Total Door SYSTEMS

Global Leader in Integrated Access Technology™

Smoke Containment Strategies for Elevator Hoistways and Lobbies

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Total Door®
6145 Delfield Dr.
Waterford, MI 48329

Course Number:
Learning Units: 1.0 LU/HSW Hour

Smoke Containment Strategies for Elevator Hoistways and Lobbies

Course Description

The course will provide you a better understanding of how smoke migrates in multi-story building fires and how building codes in the United States have evolved to address this danger. Throughout this course we will illustrate vertical smoke migration in mid- and high-rise building fires and the hazards this presents for building occupants. The instructor will discuss how building codes seek to protect building occupants from this hazard and review various Assemblies that have been accepted to meet these code requirements to limit vertical smoke migration.

Learning Objectives

- Recognize the behavior of the fire and smoke in a mid- or high-rise building.
- Understand how the building codes address smoke migration in a fire and the effect of smoke migration on the means of egress via elevator lobbies in event of a building fire.
- Review the product applications that have been developed to assist in meeting building code requirements concerning the control of smoke migration via elevator hoistways, and in providing means of egress for building occupants.
- List the design options that comply with building code requirements for egress planning.

Fire and Smoke Behavior in Buildings

- Fire problem in US
- Losses lead industrial countries
- Sprinklers control fire spread
- Sprinklers and fire / smoke
- Fire beyond room of origin: 6%
- Smoke beyond room of origin: 32%
- Smoke off floor of origin: 1 in 7 fires
- 76% of deaths, injuries, damage

The Two Largest Vertical Penetration

in a Multistory Building are

Stairwells

Elevator shafts

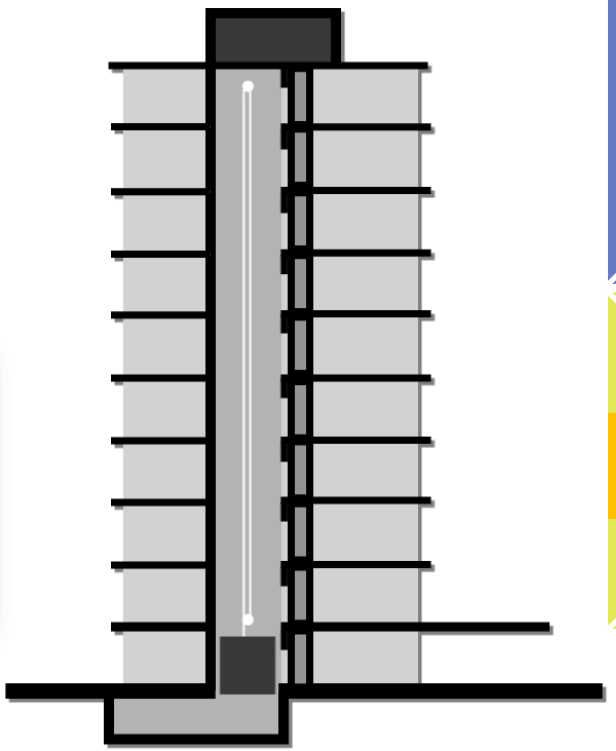
Stack Effect

Smoke Movement

Smoke and Fire in Elevator Shafts

- Elevators act like chimneys carrying smoke from floor to floor.
- Heated smoke from the fire enters the elevator shaft from each floor, displacing the resident cooler, denser air.
- The rising smoke leaks back through the elevator doors onto other floors exposing occupants to this dangerous and toxic hazard.
- Despite the design to compartmentalize, the vertical shaft compromises each floor and must be addressed to provide fire, smoke, and life safety in the building environment.

3/8” gap



STACK EFFECT PRESSURE

CHIMNEY EFFECT

Smoke & Fire in the Elevator Shaft

Impact of Human Behavior

- “Psychological ambiguity”
- People delay evacuation
- Tend to follow the same route used to enter building
- Actual evacuation time longer than anticipated

People Reactions in a Building

What do they do when they hear an alarm?

MGM Grand

Case Study

Facts

November 21,1980; 7:15 am

Las Vegas, NV

309	got dressed or partially dressed
273	looked out the window or door
226	wet towels for door or face
60	secured their valuables
53	attempted a phone call
85	deaths

Lower Level

Active vs. Passive

Where Can the Codes be Found?

The goal of the fire and life safety aspects of the IBC is to compartmentalize buildings with fire-rated walls, floors, and doors, restricting the movement of smoke and fire. Elevator shafts work against this principle, penetrating floor-to-floor separations. These areas are specifically addressed within the code.

Enclosed Elevator Lobby Requirements

IBC requires elevator shafts 3 stories and greater to isolate the shaft with both smoke and fire protection.

IBC prescribes a "fire-rated enclosed elevator lobby”.
(IBC 2009 Section 708.14.1 -- IBC 2012 713.14.1)

When an elevator shaft enclosure connects more than 3 stories, it must be constructed as fire partitions (Section 709).

Elevator lobby doors must comply with Section 715.4.3

Ducts and penetrations of the elevator lobby enclosure must stop the air transfer of the opening in accordance with Section 716.5.4.1

Elevator lobbies shall have at least one means of egress complying with Chapter 10 and other provisions within the Code.

The elevator share enclosure must be constructed with walls that have a one hour fire rating and doors that have a 20 minute fire rating -- MINIMUM.

All rated corridor walls and doors must "resist the passage of smoke”.

Standard: UL 1784

What is UL1784?

UL 1784 TESTING -
Standard for Air Leakage Tests of Door Assemblies and Other Opening Protectives

UL 1784 covers the testing of air leakage through door assemblies and other opening protectives installed in wall openings where air leakage is intended to be controlled.

Use of an Artificial Bottom Seal

During the UL 1784 test, tape is used across the bottom of the door to seal off the undercut. This allows the jambs and header to be tested for air leakage. The tape used across the bottom of the door is referred to as an "artificial bottom seal."

Code officials want to know that the doors have been tested without an artificial bottom seal to ensure that the door assembly will not exceed the 3 CFM per square foot of door opening at 0.10 inch of water for both the ambient temperature and the elevated temperature exposure test.

The door needs to be tested with all components during the test (components: panic hardware, locks, hinges, sweeps, closers, gasketing, etc.) You cannot add brush sweeps to a conventional door and call it a tested assembly to meet code requirements. Products for this application must show certification of proof that they have been tested without an artificial bottom.

IBC 2012 Section 713.14.1
Exception No. 3 – Enclosed Elevator Lobbies:

" Enclosed elevator lobbies are not required when additional doors are provided at the hoistway opening in accordance with section 3002.6. Such doors shall comply with the smoke and draft control door assembly requirements in section 716.5.3.1 when tested in accordance with UL 1784 without an artificial bottom seal."

IBC 2015 Section #3006.2
Hoistway Opening Protection:

" Such doors shall comply with the smoke and draft control door assembly requirements in section 716.5.3.1 when tested in accordance with UL 1784 without an artificial bottom seal."

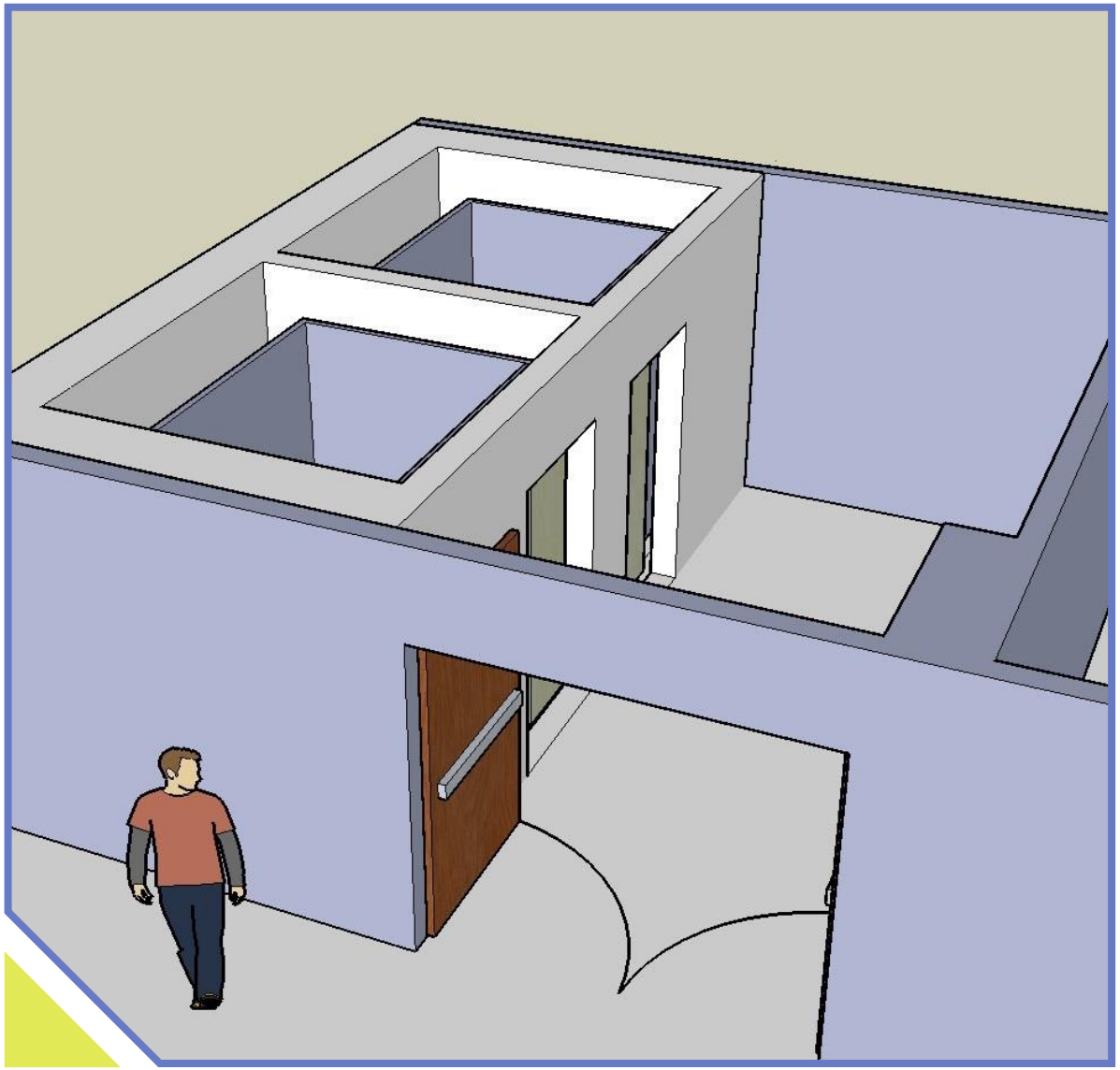
IBC 2012 Section #3007.7.3
Fire Service Access Elevator Lobby Doors:

IBC 2015 Section #3007.6.3
Fire Service Access Elevator Lobby Doors:

