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USACE / NAVFAC / AFCEC / NASA	**UFGS-08 39 53 (February 2019)** **Change 1 - 05/20**
Preparing Activity: USACE	**Superseding** **UFGS-08 39 53 (April 2006)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2021

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BLAST RESISTANT DOORS (EARTH COVERED MAGAZINES)

02/19, CHG 1: 05/20

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SECTION 08 39 53

BLAST RESISTANT DOORS (EARTH COVERED MAGAZINES)
02/19, CHG 1: 05/20

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NOTE: This guide specification covers the requirements for blast resistant doors used in the construction or retrofit of earth covered magazines. It is highly recommended that installations and designers consult Department of Defense Explosives Safety Board Technical Paper 15 to determine if any ECM designs approved for new construction will fit the needs of the users. If a design is selected from Technical Paper 15 that is approved for new construction and the design of the door, door frame and its reinforced concrete structural elements which support the door under blast loading are unchanged from the approved design drawings, the specification should be used, but no additional blast design effort is needed. If a design is used that is not included in the list in Technical Paper 15 approved for new construction, or if a blast door is selected from an approved Technical Paper 15 design but the door frame or supporting reinforced concrete headwall deviates from this design, then this specification should be used.

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).

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NOTE: The following information must be shown on the project drawings:

1. The extent and location of structural steel;

2. Designations of steel members;

3. Yield strength of steel used in design;

4. Locations where galvanized steel will be used;

5. Types of connections (welded and bolted);

6. Locations where high-strength bolts and slip critical connections are required and the loads and stresses required if design is provided by Contractor.

7. Structural Designation of the ECM to be constructed (7 bar, 3 bar, or Undefined), as defined in DoD 6055.09-M.

8. Standard design from DDESB Technical Paper 15 being used, if applicable.

****

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.

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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 BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 9	(2015) Load Ratings and Fatigue Life for Ball Bearings
ABMA 11	(2014) Load Ratings and Fatigue Life for Roller Bearings

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 301	(2016) Specifications for Structural Concrete
ACI 318	(2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)
ACI 318M	(2014; ERTA 2015) Building Code Requirements for Structural Concrete & Commentary

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 303	(2016) Code of Standard Practice for Steel Buildings and Bridges
AISC 325	(2017) Steel Construction Manual
AISC 360	(2016) Specification for Structural Steel Buildings

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(2012) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS A5.4/A5.4M	(2012) Specification for Stainless Steel Electrodes for Shielded Metal Arc Welding
AWS D1.1/D1.1M	(2020) Structural Welding Code - Steel
AWS D1.3/D1.3M	(2018) Structural Welding Code - Sheet Steel

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 A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A242/A242M	(2013; R 2018) Standard Specification for

	High-Strength Low-Alloy Structural Steel
ASTM A307	(2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A325	(2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A490	(2014a) Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
ASTM A500/A500M	(2021) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A501/A501M	(2014) Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A514/A514M	(2018) Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding
ASTM A529/A529M	(2019) Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality
ASTM A534	(2017) Standard Specification for Carburizing Steels for Anti-Friction Bearings
ASTM A563	(2015) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A572/A572M	(2021) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A588/A588M	(2019) Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance
ASTM A615/A615M	(2020) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A618/A618M	(2004; R 2010) Standard Specification for Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing
ASTM A706/A706M	(2016) Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement

ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A992/A992M	(2020) Standard Specification for Structural Steel Shapes
ASTM F436	(2011) Hardened Steel Washers
ASTM F844	(2019) Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use

DEPARTMENT OF DEFENSE EXPLOSIVES SAFETY BOARD (DDESB)

DDESB Technical Paper 15	(2010) Approved Protective Construction

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 101	(2021) Life Safety Code

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD 5100.76-M	(2012; Change 1-2018; Change 2-2020) Physical Security of Sensitive Conventional Arms, Ammunition, and Explosives
DOD 6055.09-M	(2010; Change 1-2012) DoD Ammunition and Explosives Safety Standards: General Explosives Safety Information and Requiements
MIL-DTL-29181	(2014; Rev C; Notice 3) Hasp, High Security, Shrouded for High and Medium Security Padlock
MIL-DTL-43607	(2015; Rev J; Notice 1) Padlock, Key Operated, High Security, Shrouded Shackle
UFC 3-340-02	(2008, Change 2, 2014) Structures to Resist the Effects of Accidental Explosions

1.2 SYSTEM DESCRIPTION

****

NOTE: This specification applies solely to the main exterior doors of ECMs with the design intent of protecting AE stored therein from blast overpressures produced by an accidental detonation in an adjacent AE storage magazine sited in accordance with DOD 6055.09-M.

