Process Industry Practices
Architectural

PIP ARS08390
Blast Resistant Doors, Frames, and Related Hardware Specification
PURPOSE AND USE OF PROCESS INDUSTRY PRACTICES

In an effort to minimize the cost of process industry facilities, this Practice has been prepared from the technical requirements in the existing standards of major industrial users, contractors, or standards organizations. By harmonizing these technical requirements into a single set of Practices, administrative, application, and engineering costs to both the purchaser and the manufacturer should be reduced. While this Practice is expected to incorporate the majority of requirements of most users, individual applications may involve requirements that will be appended to and take precedence over this Practice. Determinations concerning fitness for purpose and particular matters or application of the Practice to particular project or engineering situations should not be made solely on information contained in these materials. The use of trade names from time to time should not be viewed as an expression of preference but rather recognized as normal usage in the trade. Other brands having the same specifications are equally correct and may be substituted for those named. All Practices or guidelines are intended to be consistent with applicable laws and regulations including OSHA requirements. To the extent these Practices or guidelines should conflict with OSHA or other applicable laws or regulations, such laws or regulations must be followed. Consult an appropriate professional before applying or acting on any material contained in or suggested by the Practice.

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1. Introduction

1.1 Purpose
This Practice provides the supplier with requirements for the manufacture and installation of blast resistant doors and frames.

1.2 Scope
This Practice describes the requirements for design, materials, fabrication, finishes, delivery, and installation of blast resistant doors, frames, related hardware, and accessories. This Practice does not include requirements for field-applied finish painting.

2. References

Applicable parts of the following Practices, industry codes and standards, and references shall be considered an integral part of this Practice. The edition in effect on the date of contract award shall be used, except as otherwise noted. Short titles are used herein where appropriate.

2.1 Process Industry Practices (PIP)
- PIP STC01018 - Blast Resistant Building Design Criteria
- PIP STC01018-D - Blast Resistant Buildings Data Sheet (U.S. Customary Units)
- PIP STC01018-DM - Blast Resistant Buildings Data Sheet (S.I. Units)

2.2 Industry Codes and Standards
- ASTM International (ASTM)
  - ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)
  - ANSI/BHMA A156.4 - Door Controls - Closers
  - ANSI/BHMA A156.18 - Materials and Finishes
  - ANSI/BHMA A156.21 - Thresholds
• American National Standards Institute (ANSI) / Steel Door Institute (SDI) (Joint Publications)
  – ANSI/SDI A250.8 - SDI 100 Recommended Specifications for Standard Steel Doors and Frames

• American Welding Society (AWS)
  – AWS D1.1/D1.1M - Structural Welding Code - Steel
  – AWS D1.2/D1.2M - Structural Welding Code - Aluminum
  – AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel

• National Fire Protection Association (NFPA)
  – NFPA 80 - Standard for Fire Doors and Other Opening Protectives
  – NFPA 252 - Standard Methods of Fire Tests of Door Assemblies

• Steel Door Institute (SDI)
  – SDI-117 - Manufacturing Tolerances Standard Steel Doors and Frames

• Underwriters Laboratories (UL)
  – ANSI/UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies

2.3 Government Regulations

• U.S. Department of Justice (DOJ) - Americans with Disabilities Act (ADA)
  – 2010 ADA Standards for Accessible Design
  – Guidance on the 2010 ADA Standards for Accessible Design

• U.S. Department of Labor (DOL) - Occupational Safety and Health Administration (OSHA)

3. Definitions

astragal: The seal between the central joint and two swinging doors and/or transom panels

blast loads: The transient dynamic loads from the blast effects of an explosion, usually stated in terms of peak pressure and impulse or duration

contract documents: Any and all documents, including codes, studies, design drawings, specifications, sketches, practices, and data sheets, that the purchaser has transmitted or otherwise communicated, either by incorporation or reference, and made part of the legal contract agreement or purchase order between the purchaser and the supplier

exit door: A door used in conjunction with interior exit stairways, interior exit ramps, exit passageways, exterior exit stairways and exterior exit ramps, and horizontal exits. Fire resistance and rating of the door assembly, where required, shall be in accordance with the applicable building code.
**inspector**: The party responsible for verifying the quality of all materials, installations, and workmanship furnished by the supplier. Inspectors shall be qualified by training and experience and hold certifications or documentation of their qualifications.

**manufacturer**: The party who produces and warrants the performance of the blast resistant doors and related products provided in accordance with the contract documents. The products are manufactured in a controlled process using standard codes, specifications, tests and possibly include shop drawings to assist in proper application, installation and/or use. Unless otherwise noted, the term manufacturer shall apply also to the manufacturer’s subcontractor(s) and/or vendor(s).

