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KUNSAN AIR BASE, KOREA

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DIVISION 08 - DOORS & WINDOWS
SECTION 08390
BLAST RESISTANT DOORS

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SECTION 08390

BLAST RESISTANT DOORS

PART 1  GENERAL

1.1 REFERENCES

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

ACI INTERNATIONAL (ACI)


AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABEMA)

ABEMA Std 9         (1990) Load Ratings and Fatigue Life for Ball Bearings
ABEMA Std 11        (1990) Load Ratings and Fatigue Life for Roller Bearings

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)


AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M    (1996) Carbon Structural Steel
ASTM A 242/A 242M  (1993a) High-Strength Low-Alloy Structural Steel
ASTM A 307         (1994) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 325         (1996) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
<table>
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<th>Standard Number</th>
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<tr>
<td>ASTM A 354</td>
<td>(1995) Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners</td>
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<td>(1993) Quenched and Tempered Steel Bolts and Studs</td>
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<tr>
<td>ASTM A 490</td>
<td>(1993) Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength</td>
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<tr>
<td>ASTM A 500</td>
<td>(1993) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes</td>
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<tr>
<td>ASTM A 501</td>
<td>(1993) Hot-Formed Welded and Seamless Carbon Steel Structural Tubing</td>
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<tr>
<td>ASTM A514/A514M</td>
<td>(1994a) High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding</td>
</tr>
<tr>
<td>ASTM A529/A529M</td>
<td>(1994) High-Strength Carbon-Manganese Steel of Structural Quality</td>
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<tr>
<td>ASTM A 534</td>
<td>(1994) Carburizing Steels for Anti-Friction Bearings</td>
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<tr>
<td>ASTM A 563</td>
<td>(1994) Carbon and Alloy Steel Nuts</td>
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<tr>
<td>ASTM A572/A572M</td>
<td>(1994c) High-Strength Low-Alloy Columbium-Vanadium Structural Steel</td>
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<tr>
<td>ASTM A 574</td>
<td>(1992a) Alloy Steel Socket-Head Cap Screws</td>
</tr>
<tr>
<td>ASTM A588/A588M</td>
<td>(1994) High-Strength Low-Alloy Structural Steel with 50 ksi (345Mpa) Minimum Yield point to 4 in (100mm) Thick</td>
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<tr>
<td>ASTM A615/A615M</td>
<td>(1996a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement</td>
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<tr>
<td>ASTM A 618</td>
<td>(1993; R 1995) Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing</td>
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<tr>
<td>ASTM A 687</td>
<td>(1993) High-Strength Non headed Steel Bolts and Studs</td>
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<tr>
<td>ASTM A706/A706M</td>
<td>(1995b) Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement</td>
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<tr>
<td>ASTM F 436</td>
<td>(1993) Hardened Steel Washers</td>
</tr>
<tr>
<td>ASTM F 835</td>
<td>(1993) Alloy Steel Socket Button and Flat Countersunk Head Cap Screws</td>
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</table>
1.2 DESCRIPTION

Structural steel doors shall be flush mounted in frames. Reinforced concrete doors shall be surface mounted. Doors shall be the manually operated, side hinged, swinging type. Each door assembly shall include the door, frame, anchors, hardware, and accessories and shall be provided by a single manufacturer.

Frames and anchors shall be capable of transferring blast and rebound reactions to the adjacent supporting structure. Resistance to blast shall be demonstrated either by design calculations or tests on prototype door assemblies.

1.2.1 Design Requirements

1.2.1.1 Static Material Strength

The static values for minimum yield strength (or yield point) and (ultimate) tensile strength for steel shall be obtained from the applicable material specification. For tensile strength specified in terms of a tensile strength range, the lowest tensile strength specified shall be selected for design. Structural steel having a minimum static yield strength (or yield point) less than 345 MPa (50 ksi) and Grade 60 (SD40) reinforcing bars shall be designed using an average yield strength computed as 1.1 times the minimum static yield strength or yield point. When the minimum static yield for structural steel exceeds 345 MPa (50 ksi), the average yield strength shall be taken as equal to the minimum static yield strength or yield point without increase. The in-place compressive strength of concrete shall be computed by adding 3 MPa (0.5 ksi) to the specified compressive strength to reach the average compressive strength and then multiplying by 1.1 to account for age effects.
1.2.1.2 Dynamic Material Strength

The dynamic material strength shall be computed by applying a dynamic increase factor that accounts for the increase in material strength due to strain rate effects. The dynamic increase factor for structural steel in flexure shall be applied to the average yield strength and shall be 1.29, 1.19, and 1.09 for structural steel having a minimum yield strength (or yield point) of 248 MPa (36 ksi), 345 MPa (50 ksi), and 689 MPa (100 ksi), respectively. The dynamic increase factor for structural steel having a minimum yield strength (or yield point) between these values shall be obtained by interpolation. Optionally, for structural steel in these yield ranges, the dynamic increase factor shall be determined 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) shall be 1.0.

