

**Basic Fire Door,
Fire Door Frame,
Transom/Sidelight Frame,
and Window Frame
Requirements**



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Basic Fire Door, Fire Door Frame, Transom/Sidelight Frame, and Window Frame Requirements

1 Introduction

Fire testing of doors, door frames, transom/sidelight frames, window frames, glazing, and hardware and the resulting labeling programs granted by third-party testing agencies are complex subjects better understood when basic rules and guidelines are applied.

2 Doors

The fire rating classification of the wall into which the door is installed dictates the required fire rating of the door. The location of the wall in the building and prevailing building codes establish the fire rating requirements for the wall. The associated door ratings are shown in Table 1 below.

2.1 Hourly ratings

Steel fire doors are “rated” by time (in minutes or hours) that a door can withstand exposure to fire test conditions. Hourly ratings include 1-½-hours, 1-hour, ¾-hour, and ⅓-hour, with the maximum rating required of any swinging type fire door being three hours.

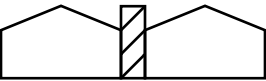
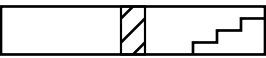
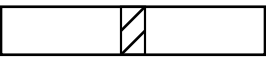
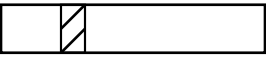
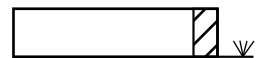
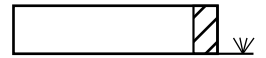
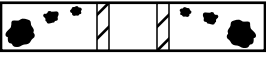
2.2 Three-hour (180-minute) doors

A door with a three-hour fire protection rating is usually required in walls that separate buildings or that divide a large building into smaller fire areas. The wall rating is four hours.

2.3 1-½-hour (90-minute) doors

Doors rated for 1-½ hours are required in 2-hour rated walls. These doors are commonly located in stairwells, or other enclosures of vertical

Table 1 – Fire door openings

| Opening | Wall Rating | Door and Frame Rating | Description and Use |
|-------------------------------------------------------------------------------------|-------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | 4 Hour | 3 Hour (180 minutes) | These openings are in walls that separate buildings or divide a single building into designated fire areas. |
|  | 2 Hour | 1-½ Hour (90 minute) | Openings of this type are used in enclosures of vertical communication or egress through buildings. Examples of these types of openings include stairwells and elevator shafts. |
|  | 1 Hour | 1 Hour (60 minute) | These door and frame assemblies divide occupancies in a building. |
|  | 1 Hour | ¾ Hour (45 minute) | For use where there are openings in corridors or room partitions. |
|  | 2 Hour | 1-½ Hour (90 minute) | This opening is in a wall where there is the potential for severe fire exposure from the exterior of the building. |
|  | 1 Hour | ¾ Hour (45 minute) | This opening is in an exterior wall that has the potential to be exposed to moderate to light fire from the exterior of the building. |
|  | 1 Hour | ⅓ Hour (20 minute) | These openings are in corridors where smoke and draft control is required. The minimum wall rating is ½ hour. |

passage through a building. They also occur in boiler rooms and in exterior walls that have the potential for severe fire exposure from the outside of the building.

2.4 One-hour (60 minute) doors

One-hour rated doors are used in occupancy separation walls, which are also one-hour rated.

2.5 ¾-hour (45 minute) doors

Doors with ¾-hour fire protection ratings are used in one-hour walls. A ¾-hour rated door is required in walls of corridors and room partitions. A door with this rating may also be located in the exterior wall of a building subject to moderate fire exposure from the outside of the building.

2.6 ⅓-hour (20 minute) doors

One-third-hour or 20 minute doors are used in one-hour walls. These doors are used for corridor applications and in other applications where smoke and draft control is a primary concern.

2.7 Twenty-minute doors tested without hose stream

Doors and frames may also be rated as 20 minutes without a hose stream. These doors have successfully passed a 20-minute fire test, with the omission of the hose stream test, and bear a label that specifically states "Twenty-Minute-Rating Tested Without Hose Stream." These doors may be provided with vision lights only limited in size by the door manufacturer's fire labeling procedure authority.

