



September 12, 2008

**TO: PARTIES INTERESTED IN SMOKE CONTAINMENT SYSTEMS USED WITH FIRE-RESISTANCE-RATED ELEVATOR HOISTWAY DOORS AND FRAMES**

**SUBJECT: Proposed Revisions to the Acceptance Criteria for Smoke-containment Systems Used with Fire-resistance-rated Hoistway Doors and Frames, Subject AC77-1008-R1 (ST/MB)**

**Hearing Information:**

Tuesday, October 21, 2008  
8:00 a.m.

**Holiday Inn, Albany on Wolf Road**  
205 Wolf Road  
Albany, New York 12205  
(800) 465-4329

Dear Madam or Sir:

Revisions to the subject criteria will be considered by the ICC-ES Evaluation Committee at the hearing noted above.

An applicant has requested a revision to AC77 to include allowance for testing of the smoke containment systems in accordance with UL 10C instead of UL10B. UL10C is a more restrictive test method than UL10B since it requires a positive pressure level in the furnace instead of a neutral pressure level.

The applicant's purpose is to gain recognition for use of a smoke containment system that passes UL 10C as an alternative to the 20-minute fire door assemblies required by Section 707.14.1 of the 2006 *International Building Code*® (IBC), installed in corridor walls or smoke-barrier walls as required in Section 715.4.3 of the IBC. It should be noted that IBC Section 715.4.3.1 also requires that the fire door assembly meet requirements for smoke and draft control by testing in accordance with UL 1784, which is currently included in the scope of AC77 and already required for these systems.

In summary, the addition of UL 10C testing to AC77, in conjunction with the current UL 1784 test requirements, would result in the smoke containment system being recognized as an alternative to the 20-minute fire door assemblies required for use in smoke barriers and elevator lobbies.

Revisions to AC77 were proposed in August under the alternative criteria process, and were approved by the Evaluation Committee. Since the time between the August posting and the draft now being proposed for the October hearing is so short, we have included a copy of the criteria as it was approved after the August posting. Changes in the draft dated October 2008 are indicated by bars in the margins and by ~~strikeout~~/underline text.

You are cordially invited to submit written comments on agenda items, or to attend the Evaluation Committee hearing and present verbal comments. If you wish to contribute to the hearing, please note the following:

1. Written comments that are received by the Los Angeles business/regional office by **October 7, 2008**, will be forwarded to the committee prior to the hearing, and will be posted on the ICC-ES web site shortly after the comment deadline.
2. Written comments received up to ten days before the meeting, and staff memos responding to comments, will be posted to the web site on **October 16, 2008**.
3. ICC-ES is no longer providing printed copies at the meeting of proposed acceptance criteria, staff memos or public comments. These documents will be available on a limited number of CDs at the meeting, for uploading to computers; and ICC-ES will make arrangements with the hotel business center to have hard copies available for photocopying.
4. Written comments that miss the deadline noted in item (1), above, will only be available at the meeting if you provide 35 copies, collated, stapled, and three-hole punched, either at the meeting itself or to the Los Angeles business/regional office by **October 16, 2008**.
5. If you plan to speak for more than 15 minutes, or offer a visual presentation lasting longer, you should notify ICC-ES staff as far as possible in advance. There will be a computer, projector, and screen available at the meeting for anyone wishing to make a visual presentation, and presentations in most cases will need to be in PowerPoint format. Also, ICC-ES will need to be provided with your presentation at least a half-hour before the start of the relevant meeting session (morning or afternoon) on either a CD or a flash card.
6. If you have any special needs related to a presentation, you should contact ICC-ES staff well in advance of the meeting.
7. Any visual aids for viewing at committee meetings (charts, overhead transparencies, slides, videos, electronic presentations, etc.) will be permitted only if a copy is provided to ICC-ES, before the presentation, in a medium that can be retained with other records of the meeting.

8. Any materials submitted for committee consideration are considered nonconfidential and available for public discussion, as noted in Section 2.7 of the ICC-ES Rules of Procedure for the Evaluation Committee.
9. Prior to the meeting, you should refrain from trying to communicate directly with committee members about agenda items, either verbally or in writing. Committee members reserve the right to refuse such communications.

Your cooperation with these guidelines is much appreciated, as is your interest in the deliberations of the Evaluation Committee. If you have any question, please contact the undersigned at (800) 423-6587, extension 3289, or Steven Thorsell, AIA, Director of Projects, at extension 4313. You may also reach us by e-mail at [es@icc-es.org](mailto:es@icc-es.org).

Yours very truly,

A handwritten signature in black ink that reads "Michael Beaton". The signature is written in a cursive style with a large, prominent initial "M".

Michael Beaton, P.E.  
Vice President – Whittier Operations

MB/gh

Enclosures

cc: Evaluation Committee



## ICC EVALUATION SERVICE, INC., RULES OF PROCEDURE FOR THE EVALUATION COMMITTEE

### 1.0 PURPOSE

The purpose of the Evaluation Committee is to monitor the work of ICC-ES, in issuing evaluation reports; to evaluate and approve acceptance criteria on which evaluation reports may be based; and to sponsor related changes in the applicable codes.

### 2.0 MEETINGS

**2.1** The Evaluation Committee shall schedule meetings that are open to the public in discharging its duties under Section 1, subject to Section 3.

**2.2** All scheduled meetings shall be publicly announced.

**2.3** Two-thirds ( $\frac{2}{3}$ ) of the voting Evaluation Committee members shall constitute a quorum. A majority vote of members present is required on any action.

**2.4** In the absence of the nonvoting chairman-moderator, Evaluation Committee members present shall elect an alternate chairman from the committee for that meeting. The alternate chairman shall be counted as a voting committee member for purposes of maintaining a committee quorum and to cast a tie-breaking vote of the committee.

**2.5** Minutes of the meetings shall be kept.

**2.6** An electronic audio record of meetings shall be made by ICC-ES; no other audio, video, electronic or stenographic recordings of the meetings will be permitted. Visual aids (including, but not limited to, charts, overhead transparencies, slides, videos, or presentation software) viewed at meetings shall be permitted only if the presenter provides ICC-ES before presentation with a copy of the visual aid in a medium which can be retained by ICC-ES with its record of the meeting and which can also be provided to interested parties requesting a copy. A copy of the ICC-ES recording of the meeting and such visual aids, if any, will be available to interested parties upon written request made to ICC-ES together with a payment as required by ICC-ES to cover costs of preparation and duplication of the copy. These materials will be available beginning five days after the conclusion of the meeting but will no longer be available after one year from the conclusion of the meeting.

**2.7** Parties interested in the deliberations of the committee should refrain from communicating, whether in writing or verbally, with committee members regarding agenda items. All written communications and submissions regarding agenda items should be delivered to ICC-ES. All such written communications and submissions shall be considered nonconfidential and available for discussion in open session of an Evaluation Committee meeting, and shall be delivered at least ten days before the scheduled Evaluation Committee meeting if they are to be forwarded to the committee. Materials delivered to ICC-ES at least ten

days before the scheduled meeting will be posted on the ICC-ES web site ([www.icc-es.org](http://www.icc-es.org)) prior to the meeting. After this time, parties wishing to submit materials for consideration by the Evaluation Committee must deliver a sufficient number of copies as directed by ICC-ES. Consideration of materials not received by ICC-ES at least ten days before the meeting is at the discretion of the Evaluation Committee. Following the meeting, ICC-ES will make all materials considered by the Evaluation Committee available on the web site for a maximum period of one year following the meeting. The committee reserves the right to refuse recognition of communications which do not comply with the provisions of this section.

### 3.0 CLOSED SESSIONS

Evaluation Committee meetings shall be open except that the chairman may call for a closed session to seek advice of counsel.

### 4.0 ACCEPTANCE CRITERIA

**4.1** Acceptance criteria are established by the committee to provide a basis for issuing ICC-ES evaluation reports on products and systems under codes referenced in Section 2.0 of the Rules of Procedure for Evaluation Reports. They also clarify conditions of acceptance for products and systems specifically regulated by the codes.