**owner**: The party who has authority through ownership, lease, or other legal agreement over the facility wherein blast resistant doors and frames will be used

**professional engineer**: An engineer, other than the engineer of record, licensed as defined by the laws of the locality in which the blast resistant doors and frames are to be installed, and qualified to practice in the specialty discipline required for the work described in the contract documents.

**purchaser**: The party who awards the contract to the manufacturer. The purchaser may be the owner or the owner’s authorized agent.

**rebound**: The deformation in the direction opposing the initial blast pressure. This deformation occurs after a component has reached a peak deformation and returns in the direction of its initial position.

**supplier**: The party responsible for providing and installing blast resistant doors and frames in accordance with the contract documents

### 4. Requirements

#### 4.1 Quality Assurance

4.1.1 Blast resistant doors and frames shall be provided and installed in accordance with this Practice.

4.1.2 All components shall be designed and provided by one manufacturer.

4.1.3 The quality of items and services shall be controlled in accordance with the requirements of this Practice, applicable codes, and standards.

4.1.4 The purchaser or inspector shall have the right to inspect all materials and workmanship and shall have unrestricted access to fabrication shops and work sites at all times during which the work is being performed.

#### 4.2 Submittals

4.2.1 Any conflicts or inconsistencies between this Practice, the design drawings, or contract documents shall be brought to the attention of purchaser for resolution.
4.2.2 The following submittals shall be provided:

4.2.2.1 Product data, including the following items:

a. Product specifications
b. Standard details
c. Certified product test results from independent testing firm
d. Door weight
e. Force required to open door before blast load
f. Evidence door shall be operable in accordance with Section 4.5.6 after blast load
g. Installation instructions

4.2.2.2 Manufacturer’s QA plan

4.2.2.3 Detailed shop drawings and data, including the following items:

a. Dimensioned plans and elevation
b. All details of design and fabrication, connections, and anchorage
c. Details and location of reinforcement for hardware
d. Parts list

4.2.2.4 Either of the following methods of showing system performance shall be provided:

a. Design calculations in accordance with the following:

(1) Calculations shall be done by or under the supervision of a professional engineer registered in the locality where the blast door(s) is to be installed. The professional engineer shall stamp sign and date the calculations.

(2) The calculations shall be based on the loads specified in Section 4.5.

(3) The professional engineer shall verify that the door, frame, sub-frame and hardware can withstand the design pressure loading and still be operable by a person both from inside and outside the building.

(4) Subframe and subframe-to-wall connection submittals shall include the calculated reactions at the subframe vs. time.

(5) Calculations for hardware and operating mechanisms shall be provided if these items affect blast capacities of the doors (i.e., hinges, latches, pins, doorstops, etc.).

(6) The calculations may be in either US Customary or metric units but shall be consistent.

(7) Unless otherwise specified, all text shall be in English.
b. Certified dynamic test results from an independent testing agency, showing that door and frame assembly meet performance requirements

4.2.2.5 Welding procedures and welder’s qualifications

4.2.2.6 For fire rated door assemblies as specified in the contract documents, certification that each door and frame assembly is in accordance with design, materials, and construction equivalent to requirements for labeled construction in accordance with *NFPA 80*, *NFPA 252*, and *ANSI/UL 10C*

4.2.2.7 A letter of conformance stating that the doors furnished have been tested in accordance with *ASTM E330*

4.2.2.8 Instructions for installation and maintenance

4.2.2.9 Operation, service, and replacement parts manuals including the following information:

   a. Complete installation, disassembly, operating, and maintenance instructions

   b. Instructions for maintaining the blast resistant function of doors

   c. Complete parts list including make and model of components from the various parts manufacturers of the systems as supplied

   d. Unless otherwise specified, the manuals shall be in English.

4.2.2.10 If the contract documents require the doors to be furnished with factory-baked-on finish coats, submit the full range of supplier’s standard colors of finish paint for color selection by the purchaser.

### 4.2.3 Guarantee

A written, five-year guarantee covering the design, all materials and labor shall be provided to the purchaser. The guarantee shall include the following provisions:

4.2.3.1 Repair or replacement of materials and systems that were defective before installation

4.2.3.2 Repair or replacement of materials and systems that fail within five years after installation because of defective materials or fabrication

4.2.3.3 Repair or replacement of related materials and systems that were damaged as a result of the aforementioned defective or failed material or fabrication

4.2.4 The submittals listed in Sections 4.2.2 and 4.2.3 shall be provided in accordance with the schedule furnished in the contract documents.

### 4.3 Delivery, Storage and Handling

4.3.1 The supplier shall have full responsibility for shipping the required number of units of size, thickness, and hand in accordance with the contract documents.
4.3.2 Doors and frames shall be factory assembled, completely operable, and shipped as a unit.

4.3.3 Doors, frames, and accessories shall be clearly marked with door number to identify the openings in which they are to be installed.

4.3.4 Doors and frames shall be delivered palletized and wrapped in cardboard or crated to provide protection while in transit.

