

בטיחות אש בבניינים: מדפי עשן

Fire safety in buildings: Smoke dampers

תקן זה הוכן על ידי ועדת מומחים בהרכב זה:
אבי בלייברג, ריכרדו גורה, ירמי לימור, שמואל נתנאל, צבי רונן (יו"ר)

תקן זה אושר על ידי הוועדה הטכנית 116 - בטיחות אש בבניינים, בהרכב זה:

- | | | |
|----------------------------------|---|-------------------------|
| אגודת חוקרי דליקות בישראל | - | יצחק דגון |
| איגוד לשכות המסחר בישראל | - | יורם אורדן |
| הטכניון - הפקולטה להנדסה אזרחית | - | רחל בקר |
| התאחדות הקבלנים והבונים בישראל | - | איתמר הילדסהיימר |
| התאחדות התעשיינים בישראל | - | אמנון אליהו, שרון דרורי |
| מכון התקנים הישראלי - אגף הבניין | - | ריכרדו גורה |
| משרד הבינוי והשיכון | - | לזר פלדמן |
| משרד הפנים | - | דוד פילזר (יו"ר) |
| נציבות כבאות והצלה | - | אנקה בלומר |
| רשות ההסתדרות לצרכנות | - | דניאל בלסנהיים |

דני בודור ריכז את עבודת הכנת התקן.

הודעה על מידת התאמת התקן הישראלי לתקנים או למסמכים זרים

תקן זה, למעט השינויים והתוספות הלאומיים המצוינים בו,

זהה לתקן האמריקני ANSI /UL 555S - April 30, 2003

מילות מפתח:

בקרת עשן, הוצאת עשן (בניינים), אמצעי שיכור, מערכות מובלי אוויר, בטיחות אש, התקני חימום, דלתות לבקרת עשן, סגר לבקרת עשן, גלאי עשן.

Descriptors:

smoke control, smoke extraction (buildings), damping devices, air ducting systems, fire safety, heating installations, smoke control doors, smoke control shutter, smoke detectors.

עדכניות התקן

התקנים הישראליים עומדים לבדיקה מזמן לזמן, ולפחות אחת לחמש שנים, כדי להתאימם להתפתחות המדע והטכנולוגיה. המשתמשים בתקנים יודאו שבידיהם המהדורה המעודכנת של התקן על גיליונות התיקון שלו. מסמך המתפרסם ברשומות כגיליון תיקון, יכול להיות גיליון תיקון נפרד או תיקון המשולב בתקן.

תוקף התקן

תקן ישראלי על עדכוניו נכנס לתוקף החל ממועד פרסומו ברשומות. יש לבדוק אם התקן רשמי או אם חלקים ממנו רשמיים. תקן רשמי או גיליון תיקון רשמי (במלואם או בחלקם) נכנסים לתוקף 60 יום מפרסום ההודעה ברשומות, אלא אם בהודעה נקבע מועד מאוחר יותר לכניסה לתוקף.

סימון בתו תקן



כל המייצר מוצר, המתאים לדרישות התקנים הישראליים החלים עליו, רשאי, לפי היתר ממכון התקנים הישראלי, לסמנו בתו תקן:

זכויות יוצרים

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הקדמה לתקן הישראלי

תקן ישראלי זה הוא התקן האמריקני ANSI/UL 555S מאפריל 2003, שאושר כתקן ישראלי בשינויים ובתוספות לאומיים.

תקן זה כולל, בסדר המפורט להלן, רכיבים אלה:

- סעיף חלות התקן בשינויים ובתוספות לאומיים (בעברית)
- פירוט השינויים והתוספות הלאומיים לסעיפי התקן האמריקני (בעברית)
- התקן האמריקני (כלשונו)

תקן זה הוא חלק מסדרת תקנים הדנים בטיחות אש בבניינים.