Acceptance criteria may involve a product, material, method of construction, or service. Consideration of any acceptance criteria must be in conjunction with a current and valid application for an ICC-ES evaluation report, an existing ICC-ES evaluation report, or as otherwise determined by the Evaluation Committee.

#### 4.2 Procedure:

**4.2.1** Proposed acceptance criteria shall be developed by the ICC-ES staff and discussed in open session with the Evaluation Committee during a scheduled meeting, except as permitted in Section 5.0 of these rules.

**4.2.2** Proposed acceptance criteria shall be available to interested parties at least 30 days before discussion at the committee meeting.

**4.2.3** The committee shall be informed of all pertinent written communications received by ICC-ES.

**4.2.4** Attendees at Evaluation Committee meetings shall have the opportunity to speak on acceptance criteria listed on the meeting agenda, to provide information to committee members.

**4.3** Approval of acceptance criteria shall be as specified in Section 2.3 of these rules.

**4.4** Actions of the Evaluation Committee may be

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appealed in accordance with the ICC-ES Rules of Procedure for Appeal of Acceptance Criteria or the ICC-ES Rules of Procedure for Appeals of Evaluation Committee Technical Decisions.

**5.0 COMMITTEE BALLOTING FOR ACCEPTANCE CRITERIA**

**5.1** Acceptance criteria may be issued without a public hearing following a 30-day public comment period and a majority vote for approval by the Evaluation Committee when, in the opinion of ICC-ES staff, one or more of the following conditions have been met:

1. The subject is nonstructural, does not involve life safety, and is addressed in nationally recognized standards or generally accepted industry standards.
2. The subject is a revision to an existing acceptance criteria that requires a formal action by the Evaluation Committee, and public comments raised were resolved by staff with commenters fully informed.
3. Other acceptance criteria and/or the code provide precedence for the revised criteria.

**5.2** Negative votes must be based upon one or more of the following, for the ballots to be considered valid and require resolution:

- a. *Lack of clarity:* There is insufficient explanation of the scope of the acceptance criteria or insufficient description of the intended use of the product or system; or the acceptance criteria is so unclear as to be unacceptable. (The areas where greater clarity is required must be specifically identified.)
- b. *Insufficiency:* The criteria is insufficient for proper evaluation of the product or system. (The provisions of the criteria that are in question must be specifically identified.)
- c. *The subject of the acceptance criteria is not within the scope of the applicable codes:* A report issued by ICC-ES is intended to provide a basis for approval under the codes. If the subject of the acceptance criteria is not regulated by the codes, there is no basis for issuing a report, or a criteria. (Specifics must be provided concerning the inapplicability of the code.)

d. *The subject of the acceptance criteria needs to be discussed in a public hearings.* The committee member requests additional input from other committee members, staff or industry.

**5.3** An Evaluation Committee member, in voting on an acceptance criteria, may only cast the following ballots:

- Approved
- Approved with Comments
- Negative: Do Not Proceed

**6.0 COMMITTEE COMMUNICATION**

Direct communication between committee members, and between committee members and an applicant or concerned party, with regard to the processing of a particular acceptance criteria or evaluation report shall take place only in a public hearing of the Evaluation Committee. Accordingly:

**6.1** Committee members receiving an electronic ballot should respond only to the sender (staff). Committee members who wish to discuss a particular matter with other committee members, before reaching a decision, should ballot accordingly and bring the matter to the attention of ICC-ES staff, so the issue can be placed on the agenda of a future committee meeting.

**6.2** Committee members who are contacted by an applicant or concerned party on a particular matter that will be brought to the committee will refrain from private communication and will encourage the applicant or concerned party to forward their concerns through the ICC-ES staff in writing, and/or make their concerns known by addressing the committee at a public hearing, so that their concerns can receive the attention of all committee members. ■

***Effective March 18, 2008***



## ACCEPTANCE CRITERIA FOR SMOKE-CONTAINMENT SYSTEMS USED WITH FIRE-RESISTANCE-RATED ELEVATOR HOISTWAY DOORS AND FRAMES

AC77

Approved September 2008

Previously approved October 2007, October 2003, January 2001, September 1992

### PREFACE

Evaluation reports issued by ICC Evaluation Service, Inc. (ICC-ES), are based upon performance features of the International family of codes and other widely adopted code families, including the Uniform Codes, the BOCA National Codes, and the SBCCI Standard Codes. Section 104.11 of the *International Building Code*® reads as follows:

The provisions of this code are not intended to prevent the installation of any materials or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

Similar provisions are contained in the Uniform Codes, the National Codes, and the Standard Codes.

This acceptance criteria has been issued to provide all interested parties with guidelines for demonstrating compliance with performance features of the applicable code(s) referenced in the acceptance criteria. The criteria was developed and adopted following public hearings conducted by the ICC-ES Evaluation Committee, and is effective on the date shown above. All reports issued or reissued on or after the effective date must comply with this criteria, while reports issued prior to this date may be in compliance with this criteria or with the previous edition. If the criteria is an updated version from the previous edition, a solid vertical line (|) in the margin within the criteria indicates a technical change, addition, or deletion from the previous edition. A deletion indicator (→) is provided in the margin where a paragraph has been deleted if the deletion involved a technical change. This criteria may be further revised as the need dictates.

ICC-ES may consider alternate criteria, provided the report applicant submits valid data demonstrating that the alternate criteria are at least equivalent to the criteria set forth in this document, and otherwise demonstrate compliance with the performance features of the codes. Notwithstanding that a product, material, or type or method of construction meets the requirements of the criteria set forth in this document, or that it can be demonstrated that valid alternate criteria are equivalent to the criteria in this document and otherwise demonstrate compliance with the performance features of the codes, ICC-ES retains the right to refuse to issue or renew an evaluation report, if the product, material, or type or method of construction is such that either unusual care with its installation or use must be exercised for satisfactory performance, or if malfunctioning is apt to cause unreasonable property damage or personal injury or sickness relative to the benefits to be achieved by the use of the product, material, or type or method of construction.

**Acceptance criteria are developed for use solely by ICC-ES for purpose of issuing ICC-ES evaluation reports.**

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# ACCEPTANCE CRITERIA FOR SMOKE-CONTAINMENT SYSTEMS USED WITH FIRE-RESISTANCE-RATED ELEVATOR HOISTWAY DOORS AND FRAMES (AC77)

## 1.0 INTRODUCTION

**1.1 Purpose:** The purpose of this criteria is to establish the basis for recognition in ICC Evaluation Service, Inc. (ICC-ES), evaluation reports of smoke-containment systems as tight-fitting, smoke and draft control assemblies under Section 715.4.3 of the 2006 *International Building Code*<sup>®</sup> (IBC), Section 1004.3.4.3.2.1 of the 1997 *Uniform Building Code*<sup>™</sup> (UBC), or Section 705.1.3.2 of the 1999 *Standard Building Code*<sup>®</sup> (SBC). The reason for this criteria is the absence of referenced standards within the IBC upon which to determine code compliance, therefore this subject is an alternative material to what is prescribed in the codes. Bases of recognition are IBC Section 104.11.

**1.2 Scope:** The systems are used with fire-resistance-rated elevator hoistway doors and frames or as smoke curtain systems installed remotely from the hoistway door at the intersection of the elevator lobby and corridor. Use of either type of system would permit deletion of the separated elevator lobby required under IBC Section 707.14.1, UBC Section 1004.3.4.5, or SBC Section 412.6.1. Recognition under the SBC is applicable to Group B and R high-rise buildings.

Smoke-protected elevator lobbies are not specifically required by the BOCA<sup>®</sup> *National Building Code*/1999 (BNBC). However, where smoke-protected elevator lobbies are proposed to be provided as part of a building design, the smoke-containment system described in the ICC-ES evaluation report is permitted under the BNBC, when installation is in accordance with the evaluation report.

**1.3 Reference Standards:** Where standards are referenced in this criteria, these standards shall be applied consistently with the code (IBC, UBC or SBC) upon which compliance is based. Standard editions applicable to each code are summarized in Table 1.