Unlike most other doors, a blast door must be designed in accordance with the provisions of UFC 3-340-02 and should be provided by one manufacturer as a complete assembly including the door, frame, hardware, and accessories. This must be done

because items such as the door, frame, latches, and hinges are of special manufacture and are interdependent parts of blast resistance. To facilitate the specification of individual door assemblies, the door type, blast effects, blast rating, deformation limits, operating forces, hardware, and accessories for each door are brought together under a products specification in Part 2 where assembly specification paragraphs for the various door types are provided. Before selecting a blast door's materials, a designer should verify the availability of these structural steels in the anticipated plate thicknesses and shapes. In addition, the design drawings should clearly disallow the substitution of other materials. The designer will become familiar with UFC 3-340-02 and with these assembly paragraphs prior to specification editing.

****

Provide a blast resistant door which fits a door description as follows: [Structural steel doors must be [flush mounted in frames] [or] [surface mounted] [as indicated].] [Doors must be the manually operated, [side hinged, swinging type] [or] [horizontal sliding type]]. Each door assembly must include the door, frame, anchors, hardware, and accessories and must be provided by a single manufacturer. Frames and anchors must be capable of transferring blast reactions to the adjacent supporting structure. Resistance to blast must be demonstrated either by design calculations or tests on prototype door assemblies.

Submit data on standard blast doors consisting of catalog cuts, brochures, circulars, specifications, calculations, and product data that show complete dimensions and completely describe overpressure ratings, rebound ratings, doors, frames, anchors, hardware, and accessories. Submit manufacturers' instructions for installation and field testing. Submit information, for door description, bound in manual form consisting of manufacturer's safety precautions, preventative maintenance and schedules, troubleshooting procedures, special tools, parts list, and spare parts data. All material must be cross referenced to the door designations shown on the drawings.

1.2.1 Design Requirements

The design must be in accordance with the explosives safety requirements of DOD 6055.09-M and the protective construction requirements of UFC 3-340-02.

1.2.1.1 Static Material Strength

Obtain the static values for minimum yield strength (or yield point) and (ultimate) tensile strength for steel from the applicable material specification. For tensile strength specified in terms of a tensile strength range, the lowest tensile strength specified must be selected for design. Structural steel having a minimum static yield strength (or yield point) of 50 ksi or less [and Grade 60 reinforcing bars] must be designed using an average yield strength computed as 1.1 times the minimum static yield strength or yield point. If the minimum static yield strength for structural steel exceeds 50 ksi, the expected yield strength used for

design must be equal to the minimum specified static yield strength or yield point without increase. [The in-place compressive strength of concrete used for design shall be the specified compressive strength.]

1.2.1.2 Dynamic Material Strength

Compute the dynamic material strength by applying a dynamic increase factor that accounts for the increase in material strength due to strain rate effects. Appropriate material-specific dynamic increase factors can be found in UFC 3-340-02 for use in design.

1.2.1.3 Structural Member Design

[Obtain structural steel section properties for rolled shapes from AISC 325, or steel manufacturers' catalogs.][Nominal reinforcing bar designations, weights, and dimensions must be obtained from ACI 318M, ACI 318, or the reinforcing bar specification.]Structural members [,to include reinforced concrete members] shall be designed in accordance with UFC 3-340-02 and shall satisfy all applicable response limits.

1.2.2 Blast Effects

****
NOTE: Blast loads required to be resisted by ECM doors are specified in DoDM 6055.09-M, V2.E5.5.2.4, including overpressure and impulse loads. There are three structural designations for ECM's: 7-bar, 3-bar, and Undefined. Required minimum separation distances between ECMs vary with the ECM's structural designation. The structural designation of the ECM is based, in part, upon the capabilities of its door to withstand the loads prescribed in this section. All ECM doors should, at a minimum, satisfy Protection Category 3 response limits for a shelter, as defined by UFC 3-340-02. In addition, the inward deflection of the door under blast loading may not result in its disengagement from its supports and passage between supports into an ECM. Specifying time dependent overpressure is required for ECM doors; this will reflect the applicable blast load defined in DOD 6055.09-M.
****

1.2.2.1 Overpressure

Overpressure to be resisted must be [_____] psi [with a [_____] millisecond duration] in the seating direction. The spatial distribution of overpressure must be uniform unless otherwise specified or indicated. [For overpressure specified or indicated with duration only, the waveform must be a triangle with a zero rise time.] [Special waveforms are indicated.]

1.2.2.2 Overpressure Direction

For overpressure identified as seating and for overpressure directions not otherwise specified or indicated, the positive phase overpressure must be in the direction that causes the door to seat toward the frame.