The dynamic increase factor for Grade 60 flexural reinforcing bars shall be 1.17 applied to the average yield strength. The dynamic increase factor for concrete used in flexure shall be 1.19 applied to the in-place compressive strength. Optionally, the dynamic increase factor applied to flexural reinforcing bar yield and concrete compressive strength shall be determined by a detailed analysis that accounts for the time to steel yield and time to ultimate concrete strength.

1.2.1.3 Structural Member Design

Structural steel section properties for rolled shapes shall be obtained from AISC LFRD, Vol I, AISC ASD Manual, or steel manufacturers’ catalogs. The plastic moment capacity for single plate sections and sections built up from plates and shapes shall be computed as the average of the elastic and plastic section modulus multiplied by the dynamic yield strength, unless otherwise approved. Shear, welds, local buckling, and web crippling of structural steel shall be designed in accordance with AISC LFRD, Vol II, the plastic design provisions of AISC-04, or by other approved methods except that for blast design, the load factors and resistance factors shall be equal to 1.0 and the dynamic yield strength shall be substituted for the static yield stress. Nominal reinforcing bar designations, weights, and dimensions shall be obtained from ACI 318/318R or the reinforcing bar specification. The moment of inertia of the reinforced concrete cross section used to determine the elastic deflection shall be the average of the moment of inertia of the gross section and the moment of inertia of the cracked section. The resistance of the reinforced concrete section shall be computed in accordance with ACI 318/318R or other approved methods except that for blast design, the load and resistance factors shall be equal to 1.0 and the dynamic reinforcing bar yield strength and dynamic ultimate concrete strength shall be substituted for the static strength values.
1.2.1.4 Dynamic Analysis and Deformation

The door shall be designed using an equivalent single degree of freedom or other approved dynamic analysis method. The maximum door deformation shall be selected by the door manufacturer except that the maximum deformation in flexure shall not exceed the deformation limits specified or indicated. The deformation of structural steel members having a minimum yield strength or yield point greater than 448 MPa (65 ksi) shall not exceed the elastic deflection.

1.2.1.5 Rebound Resistance

Rebound resistance shall be the specified or indicated percentage of the door resistance at initial peak response.

1.2.2 Blast Effects

1.2.2.1 Overpressure

The spatial distribution of overpressure shall be uniform unless otherwise specified or indicated. For overpressure specified or indicated with duration only, the waveform shall be a triangle with a zero rise time.

1.2.2.2 Overpressure Direction

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

1.2.2.3 Fragment Resistance

For doors specified or indicated to resist fragments, the door and the door and frame interface shall be designed to prevent fragment perforation and the latches and latching mechanism shall be shielded from fragment damage. The fragment impact point shall be anywhere on the door and frame face exposed to overpressure.

1.2.3 Blast Door Operation

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

1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:
BLAST RESISTANT DOORS (SLIDE TYPE)

SD-01 Data

Blast Resistant Door; GA.

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.

Contractor Design Calculations; GA.

Detailed structural analysis and design calculations demonstrating resistance to blast when blast resistance is not demonstrated by prototype tests. Design calculations shall demonstrate adequacy under the blast effects specified or indicated. Design calculations shall include 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 shall cover initial response, rebound, and all secondary items such as shear, welds, local buckling, web crippling, hinges, and latches.

Test on Prototype Door; GA.

Certified test reports demonstrating blast resistance. Test reports shall include 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, and the value of measured peak door deflection and peak permanent set. Test reports shall include analysis and interpretation of test results.

SD-04 Drawings

Contractor Design of Blast Resistant Doors; GA.

For special doors or standard doors with appreciable modifications, detailed fabrication and assembly drawings 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. Weld symbols used shall conform to AWS A2.4. These drawings need not be submitted for standard doors for which manufacturer's catalog data is submitted.
BLAST RESISTANT DOORS(SLIDE TYPE)

SD-06 Instructions

Blast Resistant Door; FIO.

Manufacturer's instructions for installation and field testing.

SD-08 Statements

Manufacturer's Field Service; FIO.

