



October 1, 2008

TO: PARTIES INTERESTED IN EVALUATION REPORTS ON SMOKE AND HEAT VENTS

SUBJECT: Proposed Revisions to the Acceptance Criteria for Smoke and Heat Vents, Subject AC331-1008-R2 (RG/RK)

Dear Madam or Sir:

The revisions proposed to the subject acceptance criteria, as presented in the enclosed criteria draft, are being posted on the ICC-ES web site to allow for public review.

The proposed revisions are consistent with the document previously presented for consideration at the May 2008 ICC-ES Evaluation Committee hearing under the staff letter dated April 28, 2008, and staff memo dated May 21, 2008, except for the following revisions, which are based on comments since the hearing:

1. Section 1.1 has been revised to modify the reason statement.
2. Section 3.3 has been revised to change the conditions of acceptance for the cycling test.
3. Section 6.3 has been added, to include a snow load limitation of 10 psf based on Section 11 of UL793.

Comments 5, 6 and 7 of our staff letter dated April 28, 2008, requested additional descriptive information on the test procedures for the dust loading exposure test; additional descriptive information regarding the bag of the impact resistance test; and maximum period of time for speed of opening tests to clarify the requirements of UL793 as referenced by the 2006 IBC. No response has been received by the ICC-ES staff. As this additional information for UL793 was requested for clarification purposes only, Sections 3.4, 3.8 and 3.9 of the attached proposed revisions currently reference the code-referenced documents of UL793. Adoption of the attached proposed revisions would allow the ICC-ES staff to move forward with the evaluation of smoke and heat vents under the 2006 IBC.

You are cordially invited to submit written comments, within 30 days of the date of this letter. Please use the comment form on the web site attaching any letters to the form. An explanation of the alternate criteria process can be found on our web site at http://www.icc-es.org/Criteria_Development/alternative_criteria_process.shtml.

All comments received in the 30-day comment period will be considered. During this same 30-day period, however, the draft criteria will be balloted to the Evaluation Committee. If the public comments raise major issues, generate controversy, or require the criteria to be substantially rewritten, then ICC-ES staff may decide to reballot the criteria; or place a revised draft on the web site for further public comment; or put the criteria on the agenda for a future Evaluation Committee meeting.

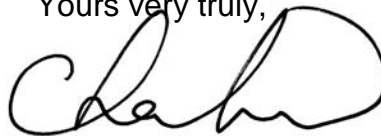
Correspondence received and a memo outlining staff's resolution of the comments in the correspondence will be posted on the web site shortly after the close of the comment period.

Your cooperation is requested in forwarding to the Los Angeles business/regional office all material directed to the Evaluation Committee. Parties interested in the deliberations of the committee should refrain from communicating, whether in writing or verbally, with committee members. The committee reserves the right to refuse communications that do not comply with this request.

Newly approved acceptance criteria may involve test methods or test protocols that are not currently included in the scope of testing services offered by accredited testing laboratories. As noted in the ICC-ES Rules of Procedure for Evaluation Reports, the scope of the laboratory's accreditation must include the type of testing that is to be reported to ICC-ES. We encourage accredited laboratories to expand their scopes of accreditation to include testing under newly approved acceptance criteria. Please note that testing laboratories must be accredited by the International Accreditation Service (IAS) or by another accreditation body that is a signatory to the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement. For further information, please contact IAS at (562) 699-0541, extension 3309, or send an e-mail to pmccullen@iasonline.org.

Please submit all comments using the form on the web site. Attach any letters to the comment form. If you have any questions (not comments), please contact the undersigned at (800) 423-6587, extension 3275, or Russ Krivchuk, P.E., at extension 3275. You may also reach us by e-mail at es@icc-es.org.

Yours very truly,



Ram Gnanasekaran
Evaluation Specialist

RG/cm;raf

Enclosure

cc: Evaluation Committee



PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR SMOKE AND HEAT VENTS

AC331

Proposed October 2008

Previously approved October 2005

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 for purposes of issuing ICC-ES evaluation reports.

PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR SMOKE AND HEAT VENTS

1.0 INTRODUCTION

1.1 Purpose: The purpose of this acceptance criteria is to establish requirements for smoke and heat vents to be recognized in an ICC Evaluation Service, Inc. (ICC-ES), evaluation report under the 2006~~3~~ *International Building Code*® (IBC) and the 2006~~3~~ *International Fire Code*® (IFC). Bases of recognition are IBC Section 104.11 and IFC Section 104.9.

The reason for development of this criteria is to establish guidelines for the evaluation of the smoke and heat vents, and to provide additional information to clarify the requirements of the IBC, the IFC and various documents referenced by those codes.