Assemblies identified as "Twenty-Minute-Rating Tested Without Hose Stream" should not be confused with ⅓-hour fire rated doors, which have been tested in accordance with the standard fire test procedure that includes the hose stream test.

2.8 Summary

Doors are rated for three-fourths of the rating of the surrounding wall: A 3-hour door is used in a 4-hour rated wall; a 1½-hour fire door is used in a 2-hour rated wall; and a ¾-hour door is used in a one-hour rated wall. The notable exception is that ⅓-hour rated doors are also used with one-hour rated walls.

However, a door with a higher fire rating than the opening requires may also be specified. For example, a door rated for 3 hours may be

used in a 1½-hour opening. All requirements for the 3-hour rating, such as maximum glazing materials size, door size, and other restrictions for the higher rated door must be met.

3 Glazing Materials

A wide variety of glazing materials and glazing compounds are available for use in fire doors and frames. Wired glass that is ¼" thick and ceramic glass are the most common types of glazing used in fire rated doors. The hourly rating of the door dictates the number and maximum size of the vision lights used in the door.

For ¼" thick wired glass, the maximum exposed area for a transom light shall not exceed 1296 square inches with no dimension of exposed wired glass greater than 54" in width or 48" in height, unless otherwise indicated in the individual glazing manufacturer's published listings. Wired glass, ¼" thick is rated for ¾-hour for an exposed area not exceeding 1296 square inches.

For glazing materials other than ¼" thick wired glass and for ¼" thick wired glass in sizes larger than those described above, the maximum exposed area per individual light, the minimum groove depth, glazing compound and the rating shall be as indicated in the individual glazing manufacturer's published listings. Consult with the door and glazing manufacturers for the limitations of size, area and number of vision lights in a door. The approved listings for fire door, transom/sidelight frame, window frame, and glazing manufacturers may be obtained through the listing agencies as follows:

Underwriters Laboratories

Use the following hyperlink to access the Underwriters Laboratories "Online Certifications Directory": Enter the "UL Category Code" indicated below for a listing of approved manufacturers.

<http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm> (*link valid as of 9/30/2013*)

Fire Door Manufacturers – GSYX or GSZN

Fire Door and Window Frame Manufacturers – GVTV

Glazing Manufacturers – KCMZ or CCET

Intertek Testing Services (Warnock Hersey)

Use the following link to access the Intertek “Listed Product Directories”: Enter keywords such as glass, glazing, fire door, fire door frame, fire window, or transom frame for a list of approved manufacturers.

https://whdirectory.intertek.com/Pages/DLP_Search.aspx (link valid as of 9/30/2013)

Vision lights are not allowed in 3-hour rated fire doors, unless allowed by the local authority having jurisdiction. The vision light kit or window frame must be approved for use in a fire rated door.

Two categories of glazing used in doors, door frames, transom/sidelight frames, and borrowed light frames are available as follows:

Fire-Protection-Rated Glazing – This glazing is evaluated for fire protection ratings measured in minutes or hours in doors in accordance with UL 10c and NFPA 252 and frames in accordance with UL 9 and NFPA 257.

Fire-Resistance-Rated Glazing – Fire-resistance-rated glazing is designed to limit the temperature rise on the unexposed surface in accordance with UL 263 and ASTM E119. Performance is rated in terms of temperature rise on the unexposed face at increments of time (minutes or hours). This glazing may be used in Temperature Rise Doors which are explained in the next section.

Fire protection and fire resistance glazing installed in fire doors and fire windows that are subject to human impact shall meet applicable impact safety standards (e.g. – 16 CFR 1201, U.S. Consumer Product Safety Commission, “Standard for Architectural Glazing”).

4 Temperature rise doors

In certain applications, fire doors are required to minimize the transmission of heat from one side of the door to the other, as in the stairwell of a high-rise building or in horizontal exits. If the door can limit the transmission of heat for a period of time, people can safely pass below the floor of fire origin in a burning building. These doors are built with a core that is specifically

designed to restrict the transmission of heat and are referred to as temperature rise doors.

