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USACE / NAVFAC / AFCEC **UFGS-08 39 54 (August 2009)**

Preparing Activity: USACE **Superseding**
UFGS-08 39 54 (April 2006)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2024
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SECTION 08 39 54

BLAST RESISTANT DOORS
08/09

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NOTE: This guide specification covers the requirements for manually operated swinging structural steel, reinforced concrete, and hollow metal blast resistant doors.

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).

****

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 318	(2019; R 2022) Building Code Requirements for Structural Concrete (ACI 318-19) and Commentary (ACI 318R-19)
ACI 318M	(2014; ERTA 2015) Building Code Requirements for Structural Concrete & Commentary

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 S100	(2012) North American Specification for the Design of Cold-Formed Steel Structural Members

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(2012) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS A5.4/A5.4M	(2012; R 2022) Specification for Stainless Steel Electrodes for Shielded Metal Arc Welding
AWS D1.1/D1.1M	(2020; Errata 1 2021) Structural Welding Code - Steel
AWS D1.3/D1.3M	(2018) Structural Welding Code - Sheet Steel

AWS D1.4/D1.4M	(2011) Structural Welding Code - Reinforcing 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	(2023) 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 A325M	(2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 830 MPa Minimum Tensile Strength (Metric)
ASTM A354	(2017; E 2017; E 2018) Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners
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 A490	(2014a) Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
ASTM A490M	(2014a) Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric)
ASTM A500/A500M	(2023) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A501/A501M	(2021) Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing

ASTM A514/A514M	(2022) 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; R 2022) Standard Specification for Carburizing Steels for Anti-Friction Bearings
ASTM A563	(2021; E 2022a) Standard Specification for Carbon and Alloy Steel Nuts
ASTM A563M	(2007; R 2013) Standard Specification for Carbon and Alloy Steel Nuts (Metric)
ASTM A572/A572M	(2021; E 2021) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A574	(2021) Standard Specification for Alloy Steel Socket-Head Cap Screws
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 A606/A606M	(2023) Standard Specification for Steel Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance
ASTM A615/A615M	(2022) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A618/A618M	(2021) Standard Specification for Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing
ASTM A653/A653M	(2023) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A706/A706M	(2022a) 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 A792/A792M	(2022) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by

	the Hot-Dip Process
ASTM E90	(2009; R2016) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
ASTM E283	(2019) Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM F436	(2011) Hardened Steel Washers
ASTM F436M	(2011) Hardened Steel Washers (Metric)
ASTM F835	(2023) Standard Specification for Alloy Steel Socket Button and Flat Countersunk Head Cap Screws
ASTM F883	(2013; R 2022) Standard Performance Specification for Padlocks
ASTM F2155	(2001; R 2017) Standard Specification for Performance of Hasps and Other Attachment Devices for Padlocks of Seals

BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

ANSI/BHMA A156.3	(2020) Exit Devices
ANSI/BHMA A156.4	(2013) Door Controls - Closers
ANSI/BHMA A156.8	(2021) Door Controls - Overhead Stops and Holders
ANSI/BHMA A156.13	(2022) Mortise Locks & Latches Series 1000
ANSI/BHMA A156.20	(2021) Strap and Tee Hinges, and Hasps

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 898-1	(2013) Mechanical Properties of Fasteners Made of Carbon Steel and Alloy Steel — Part 1: Bolts, Screws and Studs with Specified Property Classes — Coarse Thread and Fine Pitch Thread

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(2022) Standard for Fire Doors and Other Opening Protectives
NFPA 80A	(2022) Recommended Practice for Protection of Buildings from Exterior Fire Exposures
NFPA 101	(2021; TIA 21-1) Life Safety Code

NFPA 252	(2022) Standard Methods of Fire Tests of Door Assemblies

U.S. DEFENSE LOGISTICS AGENCY (DLA)

DLA Lock	DOD Lock Program; http://www.dscp.dla.mil/gi/locks/

1.2 SYSTEM DESCRIPTION

****

NOTE: Unlike most other doors, a blast door is 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, rebound, deformation limits, operating forces, hardware, and accessories for each door are brought together under a blast door assembly specification in Part 2 where assembly specification paragraphs for the various door types are provided.

The designer will become familiar with these assembly paragraphs prior to specification editing. Coordinate with paragraph BLAST DOOR ASSEMBLIES.

****

Provide a blast resistant door which fits a Door Description as follows: [Structural steel doors that are [flush mounted in frames] [or] [surface mounted] [as indicated].] [Reinforced concrete doors that are surface mounted.] [Hollow metal doors that are flush mounted in frames.] Provide manually operated, side hinged, swinging type doors. Include the door, frame, anchors, hardware, and accessories for each door assembly, provided by a single manufacturer. Provide frames and anchors capable of transferring blast and rebound reactions to the adjacent supporting structure. Demonstrate resistance to blast either by design calculations or tests on prototype door assemblies.

1.2.1 Design Requirements

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, select the lowest tensile strength specified for design. Design structural steel having a minimum static yield strength (or yield point) less than 345 MPa 50 ksi [and Grade 60 reinforcing bars] using an average yield strength computed as 1.1 times the minimum static yield strength or yield point. If the minimum static yield for structural steel exceeds 345 MPa 50 ksi, use an expected yield strength for design equal to the minimum specified static yield strength or yield point without increase. [Compute the in-place compressive strength of concrete used for design by multiplying the specified compressive strength by 1.1 to reach the expected compressed strength and then multiplying by not more than 1.15 to account for a one year age effect.] [Compute the expected yield

stress for steel sheet and strip used in design as 1.21 times the specified static yield point.]