1.2 Scope: This criteria applies to thermally activated, automatic smoke and heat vents, designed for installation on the roofs of buildings as required by Section 910 of the IBC and IFC. Smoke and heat vents with plastic covers shall also comply with the requirements in Section 2610 of the IBC.

1.3 Codes and Referenced Standards:

1.3.1 2006~~3~~ *International Building Code*® (IBC), International Code Council.

1.3.2 2006~~3~~ *International Fire Code*® (IFC), International Code Council.

1.3.3 ICC-ES Acceptance Criteria for Plastic Glazed Skylights (AC16).

1.3.4 UL 793-03, Standards for Automatically Operated Roof Vents for Smoke and Heat, Underwriters Laboratory, Inc.

1.4 Definitions:

1.4.1 Automatic Smoke and Heat Vent: A device which, when activated, opens directly to the exterior at or near the roof level of a building that relies on the buoyant forces created by a fire to exhaust smoke and heat. The device shall be constructed to remain in the fully open and locked position (90° ± 5° from plane of vent) and, subsequently, when manually closed, to relatch automatically, closed and relocked by automatic and manual means. The device operates independently of electric power or other energy sources that may be interrupted in a fire.

1.4.2 Curb-mounted Smoke and Heat Vent: A smoke and heat vent designed to be installed on a curb attached to the roof structure.

1.4.3 Deck-mounted Smoke and Heat Vent: A smoke and heat vent designed to be installed directly onto the roof structure without the need for a curb.

1.4.4 Fusible Link: A temperature-sensitive device that is activated when the ambient temperature increases to a preselected temperature that causes the link to “disengage,” releasing the smoke and heat vent cover lock.

1.4.5 Manual Release: A device utilized to manually open the smoke and heat vent from either the interior or exterior, without the activation of the fusible link.

1.4.6 Smoke and Heat Vent Components: Components of smoke and heat vents include frames, metal

or plastic domed lids, latches, springs, fusible links, manual releases and lid dampers.

2.0 BASIC INFORMATION

2.1 General: The following information shall be submitted:

2.1.1 Product Description: Complete information concerning the smoke and heat vents shall be described in the quality control manual required in Section 5.0. The information shall include the following:

2.1.1.1 Generic or trade name.

2.1.1.2 Manufacturer's catalog or model number.

2.1.1.3 Outside curb dimensions.

2.1.1.4 Inside curb dimensions.

2.1.1.5 Dimensioned section profiles of smoke and heat vent components, including the frame, metal or domed cover and glazing retainer.

2.1.1.6 Description of the materials, including physical properties of the materials from which the smoke and heat vent components are manufactured, such as the frame glazing retainers and fasteners.

2.1.1.7 Thickness, prior to thermoforming, of dome plastic glazing material, for each size.

2.1.1.8 Dome rise above the horizontal plane of the exterior face of the support frame, for each size.

2.1.1.9 Description of shape of dome.

2.1.1.10 Dimensioned drawings of assembled smoke and heat vent.

2.1.1.11 Description of fusible link, including specifications and release temperature rating.

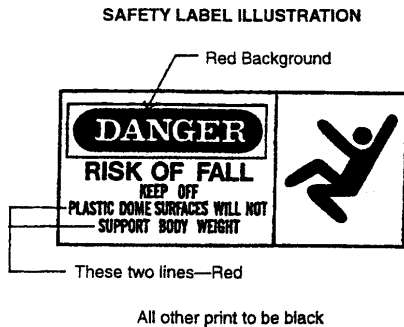
2.1.2 Installation, Operation, and Maintenance Instructions: Installation instructions with scaled drawings of skylight mounting details, including clearances; type, spacing and quantity of fasteners; caulking and other information associated with installation. The installation shall comply with applicable requirements in Sections 910 and 2610 of the IBC and Section 910 of the IFC. Instructions for operation and maintenance of the smoke and heat vents shall be submitted.

2.1.3 Packaging and Identification: A description of the methods of packaging and field identification of the smoke and heat vent.

2.1.3.1 Label: A permanent label, conspicuously located on each smoke and heat vent, shall bear the manufacturer's name and address; evaluation report number; manufacturing date or code; plastic classification (CC1 or CC2) of the plastic glazing, if applicable; thickness of plastic glazing material prior to thermoforming; the smoke and heat vent model number; and the name or logo of the inspection agency.

