) with a through-the-door disconnect switch. The control system includes but is not limited to a VFD equipped with overload and undervoltage protection, relays and timing devices as required, control circuit transformers, and a numbered terminal strip. Provide a control circuit transformer capable of reducing the voltage in the control circuits to 120 volts or less, and conforms to UL 506.

2.1.16 Electrical

Provide conduit, wire, flexible cables, boxes, devices, and accessories[, and install trolley duct,] under Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. If permanent electrical power is not available when door installation is complete, provide temporary power in accordance with distribution system requirements in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM, for testing and adjusting the doors.

Submit the door manufacturer's complete schematic wiring diagram, field wiring diagram, and a complete physical location drawing showing the location of controls with the runs of conduit, size of conduit, number and size of wires in each conduit, location of junction boxes, and full details of control mountings.

2.1.16.1 Electrical Classification

****
NOTE: A Class 1 Division 2 rating is required to 450 mm 18 inches above the floor as a minimum per UFC 4-211-01. Specify a Class 1 Division 1 rating to the required height for corrosion control or fuel cell hangars.
****

This building and these doors are required to adhere to a [Class 1 Division 1] [Class 1 Division 2] [_____] electrical classification[to a height of [_____] meters feet as shown in the Contract Drawings].

2.2 FABRICATION

2.2.1 Doors

2.2.1.1 Frames and Framing

Provide welded or bolted construction in door leaves. Design joints to develop 100 percent of the strength of the framing members. Provide continuous vertical members throughout the height of the door. When required, prepare splices to facilitate field assembly in accordance with standard practice. Provide frames and framing members true to dimensions and square in all directions; no bowed leaves, warped, or out of line in the vertical or horizontal plane of the door opening by more than 1 mm in 2 meters 1/8 inch in 20 feet. Provide diagonal bracing so that the completed leaf assembly will be braced to withstand shipping, assembly, and operational loads. Grind smooth any exposed welds and welds which interfere with the installation of various parts such as cover sheets. Prepare, prime, and coat structural framing and miscellaneous steel as specified in the paragraph FINISHES.

2.2.1.2 Exterior Covering and Interior Liner Sheets

****
NOTE: Delete the paragraph below if flat sheet liner is not specified for either exterior or exterior covering.
****

Fasten flat sheets to the frame either by edge welding, plug welding, or threaded fasteners at no greater than 300 mm 12 inches on center. The maximum area where flat sheets are attached as either exterior covering or interior liner sheets cannot exceed 2.5 square meters 25 square feet. Make edges of exterior sheets weathertight with sealant.

2.2.2 Locking Devices

Do not provide locking devices on motor-operated doors.

2.2.3 Tractor Pulls

Provide tractor pulls so that leaves can be towed by a tractor or similar equipment in the event of power failure. Design the tractor pull for drive force to tow door or 22240 N 5000 pounds whichever is greater. Provide a minimum 10 mm 3/8 inch thickness steel plate.

2.2.4 Track Cleaners

Provide a device to clear debris from the rail head and wheel flange grooves as the leaf is moved.

2.2.5 Insulation

Secure insulation to doors with clips, studs, or adhesive. Protect insulation within 2400 mm 8 feet of floor with steel liner sheets secured to framing 300 mm 12 inches on center at edges with hot dipped galvanized, self-tapping screws.

2.2.6 Interconnection of Door Leaves

****
NOTE: Designer's option. Select either Cable System or Pick Up Bracket interconnection design. Delete the paragraph for the option not selected.

Pick up brackets may be preferred when there is limited space behind or between the doors, when the doors are short (under 9 meters 30 feet), and when cost is critical. Do not specify pick up brackets on a floating group door system.

Cable Systems are preferred to reduce impact and potential fatigue issues especially in large, heavy doors that are 9 meters 30 feet tall and greater. Cable systems require more spacing between the door leaves to accommodate the sheave brackets and wire rope.
****

[Individually operated doors are not interconnected.

][2.2.6.1 Cable System for Group Doors

The minimum size for the cable which interconnects the leaves is 10 mm 3/8 inch; provide cables containing either improved plow steel with lubricated hemp centers or wire rope cores. Sheaves over which the cables operate have a diameter of at least 18 cable diameters and either sealed ball- or roller-type bearings or graphite bronze bearings of a sufficient capacity for the operating loads. Grease fittings are provided for the sheave bearings unless permanently lubricated bearings are used. Operate cable sheave systems such that the lead door travels at 20 meters 60 feet per minute.