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. Apply the dynamic increase factor for structural steel in flexure to the average yield strength and is [1.29] [_____], [1.19] [_____], and [1.09] [_____] for structural steel having a minimum yield strength (or yield point) of 248 MPa, 345 MPa, and 689 MPa 36, 50, and 100 ksi, respectively. Obtain the dynamic increase factor for structural steel having a minimum yield strength (or yield point) between these values by interpolation. Optionally, for structural steel in these yield ranges, determine the dynamic increase factor by a detailed analysis that accounts for the time to yield. The dynamic increase factor for structural steel having a minimum yield exceeding 689 MPa 100 ksi is 1.0. [The dynamic increase factor for Grade 60 flexural reinforcing bars is [1.17] [_____] applied to the average yield strength. The dynamic increase factor for concrete used in flexure is [1.19] [_____] applied to the in-place compressive strength. Optionally, determine the dynamic increase factor applied to flexural reinforcing bar yield and concrete compressive strength by a detailed analysis that accounts for the time to steel yield and time to ultimate concrete strength.] [The dynamic increase factor for steel sheet and strip used in flexure is 1.1 applied to the average yield stress.]

1.2.1.3 Structural Member Design

[Obtain structural steel section properties for rolled shapes from AISC 325, AISC 325, or steel manufacturers' catalogs. Compute the plastic moment capacity for single plate sections and sections built up from plates and shapes as the average of the elastic and plastic section modulus multiplied by the dynamic yield strength, unless otherwise approved. Design shear, welds, local buckling, and web crippling of structural steel in accordance with AISC 325, the plastic design provisions of AISC 360, or by other approved methods except that for blast design, the load factors and resistance factors are equal to 1.0 and substitute the dynamic yield strength for the static yield stress.] [Obtain nominal reinforcing bar designations, weights, and dimensions from ACI 318M ACI 318 or the reinforcing bar specification. The moment of inertia of the reinforced concrete cross section used to determine the elastic deflection is the average of the moment of inertia of the gross section and the moment of inertia of the cracked section. Compute the resistance of the reinforced concrete section in accordance with ACI 318M ACI 318 or other approved methods except that for blast design, the load and resistance factors are equal to 1.0 and substitute the dynamic reinforcing bar yield strength and dynamic ultimate concrete strength for the static strength values.] [Design hollow metal doors in accordance with AISI S100 except that for blast design, substitute the dynamic yield strength for the static yield point.]

1.2.1.4 Dynamic Analysis and Deformation

Design the door using an equivalent single degree of freedom or other approved dynamic analysis method. Select the manufacturer's maximum door deformation. Do not exceed the specified or indicated deformation limits for deformation in flexure. The deformation of structural steel members having a minimum yield strength or yield point greater than 448 MPa 65 ksi

must not exceed the elastic deflection. [Increased resistance due to strain hardening of structural steel in flexure can be used when the ductility ratio exceeds 10 or when otherwise approved.] [Do not exceed a ductility ratio of 1.0 for flexural members in hollow metal doors.]

1.2.1.5 Rebound Resistance

NOTE: For structural steel and hollow metal doors, specify 100 percent rebound resistance in the extreme case when the blast overpressure duration is much shorter than the expected period of the door and when rebound resistance must be guaranteed. Specify less than 50 percent rebound resistance in the extreme case when the blast overpressure duration is much longer than the expected period of the door. Specify zero rebound in the extreme case in which the door need not remain in place after the blast. Otherwise, specify 50 percent rebound resistance as recommended in UFC 3-340-01. The most prevalent rebound resistance for reinforced concrete doors is 20 and 100 percent.

Rebound for each door will be specified in paragraph BLAST DOOR ASSEMBLIES.

Specify or indicate rebound resistance percentage of the door resistance at initial peak response.

1.2.2 Blast Effects

NOTE: Specifying doors in terms of overpressure without duration is recommended only when the overpressure is low and the overpressure duration is greater than about 10 times the expected period of the door. Overpressure without duration is often specified for hollow metal doors because they have low overpressure resistance. Hollow metal doors are available to resist overpressures in the range from 6 to 173 kPa 1 to 25 psi, but a structural steel door option should be considered when the overpressure exceeds 83 kPa 12 psi.

Specifying time dependent overpressure is required for other than low and long duration overpressures and is recommended for reinforced concrete doors. When the waveform is other than a zero rise time triangle, show the waveform on the drawings.

1.2.2.1 Overpressure

Provide uniform spatial distribution of overpressure unless otherwise specified or indicated. [For overpressure specified or indicated without duration, the overpressure waveform must have a zero rise time and infinite duration.] [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, provide positive phase overpressure in the direction that causes the door to seat toward the frame.] [For overpressure identified as unseating, provide positive phase overpressure in the direction that causes the door to unseat away from the frame.]

1.2.2.3 Fragment Resistance

****

NOTE: Fragment design parameters will be determined in accordance with UFC 3-340-01, 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 in the door assembly paragraph.

The 100 and 200 mm 4 and 8 inch reinforced concrete nominal thickness shown are typically available.

Hollow metal doors cannot prevent perforation by primary fragments and will not be used for this purpose.

Fragment parameters or door thickness will be specified in paragraph BLAST DOOR ASSEMBLIES.

****

For doors specified or indicated to resist fragments, design the door and the door and frame interface to prevent fragment perforation and shield the latches and latching mechanism from fragment damage. Locate the fragment impact point anywhere on the door and frame face exposed to overpressure.