4.3.5 All material shall be stored under cover. The use of non-vented plastic or canvas shelters shall be avoided to prevent forming of humidity chambers, thus causing rust. In the event that the cardboard wrapping becomes wet, the cartons shall be removed immediately. A one-quarter inch (6 mm) space shall be provided between the doors to provide proper air circulation.

4.3.6 Doors and frames shall be inspected for damage upon delivery. Repair, or remove and replace damaged items as directed by owner.

4.4 Government Regulations

4.4.1 All work shall be in accordance with federal standards and instructions of OSHA, NFPA 101, and state and local codes, including any additional requirements by state or local agencies that have jurisdiction where doors and frames are to be installed.

4.4.2 Owner will specify if ADA requirements are applicable. If applicable, doors and frames shall be designed and constructed in accordance with 2010 ADA Standards for Accessible Design, Section 404, and Guidance on the 2010 ADA Standards for Accessible Design.

4.4.3 For work done outside of the United States, the owner will determine if specific regulations and other country, regional, or local safety requirements apply for specific applications of this Practice.

4.5 Design

4.5.1 Blast resistant doors shall be designed for the dynamic loads furnished in the purchaser’s PIP STC01018-D or PIP STC01018-DM Data Sheet.

4.5.2 The performance category for the blast resistant doors shall be in accordance with the purchaser’s PIP STC01018-D or PIP STC01018-DM Data Sheet, Table B.

4.5.3 The response limits and other requirements shall be in accordance with PIP STC01018, Table 10.

4.5.4 Each door system shall consist of a door, frame, hinges, latches, pins, and associated hardware.

4.5.5 The door system shall be designed to withstand the applied blast loading one time only.

4.5.6 After blast occurrence, exit doors and other doors specified in the contract documents shall be manually operable from the inside and outside to permit egress from the building. The response limit for doors other than exit doors shall be specified in the contract documents.
4.5.7 Unless otherwise specified in the contract documents, all doors shall open to the outside and shall seat against the frame in response to the positive phase blast wave.

4.5.8 The door system shall be designed to resist rebound. Maximum rebound forces shall be identified and factored into the system design.

4.5.9 Exit doors shall meet the requirements of the local building code, including accessibility requirements where applicable, for swing, maximum opening force, and clear width.

4.5.10 Dynamic elastic-plastic design techniques shall be used. Static, elastic analysis shall not be permitted.

4.5.11 The entire pressure-time history shall be included in the response calculations.

4.5.12 Increases in material strengths because of strain rate effects shall be considered.

4.5.13 Door Frames

4.5.13.1 Door frames shall be attached to subframes that are embedded into the surrounding concrete walls or attached to other structural wall material. Subframes and subframe-to-wall connections are provided by others but are designed by the blast resistant door manufacturer.

4.5.13.2 Subframe designs and details shall be provided by the supplier in sufficient time for field fabrication and installation in the building.

Comment: The intent of providing separate subframes and door frames is to permit construction of the building to proceed during fabrication of the blast resistant doors.

4.5.13.3 The connection of the subframes to the door frames shall be designed to maintain structural integrity throughout all the responses to the applied loads.

4.5.13.4 The installation and maintenance of the structural integrity of the subframe installation during construction shall be the responsibility of others.

4.6 Materials

4.6.1 General

4.6.1.1 Blast resistant doors and frames shall be fabricated from steel or aluminum sheet or plate shapes or from structural bars and shapes and reinforced in accordance with the design requirements of this Practice.

4.6.1.2 Use of alternate materials and joining methods for the doors and frames shall be approved by the purchaser.

4.6.1.3 Doors shall be flush type and of the size shown in the contract documents.
4.6.1.4 Unless otherwise specified in contract documents, blast resistant doors and removable transoms shall be filled with thermal insulation having a minimum R factor of 12.5.

4.6.1.5 If necessary, all blast resistant doors and frames shall be suitably reinforced for the hardware and closers specified in the door hardware schedule furnished in the contract documents.

4.6.1.6 Unless otherwise specified in contract documents, an ANSI/UL 10C label, which shows degree of fire protection indicated by opening class, shall be affixed and visible on all fire-rated doors and frames as evidence of compliance with procedures of label agency.

4.6.1.7 Manually operated exit doors shall be in accordance with the 2010 ADA Standards for Accessible Design if specified in contract documents and with local building codes for the maximum opening force.

4.6.1.8 Doors and transom panels for exterior exposures, and other locations specified as galvanized, shall be galvanized with minimum G60 zinc coating in accordance with ASTM A653/A653M.

4.6.2 Frames

4.6.2.1 Width and profile of frames shall be in accordance with the contract documents.

4.6.2.2 Frames for exterior doors, and other doors specified as galvanized, shall be galvanized with minimum G60 zinc coating in accordance with ASTM A653/A653M.