2.1.3.2 Safety Labeling: Smoke and heat vents shall bear a warning label complying with Class 1, ANSI Standard Z35.1, specifications for accident prevention signs, similar to the following, with signal and key words at least 1/4 inch (12.7 mm) high:

PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR SMOKE AND HEAT VENTS



2.2 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 Test Reports: Test reports shall comply with AC85. Reports of tests also shall include the following information:

2.3.1 Dates of the tests and the report.

2.3.2 Description of test sample (manufacturer's name and address, source of supply, dimensions, model types, material specifications, labeling and other pertinent information).

2.3.3 Statement that a qualified representative of the testing laboratory conducted the installation of the test units.

2.3.4 Detailed drawings of the units, showing dimensioned section profiles, installation and spacing of anchorage, material specifications for components and any other pertinent construction details. Any modifications of units to obtain reported values shall be noted on drawings.

2.3.5 Tabulation of test load increments.

2.3.6 Duration of test loads.

2.3.7 Written account of observations during and after tests, including the visual observation of each load increment; loads that produce continued deflection with no increase in pressure; permanent deformation after load is removed.

2.3.8 Mode of failure for each unit.

2.3.9 Statement from the testing laboratory indicating the tests were conducted in accordance with this criteria, or a full description of any deviations therefrom.

2.3.10 Pressures imposed on each test specimen, and identification of each specimen, particularly with respect to distinguishing features or differences from companion specimens. A separate drawing for each unit will not be required if differences are noted on the drawings provided.

2.3.11 Extrapolation of test data is prohibited.

2.4 Product Sampling: Sampling of the smoke and heat vents for tests under this criteria shall comply with Section 3.1 of AC85.

3.0 TEST AND PERFORMANCE REQUIREMENTS

3.1 General: For multiple-sized models, the largest unit

shall be utilized for testing. Except where specifically noted, the minimum number of samples for each test shall be three.

3.1.1 Evidence shall be submitted that the smoke and heat vents do not contain dissimilar materials in contact with each other that could be affected by electrolytic or chemical action.

3.1.2 The vent size shall be a minimum of 16 square feet (1.5 m²), with the least dimension not less than 48 inches (1219 mm), excluding ribs or gutters having a total width of 6 inches (152 mm). The top cover shall be a minimum of 9¹/₂ inches (241 mm) from the top of the curb when opening or when fully open.

3.1.3 For general installation, the fusible link actuating the smoke and heat vent shall comply with Section 7 of UL 793, with a minimum rating of 160°F and a maximum rating of 286°F (71°C and 141°C). For installation in nonsprinklered buildings, the fusible link actuating the smoke and heat vent shall be rated at between 100°F and 220°F (38°C and 104°C) above ambient temperatures, as required by IBC Section 910.3.2.3. and IFC Section 910.3.2.3.

3.2 Simulated Fire Test: The simulated fire test shall be conducted in accordance with Section 4.1 of this criteria.

3.3 Cycling Test: ~~A representative sample of a mechanically opened vent shall function as intended after being operated for 250 full strokes (open and closed) under static conditions:~~

~~—These operations shall be conducted by using a manual release at an ambient temperature between 10°C to 40°C (50°F to 104°F).~~

The cycling test shall be conducted in accordance with Section 9 of UL 793.

Conditions of Acceptance: ~~There shall be no permanent deflection deformation of hinges, linkages, opening mechanisms or the vent proper. The smoke vent shall close and open to the fully open and locked position in all 250 cycles of the test.~~

3.4 Speed of Opening Test: The speed of opening test shall be conducted in accordance with Section 10 of UL 793.

Conditions of Acceptance: The average time to open to the fully open and locked position of the five repetitions of each tested unit shall be a minimum of 2.5 seconds.

3.5 Opening Under Load Test: ~~A vent shall open from the closed position to the fully open position (90° ± 5° from plane of vent) five times when subjected to a live or snow load on the cover. All vents shall be designed to open by manual means. Means of opening shall be either internal or external or both, and each mode shall be verified by the testing laboratory. The load shall be the intended roof snow load, but no less than 10 psf (479 Pa). The uniformly distributed load shall be attached to the cover or placed under the dome assembly.~~

The opening under load test shall be conducted in accordance with Section 11 of UL 793.

Conditions of Acceptance: The vent shall open to the fully open and locked position when subjected to the inward acting 10 psf (479 Pa) load.

3.6 Wind-uplift Test: ~~The vent shall withstand a~~

~~wind-uplift load without opening. Test procedures shall be in accordance with Section A4.1.12 A3.2 of AC16. As an alternative to testing in accordance with Section A4.1.12 A3.2 of AC16, the smoke and heat vent test specimens may be installed in an inverted position with the vent frame supported. Sandbags of known weight shall be uniformly placed on the underside of the vent cover. The applied wind uplift load shall be the intended wind uplift load, but no less than 30 psf (1436 Pa). This test is in addition to tests for wind damage to the smoke and heat vents, or wind dislodgement of same, which shall comply with Section A4.1.12 A3.2 of AC16 with a factor of safety of 2 applied to test results.~~

The wind-uplift test shall be conducted in accordance with Section 14 of UL 793, except the load applied to the test specimen shall be the intended wind-uplift load, which shall not be less than 30 psf (1436 Pa).