1.2.3 Blast Door Operation

****

NOTE: Specify swing forces of 90 and 70 N 20 and 15 pounds for hollow metal doors, 135 and 90 N 30 and 20 pounds for structural steel doors, and 180 and 90 N 40 and 20 pounds for 200 mm 8 inch thick reinforced concrete doors and heavy structural steel doors. Use the lower values for structural and hollow metal 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 and for reinforced concrete doors. Specify 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.

Operating requirements will be specified in paragraph BLAST DOOR ASSEMBLIES.

****

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.

1.2.4 Other Submittals Requirements

Submit the following:

a. Detailed fabrication and assembly drawings for special doors or standard doors with appreciable modifications, indicating the door 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. Use weld symbols conforming to AWS A2.4.

b. Data on standard blast doors consisting of catalog cuts, brochures, circulars, specifications, and product data that show complete dimensions and completely describe overpressure ratings, rebound ratings, doors, frames, anchors, hardware, and accessories. Manufacturer's instructions for installation and field testing.

c. Detailed structural analysis and design calculations demonstrating resistance to blast when blast resistance is not demonstrated by prototype tests. 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. Cover initial response, rebound, and all secondary items such as shear, welds, local buckling, web crippling, hinges, and latches.

d. 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.

e. 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. Cross reference all material to the door designations shown on the drawings.

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 and Air Force 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 and Air Force 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

Installation; G[, [_____]]

SD-03 Product Data

Door Description; G[, [_____]]

Design Requirements; G[, [_____]]

Manufacturer's Field Service

SD-06 Test Reports

Tests

Tests, Inspections, and Verifications

Fire Rating Test and Inspection

Prototype Static Test; G[, [_____]]

Prototype Blast Test; G[, [_____]]

SD-07 Certificates

Materials

Fire-Rated Door Assemblies

Thermal Insulation

Sound Rating Test

SD-10 Operation and Maintenance Data

Door Description; G[, [_____]]

1.4 QUALITY ASSURANCE

****

NOTE: Delete AWS D1.3/D1.3M requirement when hollow metal doors are not specified. Delete AWS D1.4/D1.4M requirement when reinforced concrete doors are not specified.

****

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] [and] [welders and weld operators performing welding of reinforcing bars must be qualified in accordance with AWS D1.4/D1.4M].

1.5 DELIVERY, STORAGE,AND HANDLING

Store door assemblies, delivered and placed in storage, with protection from weather and dirt, dust, and contaminants.

1.6 WARRANTY

Furnish manufacturer's written warranty covering the blast door assembly for 2 years after acceptance by the Government. 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

Use only structural quality steel materials, for which tension properties have been obtained, to resist blast except that commercial quality steel sheet and permit strip for prototype tested hollow metal doors. Select steel used in the door, door frame, and door frame anchors, and non stainless steel fasteners that resist blast, from the materials specified.

2.1.1 Concrete and Concrete Reinforcement

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

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

2.1.2 Structural Tubing

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

Provide structural tubing conforming to ASTM A500/A500M, ASTM A501/A501M, or ASTM A618/A618M.

2.1.3 Structural Steel

****
NOTE: For reinforced concrete and hollow metal doors, specify only ASTM A36/A36M.
****

Provide structural steel bars, plates, and shapes conforming to ASTM A36/A36M, ASTM A242/A242M, ASTM A529/A529M, ASTM A572/A572M, or ASTM A588/A588M. Provide quenched and tempered steel plate conforming to ASTM A514/A514M.

2.1.4 Steel Sheet and Strip

****
NOTE: Retain this paragraph when hollow metal doors are specified.
****

Provide steel sheet and strip conforming to ASTM A653/A653M, Type A, B, and C; ASTM A653/A653M; ASTM A606/A606M; or ASTM A792/A792M, Grades 33, 37, 40, and 50.

2.1.5 Fasteners

Provide steel studs and bolts conforming to ASTM A307, ASTM A325M ASTM A325, ASTM A354, ASTM A449, or ASTM A490M ASTM A490 as applicable. Provide steel nuts that conform to ASTM A563M ASTM A563. Provide hardened circular, beveled, and clipped washers that conform to ASTM F436M ASTM F436. Provide steel hex cap screws conforming to ISO 898-1. Provide steel socket-headed cap screws conforming to ASTM A574. Provide steel button and flat-headed countersunk cap screws conforming to ASTM F835.

2.2 HARDWARE

2.2.1 Hinges

****

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

Blast door hinges are normally full surface. Mortise hinges can be specified for hollow metal doors, but availability must be verified with door manufacturers.

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 rolling 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.

****

2.2.1.1 General Requirements

Provide specially manufactured hinges to support the door and to resist blast induced loading. Determine the number of hinges by the blast door manufacturer. Use continuous welds in hinges. Attach hinges to the door and frame using mechanical fasteners, except attach full surface hinges for doors with locks to the door and frame by welding or approved tamper-resistant mechanical fasteners and hinges for doors with locks must have approved nonremovable pins. Determine load ratings and fatigue life for ball and roller bearings in accordance with ABMA 9 and ABMA 11 as applicable and, unless otherwise approved, the bearing steel must conform to ASTM A534. Provide hinges that are 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. Provide rolling bearings that are factory grease lubricated and either seal or provide with easily accessible lubrication fittings.