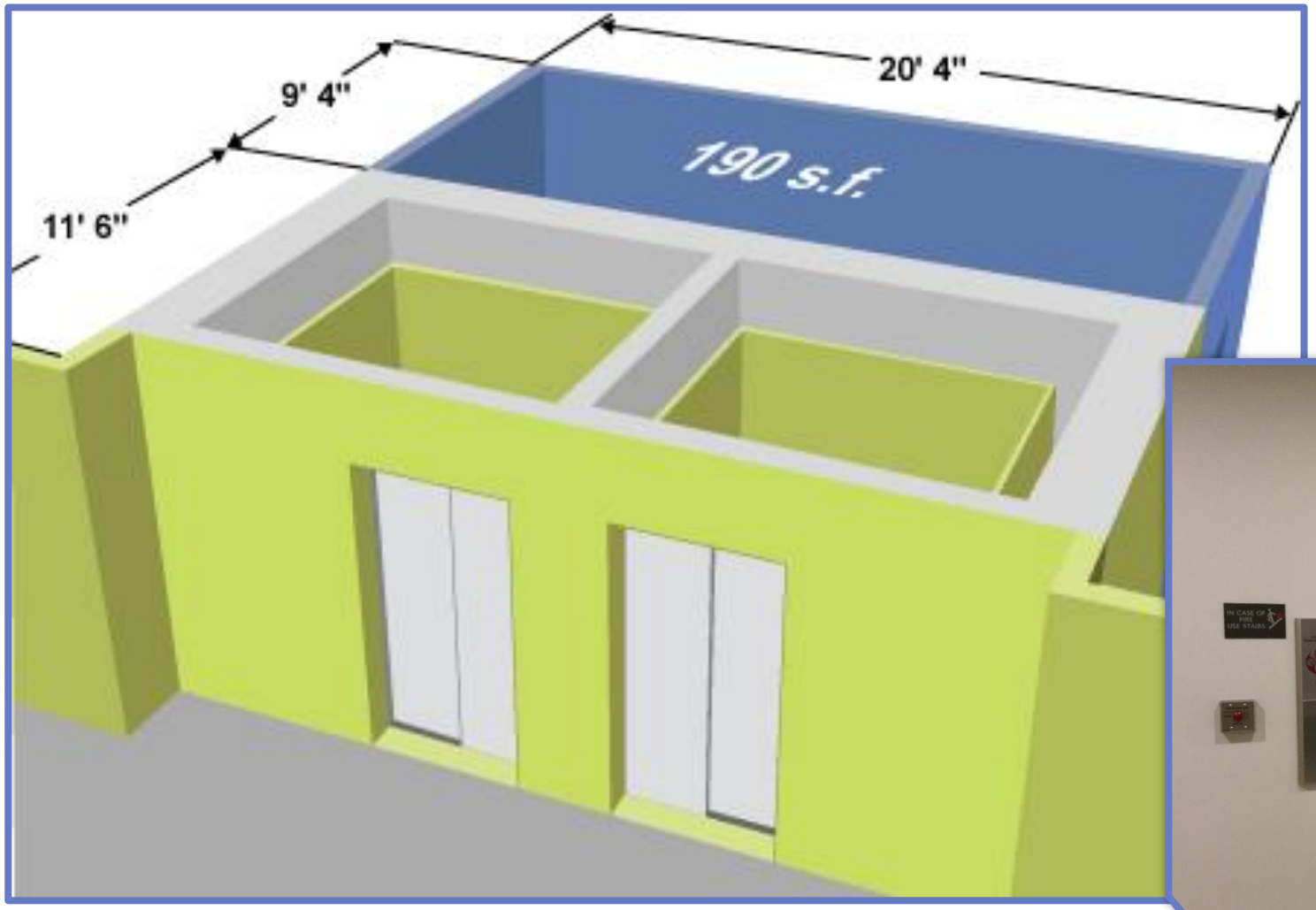
" Other than the door to the hoistway, elevator control room or elevator control space, each doorway to a fire service access elevator lobby shall be provided with a ¾-hour door assembly complying with 716.5. The fire door assembly shall also comply with the smoke and draft control door assembly requirements in section 716.5.3.1 when tested in accordance with UL 1784 without an artificial bottom seal."

IBC 2018 Chapter 30 Elevators and Conveying Systems
3006.2.1 Rated Corridors.
3006.3 Hoistway Opening Protection, Line No. 3:

Additional doors shall be provided at each elevator hoistway door openings in accordance to section 3002.6. Such doors shall comply with the smoke and draft control door assembly requirements in Section 716.2.2.1.1 when tested in accordance with UL 1784 without an artificial bottom seal.



Enclosed Elevator Lobby



Alternate Solution

Exception # 1

Street level with sprinklers on the entire floor.

Exception # 2

No lobbies are required when elevators are in an open shaft.

2

Exception # 3

Enclosed elevator lobbies are not required where additional doors are provided at the hoistway opening in accordance with Section 3002.6

Such doors shall comply with smoke and draft control door assembly requirements in Section 716.5.3.1 when tested with UL1784 without an artificial bottom seal.

3

Exception # 4

Enclosed elevator lobbies are not required where the building is protected by an automatic sprinkler system. This exception shall not apply to the following:

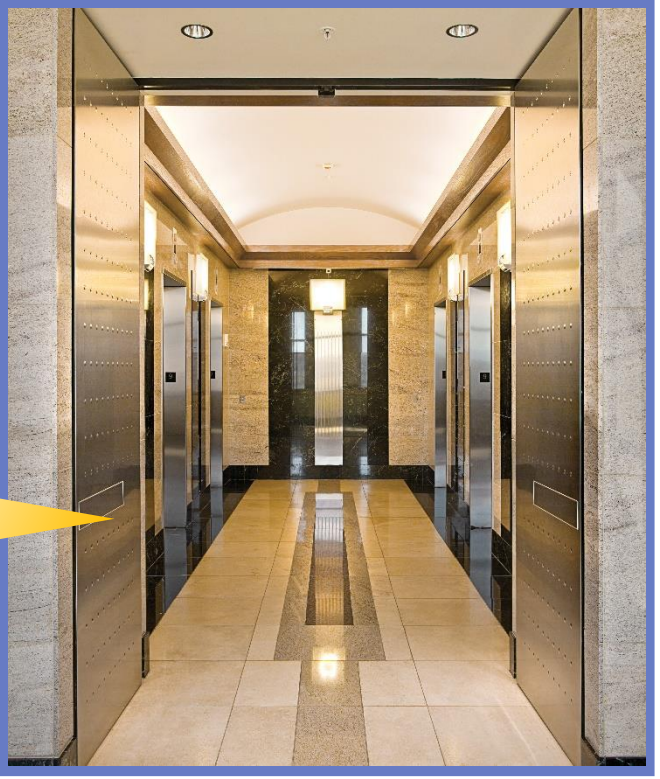
- 4.1 Group I-2 occupancies;
- 4.2 Group I-3 occupancies;
- 4.3 High-rise buildings.

Exceptions to the exception:

Exception # 5

Smoke partitions shall be permitted in lieu of fire partitions to separate the elevator lobby at each floor where the building is equipped throughout with an automatic sprinkler system.

smoke-rated assembly



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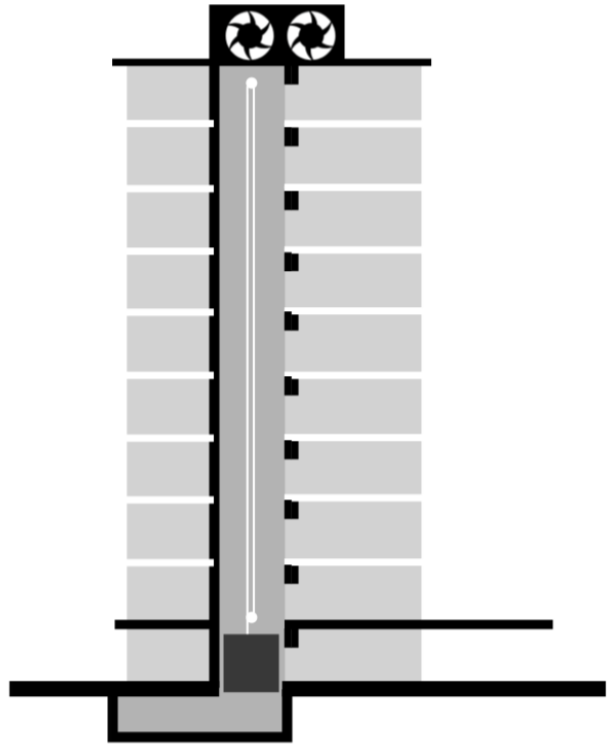
Exception # 6

Enclosed elevator lobbies are not required where the elevator hoistway is pressurized in accordance to Section 909.21



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Exception # 7

Enclosed elevator lobbies are not required where the elevator serves only open parking garages in accordance with Section 406.5.

7

Is Smoke Containment for Elevators Only Required in High-rise Buildings and Health care?

NOT ANYMORE

Corridor Continuity

2009 IBC Commentary to Section 1018.6

When an elevator opens into a corridor that is required to be of fire-resistance-rated construction, the opening between the elevator shaft and the corridor must be protected to meet not only the shaft's fire protection rating, but also the additional smoke and draft protection requirements necessary to limit the spread of smoke into the corridor. The provisions in Section 708.14 waiving the requirements for an elevator lobby do not also waive the corridor opening protection requirements.