חלקי הסדרה הם אלה:

- ת"י 1001 חלק 1 - בטיחות אש בבניינים: מערכות מיזוג אוויר ואורור
- ת"י 1001 חלק 2.1 - בטיחות אש בבניינים: מערכות בקרת עשן - בנייני מגורים שגובהם עד 12 מטר
- ת"י 1001 חלק 2.2 - בטיחות אש בבניינים: מערכות בקרת עשן - בניינים, למעט בנייני מגורים שגובהם עד 12 מטר
- ת"י 1001 חלק 2.3 - בטיחות אש בבניינים: מערכות בקרת עשן - קניונים, אטריומים וחללים גדולים דומים
- ת"י 1001 חלק 2.4 - בטיחות אש בבניינים: מערכות שחרור עשן - בניינים חד-קומתיים, למעט בנייני מגורים
- ת"י 1001 חלק 3 - בטיחות אש בבניינים: מדפי אש
- ת"י 1001 חלק 4 - בטיחות אש בבניינים: מדפי עשן
- ת"י 1001 חלק 5^(N) - בטיחות אש בבניינים: מנגנון סגירה אוטומטי לבקרת עשן
- ת"י 1001 חלק 6 - בטיחות אש בבניינים: אורור והגנה מפני אש במערכות-בישול מסחריות

1.1 חלות התקן (סעיף 1 של התקן האמריקני בשינויים ובתוספות לאומיים)

הערות:

1. השינויים והתוספות הלאומיים בסעיף זה מובאים בגופן שונה.
2. בסעיפים 1.1, 1.2, 1.3, 1.7 - תאריכי התיקונים שנערכו בתקן האמריקני אינם רלוונטיים לתקן הישראלי.

1.1 דרישות אלה נוגעות למדפי עשן המיועדים לשימוש במערכות לחימום, אורור ומיזוג אוויר (HVAC).

מדפי עשן מיועדים:

א. להגביל את פיזור העשן במערכות HVAC המתוכננות להיסגר אוטומטית בעת אירוע אש, או

ב. לסייע לבקרת הפרשי לחץ לרוחב מחסומי עשן, כאשר מערכת ה-HVAC היא חלק ממערכת בקרת עשן מתוכננת.

(N) יוכן בעתיד.

- 1.2. המדפים שדרישות אלה חלות עליהם מוערכים כמתאימים לשימוש כמפורט להלן:
- א. מדפי עשן - לשימוש במערכות HVAC שבהן המובלים עוברים דרך מחסומי עשן.
- ב. מדפים משולבים לאש ועשן - למקומות במערכות HVAC שבהם נדרשים מדף אש ומדף עשן במקום אחד.
- 1.3. מדפי עשן משמשים להגנה של פתחים במחסומי עשן או במערכות בקרת עשן המתוכננות לפי התקן הישראלי ת"י 1001 חלק 1.
- מכללי מדפים אלה מיועדים להתקנה לפי הוראות היצרן.
- 1.4. הסעיף בוטל ב-11 בינואר 2002.
- 1.5. הסעיף בוטל ב-11 בינואר 2002.
- 1.6. מדפים משולבים לאש ועשן יתאימו גם לדרישות הישימות שבתקן הישראלי ת"י 1001 חלק 3.
- 1.7. מוצר הכולל מאפיינים, אופיינים, רכיבים, חומרים או מערכות, חדשים או שונים מאלה שדנות בהם דרישות תקן זה, ושיש בו סיכון של אש או הלם חשמלי או פציעה לאדם, יוערך לפי דרישות מתאימות החלות על רכיבים נוספים ותוצרים סיומיים כדי לקיים רמת בטיחות התואמת את כוונתו המקורית של תקן זה. מוצר הכולל מאפיינים, אופיינים, רכיבים, חומרים או מערכות, הסותרים דרישות או הנחיות כלשהן של תקן זה, אינו עומד בתקן זה. עדכון של דרישות יוצע ויאומץ לפי השיטות המיושמות בפיתוח, עדכון ויישום של תקן זה.