2.2.1.2 Hinge Description

[Hinge Type 1 must be capable of smooth operation for a minimum of 250,000 cycles. Provide this type of hinge 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 except permit rolling thrust bearings and metallic journal radial bearings for hollow metal doors when the specified overpressure is less than 21 kPa 3 psi]. [Hinge Type 2 must be smooth operating and provide 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.] [Provide Hinge Type 3 with metallic bearings.]

2.2.2 Latching System

2.2.2.1 Latching Points

Determine the number of latching points by the door manufacturer. [For multiple latching points, latching points can be provided at the head, sill, and jambs.] [For jamb latching points, provide latching points at the jambs only.]

2.2.2.2 Latching System Operation

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

Provide latching systems 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. Keep latches engaged until manually released and do not release under blast loads or rebound. [Keep manually operated latches in the released position until manually engaged.] [Provide self-latching latches that provide self-activating engagement when the door is swung to the normal closed position.] Provide handles that release latches under a clockwise motion.

2.2.2.3 Latching Mechanism

[Mount latching mechanisms and latches for structural steel doors on the seating face of the door.] [Mount latching mechanisms for hollow metal doors on the seating face of the door and safety covered.] [Unless otherwise approved, extend latch handle axles (spindles) for [structural steel doors] [and] [reinforced concrete doors] through the blast load carrying portion of the door and provide with suitable metallic journal bearings.] Provide latch handle axles manufactured of hardened steel or stainless steel, and provide axles requiring lubrication with easily accessible lubrication fittings.

2.2.2.4 Safety Cover

****

NOTE: Safety covers apply to structural steel and hollow metal doors.

****

Provide safety covers consisting of steel housings that enclose the latching mechanism such that only the operating rods are exposed.

2.2.2.5 Cover Plate

Provide cover plates for structural steel doors that are manufactured of minimum 6 mm 1/4 inch thick plate and that enclose the entire latching mechanism.

2.2.2.6 Latches

****

NOTE: Retain lever type latches for reinforced concrete doors.

****

Provide latches (latch bolts) that are manufactured of structural quality steel with latch bolt throw no less than 19 mm 3/4 inch. Provide sliding type latch bolts 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]. Provide manually operated latches to draw the door toward the frame during latching.

2.2.2.7 Handle

****

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

****

[Provide handles for doors without locks that are manufactured of steel castings, forgings, pipe, round tubing, bar, or plate and are one piece or have welded joints except that wheel handles can be manufactured of aluminum castings.] [Provide handles for doors with mortise lock and latch sets that are manufactured of [steel castings] [or] [stainless steel].] Fasten latch handles firmly to axles. Lever handles must be perpendicular to the door edge when latches are engaged. [Locate single lever handles at the stile opposite the hinges.] [Locate [wheel] [and spoke lever] [spoke lever] handles approximately halfway between the stiles.]

2.2.3 Mortise Lock and Latch Set

****

NOTE: Mortise lock and latch sets are practical only for hollow metal doors. These lock and latch sets are special built and are not normally cycle tested as specified in ANSI/BHMA A156.13. Mortise lock and latch sets are usually specified only when a deadbolt function is required.

****

Release latches using a torque not exceeding 3 N-meters 27 lb-inch. Locate latches (latch bolts) at the stiles and operate from a single lever handle. Provide only one deadbolt . Provide deadbolt manufactured of structural quality steel with a deadbolt throw no less than 25 mm 1 inch. Provide mortise locks with armored fronts. Provide function numbers for mortise locks as defined in ANSI/BHMA A156.13.

2.2.4 Keying

[Conform to Section 08 71 00 DOOR HARDWARE.] [Stamp change keys for locks with change number and the inscription "U.S. Property - Do Not Duplicate." Unless otherwise specified, provide two change keys for each lock.] [Furnish locks with the manufacturer's standard construction key system.]

2.2.5 Exit Device

****
NOTE: Exit devices are practical only for hollow metal doors and light structural steel doors.
****

Release latches (latch bolts) by depressing the actuation bar using a force of no more than 67 N 15 lbf applied perpendicular to the door in the swing direction. Provide exit device that [conforms to the finish test values specified in ANSI/BHMA A156.3 and] is of [stainless steel construction] [and] plain design with straight, beveled, or smoothly rounded sides, corners, and edges. A touch bar may be provided in lieu of a conventional actuation bar (cross bar). Provide function numbers for exit devices as defined in ANSI/BHMA A156.3.

2.2.6 Straight Steel Bar Door Pull

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

Provide straight steel bar door pulls manufactured of round steel bar. Furnish [Type I: 13 mm 1/2 inch diameter, 125 mm 5 inch grip and 65 mm 2-1/2 inch projection with 13 mm 1/2 inch inside bend radiuses] [;] [and] [Type II: 16 mm 5/8 inch diameter, 300 mm 12 inch grip and 100 mm 4 inch projection with 24 mm 15/16 inch inside bend radiuses] [; and] [Type III: 16 mm 5/8 inch diameter, 200 mm 8 inch grip and 100 mm 4 inch projection with 24 mm 15/16 inch inside bend radiuses]. Grip and projection dimensions are measured from the bar centerline. Attach the pull to the door by fillet welding all around.

2.2.7 Padlock

****
NOTE: For ASTM F883 padlock, specify Type P01 (key operated) or P02 (combination operated) and Grade 1 (lowest) to 6 (highest) performance. Available ASTM F883 options are "A" (key is captive in cylinder when padlock is unlocked), "B" (removable cylinder), "C" (changeable combination), "D" (combination operated with key control), "E" (corrosion

resistant), and "F" (provided with nonferrous shackles).