In addition to the hourly rating, the fire door label will also state the temperature rise rating of the door. Temperature rise ratings are 250°F, 450°F, and 650°F, and indicate the maximum rise in temperature above ambient temperature measured on the unexposed surface (non-fire side) of the door during the first 30 minutes of the standard fire test. The 250°F temperature rise designation is the most stringent rating of the three, since it requires the most limiting rise in temperature. A 250°F temperature rise door meets the requirements of specifications calling for a 450°F or 650°F temperature rise rating.

5 Louvers

Listed louvers are permitted in 1-½-hour and ¾-hour fire doors and the louver must be installed in accordance with the manufacturer’s listing. Louvers may not be used in ⅓-hour (20-minute) rated doors, or doors of other hourly ratings that may be part of a smoke and draft assembly. Doors with glass lights, or doors equipped with fire exit devices may not have louvers unless permitted by local building codes.

6 Fire door frames

Fire door frames are not affected by the exposure ratings and opening classifications that apply to doors. There are *no hourly ratings* for a basic fire door frame unless the labeling on the frame specifically states that the frame is rated less than 3 hours. Some state and local building codes require hourly ratings up to and including 3 hours for a door frame. If a frame bears a recognized label qualifying it as a fire door frame, it may support a 3-hour, a 1-½-hour, a ¾-hour, or a ⅓-hour door. Frames used in masonry walls may be used with a maximum 3-hour fire door, while frames used in drywall stud walls are intended to be used with a maximum 1-½-hour fire door. Consult with individual fire door frame manufacturers listings for fire door frames that can be used in drywall stud walls with a maximum 3-hour rating. Grout is not required for fire rated frames installed in either drywall or masonry walls at any hourly rating.

7 Transom and sidelight assemblies

Labeled door frames are available with transom areas, sidelight areas, or a combination of both. The transom and sidelight areas can be assembled with listed panel assemblies or listed glazing material. Frames with solid transom panel and/or side panels may be used in openings rated up to and including 3 hours. Transom and sidelight frames with labeled glazing material may be used in openings rated up to 1-½ hours. The maximum hourly rating, overall frame size, panel construction, and individual glazing material exposed areas for frame and glazing manufacturers may be obtained through the listing agencies as indicated in Section 3.

The overall size of transom and sidelight frames is limited to the maximum size that a manufacturer has successfully fire tested. Since the size may vary, it is important to consult the manufacturer when writing specifications.

Some testing agencies require that the label applied to transom or sidelight assemblies shall state whether panels or glazing materials are to be used in the frame. If the frame contains both panels and glazing materials, the label for the glazing materials is used since it is the most limiting rating.

8 Fire window frames (borrowed light)

Fire window frames are labeled hollow metal glass light frames that are not attached to a door frame and are tested in accordance with NFPA 257 or UL 9 and shall be provided in accordance with the manufacturer's listing. Individual glazing material exposed areas are not to exceed 1296 square inches and the dimension for width or height shall not exceed 54 inches unless otherwise tested. The maximum hourly rating, overall window size, and individual glazing material exposed areas for frame and glazing manufacturers may be obtained through the listing agencies as indicated in Section 3. Fire window frames are typically used in corridor walls and may be provided for masonry or drywall construction. Consult the frame manufacturer as to the ability to supply fire window frames for drywall walls. Grout is not required for fire rated frames installed in either drywall or masonry walls at any hourly rating.

9 Fire doors with Builders Hardware

Fire doors with Builder's Hardware serve four main purposes:

1) To function as a door at all times; 2) to provide ready egress; 3) to keep fire from spreading throughout the building; and 4) to protect life and property.

To adequately perform these functions, a fire door must be equipped with labeled hardware for dependable operation. Proper hardware selections can be verified by consulting the current editions of the "Fire Resistance Directory" published by Underwriters Laboratories Inc. and "Directory of Listed Products" published by Intertek Testing. These directories identify hardware and other products that may be used in fire-rated assemblies. The information can also be accessed at the following links:

Underwriters Laboratories

<http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm> (*link valid as of 9/30/2013*)

Use UL Category Codes GXHX or GYJT.

Intertek Testing Services (Warnock Hersey)

https://whdirectory.intertek.com/Pages/DLP_Search.aspx (*link valid as of 9/30/2013*)

NFPA 80 provides guidance for installing fire doors, frames, and hardware in the building openings.