][2.2.6.2 Pick Up Brackets for Group Doors

Pick Up Brackets are designed to accept operational loads imparted by the lead leaf. Operate pick up bracket systems such that the lead door travels at 15 meters 45 feet per minute. Provide door spacing sufficient to allow overlap of pick up brackets not less than 13 mm 1/2 inch to prevent brackets from inadvertently passing each other. Pick up brackets not to encroach on adjacent door or its components closer than 13 mm 1/2 inch. Provide cushion on brackets to reduce noise and impact load on doors.

]2.3 OPERATION

****

NOTE: Door type, operation and control will depend upon use and configuration of the facility. Choose one of the three types of door operation in the paragraphs below compatible with the design requirements. Delete configurations not used.

NOTE: If applicable, please refer to UFC 4-211-01 Aircraft Maintenance Hangars for limitations on types, operation and control of Horizontal Rolling Steel Doors allowed for aircraft maintenance hangars.

****

2.3.1 Door Types

Provide [unidirectional] [biparting] [individually operated] [as indicated] door type. Provide [Floating Group] [Anchored Group] doors.[Floating Group doors are interconnected by cable sheaves.][Anchored Group doors are interconnected by [cable sheaves] [pick up brackets].]

[2.3.1.1 Individually Operated Doors

For each door leaf, provide a separate, traction-drive operating unit driving one or more of the bottom wheels. For each leaf, provide a motor-mounted, spring-set, solenoid-released motor brake. Provide the ability for each leaf shall move independently of the other leaves. Provide doors that require operating personnel to walk with the leaf as it moves. Do not interconnect door leaves for individually operated doors.

2.3.1.1.1 Push Buttons for Individually Operated Doors

Provide push buttons mounted on the exterior face for the leaves mounted on the outer rails; provide push buttons mounted on the interior face for

the leaves on the inner rails; and provide push buttons mounted on both the exterior and interior faces for the leaves on the middle rails. Provide the button at each edge of a leaf allowing the leaf to travel with that edge as the leading edge only. The controls are not be reversible. Provide each control button at the location indicated.

2.3.1.1.2 Plunger-Type Limit Switches

Provide at each edge of each leaf of individually operated doors. Provide limit switches actuated by 20 mm 3/4 inch diameter stainless steel rods of adjustable length, guided at both ends with nonmetallic bearings and with tape-type constant force springs to return the rods to their normal position after actuation. Provide actuating rods with sufficient over-travel so that the leaves cannot bump one another or any portion of the building or be damaged when being towed. Provide adjustability for each rod 150 mm 6 inches plus or minus from its normal position.

2.3.1.1.3 Safety Edges

Provide fail-safe safety edges on each edge of each leaf of individually operated doors.

2.3.1.1.4 Warning Device

Provide a clearly audible signal[and clearly visible LED flashing light] on each individually operated leaf group of leaves.

][2.3.1.2 Floating Group Doors

****

NOTE: Consider visual appearance when using the anchored or wraparound cable system. The cables used to move the door leaves are sometimes exposed to view.

****

Provide each group of three or more leaves with a separate, traction-drive operating unit located in each end leaf of the floating group doors, which drives one or more wheels of the end leaf, and a wraparound cable system on the intermediate leaves coupled to each end leaf. Design the door system so that movement of either end leaf allows stacking and unstacking of the other end and allows intermediate leaves to move in concert. The group of leaves traveling abreast may then be positioned as desired in the opening. Provide necessary cables, fittings, cable sheaves, housings, guards, anchors, and miscellaneous hardware. Provide doors that require operating personnel to walk with the leaf as it moves. See operator requirements for cable sheave doors. Do not use pick up brackets for floating group doors.

2.3.1.2.1 Push Buttons for Floating Group Doors

Design each group to be controlled by push button stations mounted at each end of each group of leaves. Stations contain one button for stacking the leaves and one button for unstacking the leaves. The stack push buttons are used to move the doors as a group once the doors are fully stacked. The group move function begins after the doors have grouped together and after a five second delay has expired. Provide push buttons mounted on the exterior face of the leaves mounted on the outer rail. Provide push buttons mounted on the interior face of the leaves mounted on the inner

rail. Show the location of each control station on manufacturer's drawings.