**1.3.1** 2006 *International Building Code*<sup>®</sup>, International Code Council.

**1.3.2** 1997 *Uniform Building Code*<sup>™</sup>.

**1.3.3** 1999 *Standard Building Code*<sup>®</sup>.

**1.3.4** BOCA<sup>®</sup> *National Building Code*/1999.

**1.3.5** ASTM D 412, Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers—Tension, ASTM International.

**1.3.6** ASTM D 1434, Determining Gas Permeability Characteristics of Plastic Film and Sheeting, ASTM International.

**1.3.7** ASTM D 1876, Peel Resistance of Adhesives (T-Peel Test), ASTM International.

**1.3.8** ASTM E 84, Surface Burning Characteristics of Building Materials, ASTM International.

**1.3.9** UL 10B, Fire Tests of Door Assemblies,

Underwriters Laboratories Inc.

**1.3.10** UL 1784, Air Leakage Tests of Door Assemblies, Underwriters Laboratories Inc.

**1.3.11** UL 228, Door Closers With and Without Integral Smoke Detectors, Underwriters Laboratories Inc.

**1.3.12** UL 268, Smoke Detectors for Fire Alarm Signaling Systems, Underwriters Laboratories Inc.

**1.3.13** UL 864, Standards for Control Units and Accessories for Fire Alarm Signaling Systems, Underwriters Laboratories Inc.

**1.3.14** NFPA 105, Installation of Smoke-Control Door Assemblies, National Fire Protection Association.

**1.3.15** NFPA 258, Determining Smoke Generation of Solid Materials, National Fire Protection Association.

**1.3.16** NFPA 70, National Electrical Code, National Fire Protection Association.

## 2.0 BASIC INFORMATION

**2.1 General:** The following information shall be submitted:

**2.1.1** General information on the manufacturing process.

**2.1.2** Dimensioned drawings and details noting size, component material types and materials, configuration and installation instructions.

**2.1.3** Method of field adjustment.

**2.1.4** Inspection and maintenance schedule.

**2.1.5** Maximum temperature exposure necessitating replacement.

**2.1.6** Installation instructions and details. The instructions shall address the need to field test the system for proper operation after installation.

**2.2 Product Identification:** Each smoke-containment system shall be identified as follows:

**2.2.1** The manufacturer's or private labeler's name.

**2.2.2** Reference to installation instructions.

**2.2.3** Maximum leakage rating at the specified pressure and temperature conditions (cfm/square foot of door opening).

**Exception:** Where information specified in Section 2.2.3 is in installation instructions attached to, or packaged with, the product, the above information need not be on the smoke-containment system.

**2.2.4** Type of door assembly for which smoke-containment system is intended.

**Exception:** If each product includes the information specified in Section 2.2.4 with installation instructions that

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are attached to, or packaged with, the product, the information need not be on the smoke-containment system.

**2.2.5** If a product is manufactured at several locations, each piece shall be distinctively marked to identify origin.

**2.2.6** Label of the approved inspection agency.

**2.2.7** Evaluation report number.

**2.3 Testing Laboratories, Test Reports and Product Sampling:**

**2.3.1 Testing Laboratories:** Testing laboratories shall comply with Section 2.0 of the ICC-ES Acceptance Criteria for Test Reports (AC85), and Section 4.2 of the ICC-ES Rules of Procedure for Evaluation Reports.

**2.3.2 Test Reports:** Test reports shall comply with AC85.

**2.3.3 Product Sampling:** Sampling of the smoke-containment system components for tests under this criteria shall comply with Section 3.1 of AC85.

**3.0 TEST AND PERFORMANCE REQUIREMENTS**

**3.1 Materials:** The smoke-containment system shall comply with the requirements of either Section 3.1.1, 3.1.2, 3.1.3 or 3.1.4:

**3.1.1** The smoke-containment film shall be a minimum 1-mil-thick [0.001 inch (0.025 mm)] transparent polyamide meeting the following requirements:

**3.1.1.1** The film shall be reinforced with 100 denier nomex yarn spaced  $\frac{1}{4}$  inch (6.4 mm) each way. The reinforcing fill yarn shall be attached to the film and overlap the unadhered reinforcing warp yarn. The bond between the yarn and the film shall be at least 2 pounds per inch (0.35 N/mm) when tested according to ASTM D 1876.

**3.1.1.2** The film shall be connected along its length to a  $2\frac{1}{2}$ -inch-wide-by-0.125-inch-thick (63.5 mm by 3.2 mm) PM14 multi-pole flexible magnet of energized ferrite in a nitrile rubber binder exerting minimum 1.4 MGOe of force. The multipoles shall be oriented along the length, perpendicular to the magnet width.

**3.1.1.3** The film and magnets shall be connected with a 0.5-inch-wide-by-0.125-inch-thick (12.7 mm by 3.2 mm) continuous joint of low-modulus silicone.

**3.1.1.4** The smoke-containment film shall have a flame-spread index of 25 or less and a smoke-developed rating of 50 or less when tested in accordance with ASTM E 84 (IBC and SBC) or UBC Standard 8-1 (UBC).

**3.1.1.5** The film shall maintain its physical properties after exposure to accelerated aging and certain chemicals. The test methods shall be approved by ICC-ES before the tests are conducted.

**3.1.1.6** The smoke-containment system shall be tested and comply with the requirements set forth in Sections 3.2, 3.3, 3.4.1 and 3.5 through 3.8.

**3.1.2** The smoke-containment curtain shall be a minimum 2.5-mil-thick [0.0025 inch (0.64 mm)] silica cloth curtain coated with urethane-based resin on one side and complying with the following requirements:

**3.1.2.1** The curtain shall be comprised of silica fabric panels stitched together horizontally with twisted stainless steel threads. The stitched seams shall be able to withstand a minimum pressure of 3.1 pounds per square foot (150 Pa).

**3.1.2.2** The curtain shall have a flame-spread index of 25 or less and a smoke-developed rating of 50 or less when tested in accordance with ASTM E 84 (IBC and SBC) or UBC Standard 8-1 (UBC).

**3.1.2.3** The curtain shall be attached to a horizontal steel winding shaft at the top and set in a frame assembly consisting of a horizontal steel bottom bar assembly and vertical steel guide rails that capture the edge of the curtain. Steel mounting plates attached at the tops of the guide rails support the winding shaft and provide a structure for the attachment of a sheet metal hood. A woven glass-fiber cloth smoke seal is provided on both sides of the head. Secondary components of the assembly include steel locking bolts at the edge of the curtain to retain it in the guides, steel bracket anchors and steel guide rail anchors.

**3.1.2.4** The smoke-containment system shall be tested and comply with the requirements set forth in Sections 3.2, 3.4.2 and 3.6 through 3.9.

**3.1.3** The smoke curtain system shall consist of a smoke-containment film that is a minimum 3-mil-thick [0.003 inch (0.076 mm)] PTFE-coated glass-fiber or para-aramid meeting the following requirements:

**3.1.3.1** The film shall consist of separate PTFE-coated glass-fiber or para-aramid sheets, joined horizontally by heat sealing.

**3.1.3.2** The smoke-containment film shall be connected to the drive system utilizing vertical edge containment loops on either side of the curtain. The loops slide over vertical guide rods contained within the side rails. A narrow vertical slot in each side rail prevents the screen/guide rod assembly from disengaging the side rail.

**3.1.3.3** The side rails attach from floor to ceiling on both sides of the opening to be protected. The top portion of the rails also attach to the units housing for the purpose of aligning drive components.

**3.1.3.4** The curtain is mechanically operated up and down by an electric drive motor that turns a bearing supported axle running the length of the housing, and pulleys engaging toothed drive belts and contained within the side rails adjacent to the screen guide rods. The toothed drive belt and pulleys at the end of the axle actuate loops in the drive belt. When the belt is activated, the bottom bar of the smoke curtain lowers from the housing as a screen roller tube feeds out the smoke curtain.

**3.1.3.5** An egress switch that complies with ANSI A 117.1 for operation of a powered door shall be located on both sides of the smoke curtain.

**3.1.3.6** The smoke-containment film shall have a flame-spread index of 25 or less and a smoke-developed rating of 50 or less when tested in accordance with ASTM E 84 (IBC and SBC) or UBC Standard 8-1 (UBC).