4.6.3 Astragals

4.6.3.1 Blast resistant doors and removable transom panels, if specified, shall have an astragal designed to withstand the applicable blast loading.

4.6.3.2 The astragal shall be welded to a removable panel.

4.6.3.3 Removable panel shall match the door in appearance and function and shall leave the opening clear (i.e., full height and width of perimeter frame) if removed.

4.6.3.4 If specified in the contract documents, securityastragals with integral gasket for double doors shall be provided.

4.6.4 Gaskets

4.6.4.1 Frames shall have adjustable gaskets around the perimeter at heads and jambs for perimeter sealing of doors.

4.6.4.2 Bottoms of doors shall have gaskets for sealing at sills.

4.6.4.3 Removable transom panels shall have gaskets for perimeter sealing.

4.6.4.4 Gasketing shall be in accordance with ASTM D1056, Grade 2C1, neoprene or an approved equivalent.
4.6.5 **Hardware**

4.6.5.1 Blast resistant doors shall have hardware capable of withstanding the specified loads.

4.6.5.2 Designations used in the contract documents to indicate hardware finishes are in accordance with *ANSI/BHMA A156.18*.

4.6.5.3 The finish of hardware units, including fasteners, shall be matched at each door to the greatest extent possible.

4.6.5.4 Hinges shall be heavy-duty, stainless steel, full-mortise with low friction ball bearings.

4.6.5.5 Manually operated latch bolts, for head and sill, shall be provided for the inactive leaves of double doors.

4.6.5.6 One threshold per door opening shall be provided, in accordance with *ANSI/BHMA A156.21*, for the total width of the door opening and in a finish specified by the purchaser.

4.6.5.7 For opening an unlocked door from the outside, a single, exterior door handle shall be provided that shall operate all pins and latching devices to permit opening the door. The door handle shall require only a single operation to open the door from the outside.

4.6.5.8 For opening an exit door from the inside, a panic bar mechanism shall be provided in accordance with *NFPA 101*. The panic bar shall require only a single operation to release all latching devices and open the door.

4.6.5.9 **Rebound Pins**

a. Rebound pins that are moved into the subframe by hardware and supported by pin blocks mounted on the doorplate may be provided.

b. If provided, rebound pins shall be the only hardware latching a door into its frame when the door is closed.

c. Alternate rebound pin systems that are in accordance with the performance requirements in the contract documents may be provided and shall be clearly defined in the submittals.

d. Door pins shall be tapered, self-aligning, and slam-latching.

4.6.5.10 **Hydraulic Door Closers**

a. Hydraulic door closers shall be provided on all single doors and on the active leaf of double doors.

b. Hydraulic door closers shall be in accordance with *ANSI/BHMA A156.4*.

c. Hydraulic door closers shall be of rack and pinion design with adjustable springs and high-impact noncorrosive covers.
4.6.6 **Power-Operated Doors**

4.6.6.1 Power-operated doors shall be operated by push buttons located on both sides of door.

4.6.6.2 Power-operated doors shall be manually operable during power failure.

4.6.6.3 Power-operated doors shall have safety devices (i.e., motion detectors and presence sensors) and provisions to avoid entrapment of personnel.

4.6.6.4 Power operators shall provide operation following a blast incident of design magnitude.

4.7 **Fabrication**

4.7.1 Finished work shall be neat in appearance and free from defects.

4.7.2 Surfaces shall be smooth and free from warps and buckles.

4.7.3 Welding shall be in accordance with *AWS D1.1/D1.1M, AWS D1.2/D1.2M, or AWS D1.3/D1.3M*, as appropriate.

4.7.4 Manufacturing tolerances for doors and frames shall be in accordance with *SDI-117*.

4.8 **Shop Coating**

4.8.1 Surfaces to be primed shall be cleaned and primed.

4.8.2 Unless otherwise specified in the contract documents, shop primer shall be manufacturer’s standard.

4.8.3 Unless otherwise specified, shop priming for steel doors shall be in accordance with *ANSI/SDI A250.8*.

4.8.4 Frames in contact with masonry shall be provided with field-applied bituminous coating inside frame profile.

4.9 **Installation**

4.9.1 Doors shall be installed by a manufacturer approved, qualified installer in accordance with manufacturer’s instructions and approved shop drawings. Doors shall be installed true and square in frames, shall operate freely and easily, and shall be aligned and balanced. Mechanism shall be thoroughly lubricated, and the entire installation shall be left in good operating condition.

4.9.2 Upon installation of the doors, the supplier shall demonstrate to the owner proper operation of the doors, including functioning of all safety equipment and performance of routine maintenance requirements.

4.9.3 Field welding shall be in accordance with *AWS D1.1/D1.1M, AWS D1.2/D1.2M, or AWS D1.3/D1.3M*, as appropriate.