1.2.2.3 Fragment Resistance

****

NOTE: ECMs are typically constructed in distinct AE storage areas and are oriented so that all headwalls in an area face in the same direction. For other orientations, DOD 6055.09-M typically increases the required separation distance between magazines to mitigate debris hazards. As a result, primary fragment resistance is not a typical explosives safety design requirement for ECM doors. However, when special circumstances or physical security requirements necessitate such protection, design parameters will be determined in accordance with UFC 3-340-01, DDESB Technical Paper 16, or DOD 5100.76-M, as applicable. Exposing blast doors to primary fragments is not recommended because of the resulting severe damage to hardware, because molten fragments can weld the door to the frame preventing post-blast opening, and because it is difficult to prevent perforation at the door edges. Also, while latches and latch mechanisms can be protected, it is usually not practical to protect the hinges. Worst-case fragment perforation of the door can be prevented for structural steel and reinforced concrete doors by specifying fragment characteristics or a minimum plate or concrete thickness on the design drawings.

****

Per the physical security requirements of DOD 5100.76-M, the door must be designed for fragment and ballistic resistance. Accordingly, both the door and the door and frame interface must be designed to prevent fragment or ballistic perforation in accordance with DOD 5100.76-M.

1.2.3 Rebound

The explosives safety requirements of DOD 6055.09-M are based on a single explosives detonation in an adjacent ECM of its sited net explosives weight limit. DOD 6055.09-M does not require protection from multiple detonations or address physical security requirements that may apply after an accidental detonation. Accordingly, rebound resistance is not specifically required by DOD 6055.09-M. However, per DOD 5100.76-M, rebound resistance may be a physical security requirement and must be addressed accordingly.

1.2.4 Blast Door Operation

****

NOTE: NOTE: Specify swing forces of 135 and 90 N 30 and 20 pounds for structural steel doors, and 180 and 90 N 40 and 20 pounds for heavy structural steel doors. Use the lower values for structural doors when rolling bearing hinges are specified.

For latch engagement and release, specify 90 to 135 N 20 to 30 pounds for structural steel doors without gasket seals. Specifying 135 to 180 N 30 to 40 pounds for structural steel doors with gasket seals

is recommended to accommodate the extra force required to compress the gasket during latching. For means of egress, specify NFPA 101 operating forces. In this case, Type I (rolling bearing) hinges are recommended.

****

Measure the force required to set the door in motion from the 90-degree open position, and measure the force required to engage and release the latches at the latch handle with the door in the normal closed position.

Maximum operating forces must be [30] [40] [100] [_____] lbf to set the door in motion and[20] [50] [_____] lbf to [swing] [slide] the door. Maximum force to engage and release latches must be [20] [30] [_____] lbf. [Operating forces must conform to NFPA 101.]

1.3 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-02 Shop Drawings

Blast Resistant Door; G[, [_____]]

Trolley Track; G[, [_____]]

Trolleys; G[, [_____]]

Submit templates, erection and installation drawings indicating thickness, type, grade, class of metal, and dimensions. Show construction details, reinforcement, anchorage, and installation with relation to the building construction.

SD-03 Product Data

Trolleys; G[, [_____]]

SD-05 Design Data

Manual Operator; G[, [_____]]

Submit calculations showing that manual operator has achieved by mechanical advantage, a required downward force to open the doors of not more than 18 pounds.

SD-10 Operation and Maintenance Data

Blast Resistant Door; G[, [_____]]

1.4 QUALITY ASSURANCES

****

NOTE: UFC 3-340-02 prohibits the welding of reinforcing bars.

****

Welders, welding operators, and weld inspectors must be qualified in accordance with AWS D1.1/D1.1M [except that] [welders performing arc welding of steel sheet and strip must be qualified in accordance with AWS D1.3/D1.3M].

1.5 DELIVERY, STORAGE, AND PROTECTION

Protection from corrosion, deformation, and other types of damage. Store items in an enclosed area free from contact with soil and weather, dust, and contaminants. Remove and replace damaged items with new items.

1.6 WARRANTY

Furnish manufacturer's written warranty covering the blast door assembly for 2 years after acceptance by the Government. Warranty must provide for repair and replacement of the blast door assembly and individual hardware and accessory items in the event of malfunction due to defects in design, materials, and workmanship except that the warranty need not cover finishes provided by others.

PART 2 PRODUCTS

2.1 MATERIALS

Only structural steel materials, for which tension properties have been obtained, may be used to resist blast. Select steel used in the door, door frame, and door frame anchors, and non stainless steel fasteners that resist blast, from the materials specified.

Submit structural analysis and design calculations demonstrating resistance to blast when blast resistance is not demonstrated by prototype tests. Design calculations must demonstrate adequacy under the blast effects specified or indicated. Include in the design calculations a sketch of the overpressure waveform; dimensioned sketches of blast resisting elements such as door members, frame members, latches, and hinges; section properties for blast resisting members including built-up sections; the standard under which steel is produced; static and dynamic material strength properties; the resistance, stiffness, mass, elastic natural period, and elastic deflection for flexural members; and the peak deflection, peak support rotation, and time to peak deflection for door members in flexure. Design calculations must cover initial response and all secondary items such as shear, welds, local buckling, web crippling, hinges, and latches.