**3.1.3.7** The smoke-containment system shall be tested and comply with the requirements set forth in Sections 3.2, 3.4.1 and 3.5 through 3.8.

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**3.1.4** The smoke containment curtain shall be a minimum 2.5-mil-thick [0.0025 inch (0.65 mm)] silica cloth, coated on one side with acrylic resin and complying with the following requirements:

**3.1.4.1** The curtain shall be comprised of silica cloth panels stitched together vertically with twisted stainless steel threads. The acrylic resin coating shall be applied to the corridor side of the curtain and shall have a minimum coverage of 2.36 ounces per square foot (80 g/m<sup>2</sup>). The stitched seams shall be able to withstand a minimum pressure of 3.1 pounds per square foot (150 Pa).

**3.1.4.2** The curtain material shall be connected along its length to a 3<sup>1</sup>/<sub>2</sub>-inch-wide-by-0.124-inch-thick (83 mm by 3.2 mm) multi-pole magnet of energized ferrite in an nitrile rubber binder exerting a minimum 1.4 MGOe force. The multipoles shall be oriented along the length perpendicular to the magnet width.

**3.1.4.3** The curtain material shall completely cover the magnets and shall be joined by stitching (2X) along the full length of the magnet.

**3.1.4.4** Between the magnet and the curtain material a 4<sup>3</sup>/<sub>4</sub>-inch-wide-by-5<sup>5</sup>/<sub>64</sub>-inch-thick heat expansion material consisting of intumescent graphite encapsulated in a butyl rubber sheet shall be enclosed along the full length of the magnet. The edges of the magnet shall be protected by 3<sup>3</sup>/<sub>4</sub>-inch-wide-by-5<sup>5</sup>/<sub>64</sub>-inch-thick (20 mm x 2 mm) of the same material. The heat expansion material shall have the capability of expanding a minimum of 10 times the original material thickness.

**3.1.4.5** At variable positions along the magnet length bi-metallic shape memory alloy strips consisting of Nickel – titanium and measuring 2<sup>3</sup>/<sub>4</sub>-inch-wide-by-3<sup>3</sup>/<sub>16</sub>-inch-high-by-1<sup>1</sup>/<sub>64</sub>-inch-thick (70mm by 5mm by 0.5mm) shall be riveted horizontally on the elevator side of the curtain. The bi-metallic strips shall activate at a maximum temperature of 212°F (100 °C). When heated, the bi-metallic strips shall expand differentially into a concave shape and grasp specially shaped auxiliary rails after which the intumescent material expands to protect the magnet and bimetallic strips.

**3.1.4.6** The curtain shall have a flame spread index of 25 or less and a smoke-developed index of 50 or less when tested in accordance with ASTM E 84 (IBC or SBC) or UBC Standard 8-1 (UBC).

**3.1.4.7** The smoke containment system shall be tested and comply with the requirements set forth in Sections 3.2, 3.4.1 (excluding Sections 3.4.1.6.1.3 through 3.4.1.6.1.6) and 3.6 through 3.9.

**3.2 Air Leakage:** The rate of air leakage through the smoke-containment system shall be determined at 0.1 inch (25 Pa), 0.2 inch (50 Pa) and 0.3 inch (75 Pa) water pressure differential when tested to the performance requirements of UL 1784 (IBC and SBC) or UBC Standard 7-2, Part II (UBC). Tests include cycling and air leakage at ambient and elevated [400°F (204°C)] temperatures.

**Conditions of Acceptance:** The air leakage rating at both ambient and elevated [400°F (204°C)] temperatures shall not exceed 3.0 cfm (14.16 × 10<sup>-4</sup>) per square foot of opening at 0.1 inch water pressure (25 Pa) difference.

**3.3 Expansion Characteristics:** The total expansion of

the smoke-containment system shall be determined at 0.3 inch water pressure (75 Pa) differential at both ambient and elevated [400°F (204°C)] temperatures.

**Conditions of Acceptance:** The smoke-containment system cannot expand more than 6 inches (152 mm) at this pressure difference at ambient or elevated [400°F (204°C)] temperatures.

**3.4 Cycling:** The smoke-containment system shall be cycled according to one of the following methods.

**3.4.1 Standard Test Method for Cyclic Movement of Rolling Magnetic Gasket Systems:**

**3.4.1.1 Purpose:** To determine the cyclic movement of the rolling magnetic gasket system.

**3.4.1.1.1** This test method is applicable to rolling magnetic gasket systems used to prevent the infiltration of air and smoke through an entrance or exit way.

**3.4.1.2 Apparatus:**

**3.4.1.2.1** Any arrangement of equipment capable of performing the test procedure within the allowable tolerances is permitted.

**3.4.1.2.2 Mounting Frames:** No. 14 gage ferrous metal frames shall have a 2-inch-wide (51 mm) profile. Frame shall be blind attached to the wall.

**3.4.1.3 Test Specimens:** Three full size samples shall be used. The temperatures within the laboratory shall be 73.4°F ± 3.6°F (23°C ± 2°C).

**3.4.1.4 Mounting:** The system is mounted above test frame according to the manufacturer's written installation instructions. The resulting installation shall be plumb and square.

**3.4.1.5 Procedure:** Emergency alarm contacts are first energized, allowing the curtain to drop, completely covering the opening. The rewind contacts are next energized, allowing the curtain to roll into container, completely unseating the gasket material.

The door is closed. The curtain is visually inspected after each set of 50 full cycles. The container and frame are visually inspected after each set of 100 full cycles.

**3.4.1.6 Visual Inspection:**

**3.4.1.6.1** Immediately following each set of 50 full cycles, the curtain is visually inspected for the following signs of fatigue:

**3.4.1.6.1.1** Visual metal fatigue.

**3.4.1.6.1.2** Cracks or creases in film.

**3.4.1.6.1.3** Loss of reinforcing yarn adhesion.

**3.4.1.6.1.4** Loss of sealant joint adhesion.

**3.4.1.6.1.5** Stretching of sealant joint.

**3.4.1.6.1.6** Loss of laminating adhesive.

**3.4.1.6.1.7** Misalignment of curtain reel at threshold.

**3.4.1.6.1.8** Misaligned rolling relative to the test frame.

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**3.4.1.6.2** Immediately following each set of 100 full cycles, the curtain is visually inspected for the following signs of fatigue:

**3.4.1.6.2.1** Visual metal fatigue.

**3.4.1.6.2.2** Warpage of door.

**3.4.1.6.2.3** Visual damage to hinge, latch or door stay.

**3.4.1.6.3** Immediately following each set of 100 full cycles, the test frame is visually inspected for visual wear.

**3.4.1.7 Conditions of Acceptance:** The smoke-containment system shall demonstrate no fatigue after completing 100 cycles. The system shall continue to function without impairment.

**3.4.2 Standard Test Method for Cyclic Movement of Coiling Curtain Systems:**

**3.4.2.1 Purpose:** To determine the cyclic movement of the coiling curtain system.

**3.4.2.1.1** This test method is applicable to coiling curtain systems described in Section 3.1.2 used to prevent the infiltration of air and smoke through an entrance or exit.

**3.4.2.2 Apparatus:**

**3.4.2.2.1** Any arrangement of equipment capable of performing the test procedure within the allowable tolerances is permitted.

**3.4.2.2.2 Guide Rails:** Minimum No. 16 gage steel plate, of the manufacturer's standard profile and size. Frame shall be attached to the wall in accordance with the manufacturer's standard installation instructions.

**3.4.2.3 Test Specimens:** Three full-size samples shall be used. The temperature within the laboratory shall be 73.4°F ± 3.6°F (23°C ± 2°C).

**3.4.2.4 Mounting:** The system is mounted above the test frame according to the manufacturer's written installation instructions. The resulting installation shall be plumb and square.

**3.4.2.5 Procedure:** Emergency alarm contacts are first energized, allowing the curtain to drop, completely covering the opening. The alarm contacts are de-energized and the release mechanism is reset and the curtain is rolled back into the initial open position.

The door is closed. The curtain is visually inspected after each set of 50 full cycles. The container and frame are visually inspected after each set of 100 full cycles.