פירוט השינויים והתוספות הלאומיים לסעיפי התקן האמריקני

לאחר סעיף 1 יוסף סעיף 1א כמפורט להלן:

א1. אזכורים

- בכל מקום בתקן האמריקני שמאזכרים בו התקנים האמריקניים המפורטים להלן, חלים במקומם תקנים ישראליים, כמפורט להלן:

התקן הישראלי שחל במקומו	התקן האמריקני המאוזכר
ת"י 1001 חלק 1 - בטיחות אש בבניינים: מערכות מיזוג אוויר ואוורור	NFPA 90A
ת"י 1001 חלק 3 - בטיחות אש בבניינים: מדפי אש	UL 555

- תקנים ישראליים

ת"י 755 - תגובות בשרפה של חומרי בנייה - שיטות בדיקה וסיווג

INTRODUCTION

General .2

הסעיף חל בשינוי המפורט להלן.

Units of measurement .2.2

2.2.1. הכתוב בסעיף אינו חל, ובמקומו יחול:

המידות המחייבות הן המידות המופיעות בסוגריים (לדוגמה: מילימטר, מעלת צלזיוס).
המידות שאינן בסוגריים הן למידע בלבד (לדוגמה: אינץ', מעלת פרנהייט).

PERFORMANCE

Salt-Spray Exposure Test .12

הסעיף חל בתוספות המפורטות להלן.

12.3. בתחילת הסעיף יוסף:

מדף העשן ייבדק לאחר פירוק המנוע.

12.4. בתחילת הסעיף יוסף:

מדף העשן ייבדק לאחר הרכבת המנוע.

Fire Exposure Test .13

הסעיף חל בשינויים ובתוספות המפורטים להלן.

13.1. בשורה הראשונה, המילים: "and Hose Stream" - אינן חלות.

Exception No.3

בסוף הפסקה, לאחר האזכור "UL 723" יוסף:

או שנבדקו לפי התקן הישראלי ת"י 755, סיווג V.3.3.

MARKING

General .17

הסעיף חל בתוספת המפורטת להלן.

בתחילת הסעיף יוסף:

סימון המדף יהיה בשפה העברית. נוסף על כך, ניתן לסמנו בשפה אחרת.

INSTALLATION AND OPERATING INSTRUCTIONS

General .18

הסעיף חל בתוספת המפורטת להלן.

- 18.1. בשורה השנייה, לאחר המשפט הראשון המסתיים במילים "of the damper" יוסף:
ההוראות יהיו בשפה העברית. נוסף על כך, ניתן לספק הוראות בשפה אחרת.

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APPENDIX A**Standards for Components**

Standards under which components of the products covered by this standard are evaluated include the following:

Title of Standard – UL Standard Designation

Door, Drapery, Gate, Louver, and Window Operators and Systems – UL 325

Heat Responsive Links for Fire Protection Service – UL 33

Motors, Electric – UL 1004

Organic Coatings for Steel Enclosures for Outdoor Use Electrical Equipment – UL 1332

Temperature-Indicating and -Regulating Equipment – UL 873

Test for Surface Burning Characteristics of Building Materials – UL 723

No Text on This Page

18.4 For multiple assembly of the dampers, the instructions shall also specify:

- a) The method of attaching individual sections together;
- b) When any mullions are required, their materials, sizes, locations, and the method of attaching them to the dampers;
- c) The maximum size of the multiple assembly that is capable of being assembled; and
- d) The maximum size of the individual sections that are capable of being attached together.

- d) The maximum rated air velocity and pressure difference across the closed damper established on the basis of the Operation Test, Section 11;
- e) The intended mounting position (vertical, horizontal, or both);
- f) The top of the damper;
- g) The words "Also Suitable for Use as Volume Control Damper," when tested for 100,000 cycles of operations specified in Cycling Test, Section 8; and
- h) A reference to the manufacturer's installation and operating instructions.