IBC Commentary 1018.6

IBC Commentary to Section 1018.6

When an elevator opens into a corridor that is required to be of fire—resistance—rated construction, the opening between the elevator shaft and the corridor must be protected to meet not only the shaft's fire protection rating but also the additional smoke and draft protection requirements necessary to limit the spread of smoke into the corridor. This requirement is found in Section 715.4.3.1. Because elevator hoistway doors do not typically comply as smoke—and draft—control assemblies, they would not be able to open directly into a corridor that is required to have protected openings. The provisions in Section 708.14 waiving the requirements for an elevator lobby do not waive the corridor opening protection requirements. Therefore, to maintain the integrity of the corridor, the elevator shaft doors opening into such rated corridors will need to be separated from the corridor by one of the following methods of protection:
(next slide)

Example

- This hotel has rated corridor and each hotel room is protected by swing door that has a 20 min. Smoke and fire rating.
- This elevator has no smoke protection and no lobby was provided

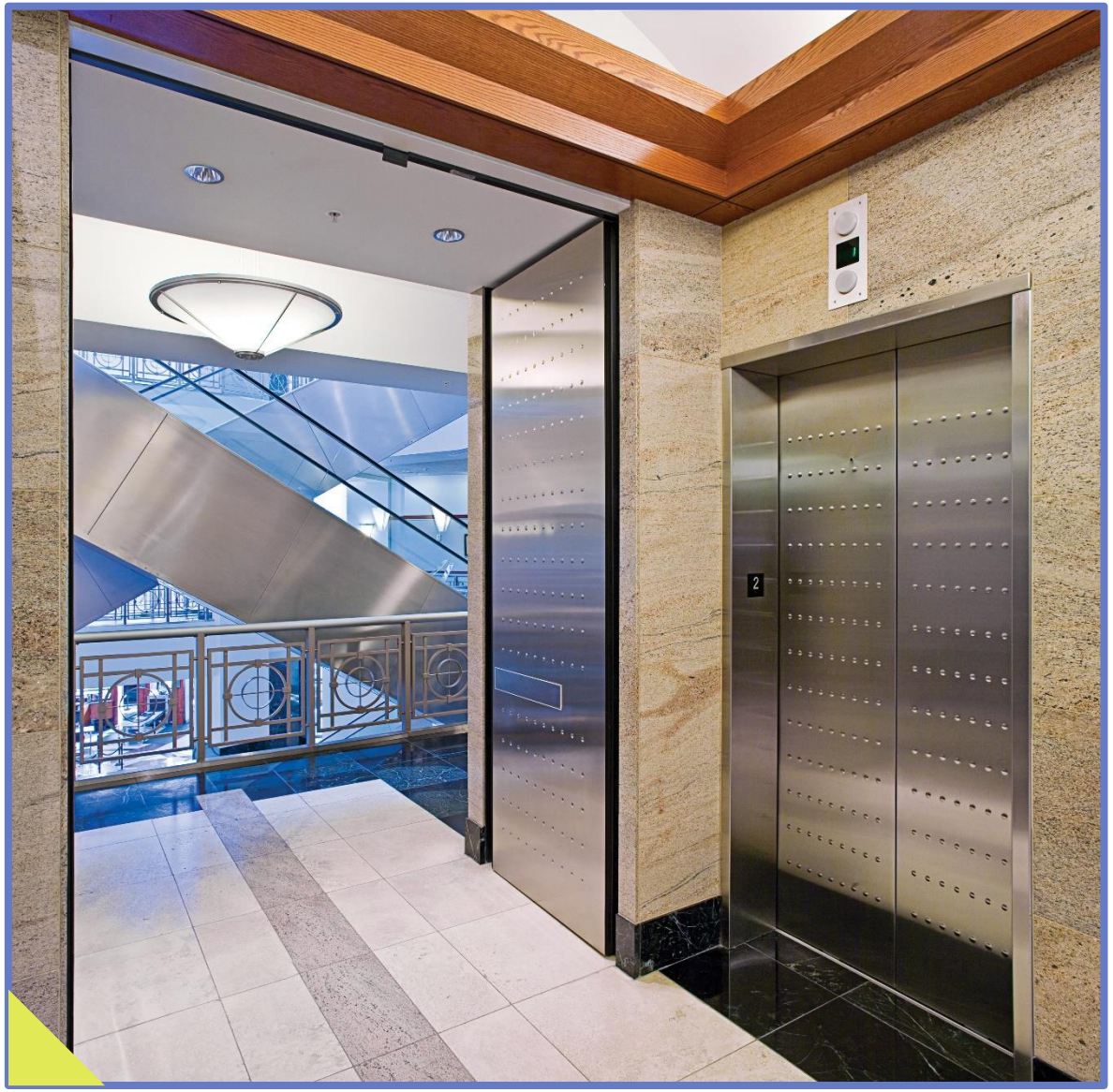
Methods of Protection

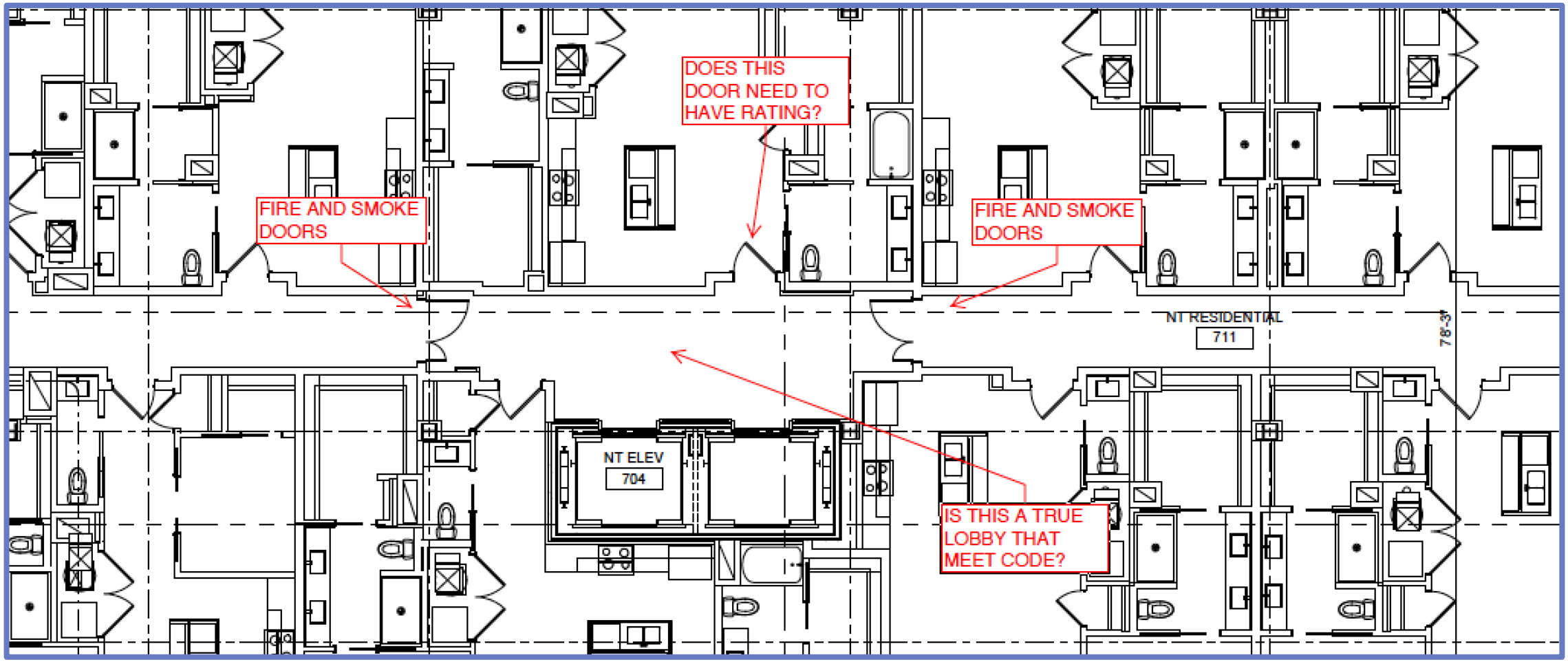
1. A lobby needs to be provided with the appropriate doors (see figure 1018.6 and Section 708.14).
2. Additional doors must be provided at the hoistway (see figure 1018.6 and Section 708.14 and 3002.6).
3. An elevator shaft door meeting both smoke and draft protection requirements for corridor doors in Section 715.4.3.1 as well as the appropriate fire protection rating of table 715.4 for the shaft must be provided.
4. The corridor must be separated from the lobby.

What are Lobbies?

- Why do we need lobbies?
- Are lobbies wasted space?
- Are lobbies taking up rentable/usable space?
- Could you eliminate lobbies in your design?

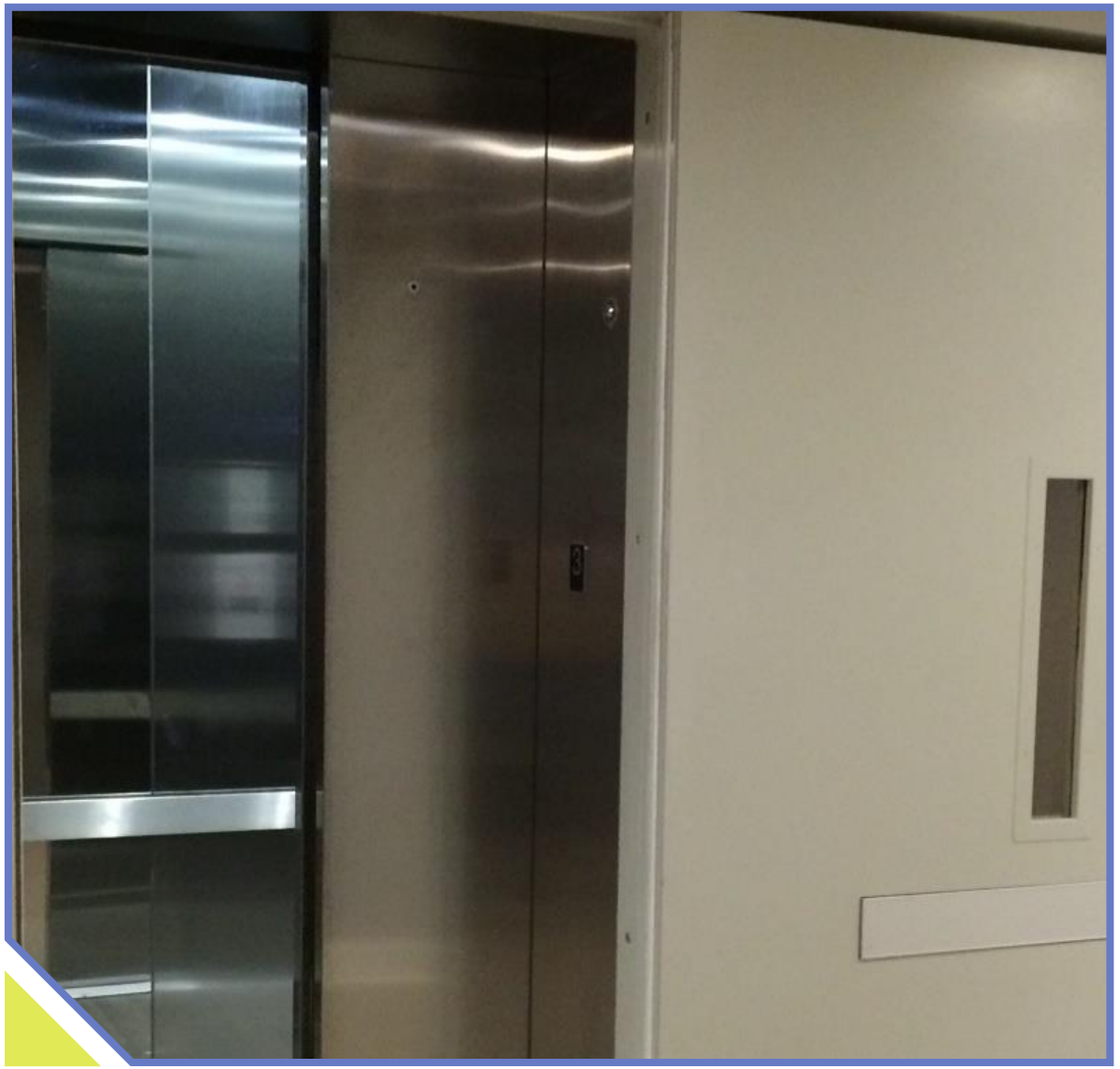
Enclosed Elevator Lobby




DOES THIS DOOR NEED TO HAVE RATING?
FIRE AND SMOKE DOORS
FIRE AND SMOKE DOORS
NT RESIDENTIAL
711
78'-3"
NT ELEV
704
IS THIS A TRUE LOBBY THAT MEET CODE?