**3.4.2.6 Visual Inspection:**

**3.4.2.6.1** Immediately following each set of 50 full cycles, the curtain is visually inspected for the following signs of fatigue:

**3.4.2.6.1.1** Cracks or creases in the fabric.

**3.4.2.6.1.2** Curtain edge retention in the vertical guiderails.

**3.4.2.6.1.3** Misalignment of the bottom bar at threshold.

**3.4.2.6.1.4** Misaligned rolling relative to the test frame.

**3.4.2.6.2** Immediately following each set of 100 full cycles, the curtain is visually inspected for the following signs of fatigue:

**3.4.2.6.2.1** Cracks or creases in the fabric.

**3.4.2.6.2.2** Warpage of curtain or frame.

**3.4.2.6.2.3** Visual damage to entire assembly.

**3.4.2.6.3** Immediately following each set of 100 full cycles, the test frame is visually inspected for visual wear.

**3.4.2.7 Conditions of Acceptance:** The smoke-containment system shall demonstrate no fatigue after completing 100 cycles. The system shall continue to function without impairment.

**3.4.3 Standard Test Method for Cyclic Movement of Smoke Curtain Systems:**

**3.4.3.1 Purpose:** To determine the cyclic movement of the smoke-containment system.

**3.4.3.1.1** This test method is applicable to smoke-containment systems described in Section 3.1.3 used to prevent the infiltration of air and smoke through an entrance or exit.

**3.4.3.2 Apparatus:**

**3.4.3.2.1** Any arrangement of equipment capable of performing the test procedure within the allowable tolerances is permitted.

**3.4.3.2.2 Mounting Frames:** For systems described in Section 3.1.1, the frame shall consist of No. 14 gage ferrous metal frames having a 2-inch-wide (51 mm) profile. The frame shall be blind-attached to the wall. For the systems described in Sections 3.1.2 and 3.1.3, the system shall be mounted in accordance with the system manufacturer's instructions.

**3.4.3.3 Test Specimens:** Three full-size samples shall be used. The temperature within the laboratory shall be 73.4°F ± 3.6°F (23°C ± 2°C).

**3.4.3.4 Mounting:** The system is mounted above the test frame according to the manufacturer's written installation instructions. The resulting installation shall be plumb and square.

**3.4.3.5 Procedure:** Emergency alarm contacts are first energized, allowing the curtain to drop, completely covering the opening. The rewind contacts are next energized, allowing the curtain to roll into container, completely unseating the gasket material.

The curtain is visually inspected, with the curtain in the closed position, after each set of 50 full cycles. The container and frame are visually inspected after each set of 100 full cycles.

**3.4.3.6 Visual Inspection:**

**3.4.3.6.1** Immediately following each set of 50 full cycles, the curtain is visually inspected for the following signs of fatigue:

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**3.4.3.6.1.1** Visual metal fatigue.

**3.4.3.6.1.2** Cracks or creases in film.

**3.4.3.6.1.3** Loss of fabric adhesion.

**3.4.3.6.1.4** Misalignment of curtain reel at threshold.

**3.4.3.6.1.5** Misaligned rolling relative to the test frame.

**3.4.3.6.2** Immediately following each set of 100 full cycles, the curtain is visually inspected for the following signs of fatigue:

**3.4.3.6.2.1** Visual metal fatigue.

**3.4.3.6.2.2** Warpage of door.

**3.4.3.6.2.3** Visual damage to operable components.

**3.4.3.6.3** Immediately following each set of 100 full cycles, the test frame is visually inspected for visual wear.

**3.4.3.7 Conditions of Acceptance:** The smoke-containment system shall demonstrate no fatigue after completing 100 cycles. The system shall continue to function without impairment.

**3.5 Motor:** The motor shall be evaluated and listed as required by NFPA70, the National Electrical Code.

**3.6 Release Mechanisms:** Components of release mechanisms shall be recognized by an independent testing

agency accredited by the International Accreditation Service, Inc. (IAS). For the system described in Section 3.1.3, the integral battery backup system that is part of the releasing drive shall be tested and listed to UL 864.

**3.7 Smoke Detector:** The smoke detector to which the smoke-containment system is connected shall be tested and listed according to UL 228 or UL 268.

**3.8 Opening Force:** The maximum force to disengage the gasketing system described in Section 3.1.1 is 15 lbf (67 N), and shall be verified by using a spring scale applied perpendicular to the plane of the film at the boundary. The maximum force to lift the curtain described in Section 3.1.2 is 15 lbf (67 N), and shall be verified by using a spring scale applied perpendicular to lower horizontal edge of the curtain assembly.

**3.9 Fire Test:** The smoke-containment system shall have a minimum 20-minute rating without hose stream when tested in accordance with UL 10B and IBC Section 715.4.2.

**4.0 QUALITY CONTROL**

**4.1** The products shall be manufactured under an approved quality control program with inspections by an inspection agency accredited by International Accreditation Service.

**4.2** Quality documentation complying with the ICC-ES Acceptance Criteria for Quality Documentation (AC10) shall be submitted. ■

**TABLE 1—CROSS REFERENCE OF STANDARD EDITIONS**

<b>STANDARD</b>	<b>1997 UNIFORM BUILDING CODE™</b>	<b>2006 INTERNATIONAL BUILDING CODE®</b>	<b>1999 STANDARD BUILDING CODE®</b>
ASTM D 412	1988	1988	1988
ASTM D 1434	1988	1988	1988
ASTM D 1876	1983	1983	1983
ASTM E 84	UBC Standard 8-1	2004	1995
NFPA 70	1996	2005	1996
NFPA 105	1989	2003	1989
NFPA 228	1986	1986	1986
NFPA 258	1987	1987	1987
UL 10B	UBC Standard 7-2, Part I	1997 with revisions through October 2001	N/A
UL 228	1986	1986	1986
UL 268	N/A	1996 with revisions through January 1999	1989
UL 864	N/A	2003 with revisions through October 2003	N/A
UL 1784	UBC Standard 7-2, Part II	1995	1995



# PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR SMOKE-CONTAINMENT SYSTEMS USED WITH FIRE-RESISTANCE-RATED ELEVATOR HOISTWAY DOORS AND FRAMES

AC77

Proposed September 2008

Previously approved September 2008, October 2007,  
October 2003, January 2001, September 1992

## PREFACE

Evaluation reports issued by ICC Evaluation Service, Inc. (ICC-ES), are based upon performance features of the International family of codes and other widely adopted code families, including the Uniform Codes, the BOCA National Codes, and the SBCCI Standard Codes. Section 104.11 of the *International Building Code*® reads as follows:

The provisions of this code are not intended to prevent the installation of any materials or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

Similar provisions are contained in the Uniform Codes, the National Codes, and the Standard Codes.

ICC-ES may consider alternate criteria, provided the report applicant submits valid data demonstrating that the alternate criteria are at least equivalent to the criteria proposed in this document, and otherwise meet the applicable performance requirements of the codes. Notwithstanding that a product, material, or type or method of construction meets the requirements of the criteria proposed in this document, or that it can be demonstrated that valid alternate criteria are equivalent to the criteria in this document and otherwise meet the applicable performance requirements of the codes, ICC-ES retains the right to refuse to issue or renew an evaluation report, if the product, material, or type or method of construction is such that either unusual care with its installation or use must be exercised for satisfactory performance, or malfunctioning is apt to cause unreasonable property damage or personal injury or sickness relative to the benefits to be achieved by the use of the product, material, or type or method of construction.

*Acceptance criteria are developed for use solely by ICC-ES for purpose of issuing ICC-ES evaluation reports.*

# PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR SMOKE-CONTAINMENT SYSTEMS USED WITH FIRE-RESISTANCE-RATED ELEVATOR HOISTWAY DOORS AND FRAMES (AC77)

## 1.0 INTRODUCTION

**1.1 Purpose:** The purpose of this criteria is to establish the basis for recognition in ICC Evaluation Service, Inc. (ICC-ES), evaluation reports of smoke-containment systems as tight-fitting, smoke and draft control assemblies under Section 715.4.3 of the 2006 *International Building Code*<sup>®</sup> (IBC), Section 1004.3.4.3.2.1 of the 1997 *Uniform Building Code*<sup>™</sup> (UBC), or Section 705.1.3.2 of the 1999 *Standard Building Code*<sup>®</sup> (SBC). The reason for this criteria is the absence of referenced standards within the IBC upon which to determine code compliance, therefore this subject is an alternative material to what is prescribed in the codes. Bases of recognition are IBC Section 104.11.