2.3.1.2.2 Plunger-Type Limit Switches

Provide at each end of each group of floating group doors. Provide limit switches actuated by 20 mm 3/4 inch diameter stainless steel rods of adjustable length, guided at both ends with nonmetallic bearings and with tape-type constant force springs to return the rods to their normal position after actuation. Provide actuating rods with sufficient overtravel so that the leaves cannot bump one another or any portion of the building or be damaged when being towed. Provide adjustability for each rod 150 mm 6 inches plus or minus from its normal position.

2.3.1.2.3 Safety Edges

Provide fail-safe safety edges on each leading and trailing edge of drive leaves for floating group doors.

2.3.1.2.4 Warning Device

Provide a clearly audible signal[and clearly visible LED flashing light] on each group of leaves.

][2.3.1.3 Anchored Group Doors

Provide a traction-drive operating unit located in the lead leaf of the group and driving one or more wheels of the lead leaf.[If connected by cable sheaves, design the leaves in each group to start to moving at the same time and arrive at their fully open or fully closed positions simultaneously.] Provide necessary[cables, fittings, sheaves, housings,] guards,[pickup, brackets,] anchors, and miscellaneous hardware. Provide doors that require operating personnel to walk with the leaf as it moves. See operator requirements for [cable sheave] [pick up bracket] doors.

2.3.1.3.1 Push Buttons for Anchored Group Doors

****

NOTE: Specify interior or exterior push buttons depending on the arrangement of the doors. Interior push buttons may become obstructed when the leading leaf is on the outermost rail.

****

Each group is controlled by a two-button push button station marked "OPEN" and "CLOSE" mounted near the [inside] [outside] leading edge of the lead leaf.

2.3.1.3.2 Lever Arm Type Limit Switches

Provide for anchored group doors to stop the travel of each group in the fully open and fully closed positions. Provide limit switches with:

a. Positive acting, snap action, lever arm type with actuating cams designed with sufficient overtravel to permit the group to come to a complete stop without over traveling the limit switches.

b. Mounted on the leaves, and the actuating cams mounted either on the top guides or on adjacent door leaves.

2.3.1.3.3 Safety Edges

Provide fail-safe safety edges on the leading edge of the drive leaf of anchored group doors.

2.3.1.3.4 Warning Device

Provide a clearly audible signal [and clearly visible LED flashing light] on each group of leaves.

]2.3.2 Operating Units

****
NOTE: Delete "lead" for individually operated doors. Leave in for group doors. Pick up bracket doors operate at 15 meters 45 feet per minute. Cable sheave doors operate at 20 meters 60 feet per minute.

Provide a Totally Enclosed Wash-Down (TEWD) motor enclosure in harsh salt air marine environments. Doors have a history of early motor failure where facilities are adjacent to the oceanor exist in corrosive environments.
****

Design each operating unit to move its [lead] leaf at a speed of approximately [20 meters] [15 meters] [60 feet] [45 feet] per minute at zero wind load conditions. Design the operating units to consist of either a separate motor and gear reducer or a gearhead motor, high-speed shaft brake, and necessary roller chains and sprockets. Provide the systems with overload protection for the drive units and a means for emergency tractor towing operation.

a. Provide NEMA MG 1, high-starting torque, reversible type motors with sufficient horsepower and torque output to operate the leaves in either direction from any position under zero wind load conditions at not more than 75 percent of their rated capacity. Motors shall operate on current voltage of the characteristics indicated at not more that 3600 [1800] rpm. Provide drip-proof type motor enclosures or NEMA totally-enclosed, fan-cooled (TEFC) [totally-enclosed, wash-down (TEWD)] type. Design motors using a minimum service factor of 1.2.

b. Provide gear reduction units that allow a reversal of effort through the gears without damage to the units.

c. Provide operating mechanisms covered on the interior of the leaf by a hinged 1.5 mm thick 16 gage flat steel cover.

2.3.3 Braking Systems

Design braking systems to ensure stoppage of the leaves under normal, dry rail conditions within the safety edge overtravel limit. Provide either a magnetic, spring-set, solenoid-released brake or hydraulic type braking systems. Provide a hand release to release the brake when it becomes necessary to move the leaf with an outside force. Provide an automatic reset type hand release so that the brake will be operable during

subsequent electrical operation of the door.