Information describing training to be provided, training aids to be used, and background data on the personnel conducting the training.

SD-09 Reports

Blast Door Shop and Field Operating Tests; GA.

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.

Fire Rated Blast Door; GA.

In lieu of a UL listing for fire door assemblies, a letter may be submitted by the testing laboratory 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.

SD-13 Certificates

Certificates of Compliance; GA.

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 shall be signed by an official authorized to certify in behalf of the manufacturer and shall identify the door assembly and date of shipment or delivery to which the certificate applies.
SD-19 Operation and Maintenance Manuals

Information 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 shall be cross referenced to the door designations shown on the drawings.

1.4 QUALIFICATIONS

Welders, welding operators, and weld inspectors shall be qualified in accordance with AWS D1.1 except that welders and weld operators performing welding of reinforcing bars shall be qualified in accordance with AWS D1.4.

1.5 DELIVERY AND STORAGE

Door assemblies delivered and placed in storage shall be stored with protection from weather and dirt, dust, and contaminants.

1.6 WARRANTY

Manufacturer’s written warranty covering the blast door assembly for 2 years after acceptance by the Government shall be furnished. Warranty shall 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 quality steel materials for which tension properties have been obtained shall be used to resist blast except that commercial quality steel sheet and strip shall be permitted for prototype tested hollow metal doors. Steel used in the door, door frame, and door frame anchors and non-stainless steel fasteners that resist blast shall be selected from the materials specified.

2.1.1 Concrete and Concrete Reinforcement

Concrete is specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Concrete reinforcement shall conform to ASTM A 615/A 615M or ASTM A 706/A 706M, Grade 60.
2.1.2 Structural Tubing

Structural tubing shall conform to ASTM A 500, ASTM A 501, or ASTM A 618.

2.1.3 Structural Steel

Structural steel bars, plates, and shapes shall conform to ASTM A 36/A 36M, ASTM A 242/A 242M, ASTM A 529/A 529M, ASTM A 572/A 572M, or ASTM A 588/A 588M. Quenched and tempered steel plate shall conform to ASTM A 514/A 514M.

2.1.4 Fasteners

Steel studs and bolts shall conform to ASTM A 307, ASTM A 325, ASTM A 499, ASTM A 490, or ASTM A 687 as applicable. Steel nuts shall conform to ASTM A 563. Hardened circular, beveled, and clipped washers shall conform to ASTM F 436. Steel hex cap screws shall conform to ASTM F 568. Steel socket-headed cap screws shall conform to ASTM A 574. Steel button and flat-headed countersunk cap screws shall conform to ASTM F 835.

2.2 HARDWARE

2.2.1 Hinges

2.2.1.1 General Requirements

Hinges shall be specially manufactured to support the door and to resist any blast induced loading. The number of hinges shall be determined by the blast door manufacturer. Welds used in hinges shall be continuous. Hinges shall be attached to the door and frame using mechanical fasteners except that full surface hinges for doors with locks shall be attached to the door and frame by welding or approved tamper-resistant mechanical fasteners and hinges for doors with locks shall have approved non-removable pins. Load ratings and fatigue life for ball and roller bearings shall be determined in accordance with ABEMA Std 9 and ABEMA Std 11 as applicable and, unless otherwise approved, the bearing steel shall conform to ASTM A 534. Hinges shall 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 shall be factory grease lubricated and either sealed or provided with easily accessible lubrication fittings.

2.2.1.2 Hinge Description

Hinge Type 2 shall be smooth operating and shall 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.
2.2.2 Latching System

2.2.2.1 Latching Points

The number of latching points shall be determined by the door manufacturer. For multiple latching points, latching points can be provided at the head, sill, and jambs.

2.2.2.2 Latching System Operation

Latches shall remain engaged until manually released and shall not release under blast loads or rebound. Manually operated latches shall remain in the released position until manually engaged. Handles shall release latches under a clockwise motion.

2.2.2.3 Latching Mechanism

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

2.2.2.4 Safety Cover

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

2.2.2.5 Cover Plate

Cover plates for structural steel doors shall be manufactured of minimum 6 mm (1/4 inch) thick Plate and shall enclose the entire latching mechanism.

2.2.2.6 Latches

Latches (latch bolts) shall be manufactured of structural quality steel and the latch bolt throw shall not be less than 19 mm (3/4 inch). Latch bolts shall 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 except that latches for doors with exit devices shall be the sliding type]. Manually operated latches shall draw the door toward the frame during latching.