Questions

What Type of Door Can be Used?



What Type of Swing doors?

- Can just any door work?
- What is a rated Assembly?
- “Assembly door” means it has be tested with all hardware installed.
- Can glass doors be installed?
- Does glass have to be rated?

Elevator Code Requirements

What is required per ASME A17.1

ASME 17.1 Elevator code

Elevator Shaft Door must be Tested as

Assembly

2.11.6.3 Egress from the interior of the car to any elevator landing by means of the car and hoistway doors shall be unrestricted once the car and hoistway doors are open. Additional doors or devices, that are not part of nor function with the elevator but are provided in lieu- of an enclosed elevator lobby in order to guard against the migration of smoke in or out of the hoistway,

shall comply with the following:

a) The building code.
b) The additional door or device, in any position, shall not interfere with the function and operation of the elevator.
c) The additional door or device shall not interfere with the fire-resistance rating and operation of the hoistway entrance. Direct or mechanical attachment (i.e., welding, holes, bolts, or rivets) shall not be made to hoistway doors or frames, unless the additional door or device and the hoistway elevator entrance are listed as a complete assembly by a certifying organization.
d) Additional door or devices when the in the closed position shall not prevent firefighter from visually observing the elevator Landing (lobby) when the hoist way door is no more than one quarter open.
e) Additional doors or devices shall be permitted to be deployed only at those hoist way openings of the elevator where fire alarm initiating devices used to initiate Phase I Emergency Recall Operation associated with that elevator have been activated.

Note: It is recommend that all additional doors or devices deployed in front of hoistway doors shall be cleared(returned to open/standby position) by authorized or emergency personnel prior to removing the elevator from Phase I Emergency Recall Operation.

Intertek

Client
Report No

Date 2-27-13
Page 4 of 10

5 Testing and Evaluation Results

5.1. RESULTS AND OBSERVATIONS

Closing Force = 8 lbs. Area = 42 ft^2

Configuration	Test Pressure ($"H_2O$)	Chamber Temp (°F)	Sample Leakage (SCFM)	Leakage Rate (SCFM/ft^2)
Inswing	0.05	69	35.66	0.85
	0.10	70	52.98	1.26
	0.20	71	74.93	1.78
	0.30	72	95.51	2.27
Outswing	0.05	69	42.09	1.00
	0.10	70	62.21	1.48
	0.20	71	91.85	2.19
	0.30	72	115.23	2.74
Outswing Elevated Temp.	0.05	394	21.47	0.51
	0.10	397	32.95	0.78
	0.20	396	46.04	1.10
	0.30	396	58.99	1.40

Note: All tests were conducted without an artificial bottom seal.

5.1.1. Statement of Measurement Uncertainty

All measurements were taken with 95% confidence level. Pressure measurements were taken with an inclined manometer (WHI #173) with an accuracy of +/- 0.02" w.c. Air flow measurements were taken with a laminar flow element (WHI #562) with an accuracy of +/- 1% of reading. Temperature measurements were taken with a thermocouple meter (WHI #95) with an accuracy of +/- 2 degrees.

UL 1784 Test

Where there is smoke there is Fire!

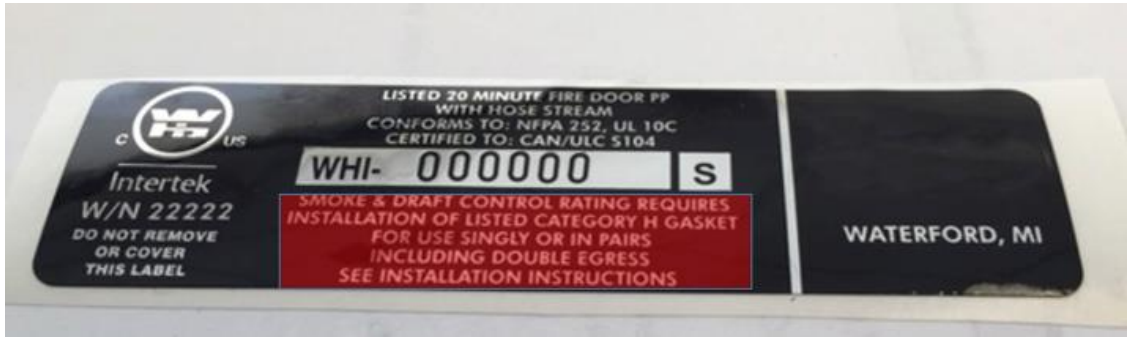
Smoke labels explained

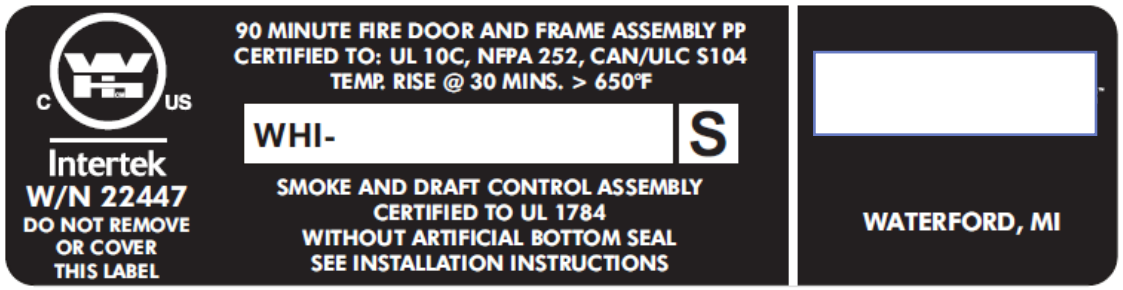
This communication is to clarify that our doors and frames are suitable for smoke door applications when used with classified smoke and draft control components that bear the "S" mark (doors and frames) and Category H smoke and draft control gasketing. This includes three sided frames without transoms (single swing, pairs, double egress pairs and multiple opening frames). Door frames with lights additionally require glazing materials classified as components in fire door assemblies complying with UL 10C. Our customer is wholly resposible for ensuring that they are providing all material that meets the building code requirement for a smoke and draft control opening. We are resposible for communicating what requirements must be met for the label to be applicable and listed.

Top label represents auxiliary label we use on UL doors and frames; bottom label is used for Warnock Hersey product.

These doors and frames will receive an auxiliary "S" label similar to the ones pictured above. They must bear a fire rating. The smoke label is in addition to the fire protection hourly fire rating and means nothing without it.

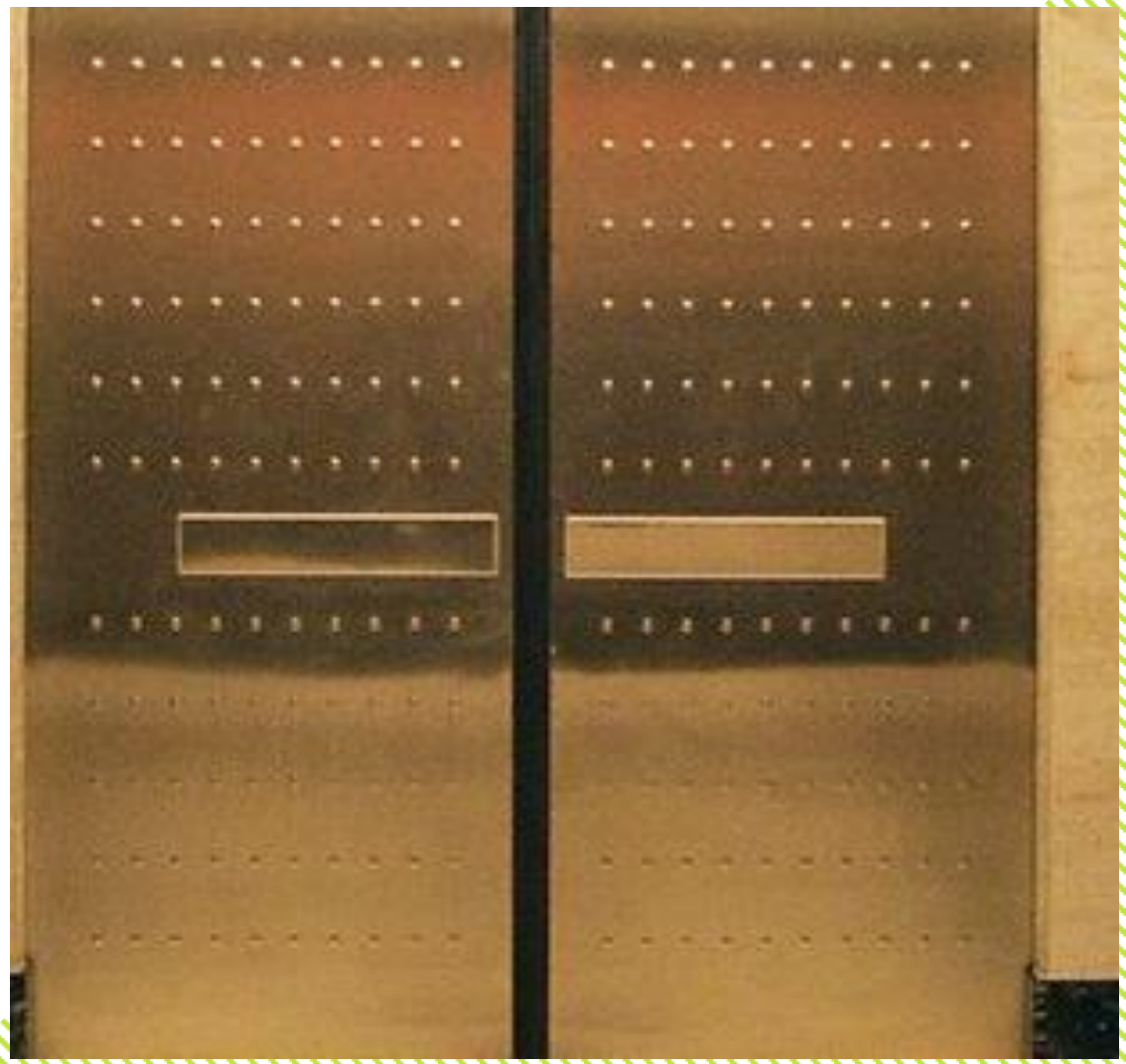
Does the Door Need to be Fire and Smoke Rated?





- Oversized fire doors shall bear an oversized fire door label by an approved agency or shall be provided with a certificate of inspection furnished by an approved testing agency (IBC 2009 715.4.6.2 and IBC 2012 716.5.7.2).
- Smoke and draft control doors shall show the letter “S” on the fire rating label of the door (IBC 2009 715.4.6.3 and IBC 2012 716.5.7.3) .