Revised 17.2 effective July 1, 2002

17.3 All labels shall be located on an internal surface of the damper.

17.4 Damper actuators shall be marked with their electrical ratings when electrical, or the maximum and minimum pressure ratings when pneumatic or hydraulic.

17.5 When a manufacturer produces dampers at more than one factory, each damper shall have a distinctive marking to identify it as the product of a particular factory.

INSTALLATION AND OPERATING INSTRUCTIONS

18 General

18.1 Each shipping container that contains a damper(s) shall be provided with legible instructions pertaining to the installation and operation of the damper. Illustrations shall be used with the required instructions to clarify the intent. Instructions shall include detailed directions and information for the intended installation and operation of the product. Dampers shipped in a common container shall be provided with at least one copy of the installation and operating instructions.

18.1 revised January 11, 2002

18.2 A copy of the installation and operating instructions intended to accompany a damper shall be used as a reference in the examination and test of the damper. For this purpose, a final printed copy is not required.

18.3 The instructions shall specify:

- a) The mounting details;
- b) The specified means of sealing the damper to ductwork or damper frame, or both;
- c) The type and size of fasteners and the spacing of the fasteners used in attaching the damper frame to the sleeve or duct;
- d) Information on connecting the actuator to the power (electric or pneumatic) supply; and
- e) Any other specific features required for the installation and operation.

Table 16.1
Leakage classifications

Table 16.1 revised January 11, 2002

Classification	Leakage, ft ³ /min/ft ² (m ³ /s/m ² ×196), at standard air conditions		
	At 4.5 inches water (1.1 kPa)		
I	8		
II	20		
III	80		
	At 8.5 inches water (2.1 kPa)	At 12.5 inches water (3.1 kPa)	
I	11	14	
II	28	35	
III	112	140	

16.2 Leakage at the prescribed pressure differences shall be no greater than the values shown in Table 16.1, within each classification.

MARKING

17 General

17.1 Each damper shall be legibly marked with:

- a) The manufacturer's name, trade name, or trademark or other descriptive marking by which the organization responsible for the damper is identified;

Exception: The manufacturer's identification is capable of being a traceable code when the damper is identified by the brand or trademark owned by a private labeler.

- b) A distinctive (catalog or model) number or the equivalent; and

- c) The date or other dating period of manufacture not exceeding any three consecutive months.

Exception: The date of manufacture is capable of being abbreviated; or in a nationally accepted conventional code or in a code affirmed by the manufacturer, when the code:

- a) Does not repeat in less than 20 years, and*

- b) Does not require reference to the production records of the manufacturer to determine when the product was manufactured.*

17.2 Each damper or each factory assembled multiple damper assembly shall be marked with:

- a) The words "Smoke Damper" if the damper has been tested as a smoke damper; and the words "Combination Fire and Smoke Damper" if the damper has been tested as a combination fire and smoke damper;

- b) Leakage classification in accordance with Table 16.1;

- c) The temperature rating established on the basis of the Operation Test, Section 11;

Table 14.2
Accelerated aging conditions

Material	Test program
Silicone, rubber, neoprene, foamed, thermoplastic (including polyvinyl chloride), and similar materials	Aged in full-draft, air-circulating oven for 1440 hours at 129°C

14.2 Foamed and thermoplastic materials used for nonmetallic or organic components such as gaskets and sealants shall be subjected to accelerated aging under the conditions specified in Table 14.2. Foamed materials shall not harden or otherwise deteriorate to a degree that affects their sealing properties. Thermoplastic materials shall not deform or melt, or otherwise deteriorate to a degree that affects their sealing properties.

14.3 When gaskets are secured by adhesives, samples of the gasket, adhesive, and mounting surface are to be subjected to accelerated aging under the conditions specified in Table 14.2. The force required to peel the gasket from its mounting surface after the aging shall not be less than 50 percent of the value determined on as-received samples.

14.4 Tensile strength and elongation are to be determined using the test methods and apparatus described in the Standard for Gaskets and Seals, UL 157.