2.3.4 Controls

Provide doors controlled by constant pressure push buttons mounted on the door leaves. Removing pressure from the button shall stop the movement of the leaves. Provide control equipment conforming to NEMA ICS 1 and NEMA ICS 2. Provide [mushroom] [guarded] head type interior push buttons, mounted in heavy-duty, oil-tight enclosures conforming to NEMA ICS 6, Type 4, except that enclosure for the VFD with disconnect switch requires [Type 12 for interior application] [Type 4 for exterior application].[Provide watertight enclosures for exterior push buttons conforming to NEMA ICS 6, Type 4.]

2.3.5 Limit Switches

Provide limit switches to prevent overtravel and bumping. Safety edges are not to be used as limit switches.

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA. Include wiring and control diagrams.

2.3.6 Safety Edges

****
NOTE: Edit to suit type of door operation required. Select pneumatic or electric type safety edge with consideration of the significant cost increase when specifying electric safety edge. Allow manufacturer to select based on their preference unless otherwise specified by A/E if a Project/Base/User preference is stated during design.
****

Provide fail-safe safety edges on door leaves from 25 mm one inch above the floor to the top of the door leaf. For leaves 300 mm 12 inches thick (including siding) or less, provide a single run of safety edge the full width of door. For leaves over 300 mm 12 inches thick (including siding,) provide a double run of safety edge spaced to provide the maximum degree of safety in stopping the leaves. For leaves over 300 mm 12 inches thick (including siding) provide a double run of safety edges on the outer edge of each side of door leaf covering no less than 80 percent of leaf.

a. Design: Provide safety edges to provide a minimum of 90 mm 3-1/2 inches of overtravel after actuation until solid resistance is met and door motion comes to a complete stop. If door requires more than 90 mm 3-1/2 inches to come to a complete stop, provide additional overtravel built into safety edge the distance required for door motion to come to a complete stop. Use [pneumatic] [electric] [pneumatic or electric] safety edges.

b. Specs: Use sensing edges of reinforced [EPDM] [polyvinyl chloride] cover or other Government-approved material with chemical resistance to diesel and JP-4 fuel, hydraulic fluids, SAE-30 oil and salt water. Use cover that provides hermetic seal for weather and moisture resistant protection of internal foam and contact elements. Internal foam may be polyurethane and/or latex foam in accordance with military specification MIL-R-5001, medium density. Use [natural gum rubber hose, plugged on one end] [two contact elements separated by

perforated foam] or other Government -approved materials and design to perform the switching function when the sensing edge encounters an obstruction along any portion of its active length.

c. Operation: Verify that actuation of the safety edge on leading edge of a group of leaves stops movement of the group. Actuation of a safety edge locks out the motor control in the direction of travel until reset, but shall permit the door to be reversed away from the obstruction which tripped the safety edge. Design safety edges to reset by moving doors away from the obstruction. Design the lower portion of the safety edges to a height of approximately 1500 mm 5 feet to be independently removable for convenience in servicing or repair. The remainder of the edge may be in one piece up to a maximum of 6000 mm 20 feet.

****

NOTE: Specify either Bumper(s) or Tow Bar. Tow bars will protect safety edges better than a bumper system and allow the door panels to be either pushed or pulled.

****

d. Door Edge Protection

[(1) Bumper(s): Protect each door leaf edge provided with a safety edge with a spring type bumper(s). Design bumper to absorb 150 percent of the door drive force when door is pushed in an emergency. For continuous safety edges, extend bumpers to the sides. For sectional safety edges, the bumper can interrupt the safety edge for a distance not greater than 305 mm 12 inches.

][(2) Tow Bar(s): Provide rigid tow bar for each door leaf edge provided with a safety edge. Design rigid tow bar assembly for 150 percent of the door drive force when door is pushed or pulled in an emergency. Provide swivel connection at door end and hook pintle hitch at opposite end.

] e. Keyed bypass: Provide a keyed bypass to the door controls to render the safety edges in a temporary "repair" mode, if necessary. The door drive shall be restored from its "fail safe" mode by activation of the keyed bypass.