2.1.1 Structural Steel

Structural steel bars, plates, and shapes must conform to ASTM A36/A36M, ASTM A242/A242M, ASTM A529/A529M, ASTM A572/A572M, ASTM A588/A588M, or ASTM A992/A992M. Quenched and tempered steel plate must conform to ASTM A514/A514M.

Submit steel mill reports covering the number, chemical composition, and tension properties for structural quality steels. When blast resistance is demonstrated by calculations, a certificate stating that the door assembly provided was manufactured using the same materials, dimensions, and tolerances shown in the calculations. When blast resistance is demonstrated by prototype testing, a certificate stating that door and frame provided was manufactured using the same materials, dimensions, and tolerances as the tested prototype and listing the hardware and frame anchors required to achieve blast resistance. Each certificate must be signed by an official authorized to certify in behalf of the manufacturer and must identify the door assembly and date of shipment or delivery to which the certificate applies.

2.1.2 Structural Tubing

****
NOTE: Retain this paragraph when structural steel doors are specified.
****

Structural tubing must conform to ASTM A500/A500M, ASTM A501/A501M, or ASTM A618/A618M.

2.1.3 Concrete and Concrete Reinforcement

****
NOTE: Retain this paragraph when doors infilled with concrete are specified.

****

Concrete is specified in Section 03 30 00 CAST-IN-PLACE CONCRETE. Concrete reinforcement must conform to ASTM A615/A615M or ASTM A706/A706M, Grade 60.

2.1.4 Bolts, Nuts, and Washers

2.1.4.1 Bolts

****
NOTE: Do not galvanize ASTM A490M ASTM A490 bolts. When galvanizing ASTM A325 bolts limit hardness of bolts to Rockwell C-32.
****

The bolt heads and the nuts of the supplied fasteners must be marked with the manufacturer's identification mark, the strength grade and type specified by ASTM specifications.

a. Anchor Bolts: ASTM A307, Grade A.

b. High Strength Bolts: ASTM A325, Type 1 or 2.

c. High Strength Bolts: ASTM A490

2.1.4.2 Nuts

ASTM A563, Grade A, heavy hex style, except nuts under 1.5 inches may be provided in hex style.

2.1.4.3 Washers

ASTM F844 washers for ASTM A307 bolts, and ASTM F436 washers for ASTM A325 bolts.

2.1.5 Welding Electrodes and Rods

AWS D1.1/D1.1M.

2.2 HARDWARE

2.2.1 Trolleys

****
NOTE: Retain this paragraph when sliding-type doors are specified.
****

Must consist of cast steel or forged steel components and be designed to operate from the track beam section furnished under this contract. Trolley wheels must be made from high alloy forged steel. The wheel tread must be accurately machined to assure concentricity of axle and tread and hardened to 425-480 Brinell. Wheel treads must be unpainted. Wheel axles must be precision machined from high alloy, heat treated steel. Minimum Rated Load Capacity of the trolley must be 3,000 lbs, but not less than the load required for door operation.

2.2.1.1 Manual Operator

Provide a cast steel or forged steel, galvanized, pull door travel chain operating over a sprocket. Extend chain loop to within 3 feet of the floor. Provide chain cleat and pin for securing pull door travel chain. Provide mechanical advantage by means of roller chain and sprocket drive and/or gearing. The downward force required to operate the door shall not exceed 18 pounds.

2.2.1.2 Trolley Track

Provide as indicated on drawings.

2.2.2 Hinges

****

NOTE: Retain this paragraph when structural steel swinging-type doors are specified.

Retain rolling bearing and operating cycle description under General Requirements when hinge Type 1 is specified.

Hinge Type 1 is intended for cases where high usage with smooth operation is the main requirement and is generally appropriate for facilities designed to resist the effects of improvised explosive devices.

Hinge Type 2 is intended for cases where in-structure shock could damage rollling thrust bearings and is recommended for facilities designed to resist the effects of conventional weapons.

Hinge Type 3 is recommended for low use applications such as infrequently used access doors.

****

2.2.2.1 General Requirements

Hinges must be specially manufactured to support the door and to resist blast induced loading. [The number and placement of hinges must be as shown on the structural drawings.] [The number of hinges must be determined by the blast door manufacturer.] Welds used in hinges must be continuous. Attach hinges to the door and frame using mechanical fasteners, except that full surface hinges for doors with locks must be attached to the door and frame by welding or approved tamper-resistant mechanical fasteners and hinges for doors with locks must have approved nonremovable pins. Load ratings and fatigue life for ball and roller bearings must be determined in accordance with ABMA 9 and ABMA 1111 as applicable and, unless otherwise approved, the bearing steel must conform ASTM A534. Hinges must be capable of operating for the minimum number of cycles specified without failure or excessive wear under the door service loads where one cycle consists of swinging the door back and forth between the normal closed position and the 90-degree open position, where failure or excessive wear means that the latches do not seat properly or the door does not swing smoothly due to hinge failure or wear, and where door service loads consist of the door weight plus any loads produced by hardware. Rolling bearings must be factory grease lubricated and either sealed or provided with easily accessible lubrication fittings.