Integrated Door Assembly

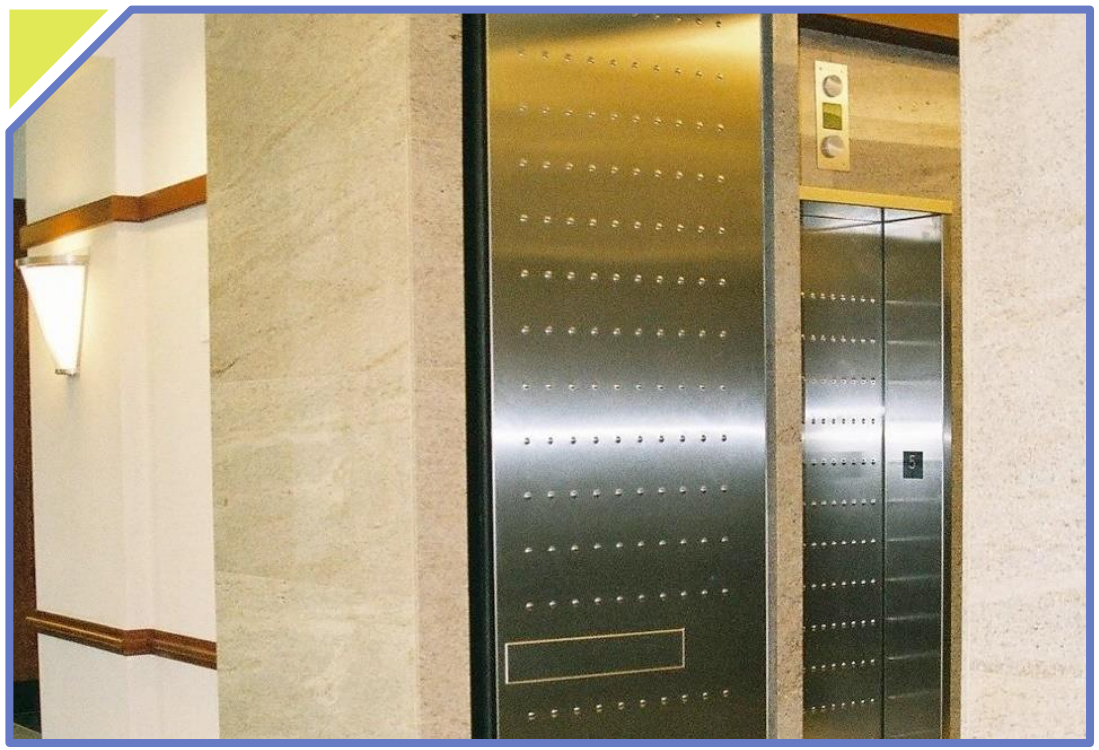


Fire Rated Door Locations

Fire partitions, smoke partitions, smoke barriers, fire walls, exit enclosures, exit passageways, horizontal exits, and means of egress doors.

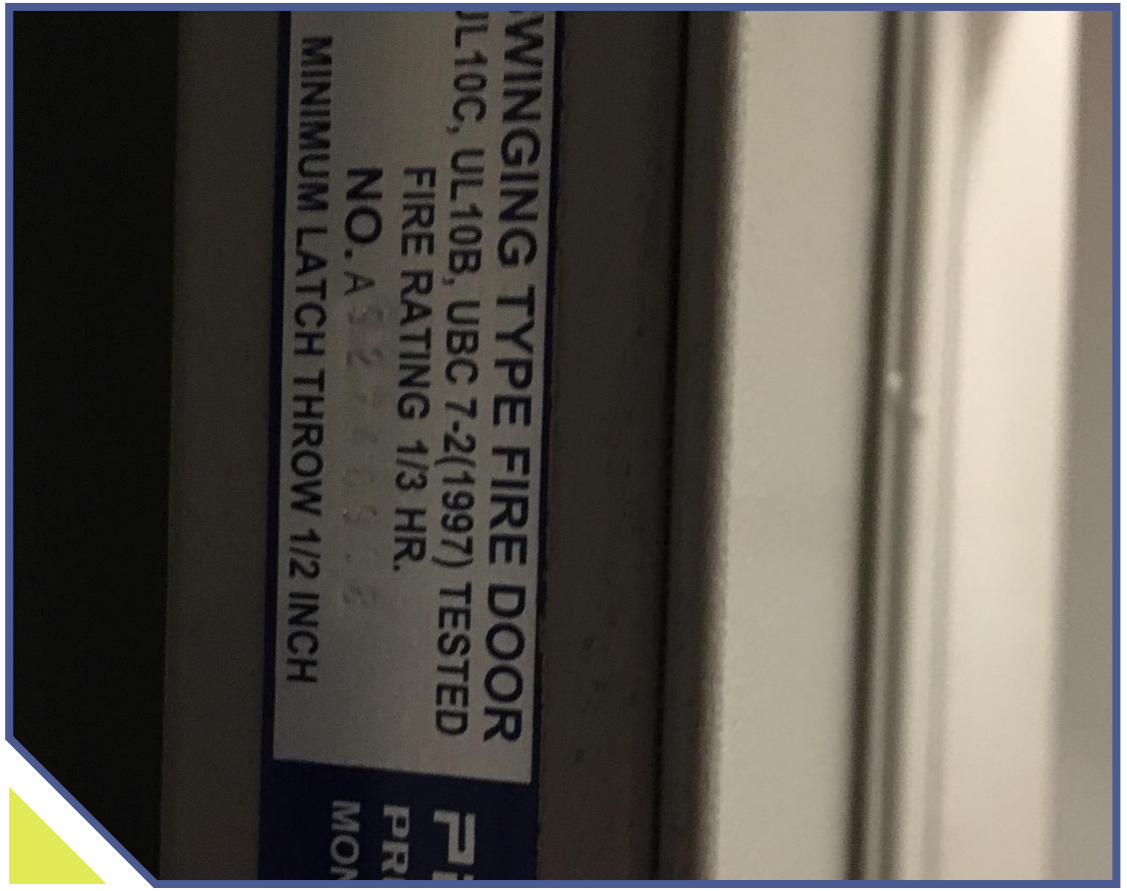
- Corridors
- Cross-corridors
- Stairway doors
- Area of refuge
- Elevator lobby
- Elevator shaft
- Security applications
- Mechanical rooms
- Between adjacent buildings
- Classrooms
- Offices
- Psychiatric applications
- Trash/laundry chutes