2.3.6.1 Electrical Safety Edges

Connect the safety edge in series with the necessary relays and resistors to make the system complete. The service shall be not more than 24 volts and the circuit shall be normally energized so that the malfunction of any of the component parts will make the door inoperative. Wire sensing edges to provide for control reliable 4-wire operation of door so that any power loss to the sensing edges is experienced, then the door becomes inoperable until power is restored and a reset operation is initiated. Install sensing edges to operate through a normally energized relay so that when the sensing edge is compressed the relay contacts open. Install relay contacts to also open if any component in the sensing edge control circuit is broken so as to break continuity. Use 24 volts electrical service to the control circuit. Ensure service to the sensing edge does not exceed a nominal 24 volts. Install a large red indicator light and/or a loud siren, to be simultaneously activated with the actuation of any sensing edge, to indicate the presence of an obstruction.

2.3.6.2 Pneumatic Safety Edges

Pneumatic safety edges operate by means of displaced air actuating air switches. Provide a minimum of one air switch for each 6 meters 20 feet of vertical edge. Provide a pneumatic sensing hose utilizing a natural gum rubber with a 20 mm 3/4 inch inside diameter. Provide electrical service to the air switch no more than 120V. Locate all air switches, associated wire, and conduit above 450 mm 18 inches minimum above the floor.

2.3.7 Warning Device

Provide warning device that complies to the following:

a. Operate when the push button is actuated for movement of the door in either direction;

b. Sound 5 seconds before the door moves, and while the door is moving; and

c. Be distinctly different than the fire alarm and be a minimum of 100 dB within 1 meter 30 feet.

2.3.8 Emergency Operation

Provide doors[, including tail doors,][, including aperture doors,] constructed and equipped so that they can be operated-manually or by tractors from the ground level in case of power failure. Design the manual operation of doors to avoid damage to safety edges.

2.3.9 Electrical Work

****

NOTE: Insert the following into Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

"HORIZONTAL ROLLING STEEL DOORS: Provide field wiring[and trolley duct installation] for doors under this section in accordance with door manufacturer's written instructions, drawings and diagrams, and NFPA 70 and NEMA ICS 1. Provide conduit, wiring, boxes, cables, devices, and accessories under this section. If permanent electrical power is not available when door installation is complete, provide temporary power for testing and adjusting doors for proper operation.[Trolley ducts will be furnished by door manufacturer and installed under this section in accordance with door manufacturer's approved drawings.][Provide draped or festooned cables or cable reels under this section. Provide extra-flexible Type SD cable, and have a spring-loaded, automatic take-up reel, coil-cord, draped cable, or equivalent device.] [as indicated.]"

****

It is the door manufacturer's responsibility to provide the proper electrical equipment and controls built in accordance with the latest NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6 standards. Provide equipment,

control circuits, and safety edge circuits that conform to NFPA 70. Where located 450 mm 18 inches or less above the floor, meet the requirements to be explosion-proof as defined in NFPA 70, Article 513. Provide mannual or automatic control devices necessary for motor operation of the doors, including push button stations, limit switches, variable frequency drive with UL 489 MCCB motor circuit protection, control circuit transformers, relays, timing devices, warning devices, and [trolley ducts with collectors or trolleys] [required festoon system].

2.3.9.1 Trolley Ducts

****

NOTE: Individually motor-operated doors and floating group doors should always be provided with a trolley duct system to bring power to door leaves. Anchored group doors may be equipped with draped or festooned cables, cable reels or trolley duct. Trolley duct systems should be specified to be furnished by door manufacturer but installed under Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM in accordance with door manufacturer's drawings. Only door manufacturer is properly qualified to know where to place trolley duct so there is adequate clearance and noninterference. This specification defines whether trolley duct or SO cable electrification is to be used. Even when a trolley duct system is used, if group doors have a personnel door interlock in a leaf other than the lead leaf, SO cable must be used to communicate the interlock back to the control panel.

****

Provide one or more runs of trolley duct as required for the door system provided. Provide ducts with solid copper conductors in a protective steel [or polyvinyl chloride] housing. Locate ducts as shown on door manufacturer's drawings. Provide adequate clearances in the top guide system for the ducts.

a. Provide each run with the required number of sections of straight track, a section of dropout track, feed boxes, end caps, couplings, hangers, and other accessories to make the system complete and workable. If required, provide expansion tracks in each run where the system crosses a building expansion joint in the roof construction and in the top guides.

b. Furnish one track-supported tandem trolley or self-supporting collector for each [individually motor-operated door] [group of doors], complete with spring-loaded brush contacts. Provide trolley pulling brackets and corrosion-protected chains attached from each side of the pulling bracket to each side of the tandem trolley or support bracket for self-supporting collectors.