2.2.2.2 Hinge Description

****

NOTE: Most hinges on DDESB-approved ECM doors in Technical Paper 15 are Type 2. Other hinge types have been included to allow for new designs to be utilized, but any new door design (including use of different components such as hinges) will need to be approved by DDESB to ensure that the ECM still qualifies for its intended blast rating.

****

[Hinge Type 1 must be capable of smooth operation for a minimum of 250,000 cycles. This type of hinge must be provided with structural quality steel [pins and leafs and either rolling bearings in both the thrust and radial directions or hardened steel washer (disc) thrust bearings and rolling radial bearings].] [Hinge Type 2 must be smooth operating and must be provided with structural quality steel pins and leafs, steel base washer (disc) thrust bearings, and metallic journal radial bearings or other approved non rolling type bearings.] [Hinge Type 3 must be provided with metallic bearings.] All hinges must conform to approved design drawings.

2.2.3 Locking System

2.2.3.1 Latching Points

The number and placement of latching points must be [as shown on the structural drawings] [determined by the door manufacturer].

[For multiple latching points, latching points can be provided at the head, sill, and jambs.] [For jamb latching points, latching points must be provided at the jambs only.]

2.2.3.2 Locking System Operation

****

NOTE: Retain the first sentence when hinge Type 1 is specified.

****

Locking systems must be capable of operating for the same number of cycles specified for the door hinges where one latch operating cycle consists of engaging and releasing using the handle. Latches must remain engaged until manually released and must not release under blast loads. [Manually operated latches must remain in the released position until manually engaged.] [Self-latching latches must provide self-activating engagement when the door is swung to the normal closed position.] Handles must release latches under a clockwise motion.

2.2.3.3 Latching Mechanism

[Latching mechanisms and latches for structural steel doors must be mounted on the seating face of the door.] [Unless otherwise approved, latch handle axles (spindles) for [structural steel doors] must extend through the blast load carrying portion of the door and must be provided with suitable metallic journal bearings.] Latch handle axles must be manufactured of hardened steel or stainless steel, and axles requiring lubrication must be provided with easily accessible lubrication fittings.

2.2.3.4 Safety Cover

****
NOTE: Safety covers apply to structural steel doors.
****

Safety covers must consist of steel housings that enclose the latching mechanism such that only the operating rods are exposed.

2.2.3.5 Cover Plate

Cover plates for structural steel doors must be manufactured of minimum 1/4 inch thick plate and must enclose the entire latching mechanism.

2.2.3.6 Latches

****
NOTE: Retain lever type latches for doors infilled with concrete.
****

Latches (latch bolts) must be manufactured of structural steel and the latch bolt throw must not be less than 3/4 inch. Latch bolts must be the sliding type in which the latch bolt slides into a matching strike in the door frame [or the lever type in which the latch bolt rotates into a groove in the frame as specified or indicated] [except that latches for doors with [mortise lock and latch sets] [and] [exit devices] must be the sliding type]. Manually operated latches must draw the door toward the frame during latching.

Submit shop and field operating test reports that include values for opening and closing forces and times, forces required to operate latches, and a description of all operating tests performed.

2.2.3.7 Handle

****
NOTE: Wheel or spoke handle options are recommended for structural steel doors when gasket seals are specified.
****

[Handles for doors with mortise lock and latch sets must be manufactured of [steel castings] [or] [stainless steel].] Latch handles must be firmly fastened to axles. Lever handles must be perpendicular to the door edge when latches are engaged. [Single lever handles must be located at the stile opposite the hinges.] [[Wheel] [and spoke lever] [Spoke lever] handles must be located approximately halfway between the stiles.]

2.2.4 Keying

[Keying must conform to Section 08 71 00 DOOR HARDWARE.] [Change keys for locks must be stamped with change number and the inscription "U.S. Property - Do Not Duplicate." Unless otherwise specified, two change keys must be provided for each lock.] [Locks must be furnished with the manufacturer's standard construction key system.]

2.2.5 Straight Steel Bar Door Pull

****
NOTE: This door pull is intended for structural steel and structural steel doors infilled with concrete. Type III normally applies.
****

Straight steel bar door pulls must be manufactured of round steel bar. The type furnished must be [Type I: 1/2 inch diameter, 5 inch grip and 2-1/2 inch projection with 1/2 inch inside bend radiuses] [;] [and] [Type II: 5/8 inch diameter, 12 inch grip and 4 inch projection with 15/16 inch inside bend radiuses] [; and] [Type III: 5/8 inch diameter, 8 inch grip and 4 inch projection with 15/16 inch inside bend radiuses]. Grip and projection dimensions are measured from the bar centerline. The pull must be attached to the door by fillet weld all around.