****

Provide low security padlocks conforming to ASTM F883, Type [PO1][PO2], Option [_____] [and] [_____], Grade [_____].

2.2.8 Shrouded Padlock

****

NOTE: Use a shrouded padlock in conjunction with a high security shrouded hasp.

****

Provide high security padlocks with shrouded shackles conforming to DLA Lock, 5340-01-217-5068.

2.2.9 Hasp

Provide low security hasps conforming to ANSI/BHMA A156.20, Grade [1] [2] [3], steel, [safety] [or] [open hinge] type with [adjustable] [,] [or] [swivel] [,] [or] [fixed] staple, [paint finished] [or] [galvanized] [as specified] and screw fastened to the door and frame.

2.2.10 High Security Hasp

****

NOTE: This high security hasp is a non-shrouded mortise type. Styles 1 through 9 are available. Consult referenced military specification.

****

Provide high security hasps conforming to ASTM F2155, Style [_____] [carbon] [corrosion resistant] steel, attached by [fasteners] [welding].

2.2.11 Shrouded Hasp

****

NOTE: Style 1 applies to right-hand doors and Style 2 to left-hand doors.

****

Provide high security shrouded hasps conforming to ASTM F2155.

2.2.12 Door Stop

Design door stops 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.

2.2.13 Surface Door Closer

****

NOTE: Door closers are practical only for hollow metal doors and light structural steel doors.

****

Provide surface door closer conforming to ANSI/BHMA A156.4. Provide size and grade selected by the door manufacturer.

2.2.14 Overhead Door Holder

Provide surface mounted overhead door holder. Provide a spring or other device to cushion the door action and limit the door swing at [85] [110] degrees. [Provide a built-in, hold-open capability at the swing limit specified.] [Provide overhead door holders for hollow metal doors weighing less than 90 kg 200 pounds conforming to ANSI/BHMA A156.8.]

2.2.15 Gasket Seal

****

NOTE: Gasket seals are recommended for reinforced concrete doors.

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

****

Provide sealed doors that have the full door perimeter and all door penetrations sealed. Provide rubber gasket perimeter seals. Provide gaskets that are removable, capable of sealing the mating surfaces, and resistant to the atmospheric environment. Provide one spare set of gasket seals for each door assembly for which gasket seals are specified.

2.2.16 Door Silencer

****

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

****

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

2.2.17 Optical Device

Provide wide angle optical device (spy hole) and do not breech or dislodge by the specified or indicated blast overpressure. Permit observation from the seating face of the door and locate approximately 1.5 m 5 feet above the seating side floor and approximately centered between the stiles.

2.3 ACCESSORIES

2.3.1 Subframe

At the Contractor's option, a subframe can be provided and built into the structure prior to installation of the frame. Provide subframe and subframe anchors that are capable of transferring blast and rebound reactions to the adjacent structure, and a frame capable of transferring these reactions to the subframe. Fabricate the subframe in the same manner specified for the frame.

2.3.2 Nameplate

Provide a permanently affixed nameplate that displays the manufacturer's name, place and year of manufacture, and the applicable peak overpressure,

impulse, and rebound rating for each door assembly.

2.3.3 Removable Threshold

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

2.3.4 Ramp

Provide structural steel, portable ramp that weighs no more than [90] [_____] kg [200] [_____] pounds. Provide ramp of sufficient length to extend the full door opening width and with the profile indicated. The ramp must be capable of supporting [a wheel load of [_____] N lbf] [the wheel load indicated].

2.3.5 Self-Rescue Kit

****

NOTE: Self-rescue kits are usually specified only when post-blast operation is desired and debris could prevent the door from opening.

****

Contain illustrated instructions, nonadjustable wrenches, screwdrivers, jacks, and all other tools required to open the blast door from the seating face to a width of at least 300 mm 12 inches. A jack capacity less than [334] [_____] kN [75,000] [_____] lbf is not permitted. Mount tools securely in a steel frame using wing nuts or other approved fasteners. Fabricate the self-rescue kit frame in the same manner specified for the door frame and anchor securely to the wall at the location indicated or as directed.

2.4 FABRICATION

2.4.1 Shop Assembly

****

NOTE: Delete welding of stainless steel when only reinforced concrete doors are specified.

For reinforced concrete doors, 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.

Specify faceplates for exterior doors in conventional weapons resistant facilities in cases where construction is to parallel NATO criteria.

Composite faceplated reinforced concrete doors with studs welded to both faceplates are also available. When these doors are required, specify the following in the fabrication paragraph: "Provide composite faceplated reinforced concrete doors with studs shop welded to faceplates at both ends of the stud. Studs must be of sufficient diameter and spacing to effectively transfer shear forces." Specify the following under door assembly paragraph Door Type:

"Composite faceplated reinforced concrete door."

****

Perform welding 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 and welding of concrete reinforcing bars must be in accordance with AWS D1.4/D1.4M. [Weld stainless steel using electrodes conforming to AWS A5.4/A5.4M.] [Structural steel doors must be of welded construction.] Provide fabricated steel that is well-formed to shape and size, with sharp lines and angles. Cope or miter intermediate and corner joints. Smooth dress exposed welds. [Close the stiles [and top] of built-up structural steel doors using channel shapes or plates.] [When feasible, provide one-piece faceplates for structural steel doors. When one-piece faceplates are not feasible, join plates using full penetration groove weld butt joints or other approved welds.] [Close reinforced concrete doors at the edges with structural steel channels or plates and mortise latch housings. Do not use lap splices for flexural reinforcing bars.] [Provide one-piece spall plates, covering the entire concrete surface on the seating face of the door, and weld securely to the door edges. Spall plates less than 6 mm 1/4 inch thick are not permitted.] [Provide faceplated reinforced concrete doors with one-piece faceplates on both door faces. Provide faceplates that cover the entire concrete surface and weld securely at the door edges. Faceplates less than 9 mm 3/8 inch thick are not permitted.] [Provide hollow metal door frames consisting of pressed steel or structural steel with welded joints. Provide steel frames or subframes installed in masonry walls with adjustable anchors. Provide hollow metal doors consisting of unitized grid construction with welded grid junctions that have flat, one-piece face sheets spot welded to each face of the grid system. Close the edges of hollow metal doors with seams continuously welded. Provide hollow metal doors that are neat in appearance, free from warpage and buckle, and provide suitable reinforcing for hardware.]