2.3.9.2 Electrical Cables

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NOTE: Draped or festooned cables and cable reels should be specified to be furnished and installed under Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

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Provide festoon flexible cables with support system or cable reels with Type SO cable with strain relief connections and support system in accordance with the door manufacturer's approved drawings and wiring diagrams.

2.3.9.3 Door Pocket Safety Device

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NOTE: If applicable, provide an illuminated push/pull emergency stop button for bi-parting and unidirectional doors at the pockets where the doors stack together. If the user is conducting work inside the door pockets, they can press the illuminated pull/push emergency stop to prevent the door from moving.

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Provide illuminated push/pull emergency stop button for bi-parting and unidirectional doors at the pockets where the doors stack together.

2.4 FINISHES

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NOTE: The coating system specified in Section 09 97 13.27 HIGH PERFORMANCE COATING FOR STEEL STRUCTURES is very robust and should always be allowed. It includes the following:

Abrasive blast prep in accordance with SSPC SP 10/NACE No. 2

Zinc-Rich Epoxy Primer Coat; 3-5 mil

Epoxy Intermediate Coat; 3-5 mil

Polyurethane Topcoat; 2-3 mil

Insert the following into Section 09 97 13.27 HIGH PERFORMANCE COATING FOR STEEL STRUCTURES, paragraph, SURFACES TO BE COATED:

Section 08 34 16.10 HORIZONTAL ROLLING STEEL DOORS references Section 09 97 13.27 HIGH PERFORMANCE COATING FOR STEEL STRUCTURES and requires shop application of these coatings.

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2.4.1 Ferrous Metal

Clean, prepare, and coat all exposed and non-exposed ferrous metal surfaces as part of the Section 09 97 13.27 HIGH PERFORMANCE COATING FOR STEEL STRUCTURES work, including all requirements, submittals, certifications, testing, and inspections required by Section 09 97 13.27. Do not coat finished bearing surfaces. Alternate coating systems or products will not be considered. Prepare surface and apply coatings in the shop, following all temperature, humidity, and testing requirements listed in the Section 09 97 13.27. After installation of the door, prep and touch up surfaces damaged during assembly and installation of the

door. Prep and coat unfinished ferrous metal accessories such as bolts and brackets.

2.4.2 Factory-Finished Panels

Provide [[galvanized G90] [galvannealed A90] per ASTM A653/A653M] [coated with a PVDF fluoropolymer equal to Kynar 500] on all factory-finished ferrous metal panels to be exposed to the interior or exterior.

2.5 SIGNAGE

Provide a placard sign immediately adjacent to all control panels explaining how to operate the door and indicating the below notices. The Notice posts the service level wind speed which corresponds to the ultimate wind speed used in design of the open/operational door in paragraph WIND LOADS.

a. Notice:

(1) Horizontal Rolling Steel Doors must be closed and not operated when wind speeds above [96.6 km/hr] [60 mph] [_____] are expected.

PART 3 EXECUTION

3.1 ERECTION

Provide all work associated with these door systems under the direct supervision and control of the fabricator for safety, control of product liability, and Engineer of Record responsibilities. Coordinate the erection of the doors with the work of other trades. Coordinate the design, fabrication and erection of the door systems and adjust for actual camber, fabrication, and erection tolerances of the surrounding framing. Verify the door system as installed within the erected superstructure accommodates the required upward and downward deflections of the top guide system including required factor of safety. Ensure that all steel support, bracing and framing members are furnished and accurately installed. Coordinate electrical work, including locations of all panels, equipment, motors and other components for required clearances, access and routing of power.

3.1.1 Assembly

Assemble and install the doors and accessories in accordance with the manufacturer's recommendations and installation manual. Provide additional supports as necessary for attachment of guides, brackets, doors, and operation mechanisms. After erection is complete and before touch-up field painting is applied, thoroughly clean all abraded surfaces, field welds, and field bolts; coat in accordance with the paragraph FINISHES.

3.1.2 Cleaning

Clean both the interior and exterior of doors after the completion of erection.

3.1.3 Control Panel Installation

Locate all door control panel indoors, adjacent to the door opening, and with an unobstructed line of sight for the entire door opening. Provide

all conduit entries into the bottom of the control panel. Mount control panels and provide three phase power to each control panel.