2.2.6 Shrouded Padlock

****
NOTE: Storage structures shall be secured with either high-security padlocks and hasps or Internal Locking Devices (ILDs) as necessary to ensure protection is afforded according to level of threat. The use of the ILD should be considered for installation and use in new construction and major renovations of magazines storing SRC I and SRC II A&E as necessary to ensure protection is afforded according to the level of threat and SRC category. Contact the DoD Lock Program Technical Support Hotline at (800) 290-7606, DSN (312) 551-1212 or via the Internet at https://portal.navfac.mil/go/locks for more information.
****

High security padlocks with shrouded shackles must conform to MIL-DTL-43607.

2.2.7 High Security Hasp

****
NOTE: Storage structures shall be secured with either high-security padlocks and hasps or Internal Locking Devices (ILDs) as necessary to ensure protection is afforded according to level of threat. The use of the ILD should be considered for installation and use in new construction and major renovations of magazines storing SRC I and SRC II A&E as necessary to ensure protection is afforded according to the level of threat and SRC category. Contact the DoD Lock Program Technical Support Hotline at (800) 290-7606, DSN (312) 551-1212 or via the Internet at https://portal.navfac.mil/go/locks for more information..
****

High security hasps must be [shrouded] [unshrouded] and must conform to MIL-DTL-29181.

2.2.8 Internal Locking Device

****

NOTE: Storage structures shall be secured with either high-security padlocks and hasps or Internal Locking Devices (ILDs) as necessary to ensure protection is afforded according to level of threat. The use of the ILD should be considered for installation and use in new construction and major renovations of magazines storing SRC I and SRC II A&E as necessary to ensure protection is afforded according to the level of threat and SRC category. Contact the DoD Lock Program Technical Support Hotline at (800) 290-7606, DSN (312) 551-1212 or via the Internet at https://portal.navfac.mil/go/locks for more information..

****

For locking mechanism requirements, refer to DOD 5100.76-M. Internal Locking Devices must be provided by a competent manufacturer. Unique keys must be provided with each ILD. [ILD must be integrated with electronic monitoring and access control systems.] [_____]

2.2.9 Door Stop

Door stops must be designed to resist the impact of the door. The stop must not scratch or scar the door finish when the door is opened against the stop.

2.2.10 Overhead Door Holder

Overhead door holder must be surface mounted. The holder must have a spring or other device to cushion the door action and must limit the door swing at [85] [110] degrees. [The holder must have a built-in, hold-open capability at the swing limit specified.]

2.2.11 Gasket Seal

****

NOTE: Gasket seals are recommended for doors infilled with concrete. Gasket seals installed in manually operated doors are not recommended for reliable prevention of blast leakage. Seals are typically used to improve the weather seal and to provide a door silencer.

****

Sealed doors must have the full door perimeter and all door penetrations sealed. Perimeter seals must be the rubber gasket type. Gaskets must be removable, capable of sealing the mating surfaces, and resistant to the atmospheric environment. One spare set of gasket seals must be provided for each door assembly for which gasket seals are specified.

2.2.12 Door Silencer

****

NOTE: When gasket door seals are specified, the gasket seal will act as the silencer.

****

Rubber door silencers must cushion the impact of the door against the frame so that steel-to-steel contact is not made during closing.

2.2.13 Intrusion Detection System

****
NOTE: Refer to DOD 5100.76-M for specific Intrusion Detection System requirements.
****

Where required, as specified in DOD 5100.76-M, the Intrusion Detection System (IDS) shall be either an approved DOD Component standardized system, a DOD Component commercial equivalent, or an integrated system.

2.3 ACCESSORIES

2.3.1 Removable Threshold

The sill must be flush with the adjacent floor when the threshold is removed. The removable threshold must be attached using approved countersunk mechanical fasteners.

2.3.2 Ramp

The ramp must be structural steel, portable, and weigh not more than [200] [_____] pounds. The ramp must be of sufficient length to extend the full door opening width and must have the profile indicated. The ramp must be capable of supporting [a wheel load of [_____] lbf] [the wheel load indicated].

2.3.3 Weatherstripping

Weatherstripping seals must be 2 inch wide rubber impregnated canvas belting at head and jambs of doorway. The material must have a minimum thickness of 3/16 inch and must be attached to structure with a continuous 1/8 inch by 1-1/4 inch metal strip and 1/4 inch by 3/4 inch metal screws at 8 inches on center.

2.3.4 Locking Bars, Restraining Bracket, Chain Guide Holder and Handle

Provide as indicated on drawings.

2.3.5 Nameplate

Each door assembly must have a permanently affixed nameplate that displays the manufacturer's name, place and year of manufacture, and the applicable peak overpressure, impulse, and rebound rating.

2.4 FABRICATION

Fabricate doors in accordance with the applicable provisions of AISC 360. Workmanship must be equal to standard commercial practice in modern metal shops. Fabricate and assemble in the shop to the greatest extent possible.