Condition of Acceptance: The vent shall withstand the wind-uplift load without opening.

~~**3.7 Corrosion Resistance:** Metal parts used in the vents shall comply with Section 6 of UL 793. Steel parts shall be corrosion-resistant through compliance with one of the requirements noted below (Sections 3.6.1 and 3.6.2). Evidence of compliance with the requirements shall be submitted; tests shall be conducted by the testing laboratory.~~

~~— 3.7.1 Stainless steel, 300 series.~~

~~— 3.7.2 Sheet steel complying with ASTM A 653 with minimum hot dipped galvanized coating designation G60. Bent portions shall be visibly examined at 25 power magnification. Failure occurs where flaking or cracking of the coating is observed.~~

3.8 Dust Loading Exposure Test: The dust loading exposure test shall be conducted in accordance with Section 13 of UL 793.

Conditions of Acceptance: The vents shall open and lock when simulating the vents' fusible link actuation after seven hours of exposure to an air-blown circulating grain dust-air mixture.

3.9 Impact Test: The impact test shall be conducted in accordance with Section 15 of UL 793.

Condition of Acceptance: The nonmetallic cover of the vents must remain intact after the impact test.

Exceptions: The impact test is not required for smoke and heat vents with a steel wire mesh above the nonmetallic cover. Steel wire mesh specifications shall comply with Section 8.1(b) of UL 793.

3.10 Testing of Structural, Environmental and Fire Smoke Vents: The vent frame, cover, and cover retainer shall be tested as a unit in accordance with requirements set forth in Section A3.0 of AC16. As an alternative to the water penetration test described in Section A3.3 A3.1.4 of AC16, the wind-driven rain test described in Section 4.2 of this criteria is permitted. The air infiltration test described in Section A3.1.3 A3.4 of AC16 is optional, when the smoke vents are limited to installation on roofs over unconditioned spaces.

4.0 TEST METHODS

4.1 Simulated Fire Tests:

4.1.1 Requirements: Vents using fusible links with the highest temperature rating shall be tested to demonstrate whether the cover moves from the closed position to the fully open and locked position ($90^\circ \pm 5^\circ$ from plane of vent) within five minutes when subjected to a precalibrated time-temperature gradient that heats the air within the vent cavity to 500°F (260°C) within the five-minute period. Where vents are operated by fixed-temperature fusible devices, the device shall be located in the expected flow pattern of hot gases and not shielded from fire temperatures. The actual load on the device shall not exceed its greatest load capacity.

4.1.2 Calibration: Correction of the vent calibration may be accomplished by varying the height of the vent being tested or the height of the test-fuel pan.

4.1.3 Test Method: Test units shall be end-supported 35 inches (890 mm) above the fire test floor. Two Type K, chrome lus. alumel, 18-gage thermocouples shall be attached to the inside of the vent, 1 inch (25.4 mm) below the highest point of the cavity. The leads shall be connected to a recording potentiometer, -18°C (0°F) to 1093°C (2000°F) range multipoint.

A 305-millimeter-by-305-millimeter (one foot square) steel test-fuel pan shall be centered under the test unit on the floor. Isopropyl alcohol shall be poured into the pan to a depth of 1/2 inch (12.7 mm). The alcohol shall be ignited and a determination made as to the ability of the test unit to meet the test requirements.

During the test there shall not be any flame impingement on the test unit lid.

4.1.4 Repetitions: Each unit shall successfully pass five simulated fire tests per mode of operation without mechanical or structural failure. Modes of operation tested shall include: (a) activation of the manual release mechanism on units so equipped; and (b) activation of the heat-sensing device.

Necessary resetting or replacement of the heat-sensing device shall not be considered a mechanical or structural failure.

4.2 Wind-driven Rain Test:

4.2.1 General: The test frame shall be approximately 10 feet by 10 feet (3048 mm by 3048 mm) and hinged at the lower end to permit roof slope variations. The frame shall be rigidly supported during the test. The test specimen shall be the largest size available in each vent profile and dome shape. The frame shall not be erected against the side of a higher building or other solid surface where normal airflow over the specimen can be affected.