3.2 PROTECTIVE COATINGS

3.2.1 Cleaning

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

3.2.2 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 and breaking the protective film. Ferrous metal surfaces that will be exposed after fabrication will be shop coated and touch-up painted in the field in accordance with the paragraph FINISHES.

3.2.3 Metal Protection

Provide in accordance with Chapter 4 of UFC 1-200-01 when door system is in a corrosion prone location or where door system components use dissimilar metals. If dissimilar metals are used, also provide in accordance with MIL-STD-889. Provide added corrosion protection to the design such as, but not limited to, the following. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact masonry or concrete, protect against corrosion by painting contact surfaces with bituminous coating.

3.3 WELDS

3.3.1 Visual Inspection

Furnish the services of AWS-certified welding inspectors for fabrication and erection inspection and testing and verification inspections in accordance with AWS D1.1/D1.1M. Perform visual inspections on 100 percent of all welds with a Certified Welding Inspector. Document this inspection in the weld inspection report.

Inspect proper preparation, size, gaging location, and acceptability of all welds; identification marking; operation and current characteristics of welding sets in use.

3.3.2 Nondestructive Testing

Perform nondestructive testing in accordance with AWS D1.1/D1.1M[and AWS D1.8/D1.8M]. Perform ultrasonic testing in accordance with Table [6.2] [or 6.3] of AWS D1.1/D1.1M. Test 50 percent of all welds, with sampling representative of all weld types and locations for the entire door system and for the duration of the fabrication schedule. All personnel performing NDT are required to be certified in accordance with ANSI/ASNT CP-189 in the method of testing being performed. Submit certificates showing compliance with ANSI/ASNT CP-189 for all NDT technicians. If more than 10 percent of welds made by a welder contain

defects identified by testing, then all groove welds made by that welder are required to be tested by ultrasonic testing, and all fillet welds made by that welder are required to be inspected by magnetic particle testing (MT) or dye penetrant testing (PT). When groove welds made by an individual welder are required to be tested, magnetic particle or dye penetrant testing may be used only in areas inaccessible to ultrasonic testing. Retest all repaired areas. Submit weld inspection report.

3.4 ELECTRICAL WORK

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

Door manufacturer to coordinate with the qualified, licensed electrical contractor who will provide and install all [208 3-phase] [480 3-phase] supply power to all components (such as Main, auxiliary, controllers, panels, motors, etc.) which require this low voltage supply power. The qualified, licensed electrical contractor will provide and install all conduit for the control level power under the review and approval of the door manufacturer. Either the qualified, licensed electrical contractor or a factory authorized technician may provide and install all wiring for control level power under the review and approval of the door manufacturer in accordance with the approved construction submittals.

3.5 ACCEPTANCE TESTING PROCEDURE AND REPORT

Submit an Acceptance Testing Procedure for approval, which includes coordination with Section 01 91 00.15 BUILDING COMMISSIONING for such items as door position switches which interact with HVAC controls. After Government approval, perform the testing and submit a report of the results. Provide acceptance testing for the entire door system, including every component, performed by the door manufacturer and suppliers. The following subparagraphs are included in the acceptance testing.

3.5.1 General

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 adjustments will be made by the manufacturer's authorized representative. Adjust and re-test the doors until the entire installation is fully operational and acceptable. Acceptance testing consists of operating each door open and closed (one cycle) ten times successfully and consecutively within a nine-hour time interval in accordance with manufacturer's recommended time interval between open/close cycles. Provide the Contracting Officer's Representative a copy of the final acceptance testing report with completed tests.

3.6 PERSONNEL TRAINING

Provide a 4-hour on-site training session for the Government's door operating personnel and maintenance. Attendees may include base personnel such as facility users, fire department and others. In the training, outline door safety, normal operation, emergency operation, troubleshooting, maintenance, and repair guidelines.[Record this on-site training and provide a video presented in an organized and coherent fashion such that the Government may use the video as the sole training program for future user operators. In multiple locations throughout the

video, specifically mention the door system must be completely closed and secured prior to experiencing [96.6 km/hr] [60 mph] [_____] wind speeds. It is acceptable to utilize stock training video content in this video provided the door operation, safety and controls are identical to the door system provided.]

-- End of Section --