**1.2 Scope:** The systems are used with fire-resistance-rated elevator hoistway doors and frames or as smoke curtain systems installed remotely from the hoistway door at the intersection of the elevator lobby and corridor. Use of either type of system would permit deletion of the separated elevator lobby required under IBC Section 707.14.1, UBC Section 1004.3.4.5, or SBC Section 412.6.1. Recognition under the SBC is applicable to Group B and R high-rise buildings.

Smoke-protected elevator lobbies are not specifically required by the BOCA<sup>®</sup> *National Building Code*/1999 (NBBC). However, where smoke-protected elevator lobbies are proposed to be provided as part of a building design, the smoke-containment system described in the ICC-ES evaluation report is permitted under the NBBC, when installation is in accordance with the evaluation report.

System tested in accordance with UL 10C (see exception to Section 3.9) are recognized for use as an alternative to a 20-minute fire door assembly complying with the requirements of IBC Sections 715.4.3 and 715.4.3.1.

**1.3 Reference Standards:** Where standards are referenced in this criteria, these standards shall be applied consistently with the code (IBC, UBC or SBC) upon which compliance is based. Standard editions applicable to each code are summarized in Table 1.

**1.3.1** 2006 *International Building Code*<sup>®</sup>, International Code Council.

**1.3.2** 1997 *Uniform Building Code*<sup>™</sup>.

**1.3.3** 1999 *Standard Building Code*<sup>®</sup>.

**1.3.4** BOCA<sup>®</sup> *National Building Code*/1999.

**1.3.5** ASTM D 412, Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers—Tension, ASTM International.

**1.3.6** ASTM D 1434, Determining Gas Permeability Characteristics of Plastic Film and Sheeting, ASTM International.

**1.3.7** ASTM D 1876, Peel Resistance of Adhesives (T-Peel Test), ASTM International.

**1.3.8** ASTM E 84, Surface Burning Characteristics of Building Materials, ASTM International.

**1.3.9** UL 10B, Fire Tests of Door Assemblies, Underwriters Laboratories Inc.

**1.3.10** UL 10C, Standard for Positive Pressure Fire Tests of Door Assemblies, Underwriters Laboratories inc.

**1.3.11** UL 1784, Air Leakage Tests of Door Assemblies, Underwriters Laboratories Inc.

**1.3.12** UL 228, Door Closers With and Without Integral Smoke Detectors, Underwriters Laboratories Inc.

**1.3.13** UL 268, Smoke Detectors for Fire Alarm Signaling Systems, Underwriters Laboratories Inc.

**1.3.14** UL 864, Standards for Control Units and Accessories for Fire Alarm Signaling Systems, Underwriters Laboratories Inc.

**1.3.15** NFPA 105, Installation of Smoke-Control Door Assemblies, National Fire Protection Association.

**1.3.16** NFPA 258, Determining Smoke Generation of Solid Materials, National Fire Protection Association.

**1.3.17** NFPA 70, National Electrical Code, National Fire Protection Association.

## 2.0 BASIC INFORMATION

**2.1 General:** The following information shall be submitted:

**2.1.1** General information on the manufacturing process.

**2.1.2** Dimensioned drawings and details noting size, component material types and materials, configuration and installation instructions.

**2.1.3** Method of field adjustment.

**2.1.4** Inspection and maintenance schedule.

**2.1.5** Maximum temperature exposure necessitating replacement.

**2.1.6** Installation instructions and details. The instructions shall address the need to field test the system for proper operation after installation.

**2.2 Product Identification:** Each smoke-containment system shall be identified as follows:

**2.2.1** The manufacturer's or private labeler's name.

**2.2.2** Reference to installation instructions.

**2.2.3** Maximum leakage rating at the specified pressure and temperature conditions (cfm/square foot of door opening).

**Exception:** Where information specified in Section 2.2.3 is in installation instructions attached to, or packaged with, the product, the above information need not be on the smoke-containment system.

**2.2.4** Type of door assembly for which smoke-containment system is intended.

**Exception:** If each product includes the information

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specified in Section 2.2.4 with installation instructions that are attached to, or packaged with, the product, the information need not be on the smoke-containment system.

**2.2.5** If a product is manufactured at several locations, each piece shall be distinctively marked to identify origin.

**2.2.6** Label of the approved inspection agency.

**2.2.7** Evaluation report number.

**2.3 Testing Laboratories, Test Reports and Product Sampling:**

**2.3.1 Testing Laboratories:** Testing laboratories shall comply with Section 2.0 of the ICC-ES Acceptance Criteria for Test Reports (AC85), and Section 4.2 of the ICC-ES Rules of Procedure for Evaluation Reports.

**2.3.2 Test Reports:** Test reports shall comply with AC85.

**2.3.3 Product Sampling:** Sampling of the smoke-containment system components for tests under this criteria shall comply with Section 3.1 of AC85.

**3.0 TEST AND PERFORMANCE REQUIREMENTS**

**3.1 Materials:** The smoke-containment system shall comply with the requirements of either Section 3.1.1, 3.1.2, 3.1.3 or 3.1.4:

**3.1.1** The smoke-containment film shall be a minimum 1-mil-thick [0.001 inch (0.025 mm)] transparent polyamide meeting the following requirements:

**3.1.1.1** The film shall be reinforced with 100 denier nomex yarn spaced 1/4 inch (6.4 mm) each way. The reinforcing fill yarn shall be attached to the film and overlap the unadhered reinforcing warp yarn. The bond between the yarn and the film shall be at least 2 pounds per inch (0.35 N/mm) when tested according to ASTM D 1876.

**3.1.1.2** The film shall be connected along its length to a 2 1/2-inch-wide-by-0.125-inch-thick (63.5 mm by 3.2 mm) PM14 multi-pole flexible magnet of energized ferrite in a nitrile rubber binder exerting minimum 1.4 MGOe of force. The multipoles shall be oriented along the length, perpendicular to the magnet width.

**3.1.1.3** The film and magnets shall be connected with a 0.5-inch-wide-by-0.125-inch-thick (12.7 mm by 3.2 mm) continuous joint of low-modulus silicone.

**3.1.1.4** The smoke-containment film shall have a flame-spread index of 25 or less and a smoke-developed rating of 50 or less when tested in accordance with ASTM E 84 (IBC and SBC) or UBC Standard 8-1 (UBC).

**3.1.1.5** The film shall maintain its physical properties after exposure to accelerated aging and certain chemicals. The test methods shall be approved by ICC-ES before the tests are conducted.

**3.1.1.6** The smoke-containment system shall be tested and comply with the requirements set forth in Sections 3.2, 3.3, 3.4.1 and 3.5 through 3.8.

**3.1.2** The smoke-containment curtain shall be a minimum 2.5-mil-thick [0.0025 inch (0.64 mm)] silica cloth curtain coated with urethane-based resin on one side and complying with the following requirements:

**3.1.2.1** The curtain shall be comprised of silica fabric panels stitched together horizontally with twisted stainless steel threads. The stitched seams shall be able to withstand a minimum pressure of 3.1 pounds per square foot (150 Pa).

**3.1.2.2** The curtain shall have a flame-spread index of 25 or less and a smoke-developed rating of 50 or less when tested in accordance with ASTM E 84 (IBC and SBC) or UBC Standard 8-1 (UBC).

**3.1.2.3** The curtain shall be attached to a horizontal steel winding shaft at the top and set in a frame assembly consisting of a horizontal steel bottom bar assembly and vertical steel guide rails that capture the edge of the curtain. Steel mounting plates attached at the tops of the guide rails support the winding shaft and provide a structure for the attachment of a sheet metal hood. A woven glass-fiber cloth smoke seal is provided on both sides of the head. Secondary components of the assembly include steel locking bolts at the edge of the curtain to retain it in the guides, steel bracket anchors and steel guide rail anchors.