The airflow over the test frame shall be directed and smoothed by suitably shaped baffles. The airstream velocity measured on a vertical plane midway between the upper and lower edge of the test specimen on a 24-inch (610 mm) grid shall be within the required axial velocity. The test report shall include the wind velocity profile developed on the 24-inch (610 mm) grid basis. The axial velocity over the test section shall be monitored with a calibrated vane-type velocimeter mounted approximately 6 feet (1829 mm)

PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR SMOKE AND HEAT VENTS

downstream of the wind source at the midheight of the panel. The velocimeter readings shall be taken with a stopwatch using minimum 1-minute duration. The wind velocity shall be maintained at between 35 and 40 miles per hour (56 and 64 km/h), and water shall be introduced into the wind stream.

4.2.2 Apparatus:

4.2.2.1 Wind Source: Airflow over the test frame shall be calibrated as previously indicated.

4.2.2.2 Water Supply: A sprinkle-pipe system, mounted on a movable frame capable of simulating a uniform 6-inch-per-hour (152 mm/hr) rainfall as monitored with flow gages calibrated in cubic feet per second, is an example of an acceptable system. Uniform distribution of simulated rainfall requires calibration of water flow gages, monitoring the water supply to ensure sufficient distribution over the test specimen surface at each specified pitch, proper orientation and airspeed. The simulated rain striking the test specimen shall be uniformly distributed within a 20 percent variation over the test deck. Distribution and calibration of water flow may also be determined by the following method: A shallow tray shall be attached to the test frame in place of the test specimen. The tray bottom shall be covered with a layer of thick absorbent paper (high-wet-strength, extra-thick, white filter paper) that has been weighed and lined to form 12-inch (305 mm) squares. At the required wind velocity, water shall be fed into the airstream at a suitable rate, indicated by the flow-rate meters, for a time sufficient to wet but not saturate the paper. The air and water flows shall then be stopped, and the paper shall be removed and cut into squares. Each square shall be weighed. Using the initial average dry weight and sample weight after exposure, the amount of water striking the test area, and the distribution, shall then be determined. The test shall be repeated with different flow meter settings at the same air velocity, to determine if distribution is affected by water flow. A chart shall then be prepared, for review and future reference, that describes the simulated-rain distribution for each flow meter setting, slope, and orientation. When the simulated-rain distribution is determined, calibration may be made by collecting water falling into a sealed box gasketed and clamped to the underside of the test frame when the test specimen frame is left open. The volume of water collected in the box over a suitable time interval shall serve as a check for the required flow. This method allows water to be collected over a longer period or allows water to be measured continuously as it is drained from the test frame box.

4.2.2.3 Procedure: The underside of the test specimen shall be photographed immediately prior to the

start of tests. The airflow shall be between 35 and 40 miles per hour (56 and 64 km/h), with velocity and pressure differentials across the test surface measured and recorded. The pressure distribution across the surface shall be measured at not less than 10 points. The water supply rate shall be adjusted for a simulated rainfall of 6 inches (152 mm) per hour. The roof slope should be the flattest proposed for installation. The test shall commence at the specified airspeed with three cycles of simulated rainfall of 15 minutes each, with the wind generator stopped for 5 minutes after each cycle to allow observation and recording of the specimen condition. The condition of joints (as viewed from the underside) shall be reported after each rainfall insofar as water infiltration is concerned. Damage, if any, to specimens and fasteners shall also be reported. Upon completion of the test, components shall be dismantled and the condition of lapped areas and undersurfaces noted and photographed.

4.2.2.4 Conditions of Acceptance: There shall be no leaks through the test specimen.

5.0 QUALITY CONTROL

5.1 The products shall be manufactured under an approved quality control program with inspections by an inspection agency accredited by the International Accreditation Service (IAS) or otherwise acceptable to ICC-ES.

5.2 Quality documentation ~~A quality control manual complying with the ICC-ES Acceptance Criteria for Quality Documentation Control Manuals (AC10)~~ shall be submitted.

6.0 EVALUATION REPORT RECOGNITION

6.1 The evaluation report shall include the maximum allowable live, snow and wind loads for the smoke vent, as determined in accordance with Section 3.0 of this criteria.

6.2 The evaluation report shall reference specific published installation instructions or installation drawings, including applicable dates and revision number of the installation instructions or drawings.

6.3 For smoke and heat vents recognized for snow loads, the evaluation report shall limit the recognition of snow loads to a maximum of 10 psf (479 Pa).

6.4 The evaluation report shall indicate that the smoke and heat vents shall be installed in accordance with IBC ~~Sections 415.6 and Section 910~~ or IFC Section 910. Smoke and heat vents with plastic covers shall also be installed in accordance with Section 2610 of the IBC. ■