9.1 Hinges

A labeled fire door must be hung on steel ball-bearing-type or listed hinges. NFPA 80 allows the use of steel hinges with steel ball-bearings without a listing. Steel hinges that meet the criteria of NFPA 80 have been proven to be adequate during a fire. There are certain hinge designs made of non-ferrous metals which may be used on fire doors in accordance with the listing information for the particular hinge but may result in a lower fire rating.

Hinges with ball bearings are required in order to provide smooth operation and to minimize wear throughout the lifetime of the opening. Remember, a fire door must close in the event of a fire. Worn hinges will cause the door to sag, effectively preventing the door from closing. Exception: Some manufacturers may provide doors with hinges that use other antifriction

bearing surfaces if they meet the requirements of ANSI/BHMA A156.1.

NFPA 80 allows the use of standard weight (0.134 inch leaf thickness) 4-½" steel hinges as a minimum on 1-¾" doors up to 4'-0" in width and 8'-0" in height. Doors over 8'-0" in height shall have heavy weight (.180 inch leaf thickness) 4-½" hinges as a minimum. Some manufacturers have the capability of providing lighter weight hinges on doors over 8'-0" in height as part of a listed assembly. (Consideration should be given to larger hinge sizes for frequently used or heavy doors.)

9.2 Latching devices

Every swinging fire door must have a labeled self-latching device. Dead bolts may be provided in addition to the latch bolt, except on doors in a means of egress, in which case interconnected locks may be used which retract the dead bolt with the latch bolt. Dead bolts may not be used in place of latch bolts.

When selecting latching devices, it is important to use the correct length of latch bolt, a requirement that can vary with the door construction and the manufacturer's fire testing program. It is common for a pair of doors to require a longer latch bolt throw than a single door. The minimum latch bolt length that must be used for any given door is indicated on the fire door label.

An exception to latching for fire rated openings is allowed by the IBC for double egress doors in corridors that are in a smoke barrier. The omission of positive latching devices must be included in the door manufacturer's listing. State and local building code authorities may also allow latching to be omitted in certain openings. Consult individual manufacturers for labeling capabilities.

9.3 Fire exit hardware

Fire exit hardware devices may be used on labeled doors provided the door labeling specifically states "Fire Door To Be Equipped With Fire Exit Hardware." This label indicates that the door has been properly reinforced for fire exit devices. Fire exit hardware used on doors that bear this label must pass a panic loading test in accordance with UL 305 and ANSI/BHMA A156.3 in addition to the standard fire test. The panic load test measures the structural

capability of the door to allow the hardware to operate in a panic situation.

Care must be taken when selecting exit devices for use on fire-rated doors, as some devices have been tested for panic loading only, and not fire tested. In addition, exit devices have size and hourly rating restrictions, and must be properly labeled and identified as fire exit hardware.

9.4 Closing devices

A properly sized closing device is the last of the "basic" fire door hardware requirements. A fire door must be in a closed and latched position to serve as a protective barrier in the event of a fire. For this reason, either listed spring hinges or a listed door closer is required to ensure that the door will close properly.

Note: Per NFPA 80, the authority having jurisdiction may allow the closer to be omitted from the inactive leaf of a pair of doors for equipment rooms to allow the movement of equipment.

9.5 Hold open devices

Tests and investigations have proven that smoke and toxic gases are the main cause of death in fires. Listed closers with closer arms that are equipped with a fusible link or a listed combination closer/holder shall be used. Mechanical hold-open only devices and hold-open only arms are not permitted on self-closing doors. Doors with surface closers equipped with a listed hold open device (e.g. electromagnetic release) also prevent the passage of the toxic gases and smoke. These devices are activated by electronic detectors that sense smoke and/or the products of combustion.

10 Hardware – pairs of doors

Pairs of doors for rated openings have some unique hardware requirements.

10.1 Hinges and closing devices

Pairs of doors for labeled openings require steel, ball-bearing-type hinges or a listed continuous hinge. Closing devices are required on both leaves of a pair of doors except on mechanical equipment rooms where the closing device may be omitted from the inactive leaf, if acceptable with the authority having jurisdiction.

10.2 Latching hardware

10.2.1 Active leaf of pairs of doors

An active leaf of a pair of doors may require labeled fire-exit hardware, or any labeled latch that shall be opened by one obvious operation from the egress side.