Submit detailed fabrication and assembly drawings for doors not conforming to those included in DDESB Technical Paper 15 or for doors that are included but with appreciable modifications, indicating the location and showing dimensions, materials, fabrication methods, hardware, and

accessories in sufficient detail to enable the Contracting Officer to check compliance with contract documents. These drawings need not be submitted for standard doors for which manufacturer's catalog data is submitted. Weld symbols used must conform to AWS A2.4.

Submit blast analyses and design calculations for any blast door frame or supporting reinforced concrete section that either is not listed as approved for new construction in Technical Paper 15 or does not conform to the approved Technical Paper 15 drawings for the door selected.

2.4.1 Shop Assembly

****
NOTE: For doors infilled with concrete, spall plates will be specified for all cases except in extreme cases where it is certain that spall damage is nonexistent or when faceplates are used.
****

Welding must be in accordance with AWS D1.1/D1.1M except that arc welding of steel sheet and strip must be in accordance with AWS D1.3/D1.3M. For the doors, welding might cause significant residual stresses; therefore, Contractor must submit for approval by the Contracting Officer a detailed sequence of the welding, augmenting the requirements given by the AWS specifications. [Stainless steel must be welded using electrodes conforming to AWS A5.4/A5.4M] Fabricated steel must be well-formed to shape and size, with sharp lines and angles. Intermediate and corner joints must be coped or mitered. Exposed welds must be dressed smooth. [The stiles [and top] of built-up structural steel doors must be closed using channel shapes or plates.] [When feasible, faceplates for structural steel doors must be one piece. When one-piece faceplates are not feasible, plates must be joined using full penetration groove weld butt joints or other approved welds.]

2.4.2 Shop Finishing

[Shop priming of steel surfaces must conform to Section 09 90 00 PAINTS AND COATINGS, except that surfaces that will be embedded in concrete need not be primed]. [Galvanizing of doors and frames must conform to ASTM A123/A123M or other approved methods. Surfaces that will be embedded in concrete need not be galvanized. Galvanizing of exposed portions of concrete anchors, non stainless steel fasteners, and hardware other than factory finished hardware must conform to ASTM A153/A153M or other approved methods.] All exposed surfaces must be primed and interior surfaces coated with an approved rust inhibitor.

2.4.3 Repair of Zinc-Coated Surfaces

Repair damaged surfaces with galvanizing repair method and paint conforming to ASTM A780/A780M or by the application of stick or thick paste material specifically designed for repair of galvanizing, as approved by the Contracting Officer. Clean areas to be repaired and remove the slag from the welds. Heat surfaces in which stick or paste material is applied, with a torch to a temperature sufficient to melt the metallics in stick or paste; spread the molten material uniformly over surfaces to be coated and wipe the excess material off.

2.4.4 Painting

****
NOTE: Coordinate color of door and assembly with Contracting Officer.
****

The blast resistant door assembly must be shop painted in accordance with Section 09 90 00 PAINTS AND COATINGS.

2.4.5 Clearance

[Trolley, trolley track, and blast door] [Hinge, frame, and blast door] must be designed together as a system to operate properly within the vertical and horizontal space provided. [The clearance between the seated steel surfaces of structural steel doors and frames must not exceed 1/16 inch.] [The lateral clearance between flush mounted structural steel doors and frames must not exceed [1/4] [_____] inch at the head and jambs and the clearance between the meeting edges of pairs of doors must not exceed [1/2] [_____] inch.] The clearance between the door bottom and threshold must not exceed 3/4 inch.

2.4.6 Door Support System

Provide track clamps, threaded suspension rods, support brackets, hinge support plates, and door frame stiffeners as shown on the drawings such that the assembly is capable of supporting 150 percent of the design door loads.

PART 3 EXECUTION

3.1 ERECTION

3.1.1 Procedure

Erect in accordance with the manufacturer's written instuctions, AISC 360, and ACI 318. Use erecting equipment suitable for the work and in first class condition. Where parts cannot be assembled or fitted properly as a result of errors in fabrication or of deformation due to handling or transportation, report such condition immediately to the Contracting Officer and obtain approval of the method of correction; make the correction in his presence. The straightening of plates and angles or other shapes must be done by the methods approved by the Contracting Officer. If heating of metal is approved for straightening, it shall not be to a higher temperature than that producing a dark "cherry red" color. After heating, the metal must be cooled as slowly as possible. There shall be no evidence of fracture on the surface of the metal after straightening. Drain steelwork properly; fill pockets exposed to the weather with an approved waterproof material.

3.1.2 Connections

Provide anchor bolts and other connections between the steel and concrete and properly locate and build into connecting work. Design connections for which details are not indicated in accordance with AISC 360 and UFC 3-340-02.