2.2.2.7 Handle

Handles for doors without locks shall be manufactured of steel castings, forgings, pipe, round tubing, bar, or plate and shall be one piece or have welded joints except that wheel handles can be manufactured of aluminum castings. Latch handles shall be firmly fastened to axles. Lever handles shall be perpendicular to the door edge when latches are engaged. Single lever handles shall be located at the stile opposite the hinges. Spoke lever handles shall be located approximately halfway between the stiles.
BLAST RESISTANT DOORS (SLIDE TYPE)

2.2.3  Straight Steel Bar Door Pull

Straight steel bar door pulls shall be manufactured of round steel bar. The type furnished shall be 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 radiusses. Grip and projection dimensions are measured from the bar centerline. The pull shall be attached to the door by fillet welding all around.

2.2.4  Shrouded Padlock

High security padlocks with shrouded shackles shall conform to MS MIL-P-43607. High security padlocks are required on mechanical room doors.

2.2.5  High Security Hasp

High security hasps shall conform to MS MIL-H-43905, Style 1 carbon steel, attached by welding.

2.2.6  Door Stop

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

2.2.7  Overhead Door Holder

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

2.2.8  Gasket Seal

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

2.3  ACCESSORIES

2.3.1  Sub-frame

At the Contractor's option, a sub-frame can be provided and built into the structure prior to installation of the frame. The sub-frame and sub-frame anchors shall be capable of transferring blast and rebound reactions to the adjacent structure, and the frame shall be capable of transferring these reactions to the sub-frame. The sub-frame shall be fabricated in the same manner specified for the frame.

2.3.2  Nameplate

Each door assembly shall 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.
2.3.3 Ramp

The ramp shall be structural steel, portable, and weigh not more than 90 kg (200 pounds). The ramp shall be of sufficient length to extend the full door opening width and shall have the profile indicated. The ramp shall be capable of supporting a wheel load of 2220 N (500 pounds).

2.3.4 Self-Rescue Kit

Self-rescue kits shall 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). The jack capacity shall not be less than 334 kN (75,000 pounds). Tools shall be securely mounted in a steel frame using wing nuts or other approved fasteners. The self-rescue kit frame shall be fabricated in the same manner specified for the door frame and shall be securely anchored to the wall at the location indicated or as directed.

2.4 FABRICATION

2.4.1 Shop Assembly

Welding shall be in accordance with AWS D1.1 except that welding of concrete reinforcing bars shall be in accordance with AWS D1.4. Structural steel doors shall be of welded construction. In order to reduce distortion and residual stresses, a welding sequence shall be used. All welds shall be stress relieved, and welded doors and frames shall be post-weld straightened. Fabricated steel shall be well-formed to shape and size, with sharp lines and angles. Intermediate and corner joints shall be coped or mitered. Exposed welds shall be dressed smooth. The stiles and top of built-up structural steel doors shall be closed using channel shapes or plates. When feasible, faceplates for structural steel doors shall be one piece. When one-piece faceplates are not feasible, plates shall be joined using full penetration groove weld butt joints or other approved welds. Reinforced concrete doors shall be closed at the edges with structural steel channels or plates and latch housings shall be mortised. Lap splices shall not be used for flexural reinforcing bars. Spall plates shall be one piece, covering the entire concrete surface on the seating face of the door, and shall be securely welded to the door edges. Spall plates shall not be less than 6 mm (1/4 inch) thick. Face plated reinforced concrete doors shall be provided with one-piece faceplates on both door faces. Faceplates shall cover the entire concrete surface and shall be securely welded at the door edges. Faceplates shall be not less than 9 mm (3/8 inch).

2.4.2 Mullion

Mullions for double doors shall be fabricated in the same manner specified for frames. Removable mullions shall be attached to the frame with mechanical fasteners that are accessible for mullion removal or, in lieu of the removable mullion, an astragal shall be provided at the seating face of the inactive door leaf. Doors shall seat directly against the mullion, and the mullion or astragal shall be capable of transferring the door reactions to the frame.
2.4.3 Shop Finishing

Shop priming of steel surfaces shall conform to Section 09900 PAINTING, GENERAL except that surfaces that will be embedded in concrete need not be primed.

2.4.4 Clearance

The clearance between the seated steel surfaces of structural steel doors and frames shall not exceed 1.6 mm. 1/16 inch. The lateral clearance between flush mounted structural steel doors and frames shall not exceed 6 mm 1/4 inch at the head and jambs and the clearance between the meeting edges of pairs of doors shall not exceed 13 mm. 1/2 inch.