2.4.2 Mullion

Fabricate mullions for double doors in the same manner specified for frames. [Weld fixed mullions to the frame.] [Attach removable mullions to the frame with mechanical fasteners that are accessible for mullion removal or, in lieu of the removable mullion, provide an astragal at the seating face of the inactive door leaf.] Doors must seat directly against the mullion, and the mullion or astragal must be capable of transferring the door reactions to the frame.

2.4.3 Thermal Insulation

****

NOTE: Thermal insulation is practical only for hollow metal doors.

****

Completely fill the interior cells between the unitized grid with thermal insulation material. The U value through the door (panel) must not exceed [1.36] [_____] W per square meter per degree K [0.24] [_____] Btu per square foot per hour per degree F. Submit certification or test report for [thermal insulated] [sound rated] doors listing the type of hardware used to achieve the rating; see paragraph SOUND RATING TEST below.

2.4.4 Shop Finishing

[Shop prime steel surfaces in conformance to Section 09 90 00 PAINTS AND COATINGS, except that surfaces that will be embedded in concrete need not be primed and either dip hollow metal doors in primer after welding is completed, or prime exposed surfaces and coat interior surfaces with an approved rust inhibitor]. [Galvanize doors and frames conforming to ASTM A123/A123M or other approved methods. Surfaces that will be embedded in concrete need not be galvanized and the interior of hollow metal doors may be treated with an approved rust inhibitor in lieu of galvanizing. Galvanize exposed portions of concrete anchors, non stainless steel fasteners, and hardware other than factory finished hardware conforming to ASTM A153/A153M or other approved methods.]

2.4.5 Clearance

[The clearance between the seated steel surfaces of structural steel doors and frames must not exceed 1.6 mm 1/16 inch.] [The lateral clearance between flush mounted structural steel doors and frames must not exceed [6] [_____] mm [1/4] [_____] inch at the head and jambs and the clearance between the meeting edges of pairs of doors must not exceed [13] [_____] mm [1/2] [_____] inch.] [The lateral clearance between hollow metal doors and frames must not exceed 3 mm 1/8 inch at the head and jambs and the clearance between the meeting edges of pairs of doors must not exceed 6 mm 1/4 inch.] The clearance between the door bottom and threshold must not exceed 19 mm 3/4 inch.

2.5 BLAST DOOR ASSEMBLIES

****
NOTE: The assembly paragraphs provided for structural steel, reinforced concrete, and hollow metal doors will be repeated and edited as many times as required to specify all door assemblies. The door designations will then be referenced in the door schedule on the drawings. Items shown on the drawings will not be duplicated in the door assembly paragraphs. The door assembly paragraphs are pre-edited to show normal use and hardware availability; e.g., thermal insulation, sound rating, and mortise locks are omitted for structural steel and reinforced concrete doors, Type 2 hinges are normally used for reinforced concrete doors and thus are shown without brackets, etc.
****

2.5.1 Door [_____]; Steel

****
NOTE: Coordinate with paragraphs DESCRIPTION and BLAST DOOR ASSEMBLIES.
****

2.5.1.1 Type

Type must be [structural steel] [double structural steel door with [fixed] [or] [removable] mullion] [,] [galvanized] [,] [and] [fire-rated].

2.5.1.2 Overpressure

Provide overpressure of [_____] kPa psi [with a [_____] millisecond duration] in the [seating] [unseating] direction [and [_____] kPa psi [with a [_____] millisecond duration] in the unseating direction]. Indicate the [shock and gas overpressure] [overpressure] waveform.

2.5.1.3 Fragment

****

NOTE: Coordinate with paragraph Fragment Resistance, under paragraph DESCRIPTION.

****

[The fragment must be [_____] g ounces with a velocity of [_____] m/s fps and impact [normal to] [at an angle of [_____] degrees measured from] the door face.] [Provide protection from fragments by steel plate no less than [_____] mm inches in thickness.]

2.5.1.4 Rebound

****

NOTE: Coordinate with paragraph Rebound Resistance, under paragraph DESCRIPTION.

****

Provide rebound resistance of [50] [100] [_____] percent.

2.5.1.5 Deformation Limits

****

NOTE: For structural steel doors, the deformation limit criteria for accidental explosion applications is given below.

Prot. Cat. No.	Support Rotation (Deg.)	Ductility Ratio
1	2	10
2	12	20

A 2-degree support rotation and ductility ratio of 10 is recommended when post-blast opening is required. This deformation limit is recommended for conventional weapon and improvised weapon exterior door applications in order to avoid entrapment of personnel.

****

Do not exceed [10 and do not exceed 2 degrees for support rotation] [20 and do not exceed 12 degrees for support rotation] for ductility ratio.