10.2.2 Inactive leaf of pairs of doors

Local codes may allow manual flush or surface mounted bolts to be used to secure the inactive leaf of pairs of doors being used as entrances to equipment rooms or similar situations. The IBC requires that the inactive leaf have no knob or other visible hardware that implies means of egress.

Labeled fire exit devices are mandatory for exits unless local authorities give specific approval for the use of labeled self-unlatching and latching devices, such as automatic flush bolts on the inactive leaf. The self-unlatching feature must work only when the active leaf is opened.

10.3 Double egress pairs

Double egress pairs of doors should only be provided with vertical rod fire-exit hardware devices on both leaves. The vertical rod devices may be either surface mounted or concealed.

10.4 Astragals

The application of astragals on pairs of doors depend upon the individual door manufacturer's published listings. Pairs of doors that do require an astragal shall have at least one that projects a minimum of $\frac{3}{4}$ -inch beyond the edge of the door to which the astragal is attached. Pairs of doors that are in a required means of egress may not be equipped with an astragal that inhibits the free use of either leaf. An overlapping astragal may not be used on pairs of doors swinging in the same direction with vertical rod exit devices on both leaves of the pair.

In some situations a coordinator may be needed to allow the inactive leaf to close before the active leaf. This ensures proper latching of pairs of doors. Some manufacturers are able to supply labeled pairs of doors with an open-back strike without an astragal, which eliminates the need for a coordinator.

11 Product labeling

There are several materials and attachment methods for fire labels that are approved by recognized labeling agencies. These include steel, brass, aluminum, and non-metallic materials such as foil and mylar. Metal labels are attached with welds, rivets, drive screws, or adhesive. Non-metallic labels are either die-slit or tamper proof with an adhesive back. Once applied, if any attempt is made to remove the label it will tear apart indicating tampering. Embossed metal labels and embossments directly applied to doors and frames may be painted as long as the listing agency mark and all listing information is legible.

The mark of a labeling agency shall be provided on all labels applied to fire-rated doors and frames. The agency mark or manufacturer isn't required to be the same on the door, frame, and hardware. Labels are located on the edge of a door between the top and middle hinges. Labels are located on the frame rabbet between the top and middle hinges. Labels may be located on the top of the door or head of the frame if there is interference with hardware (e.g. electric power transfer, continuous hinge, smoke seals) that would obscure the label.

Fire labels on doors and frames are not intended to survive a fire. The label is there to indicate that the opening is protected by a properly constructed steel door and frame.

12 Fire test methods

There are two primary fire test methods that are used to establish the fire ratings of doors. The first is ANSI/UL 10B and is referred to as neutral pressure; the second is ANSI/UL 10C, and is referred to as positive pressure.

The difference between the two test methods concerns the location of a neutral pressure plane in the test furnace. In the late 1990's, the test method required in building codes changed to a positive pressure test method. This change was adopted by the International Building Code (IBC) for swinging-type fire doors.

Fire doors required to be tested to either method may be specified by calling out the test method or by indicating that the product must meet a specific section of a model building code.

13 Smoke and draft control

Doors that open into corridors that are used for a means of egress may be required to have a smoke and draft control rating. Smoke and draft control assemblies are tested for air leakage per UL 1784 and NFPA 105 and fire protection ratings as previously discussed.

13.1 Gaskets

Gaskets are required for doors to pass a smoke and draft control test. The requirement for a gasket also includes the meeting edges of a pair of doors. The gaskets used in a smoke and draft control assembly must be fire rated and be listed for use in a smoke and draft control assembly. A bottom seal is not required for smoke and draft control assemblies.

13.2 Marking

The IBC requires smoke and draft control assemblies to have an identification mark of "S" which appears on the door label following the hourly rating. The frame doesn't require the "S" mark.

14 Smoke barrier doors

The IBC includes a requirement for smoke barrier doors. These doors need to provide smoke and fire protection as previously described in this document. The IBC includes an exception for double egress doors that require that these doors have the same characteristics of a fire door except a fire protection rating and self latching are not required. Double egress doors used in a smoke barrier are used in cross corridor applications.