Pocket your Fire Doors

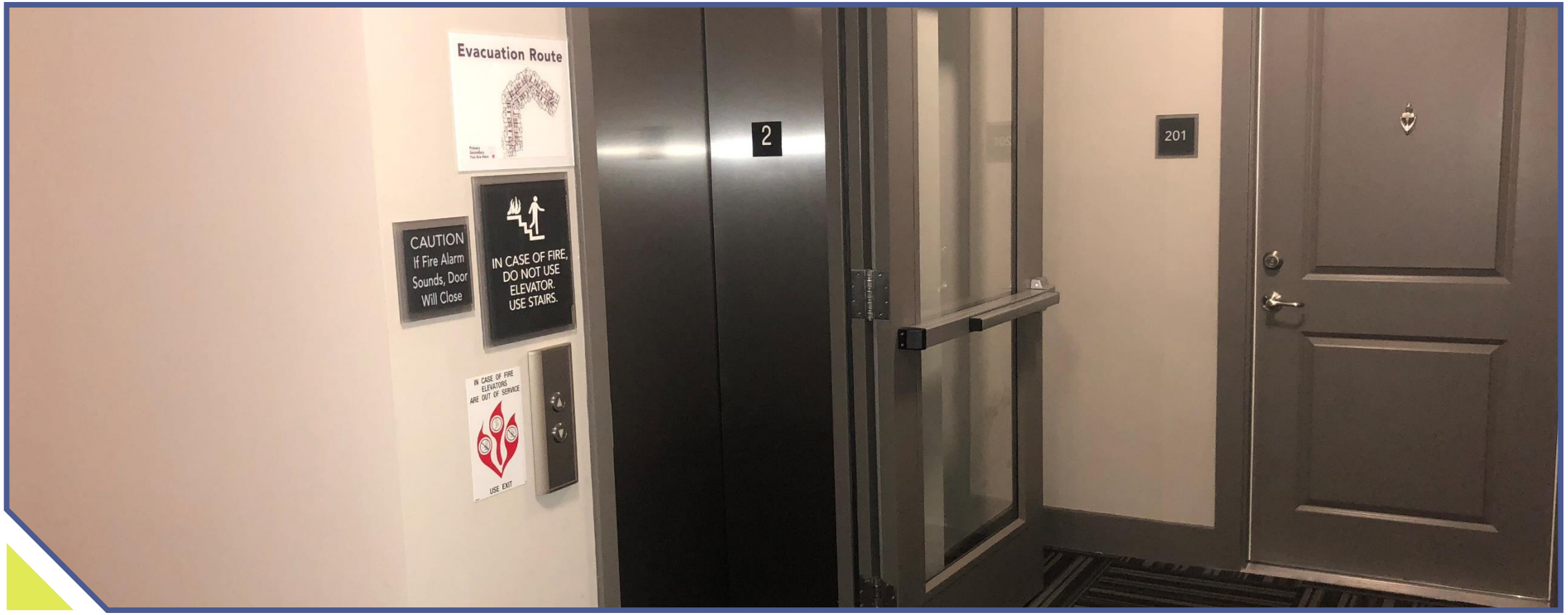


Compliant Assembly

Noncompliant due to not being a tested Assembly

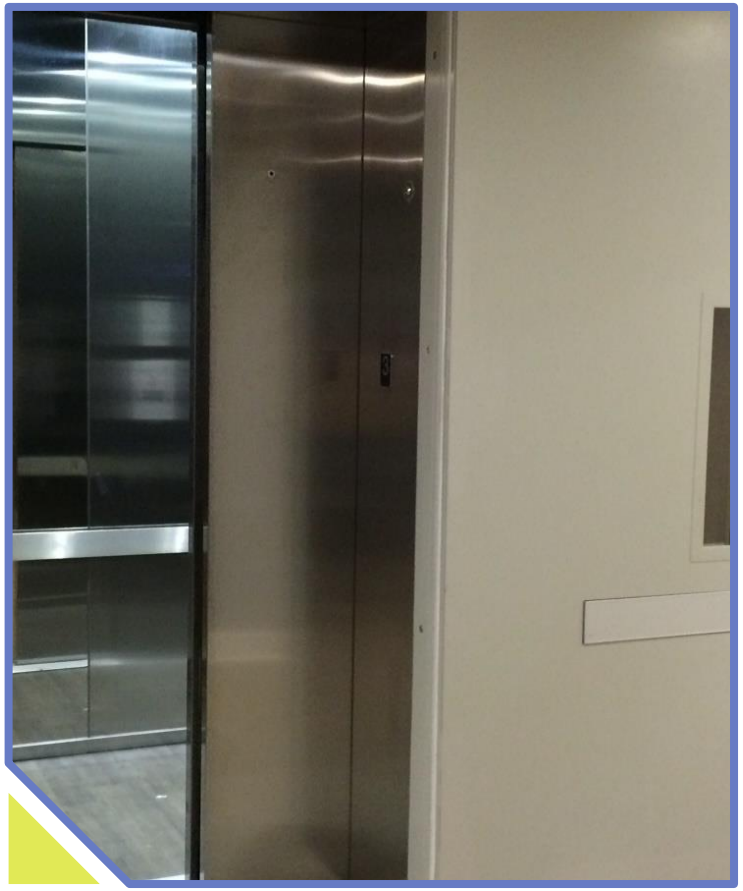

WINGING TYPE FIRE DOOR
UL10C, UL10B, UBC 7-2(1997) TESTED
FIRE RATING 1/3 HR.
NO.
MINIMUM LATCH THROW 1/2 INCH

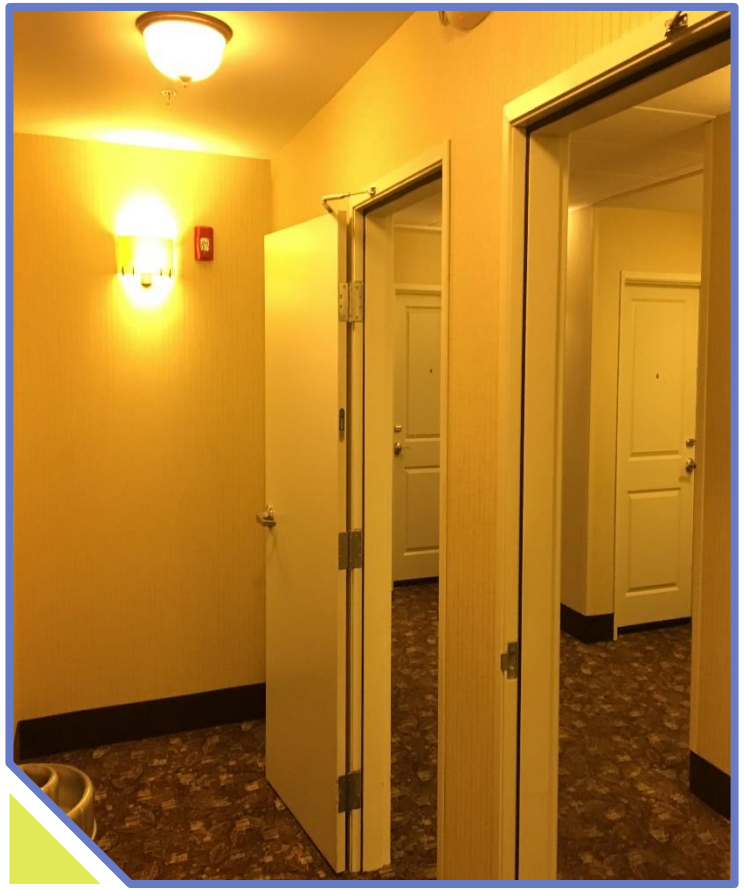
Not allowed



Noncompliant

Noncompliant





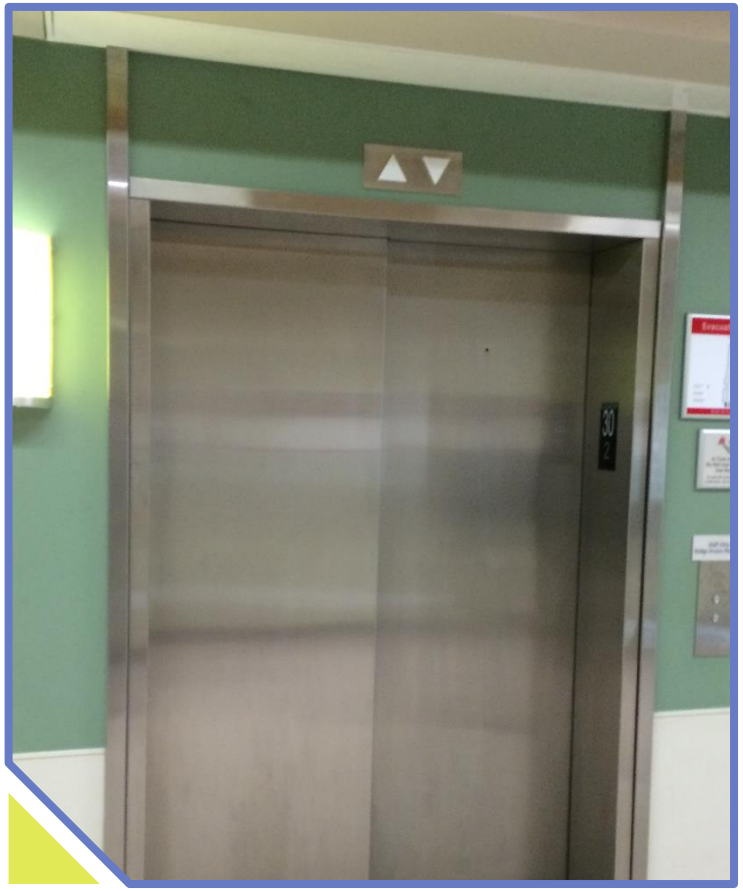
IBC 2009—Section 708.14.1

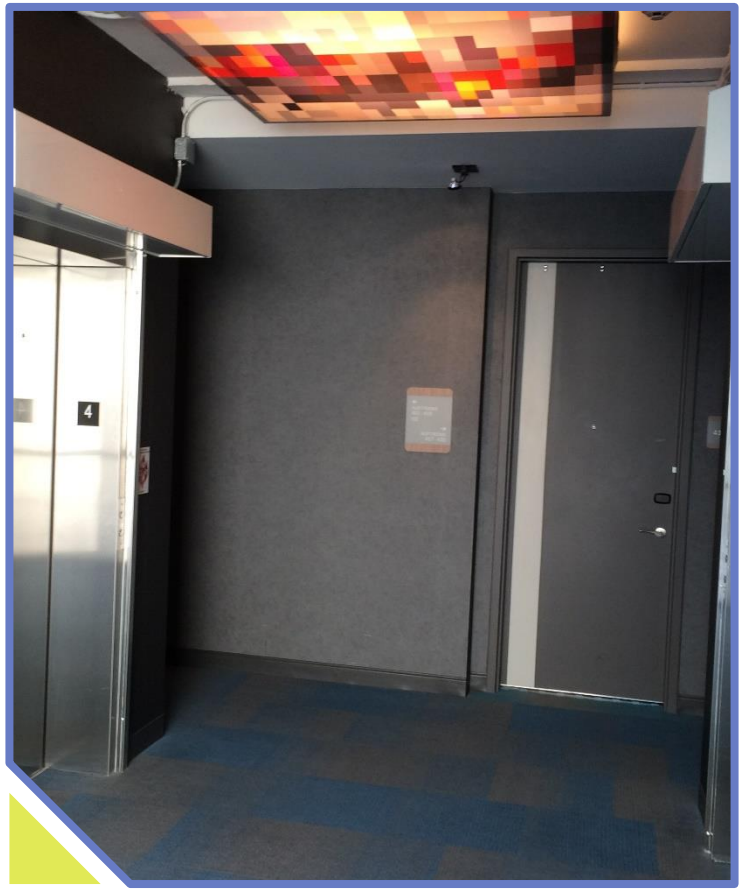
The Advantages of Using Swing Doors in Lieu of Smoke Curtains

Some of the Advantages of Using Swing Door Assemblies

Instead of Smoke Curtains for Elevators

- Swing Door Assemblies will have both fire and smoke ratings.
- Swing Door Assemblies will not touch the elevator frames.
- Swing Door Assemblies does not require Contractors to construct special soffits, added construction required to install the smoke curtain housing in ceiling.
- Swing Door Assemblies are well known at the point of access to a elevator car and are readably openable from the car side of the elevator without a key, tools, special knowledge or effort. (per Section 3002.6 requirements)





Smoke Curtains

Rated Curtain at the Elevator Openings?

- IBC Section 3002.6 applies in this case as well.
- No means of egress in deployed position as curtain capture in side guides.
- Lack of an engineering judgment or and ICC-ES report renders this noncompliant with US codes
- Curtain must have vision panels to meet Elevator code.

Rated Curtain at the Elevator Openings?

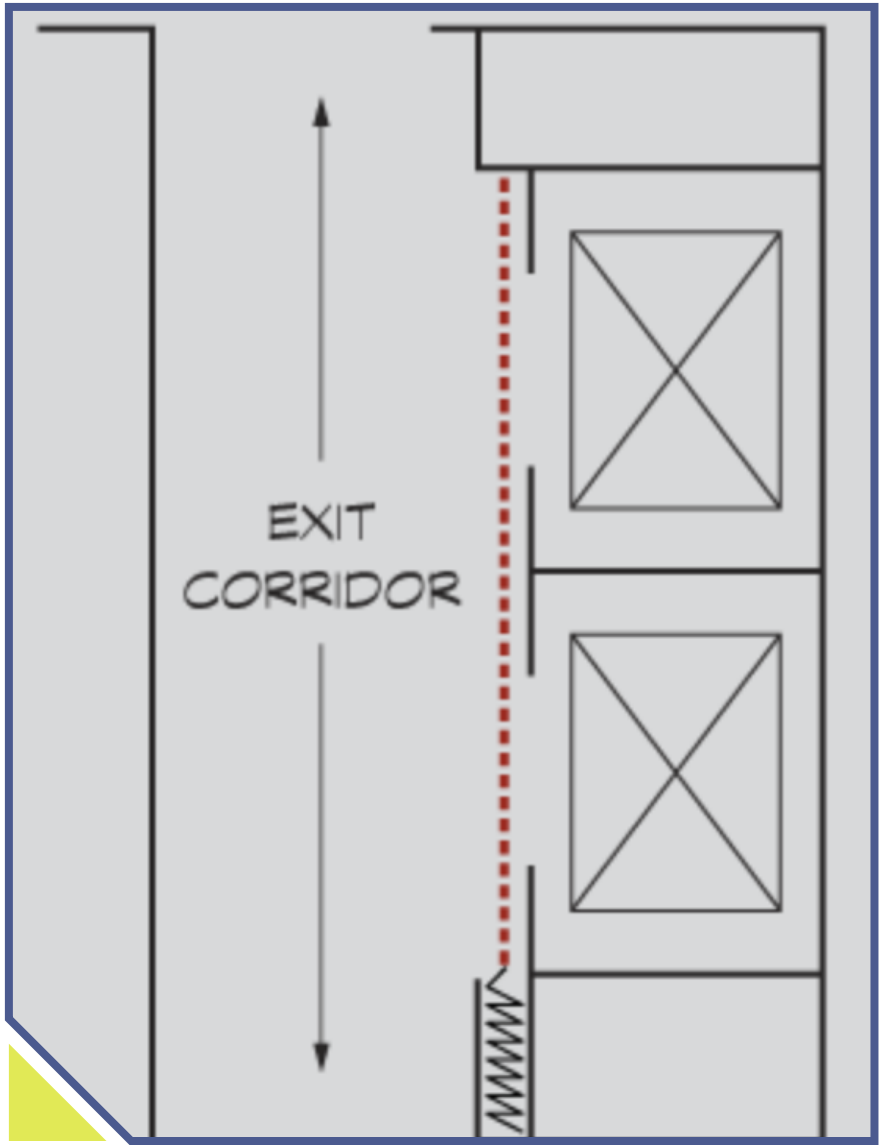
Must not require special keys, tools, knowledge to open

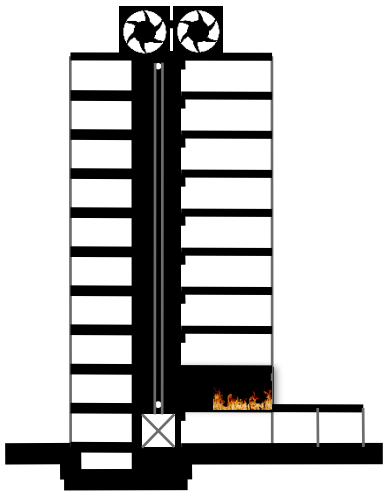
Rated Curtain at the Elevator Openings?