2.5.1.6 Hardware

****

NOTE: Coordinate with paragraph Hinges, under paragraph HARDWARE. A door pull is recommended.

****

Provide Type [1] [2] [3] full surface hinges. Provide [multiple] [jamb] latching points and [multiple lever handles] [,] [or] [a single lever handle] [,] [or] [a wheel handle] [,] [or] [a spoke lever handle] operated from [the seating face] [and] [opposite the seating face] with [manual] [self-latching] latch engagement and [either] sliding [or lever] latch bolts. Provide [safety] [or] [cover] plated latching mechanism. Provide a [Type [I] [II] [III] straight steel bar door pull] [,] [and] [padlock] [shrouded padlock] [,] [and] [hasp] [high security hasp] [shrouded hasp] [,] [and] [door stop] [,] [and] [surface door closer] [overhead door holder] [,] [and] [gasket seals] [door silencer] [,] [and] [optical device].

2.5.1.7 Operating Forces

****
NOTE: Coordinate with paragraph Blast Door Operation, under paragraph DESCRIPTION.
****

[Provide maximum operating forces of [135] [180] [_____] N [30] [40] [_____] lbf to set the door in motion and [90] [_____] N [20] [_____] lbf to swing the door. Provide maximum force to engage and release latches of [90] [135] [180] [_____] N [20] [30] [40] [_____] lbf.] [Operating forces must conform to NFPA 101.]

2.5.1.8 Accessories

Provide a [removable threshold] [or] [ramp] [and] [self-rescue kit].

2.5.2 Door [_____]; Concrete

****
NOTE: Coordinate with paragraph DESCRIPTION and paragraph BLAST DOOR ASSEMBLIES.
****

2.5.2.1 Type

Type must be [reinforced concrete] [double reinforced concrete] door with [fixed] [or] [removable] [mullion] [and] [with] [spall plate] [faceplates].

2.5.2.2 Overpressure

Provide overpressure of [_____] kPa psi [with a [_____] millisecond duration] in the [seating] [unseating] direction [and [_____] kPa psi with a [_____] millisecond duration in the unseating direction]. Indicate the [shock and gas overpressure] [overpressure] waveform.

2.5.2.3 Fragment

****
NOTE: Coordinate with paragraph Fragment Resistance, under paragraph DESCRIPTION.
****

[The fragment must be [_____] g ounces with a velocity of [_____] m/s fps and impact [normal to] [at an angle of [_____] degrees measured from] the door face.] [Provide nominal door thickness no less than [100] [200]

[_____] mm [4] [8] [_____] inches].

2.5.2.4 Rebound

****
NOTE: Coordinate with paragraph Rebound Resistance, under paragraph DESCRIPTION.
****

Provide rebound resistance of [20] [100] [_____] percent.

2.5.2.5 Deformation Limits

****
NOTE: For reinforced concrete doors, the deformation limit criteria for accidental explosion applications is given below.

Door Type	Prot. Cat. No.	Support Rotation (Deg.)
One-way	1	1
acting without stirrups	2	2
One-way	1	2
acting with stirrups	2	4
Two-way	1	2
acting	2	8

A support rotation of not more than 2 degrees is recommended when post-blast opening is required. This deformation limit is recommended for conventional weapon and improvised weapon exterior door applications in order to avoid entrapment of personnel.
****

[Do not exceed [1 degree] [2 degrees] door support rotation for one-way acting doors without stirrups, [2] [4] degrees for one-way acting doors with stirrups, and [2] [8] degrees for two-way acting doors.] [Do not exceed 2 degrees support rotation except do not exceed 1 degree support rotation for one-way acting doors without stirrups.]

2.5.2.6 Hardware

Provide Type 2 hinges. Provide [multiple] [jamb] latching points and multiple lever handles operated from [the seating face] [and] [opposite the seating face] with manual latch engagement and lever latch bolts. Provide Type [I] [II] [III] straight steel bar door pull [,] [and] [padlock] [shrouded padlock] [,] [and] [hasp] [high security hasp] [shrouded hasp] [,] [and] [door stop] [,] gasket seals [, and optical device].

2.5.2.7 Operating Forces

****
NOTE: Coordinate with paragraph Blast Door Operation, under paragraph DESCRIPTION.
****

Provide maximum operating forces of [180] [_____] N [40] [_____] lbf to set the door in motion and [90] [_____] N [20] [_____] lbf to swing the door. Provide maximum force to engage and release latches of [135] [_____] N [30] [_____] lbf.

2.5.2.8 Accessories

Provide a [removable threshold] [ramp] [and] [self-rescue kit].

2.5.3 Door [_____]; Metal

****
NOTE: Coordinate with paragraph DESCRIPTION and with paragraph BLAST DOOR ASSEMBLIES.

The STC value bracketed is close to the highest obtainable for blast doors.
****

2.5.3.1 Type

Type must be [hollow metal] [double hollow metal door with a [fixed] [or] [removable] mullion] [,] [galvanized] [;] [and] [thermal insulation] [sound-rated to STC [40] [_____]] [, and] [fire-rated].

2.5.3.2 Overpressure

Provide overpressure of [_____] kPa psi in the [seating] [unseating] direction [and [_____] kPa psi in the unseating direction].

2.5.3.3 Rebound

****
NOTE: Coordinate with subparagraph Rebound Resistance, under paragraph DESCRIPTION.
****

Provide rebound resistance of [50] [100] [_____] percent.