15 Field modifications

Clarifications for field modifications were added to NFPA 80 in 2007. If the product or component requires a field modification, the agency that the product or component was listed with shall be provided with the description of the modification. The agency will not have to conduct a field inspection if they determine that the modification does not affect the integrity and fire protection capabilities of the opening.

16 Fire door inspections

NFPA 80 incorporated a requirement for annual fire door inspections in the 2007 version of the standard. Building owners are required

to inspect all components of the opening and document the results. Adjustments and component replacement are required if the opening does not comply with the code requirements.

17 References

ANSI/BHMA A156.1-2006 "American National Standard for Butts and Hinges"

ANSI/BHMA A156.3-2008, "American National Standard for Exit Devices"

ASTM E119-11 "Standard Test Methods for Fire Tests of Building Construction and Materials"

NFPA 80-2010 "Standard for Fire Doors and Other Opening Protectives"

NFPA 105-2010, "Standard for the Installation of Smoke Door Assemblies and Other Opening Protectives"

NFPA 252-2008 "Standard Methods of Fire Tests of Door Assemblies"

NFPA 257-2007 "Standard Methods of Fire Tests of Window Assemblies"

Underwriters Laboratories Standard for Safety ANSI/UL 9 "Fire Tests of Window Assemblies"

Underwriters Laboratories Standard for Safety ANSI/UL 10B "Fire Tests of Door Assemblies"

Underwriters Laboratories Standard for Safety ANSI/UL 10C "Positive Pressure Fire Tests of Door Assemblies"

Underwriters Laboratories Standard for Safety ANSI/UL 263, "Fire Tests of Building Construction and Materials", 13th Edition, April 4, 2003, revisions up to and including October 24, 2007

Underwriters Laboratories Standard for Safety ANSI/UL 305, "Standard for Panic Hardware", 2007

Underwriters Laboratories Standard for Safety ANSI/UL 1784, "Air Leakage Tests of Door Assemblies", 2001

International Building Code 2009

AVAILABLE PUBLICATIONS

Specifications

- ANSI/SDI A250.6** Recommended Practice for Hardware Reinforcings on Standard Steel Doors and Frames
- ANSI/SDI A250.8** SDI 100 Specifications for Standard Steel Doors & Frames
- SDI-108** Recommended Selection & Usage Guide for Standard Steel Doors
- SDI-118** Basic Fire Door, Fire Door Frame, Transom/Sidelight Frame, and Window Frame Requirements
- SDI-128** Guidelines for Acoustical Performance of Standard Steel Doors & Frames
- SDI-129** Hinge & Strike Spacing

Test Procedures

- ANSI/SDI A250.3** Test Procedure & Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors & Frames
- ANSI/SDI A250.4** Test Procedure & Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors
- ANSI/SDI A250.10** Test Procedure & Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors & Frames
- ANSI/SDI A250.13** Testing and Rating of Severe Windstorm Resistant Components for Swinging Door Assemblies for Protection of Building Envelopes (Not applicable for FEMA 320/361 or ICC-500 Shelters)
- SDI-113** Standard Practice for Determining the Steady State Thermal Transmittance of Steel Door & Frame Assemblies
- SDI-131** Accelerated Physical Endurance Test Procedure for Steel Doors, Frames and Frame Anchors

Construction Details

- ANSI/SDI A250.11** Recommended Erection Instructions for Steel Frames
- SDI-110** Standard Steel Doors & Frames for Modular Masonry Construction
- SDI-111** Recommended Details for Standard Details Steel Doors, Frames, Accessories and Related Components
- SDI-122** Installation Troubleshooting Guide for Standard Steel Doors & Frames

Miscellaneous Documents

- SDI-112** Zinc-Coated (Galvanized/Galvannealed) Standard Steel Doors & Frames
- SDI-117** Manufacturing Tolerances for Standard Steel Doors & Frames
- SDI-124** Maintenance of Standard Steel Doors & Frames
- SDI-127** Industry Alert Series (A-L)
- SDI-130** Electrified Hinge Preparations
- SDI-134** Nomenclature for Standard Steel Doors & Steel Frames

AUDIO-VISUAL PROGRAMS ALSO AVAILABLE

MEMBERS OF THE STEEL DOOR INSTITUTE

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