**3.1.2.4** The smoke-containment system shall be tested and comply with the requirements set forth in Sections 3.2, 3.4.2 and 3.6 through 3.9.

**3.1.3** The smoke curtain system shall consist of a smoke-containment film that is a minimum 3-mil-thick [0.003 inch (0.076 mm)] PTFE-coated glass-fiber or para-aramid meeting the following requirements:

**3.1.3.1** The film shall consist of separate PTFE-coated glass-fiber or para-aramid sheets, joined horizontally by heat sealing.

**3.1.3.2** The smoke-containment film shall be connected to the drive system utilizing vertical edge containment loops on either side of the curtain. The loops slide over vertical guide rods contained within the side rails. A narrow vertical slot in each side rail prevents the screen/guide rod assembly from disengaging the side rail.

**3.1.3.3** The side rails attach from floor to ceiling on both sides of the opening to be protected. The top portion of the rails also attach to the units housing for the purpose of aligning drive components.

**3.1.3.4** The curtain is mechanically operated up and down by an electric drive motor that turns a bearing supported axle running the length of the housing, and pulleys engaging toothed drive belts and contained within the side rails adjacent to the screen guide rods. The toothed drive belt and pulleys at the end of the axle actuate loops in the drive belt. When the belt is activated, the bottom bar of the smoke curtain lowers from the housing as a screen roller tube feeds out the smoke curtain.

**3.1.3.5** An egress switch that complies with ANSI A 117.1 for operation of a powered door shall be located on both sides of the smoke curtain.

**3.1.3.6** The smoke-containment film shall have a flame-spread index of 25 or less and a smoke-developed rating of 50 or less when tested in accordance with ASTM E 84 (IBC and SBC) or UBC Standard 8-1 (UBC).

**3.1.3.7** The smoke-containment system shall be tested and comply with the requirements set forth in Sections 3.2, 3.4.1 and 3.5 through 3.8.

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**3.1.4** The smoke containment curtain shall be a minimum 2.5-mil-thick [0.0025 inch (0.65 mm)] silica cloth, coated on one side with acrylic resin and complying with the following requirements:

**3.1.4.1** The curtain shall be comprised of silica cloth panels stitched together vertically with twisted stainless steel threads. The acrylic resin coating shall be applied to the ~~corridor side of the curtain and shall~~ have a minimum coverage of 2.36 ounces per square foot (80 g/m<sup>2</sup>). The stitched seams shall be able to withstand a minimum pressure of 3.1 pounds per square foot (150 Pa).

**3.1.4.2** The curtain material shall be connected along its length to a 3<sup>1</sup>/<sub>2</sub>-inch-wide-by-0.124-inch-thick (83 mm by 3.2 mm) multi-pole magnet of energized ferrite in an nitrile rubber binder exerting a minimum 1.4 MGOe force. The multipoles shall be oriented along the length perpendicular to the magnet width.

**3.1.4.3** The curtain material shall completely cover the magnets and shall be joined by stitching (2X) along the full length of the magnet.

**3.1.4.4** Between the magnet and the curtain material a 4<sup>3</sup>/<sub>4</sub>-inch-wide-by-5<sup>5</sup>/<sub>64</sub>-inch-thick heat expansion material consisting of intumescent graphite encapsulated in a butyl rubber sheet shall be enclosed along the full length of the magnet. The edges of the magnet shall be protected by 3<sup>3</sup>/<sub>4</sub>-inch-wide-by-5<sup>5</sup>/<sub>64</sub>-inch-thick (20 mm x 2 mm) of the same material. The heat expansion material shall have the capability of expanding a minimum of 10 times the original material thickness.

**3.1.4.5** At variable positions along the magnet length bi-metallic shape memory alloy strips consisting of Nickel – titanium and measuring 2<sup>3</sup>/<sub>4</sub>-inch-wide-by-3<sup>3</sup>/<sub>16</sub>-inch-high-by-1<sup>1</sup>/<sub>64</sub>-inch-thick (70mm by 5mm by 0.5mm) shall be riveted horizontally on the elevator side of the curtain. The bi-metallic strips shall activate at a maximum temperature of 212°F (100 °C). When heated, the bi-metallic strips shall expand differentially into a concave shape and grasp specially shaped auxiliary rails after which the intumescent material expands to protect the magnet and bimetallic strips.

**3.1.4.6** The curtain shall have a flame spread index of 25 or less and a smoke-developed index of 50 or less when tested in accordance with ASTM E 84 (IBC or SBC) or UBC Standard 8-1 (UBC).

**3.1.4.7** The smoke containment system shall be tested and comply with the requirements set forth in Sections 3.2, 3.4.1 (excluding Sections 3.4.1.6.1.3 through 3.4.1.6.1.6) and 3.6 through 3.9.

**3.2 Air Leakage:** The rate of air leakage through the smoke-containment system shall be determined at 0.1 inch (25 Pa), 0.2 inch (50 Pa) and 0.3 inch (75 Pa) water pressure differential when tested to the performance requirements of UL 1784 (IBC and SBC) or UBC Standard 7-2, Part II (UBC). Tests include cycling and air leakage at ambient and elevated [400°F (204°C)] temperatures.

**Conditions of Acceptance:** The air leakage rating at both ambient and elevated [400°F (204°C)] temperatures shall not exceed 3.0 cfm (14.16 × 10<sup>-4</sup>) per square foot of opening at 0.1 inch water pressure (25 Pa) difference.

**3.3 Expansion Characteristics:** The total expansion of

the smoke-containment system shall be determined at 0.3 inch water pressure (75 Pa) differential at both ambient and elevated [400°F (204°C)] temperatures.

**Conditions of Acceptance:** The smoke-containment system cannot expand more than 6 inches (152 mm) at this pressure difference at ambient or elevated [400°F (204°C)] temperatures.

**3.4 Cycling:** The smoke-containment system shall be cycled according to one of the following methods.

**3.4.1 Standard Test Method for Cyclic Movement of Rolling Magnetic Gasket Systems:**

**3.4.1.1 Purpose:** To determine the cyclic movement of the rolling magnetic gasket system.

**3.4.1.1.1** This test method is applicable to rolling magnetic gasket systems used to prevent the infiltration of air and smoke through an entrance or exit way.

**3.4.1.2 Apparatus:**

**3.4.1.2.1** Any arrangement of equipment capable of performing the test procedure within the allowable tolerances is permitted.

**3.4.1.2.2 Mounting Frames:** No. 14 gage ferrous metal frames shall have a 2-inch-wide (51 mm) profile. Frame shall be blind attached to the wall.

**3.4.1.3 Test Specimens:** Three full size samples shall be used. The temperatures within the laboratory shall be 73.4°F ± 3.6°F (23°C ± 2°C).

**3.4.1.4 Mounting:** The system is mounted above test frame according to the manufacturer's written installation instructions. The resulting installation shall be plumb and square.

**3.4.1.5 Procedure:** Emergency alarm contacts are first energized, allowing the curtain to drop, completely covering the opening. The rewind contacts are next energized, allowing the curtain to roll into container, completely unseating the gasket material.

The door is closed. The curtain is visually inspected after each set of 50 full cycles. The container and frame are visually inspected after each set of 100 full cycles.

**3.4.1.6 Visual Inspection:**

**3.4.1.6.1** Immediately following each set of 50 full cycles, the curtain is visually inspected for the following signs of fatigue:

**3.4.1.6.1.1** Visual metal fatigue.

**3.4.1.6.1.2** Cracks or creases in film.

**3.4.1.6.1.3** Loss of reinforcing yarn adhesion.

**3.4.1.6.1.4** Loss of sealant joint adhesion.

**3.4.1.6.1.5** Stretching of sealant joint.

**3.4.1.6.1.6** Loss of laminating adhesive.

**3.4.1.6.1.7** Misalignment of curtain reel at threshold.

**3.4.1.6.1.8** Misaligned rolling relative to the test frame.

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**3.4.1.6.2** Immediately following each set of 100 full cycles, the curtain is visually inspected for the following signs of fatigue:

**3.4.1.6.2.1** Visual metal fatigue.

**3.4.1.6.2.2** Warpage of door.

**3.4.1.6.2.3** Visual damage to hinge, latch or door stay.

**3.4.1.6.3** Immediately following each set of 100 full cycles, the test frame is visually inspected for visual wear.

**3.4.1.7 Conditions of Acceptance:** The smoke-containment system shall demonstrate no fatigue after completing 100 cycles. The system shall continue to function without impairment.