- No fixed guides
- No heavy bottom bar

Noncompliant!

Accordion Fire Doors


EXIT
CORRIDOR



Egress Through Intervening Spaces

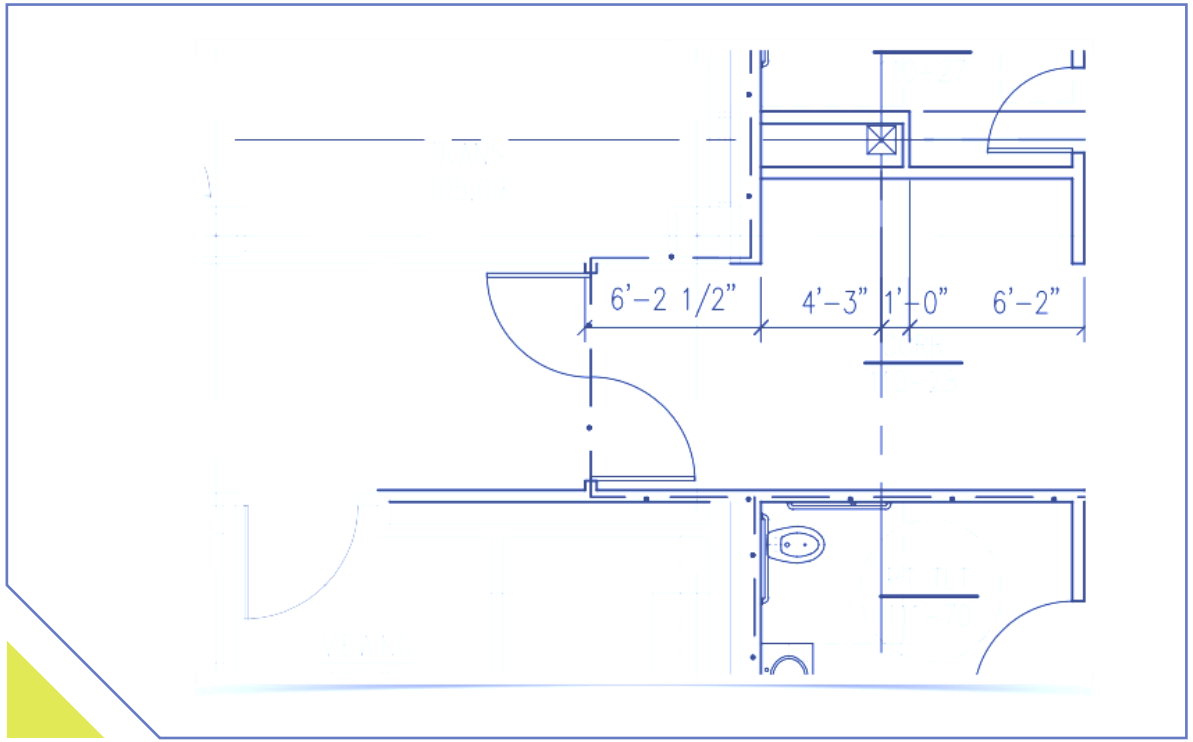
1016.2 IBC 2015

“Exit Access” through an enclosed elevator lobby is permitted. Access to not less than one of the required exits shall be provided without travel through the enclosed elevator lobbies required by section 3006

Egress Through Intervening Spaces

(Considerations)

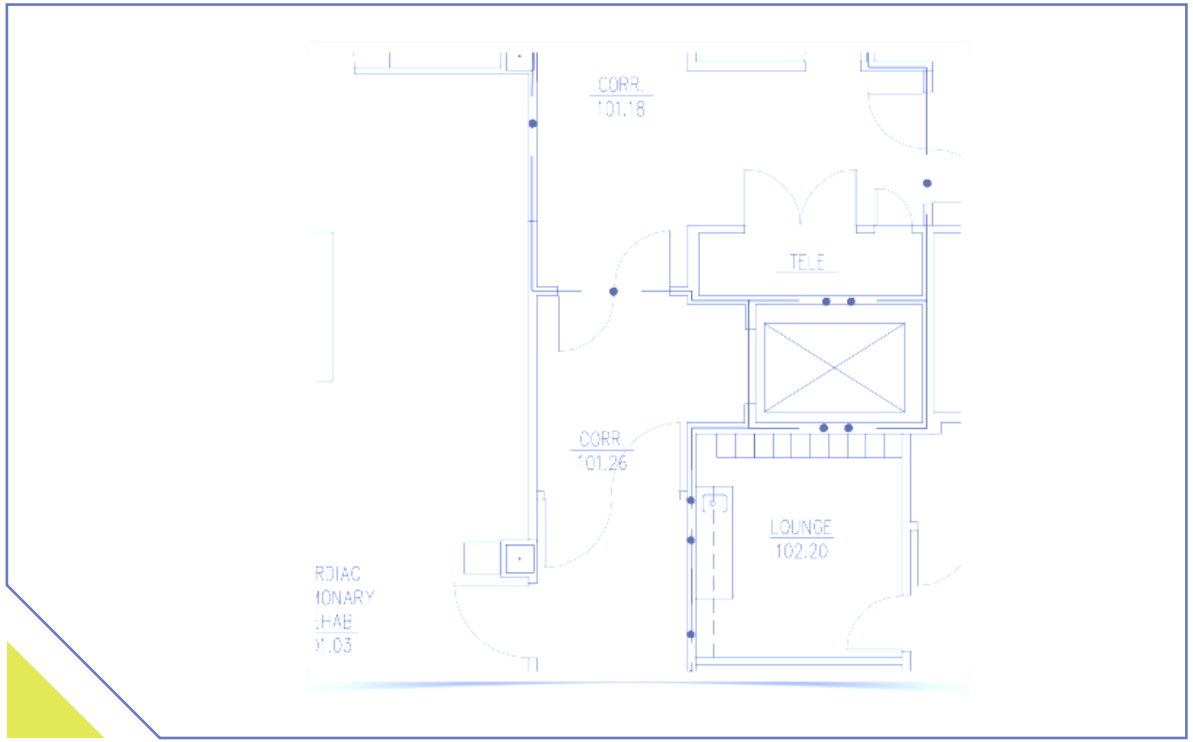
Travel through an elevator lobby must accommodate both directions of egress travel



Egress Through Intervening Spaces

(Considerations)

Requires approximately 19 linear feet of hallway for single elevator



Egress Through Intervening Spaces

(Considerations)

Conventional doors pose obstruction challenges and are subject to damage.

Egress Through Intervening Spaces

(Considerations)

Integrated door assemblies eliminate corridor obstructions, avoid damage and compliment surrounding construction

Flush Hardware with No encroachment into corridor hardware

Fire Service Access Elevator Lobbies

- 403.6.1-IBC 2009
  "In buildings with an occupied floor more than 120 feet (36 5766 mm) above the lowest level of fire department vehicle access, a minimum of one fire service access elevator shall be provided in accordance with section 3007."

- 403.6.1-IBC 2012, 2015
  "In buildings with an occupied floor more than 120 feet (35 5766mm) above the lowest level of fire department vehicle access, no fewer than two fire service access elevators, or all elevators, whichever is less, shall be provided in accordance with section 3007"

Fire Service Access Elevator Lobbies

3007.4 IBC 2009, 3007.7, IBC 2012, 3007.6 IBC 2015

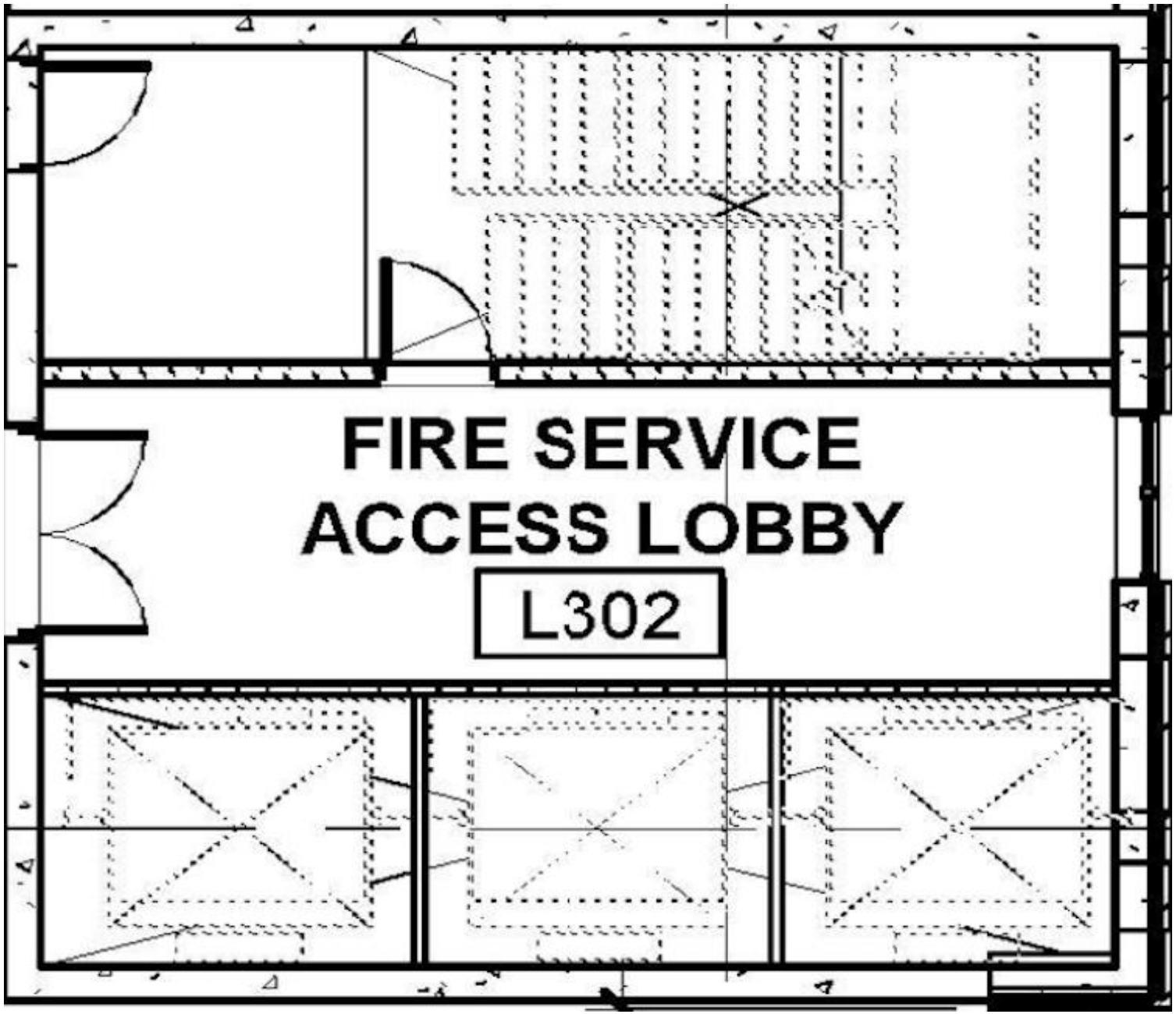
- "Fire service access elevator lobby shall have direct access to an exit enclosure."
- "Shall be enclosed with a smoke barrier having a minimum 1 hour fire resistance rating."
- "Exception" - fire service access elevator lobbies shall not be required at the street floor