3.1.3 High-Strength Bolting

Specification for structural joints using ASTM A325 bolts, approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation must govern the furnishing and installation of high-strength bolting, with the following modifications. Alternate fasteners, specified in paragraph 2(d) will not be permitted.

3.1.4 Erection Tolerances

[Steel construction must be in accordance with AISC 303.] [Concrete construction tolerances must be in accordance with ACI 301.]

3.1.5 Temporary Welds and Backing Strips

Temporary Welds and Backing Strips must be removed.

3.2 TESTS, INSPECTIONS, AND VERIFICATIONS

Submit shop and field operating test reports that include values for opening and closing forces and times, forces required to operate latches, and a description of all operating tests performed.

3.2.1 Inspection

The manufacturer of the doors must provide a field inspection engineer to perform the following:

a. Check installation of embedded items before pouring of concrete (after forms or shoring are in place) to insure that the dimensional tolerances recommended by door manufacturer have been complied with.

b. Re-check embedded items to verify the accuracy of dimensions after shoring and forms are removed from concrete.

c. Supervise any necessary corrective action.

d. Supervise the job site assembly and installation of the doors and operators.

e. Inspect final assembly of doors and operators after corrections and adjustments have been made to doors.

f. Demonstrate to the Contracting Officer that operation of the door assembly is as specified.

3.2.2 Visual Inspection of Welding

Visually inspect welding while the operators are making the welds and again after the work is completed. After the welding is completed, hand or power wire brush welds and thoroughly clean them before the inspector makes the check inspection. Inspect welds with magnifiers under strong, adequate light for surface cracking, porosity, and slab inclusions; excessive roughness, unfilled craters, gas pockets, undercuts, overlaps, size and insufficient throat and concavity. Inspect the preparation of groove welds for adequate throat opening and for snug position of back-up-bars.

3.2.3 Nondestructive Testing

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NOTE: The designer must indicate the location of test welds and types of testing desired. The following information is presented as guidance. Dye penetrant testing detects small surface defects by enhancing the visibility of the flaw. Magnetic particle testing detects surface cracks and near-surface cracks; this test provides more information than the dye penetrant testing, and for approximately the same cost. Ultrasonic and radiographic testing detect surface and internal cracks, delaminations, lack of fusion, and density and thickness variations; these tests offer basically the same information, but their usage is limited by location and type of weld. Generally, fillet welds can only be dye penetrant or magnetic particle tested. Complete penetration welds at butt joints should be radiographically tested; all other complete penetration welds should be ultrasonically tested.

****

AWS D1.1/D1.1M. Test locations must be [as indicated] [selected by the Contracting Officer]. If more than [20] [_____] percent of welds made by a welder contain defects identified by testing, then all welds made by that welder must be tested by radiographic or ultrasonic testing, as approved by the Contracting Officer. When all welds made by an individual welder are required to be tested, magnetic particle testing must be used only in areas inaccessible to either radiographic or ultrasonic testing. Retest defective areas after repair.

Testing frequency: Provide the following types and number of tests:

Test Type	Number of Tests
Radiographic	[_____]
Ultrasonic	[_____]
Magnetic Particle	[_____]
Dye Penetrant	[_____]

Any weld repairs required must be in accordance with AWS D1.1/D1.1M.

3.2.4 Operational Tests

After installation is completed, field test each door for operation, clearance, fit, and seating by operating the door and hardware through at least 10 operating cycles. Test door and hardware operation using the forces specified. Provide personnel and equipment required to perform field testing. Unless waived, perform all field tests in the presence of the Contracting Officer. After testing is completed, prepare test reports and furnish [three] [_____] copies.

3.2.5 Prototype Static Test

****

NOTE: Retain this paragraph when dynamic design and/or blast testing is not used.

****

Static tests on prototype door assemblies must demonstrate that the door will resist the blast overpressure. Static tests will be accepted only if the door and frame proposed are manufactured using the same materials, dimensions, and tolerances as those in the prototype static test and the static overpressure used in the test is at least two times the blast overpressure. Static test reports must be supplemented with calculations that demonstrate rebound resistance when rebound resistance is required and is not tested.

3.2.6 Prototype Blast Test

Blast tests on the prototype door assembly must demonstrate that the door will resist the overpressure waveform. Blast tests will be accepted only if the door and frame proposed are manufactured using the same materials, dimensions, and tolerances as those in the prototype blast tests. The rise time of the test waveform must be zero or subject to approval. The overpressure waveform used in the test must exceed the overpressure waveform in both peak overpressure and impulse, and the blast test report must be supplemented with calculations that demonstrate the required rebound resistance is met. Submit certified test reports demonstrating blast resistance. Include in the test reports the name and location of the testing agency or laboratory, a description of the testing apparatus, the date of the tests, a description of the door specimen tested, descriptions of loadings, the value of measured peak door deflection and peak permanent set and analysis and interpretation of test results.

-- End of Section --