**3.4.2 Standard Test Method for Cyclic Movement of Coiling Curtain Systems:**

**3.4.2.1 Purpose:** To determine the cyclic movement of the coiling curtain system.

**3.4.2.1.1** This test method is applicable to coiling curtain systems described in Section 3.1.2 used to prevent the infiltration of air and smoke through an entrance or exit.

**3.4.2.2 Apparatus:**

**3.4.2.2.1** Any arrangement of equipment capable of performing the test procedure within the allowable tolerances is permitted.

**3.4.2.2.2 Guide Rails:** Minimum No. 16 gage steel plate, of the manufacturer's standard profile and size. Frame shall be attached to the wall in accordance with the manufacturer's standard installation instructions.

**3.4.2.3 Test Specimens:** Three full-size samples shall be used. The temperature within the laboratory shall be 73.4°F ± 3.6°F (23°C ± 2°C).

**3.4.2.4 Mounting:** The system is mounted above the test frame according to the manufacturer's written installation instructions. The resulting installation shall be plumb and square.

**3.4.2.5 Procedure:** Emergency alarm contacts are first energized, allowing the curtain to drop, completely covering the opening. The alarm contacts are de-energized and the release mechanism is reset and the curtain is rolled back into the initial open position.

The door is closed. The curtain is visually inspected after each set of 50 full cycles. The container and frame are visually inspected after each set of 100 full cycles.

**3.4.2.6 Visual Inspection:**

**3.4.2.6.1** Immediately following each set of 50 full cycles, the curtain is visually inspected for the following signs of fatigue:

**3.4.2.6.1.1** Cracks or creases in the fabric.

**3.4.2.6.1.2** Curtain edge retention in the vertical guiderails.

**3.4.2.6.1.3** Misalignment of the bottom bar at threshold.

**3.4.2.6.1.4** Misaligned rolling relative to the test frame.

**3.4.2.6.2** Immediately following each set of 100 full cycles, the curtain is visually inspected for the following signs of fatigue:

**3.4.2.6.2.1** Cracks or creases in the fabric.

**3.4.2.6.2.2** Warpage of curtain or frame.

**3.4.2.6.2.3** Visual damage to entire assembly.

**3.4.2.6.3** Immediately following each set of 100 full cycles, the test frame is visually inspected for visual wear.

**3.4.2.7 Conditions of Acceptance:** The smoke-containment system shall demonstrate no fatigue after completing 100 cycles. The system shall continue to function without impairment.

**3.4.3 Standard Test Method for Cyclic Movement of Smoke Curtain Systems:**

**3.4.3.1 Purpose:** To determine the cyclic movement of the smoke-containment system.

**3.4.3.1.1** This test method is applicable to smoke-containment systems described in Section 3.1.3 used to prevent the infiltration of air and smoke through an entrance or exit.

**3.4.3.2 Apparatus:**

**3.4.3.2.1** Any arrangement of equipment capable of performing the test procedure within the allowable tolerances is permitted.

**3.4.3.2.2 Mounting Frames:** For systems described in Section 3.1.1, the frame shall consist of No. 14 gage ferrous metal frames having a 2-inch-wide (51 mm) profile. The frame shall be blind-attached to the wall. For the systems described in Sections 3.1.2 and 3.1.3, the system shall be mounted in accordance with the system manufacturer's instructions.

**3.4.3.3 Test Specimens:** Three full-size samples shall be used. The temperature within the laboratory shall be 73.4°F ± 3.6°F (23°C ± 2°C).

**3.4.3.4 Mounting:** The system is mounted above the test frame according to the manufacturer's written installation instructions. The resulting installation shall be plumb and square.

**3.4.3.5 Procedure:** Emergency alarm contacts are first energized, allowing the curtain to drop, completely covering the opening. The rewind contacts are next energized, allowing the curtain to roll into container, completely unseating the gasket material.

The curtain is visually inspected, with the curtain in the closed position, after each set of 50 full cycles. The container and frame are visually inspected after each set of 100 full cycles.

**3.4.3.6 Visual Inspection:**

**3.4.3.6.1** Immediately following each set of 50 full cycles, the curtain is visually inspected for the following signs of fatigue:

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**3.4.3.6.1.1** Visual metal fatigue.

**3.4.3.6.1.2** Cracks or creases in film.

**3.4.3.6.1.3** Loss of fabric adhesion.

**3.4.3.6.1.4** Misalignment of curtain reel at threshold.

**3.4.3.6.1.5** Misaligned rolling relative to the test frame.

**3.4.3.6.2** Immediately following each set of 100 full cycles, the curtain is visually inspected for the following signs of fatigue:

**3.4.3.6.2.1** Visual metal fatigue.

**3.4.3.6.2.2** Warpage of door.

**3.4.3.6.2.3** Visual damage to operable components.

**3.4.3.6.3** Immediately following each set of 100 full cycles, the test frame is visually inspected for visual wear.

**3.4.3.7 Conditions of Acceptance:** The smoke-containment system shall demonstrate no fatigue after completing 100 cycles. The system shall continue to function without impairment.

**3.5 Motor:** The motor shall be evaluated and listed as required by NFPA70, the National Electrical Code.

**3.6 Release Mechanisms:** Components of release mechanisms shall be recognized by an independent testing agency accredited by the International Accreditation Service, Inc. (IAS). For the system described in Section 3.1.3, the integral battery backup system that is part of the

releasing drive shall be tested and listed to UL 864.

**3.7 Smoke Detector:** The smoke detector to which the smoke-containment system is connected shall be tested and listed according to UL 228 or UL 268.

**3.8 Opening Force:** The maximum force to disengage the gasketing system described in Section 3.1.1 is 15 lbf (67 N), and shall be verified by using a spring scale applied perpendicular to the plane of the film at the boundary. The maximum force to lift the curtain described in Section 3.1.2 is 15 lbf (67 N), and shall be verified by using a spring scale applied perpendicular to lower horizontal edge of the curtain assembly.

**3.9 Fire Test:** The smoke-containment system shall have a minimum 20-minute rating without hose stream when tested in accordance with UL 10B and IBC Section 715.4.2.

**Exception:** When recognition of the system for use as an alternative to a 20-minute fire door assembly complying with the requirements of the IBC Section 715.4.3, the smoke-containment system shall have a minimum 20-minute rating without hose stream when tested in accordance with the UL 10C.

**4.0 QUALITY CONTROL**

**4.1** The products shall be manufactured under an approved quality control program with inspections by an inspection agency accredited by International Accreditation Service.

**4.2** Quality documentation complying with the ICC-ES Acceptance Criteria for Quality Documentation (AC10) shall be submitted. ■

**TABLE 1—CROSS REFERENCE OF STANDARD EDITIONS**

STANDARD	1997 UNIFORM BUILDING CODE™	2006 INTERNATIONAL BUILDING CODE®	1999 STANDARD BUILDING CODE®
ASTM D 412	1988	1988	1988
ASTM D 1434	1988	1988	1988
ASTM D 1876	1983	1983	1983
ASTM E 84	UBC Standard 8-1	2004	1995
NFPA 70	1996	2005	1996
NFPA 105	1989	2003	1989
NFPA 228	1986	1986	1986
NFPA 258	1987	1987	1987
UL 10B	UBC Standard 7-2, Part I	1997 with revisions through October 2001	N/A
<u>UL 10C</u>	<u>N/A</u>	<u>1998 with revisions through November 2001</u>	<u>N/A</u>
UL 228	1986	1986	1986
UL 268	N/A	1996 with revisions through January 1999	1989
UL 864	N/A	2003 with revisions through October 2003	N/A
UL 1784	UBC Standard 7-2, Part II	1995	1995