2.5 BLAST DOOR ASSEMBLIES

Blast resistant doors may be steel plate or concrete filled doors.

2.5.1 Door Overpressure

Blast resistant door overpressures given are in the seating direction. Door D3 is a double leaf door. All others are single leaf. The shock and gas overpressure waveform is triangular with a zero rise time. Steel fragment impact need not be considered.

<table>
<thead>
<tr>
<th>Door Mark</th>
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<td>0.257</td>
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2.5.2 Steel Doors

2.5.2.1 Type

Type shall be structural steel, except that door D3 type shall be double structural steel door with removable mullion.

2.5.2.2 Rebound

Rebound resistance shall be 50 percent.

2.5.2.3 Deformation Limits

The ductility ratio shall not exceed 10 and the support rotation shall not exceed 2 degrees.
2.5.2.4 Hardware

Full surface hinges shall be Type 2. 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 shall be provided. A straight steel bar door pull shall be provided on all doors. Door D3 shall have a shrouded padlock and high security hasp. All blast resistant doors shall have gasket seals.

2.5.2.5 Operating Forces

Maximum operating forces shall be 135 N (30 pounds) to set the door in motion and 90 N (20 pounds) to swing the door. Maximum force to engage and release latches shall be 180 N (40 pounds).

2.5.2.6 Accessories

A removable ramp and self-rescue kit shall be provided.

2.5.3 Concrete Doors

2.5.3.1 Type

Type shall be reinforced concrete door, except that door D3 shall be double reinforced concrete door with removable mullion.

All concrete doors shall have faceplates, and the inside faceplate shall function as a spall plate.

2.5.3.2 Rebound

Rebound resistance shall be 20 percent.

2.5.3.3 Deformation Limits

The door support rotation shall not exceed 2 degrees for one-way acting doors without stirrups and 4 degrees for one-way acting doors with stirrups.

2.5.3.4 Hardware

Full surface hinges shall be Type 2. 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 shall be provided. A straight steel bar door pull shall be provided on all doors except D68 which has no pull. Door D3 shall have a shrouded padlock and high security hasp. All blast resistant doors shall have gasket seals.

2.5.3.5 Operating Forces

Maximum operating forces shall be 180 N (40 pounds) to set the door in motion and 90 N (20 pounds) to swing the door. Maximum force to engage and release latches shall be 180 N (40 pounds).
2.5.3.6 Accessories

A removable ramp and self-rescue kit shall be provided for all doors.

2.6 TESTS, INSPECTIONS, AND VERIFICATIONS

2.6.1 Prototype Blast Test

Blast tests on the prototype door assembly shall 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 shall be zero or subject to approval. For overpressure with finite duration, the overpressure waveform used in the test shall exceed the overpressure waveform in both peak overpressure and impulse and the blast test report shall be supplemented 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.

2.6.2 Shop Operating Test

Prior to shipment, each door assembly shall be fully erected in a supporting structure and tested for proper operation. Such testing shall include opening, closing, and operating all moving parts to ensure smooth operation and proper clearance, fit, and seating. The operating forces and opening and closing times shall be determined. The Contracting Officer shall be notified at least 14 calendar days prior to the start of testing and all doors shall be tested in the presence of the Contracting Officer. A test report shall be prepared and three copies furnished within 14 calendar days after testing.

PART 3 EXECUTION

3.1 INSTALLATION

Doors and frames shall be installed in accordance with the manufacturer's written instructions. Concrete shall be placed in reinforced concrete doors using the door manufacturer's standard forms. Exposed surfaces shall be finish painted in accordance with Section 09900 PAINTING, GENERAL.

3.2 TESTS

After installation is completed, each door shall be field tested for operation, clearance, fit, and seating by operating the door and hardware through at least 10 operating cycles. Door and hardware operation shall be tested using the forces specified. Personnel and equipment required to perform field testing shall be provided by the Contractor. Unless waived, all field tests shall be performed in the presence of the Contracting Officer. After testing is completed, test reports shall be prepared and 6 copies furnished.
3.3 MANUFACTURER'S FIELD SERVICE

Installation and testing of door assemblies shall be under the supervision of the door manufacturer's Erection engineer. Upon completion of the work, and at a time designated by the Contracting Officer, the services of one engineer and other technical personnel as required shall be provided 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 section. The instructions shall also include use of the operation and maintenance manual. The instructions shall include videotapes. An instruction outline and procedure shall be submitted and approved prior to scheduling the instruction. One copy of all instruction material shall be provided at the time of instruction.

-- End of Section--