2.5.3.4 Hardware

****
NOTE: Coordinate with subparagraph Hinges, under paragraph HARDWARE.

Delete the latch sentence when a mortise lock and latch set or exit device is specified.
****

Provide Type [1] [2] [3] [full surface] [mortise] hinges. [Provide [multiple] [jamb] latch points and [multiple lever handles] [or] [a single lever handle] operated from the [seating face] [and] [opposite the seating

face] with [manual] [self-latching] latch engagement and [either] sliding [or lever] latch bolts.] [Provide exit device with [multiple latch points] [jamb latch points] [and with function [_____]].] [Provide mortise lock and latch set [with function [_____]].] [Provide a [padlock] [and] [hasp] [,] [and] [door stop] [,] [and] [surface door closer] [overhead door holder] [,] [and] [gasket seals] [door silencer] [,] [and] [optical device].]

2.5.3.5 Operating Forces

****
NOTE: Delete the latch operating force sentence when a mortise lock and latch set or exit device is specified.

Coordinate with paragraph Blast Door Operation, under paragraph DESCRIPTION.
****

[Provide maximum operating forces of [90] [_____] N [20] [_____] lbf to set the door in motion and [70] [_____] N [15] [_____] lbf to swing the door.] [Provide operating forces conforming to NFPA 101.] Provide maximum force of [90] [_____] N [20] [_____] lbf to engage and release latches.

2.5.3.6 Accessories

Provide a [removable threshold] [or] [ramp].

2.6 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.

2.6.1 Prototype Static Test

****
NOTE: Retain this paragraph when overpressure is specified without duration.
****

Perform static tests on prototype door assemblies to 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. Supplement static test reports with calculations that demonstrate rebound resistance when rebound is not tested.

2.6.2 Prototype Blast Test

Perform blast tests on the prototype door assembly to 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. [For an overpressure with infinite duration, use the overpressure in the test that is no less than that specified or indicated

for a duration equal to at least five times the natural period of the door and supplement the test report with calculations that demonstrate the specified or indicated rebound resistance.] [For overpressure with finite duration, use the overpressure waveform in the test that exceeds the overpressure waveform in both peak overpressure and impulse and supplement the blast test report with calculations that demonstrate the specified or indicated rebound resistance when the positive phase waveform duration in the test exceeds the positive phase duration specified or indicated.] 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.

2.6.3 Shop Operating Test

Prior to shipment, fully erect each door assembly in a supporting structure and test for proper operation. Such testing includes opening, closing, and operating all moving parts to ensure smooth operation and proper clearance, fit, and seating. Determine the operating forces and opening and closing times. Notify the Contracting Officer at least [7] [_____] calendar days prior to the start of testing and test [all doors] [door [_____] [,] [_____] [,] [and] [_____]] in the presence of the Contracting Officer. Prepare a test report and furnish [three] [_____] copies within [7] [_____] calendar days after testing.

2.6.4 Air Leakage Test

****
NOTE: Retain and edit this paragraph when door seals or thermal insulation are specified.
****

Factory test each door assembly for which [door seals] [or] [thermal insulation] [are] [is] specified for air leakage rate in accordance with ASTM E283. The rate of air leakage per unit length of crack must not exceed [0.90] [_____] L/s [0.20] [_____] cfm using a pressure difference of [76.7] [_____] Pa [1.57] [_____] psf. Prototype tests can be substituted for door assembly tests when the prototype door, frame, and hardware tested are equivalent to that provided or when otherwise approved.

2.6.5 Sound Rating Test

****
NOTE: Retain this paragraph when sound-rated hollow metal doors are specified.
****

Determine the sound transmission class (STC) rating in accordance with ASTM E90.

2.6.6 Fire Rating Test and Inspection

****
NOTE: Retain this paragraph when fire rating is required. The door schedule on the drawings will indicate where fire-rated doors are to be used and their rating requirements.

****

Provide fire-rated door assemblies bearing the listing identification label of the UL, or other nationally recognized testing laboratory qualified to perform tests of fire door assemblies in accordance with NFPA 252 and having a listing for the tested assemblies. Inspect doors exceeding the size for which listing label service is offered in accordance with NFPA 80, NFPA 80A, and NFPA 101. A letter may be submitted by the testing laboratory (in lieu of a UL listing for fire door assemblies) which identifies the submitted product by manufacturer and type or model and certifies that it has tested a sample assembly and issued a current listing. Submit certificate of inspection conforming to NFPA 80, NFPA 80A, and NFPA 101 for fire doors exceeding the size for which label service is available.

PART 3 EXECUTION

3.1 INSTALLATION

Install doors and frames in accordance with the manufacturer's written instructions. [Place concrete in reinforced concrete doors using the door manufacturer's standard forms.] [Fully grout pressed steel frames for hollow metal doors.] Finish paint exposed surfaces in accordance with Section 09 90 00 PAINTS AND COATINGS. Repair galvanized surfaces damaged prior to final acceptance in accordance with ASTM A780/A780M to the same thickness as the original galvanizing.

3.2 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.

3.3 MANUFACTURER'S FIELD SERVICE

Perform installation and testing of door assemblies under the supervision of the door manufacturer's erection engineer. Upon completion of the work, and at a time designated by the Contracting Officer, provide the services of one engineer and other technical personnel, as required, for a period of not less than [4] [_____] hours to instruct Government personnel in the operation and maintenance of the blast doors and all other items furnished under this specification. Include in the instructions videotapes and use of the operation and maintenance manual. Submit an instruction outline and procedure for approval prior to scheduling the instruction and information describing training to be provided, training aids to be used, and background data on the personnel conducting the training.

-- End of Section --