Fire Service Access Elevator Lobby Doors

3007.4.3 IBC 2009, 3007.7.3 IBC 2012, 3007.6.3 IBC 2015

"Other than the door to the hoistway, elevator control room or elevator control space, each doorway to a fire service access elevator lobby shall be provided with a 3/4 - hour fire door assembly complying with 716.5. The fire door assembly shall also comply with the smoke and draft control door assembly requirements of 716.5.3.1 with the UL 1784 test conducted without an artificial bottom seal."

Example of Fire Service Access Elevator Lobby



Occupant Evacuation Elevator Lobbies

IBC 2009, 2012, 2016

Exception to 403.5.2 for buildings more than 420 feet "an additional interior exit stairway shall not be required to be installed in buildings having elevators used for occupant self-evacuation in accordance with section 3008"

Occupant Evacuation Elevator Lobbies

- 3008.11.1 IBC 2009 & 2012, 3008.6.1 IBC 2015
  "The occupant evacuation elevator lobby shall have direct access to an exit enclosure"

- 3008.11.2 IBC 2009 & 2012, 3008.6.2 IBC 2015
  "The occupant evacuation elevator lobby shall be enclosed with a smoke barrier having a minimum 1-hour fire resistance rating, except that lobby doorways shall comply with 308.1.1.5"

Occupant Evacuation Elevator Lobby Doors

3008.11.3 IBC 2009 & 2012, 3008.6.3 IBC 2015

Other than the door to the hoistway, elevator control room or or elevator control space, each doorway to a fire service access elevator lobby shall be provided with a 3/4 - hour fire door assembly complying with 716.5. The fire door assembly shall also comply with the smoke and draft control door assembly requirements of 716.5.3.1 with the UL 1784 test conducted without an artificial bottom seal

Occupant Evacuation Elevator Lobby Doors

3008.11.3.1 IBC 2009 & 2012, IBC 3008.6.3.1

"A vision panel shall be installed in each fire door assembly protecting the lobby doorway. The vision panel shall consist of fire protection rated glazing and shall be located to furnish clear vision of the occupant evacuation elevator lobby."

UL 1784 TEST

5 Testing and Evaluation Results

5.1. RESULTS AND OBSERVATIONS

Closing Force = 8 lbs. Area = 42 ft^2

Configuration	Test Pressure ("H_2O)	Chamber Temp (°F)	Sample Leakage (SCFM)	Leakage Rate (SCFM/ft^2)
Inswing	0.05	69	35.66	0.85
	0.10	70	52.98	1.26
	0.20	71	74.93	1.78
	0.30	72	95.51	2.27
Outswing	0.05	69	42.09	1.00
	0.10	70	62.21	1.48
	0.20	71	91.85	2.19
	0.30	72	115.23	2.74
Outswing Elevated Temp.	0.05	394	21.47	0.51
	0.10	397	32.95	0.78
	0.20	396	46.04	1.10
	0.30	396	58.99	1.40

Note: All tests were conducted without an artificial bottom seal.

5.1.1. Statement of Measurement Uncertainty

All measurements were taken with 95% confidence level. Pressure measurements were taken with an inclined manometer (WHI #173) with an accuracy of +/- 0.02" w.c. Air flow measurements were taken with a laminar flow element (WHI #562) with an accuracy of +/- 1% of reading. Temperature measurements were taken with a thermocouple meter (WHI #95) with an accuracy of +/- 2 degrees.

Code Officials Role

- Render interpretations of the building code
- Receive applications for building permits
- Review construction documents
- Issue building permits
- Inspect the premises for which permits have been issued.
- Enforce compliance with provisions of code

I have a permit-
Am I home free?

105.4 Validity of permit:

"The issuance or granting of a permit shall not be construed to be a permit for or approval of any violation of this code…..permits presuming to give authority to violate or cancel the provisions of this code or other ordinances of the jurisdiction shall not be valid. The building official is also authorized to prevent occupancy or use of a structure where in violation of this code or of other ordinances of this jurisdiction."

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Thank you for your attendance!

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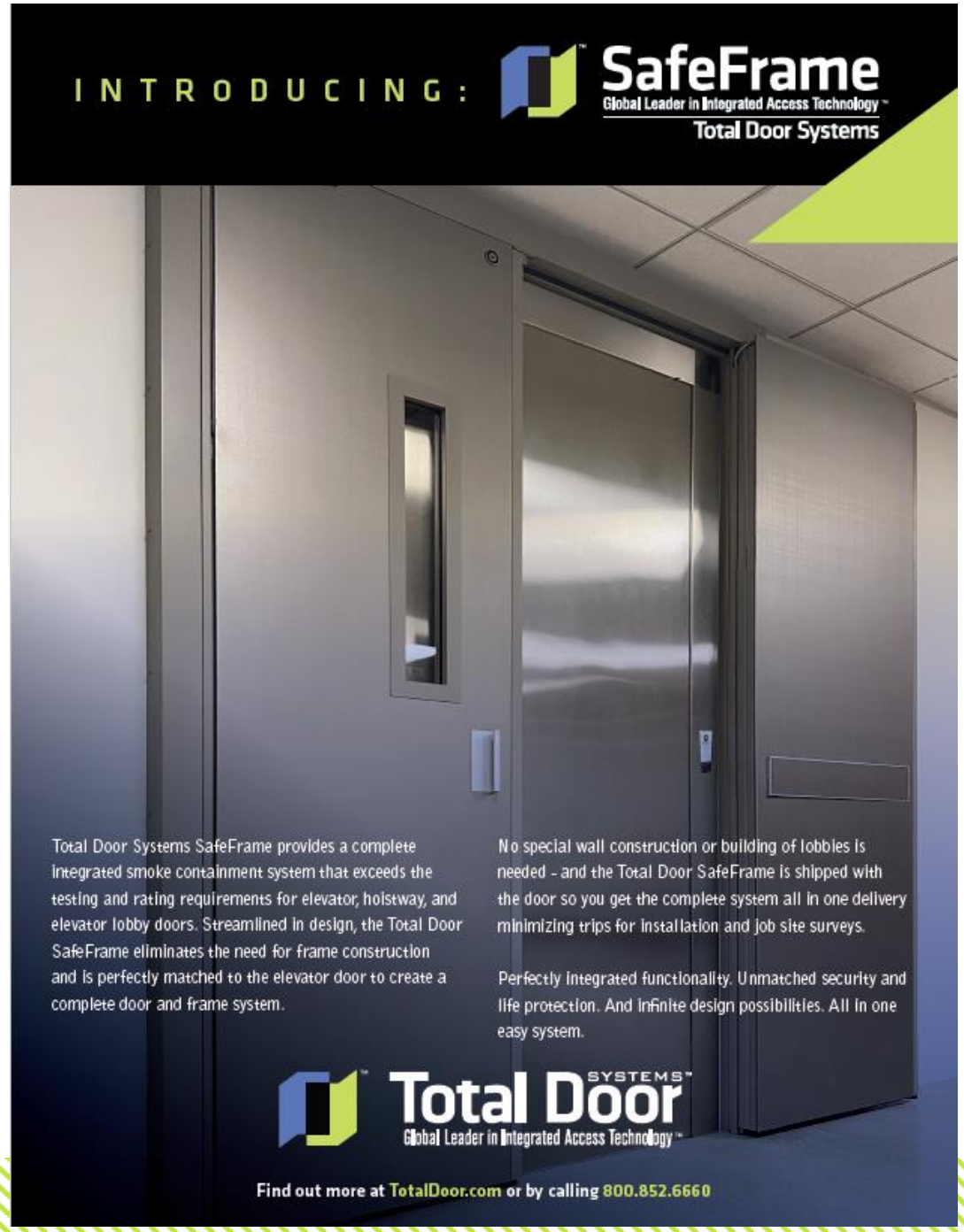

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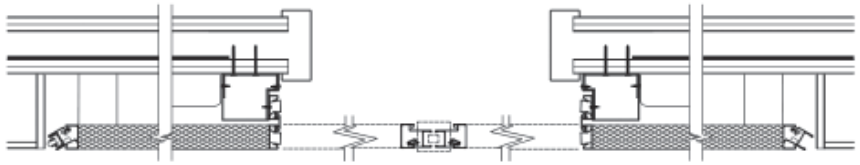
Smoke Containment Swing Door and **SafeFrame** System

Now, you get a complete door and frame system with:

- SafeFrame and integrated door shipped together in one package
- Built-in concealed magnetic holder with armor loop directly tied into each floor's smoke detector
- Wall mounted closers behind door when in open position
- Surface mounted knock down sub-buck frame to mount directly to shaft face
- Fire and smoke rated system
- Complete system tested to meet code UL1784 without an artificial bottom seal
- Meets ASME 17.1 elevator code requirements
- BHMA certified to A156.32
- Meets IBC requirements for air leakage of assemblies. Less than 3 cfm per s.f. of door at .10 inch (24.9 Pa) of water column pressure.

We offer single door and paired door applications.

Total Door has always offered custom design and manufacture of fully integrated door systems that stay true to your design vision and building needs. Now, with our new SafeFrame (patented), it is a truly integrated system, ready to be installed with no additional construction. Now, more than ever, we have your back.



Label allows for easy field verification of code compliance.
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