15 Hydrostatic Strength Test for Pneumatic Actuators

15.1 When tested as described in 15.2, the sample shall withstand the test pressure for 1 minute without leakage or rupture.

Exception: Leakage at a gasket or fitting during the hydrostatic pressure test is not prohibited when it occurs at a pressure more than 50 percent of the required test pressure.

15.1 revised January 11, 2002

15.2 A pneumatic actuator is to be subjected to a hydrostatic test pressure 5 times its maximum rated pressure. The sample is to be filled with water to exclude air and is to be connected to a hydraulic pump. The pressure is to be raised gradually to the required test pressure.

CLASSIFICATION

16 General

16.1 The highest leakage obtained on the representative samples tested in accordance with the Leakage Tests, Section 10, shall determine the leakage classification for the overall design, as specified in Table 16.1.

Exception: For dampers smaller than 1 square foot (0.09 m²) in size, the maximum leakage shall be the same as that for a damper sized 1 square foot.

16.1 revised January 11, 2002

12.4 At the conclusion of the exposure, the damper is to be removed from the chamber and dried at a temperature of $75 \pm 10^\circ\text{F}$ ($23.9 \pm 5.5^\circ\text{C}$) for a minimum of 24 hours. It is then to be placed in its intended mounting position and tested for closing and latching (when a latch is provided).

12.4 revised January 11, 2002

13 Fire Exposure Test

13.1 When tested as specified in the fire test portion of the Fire Endurance and Hose Stream Test as specified in the Standard for Fire Dampers, UL 555, there shall be no flaming of the damper assembly materials on the unexposed side.

Exception No. 1: Flaming of nonmetallic or organic components used in a damper assembly is not prohibited on the unexposed side when the flames do not exceed 6 inches (152 mm) in length.

Exception No. 2: This requirement does not apply to nonmetallic or organic components used in a damper assembly when the total exposed surface area of the nonmetallic or organic components is 25 square inches (161 cm²) or less.

Exception No. 3: This requirement does not apply to nonmetallic or organic components used in a damper assembly which are classified as to surface burning characteristics and which have a flame spread value of 25 or less and a smoke developed value of 50 or less when tested as specified in the Standard for Test for Surface Burning Characteristics of Building Materials, UL 723.

14 Accelerated Aging Test

14.1 Nonmetallic components such as gaskets and sealants made of silicone, rubber, neoprene, and other such materials except foamed materials shall have physical properties as specified in Table 14.1 after accelerated aging under the conditions specified in Table 14.2.

Table 14.1
Physical properties for gaskets and sealants

Physical property	After test
Elongation – Minimum increase in distance between 1 inch (25.4 mm) gauge marks at break	60 percent of original
Tensile Strength – Minimum force at breaking point	60 percent of original

11.2.11 A damper equipped with an external actuator is to be tested with an enclosure around the actuator. The enclosure containing the actuator is to be equipped with a heater which raises the temperature inside the enclosure to the same rating temperature and for the same duration as that to which the damper is subjected. There is to be no airflow through the enclosure containing the actuator.

Effective date for 11.2.11 changed from June 1, 2001 to July 1, 2002

11.2.12 The measured temperature is to be the average temperature obtained from the readings of not less than nine thermocouples. The thermocouples are to be 0.04 to 0.06 inch (1.0 to 1.6 mm) outside diameter sheathed-junction thermocouples symmetrically disposed and distributed. The distance of the thermocouple junctions from the damper blades, as measured with the damper in the closed position, is to be not greater than 12 inches (305 mm) upstream from the damper. The temperature is to be recorded at least as frequently as every 10 seconds from the time heat is introduced into the system until the damper fully closes.

Revised 11.2.12 effective July 1, 2002

11.3 Multiple assembly

11.3.1 A multiple assembly is to be mounted as described in 11.1.2.

11.3.2 When the multiple assembly incorporates individual sections operated by their own closure mechanism or actuator, each individual section is to be operated at the maximum specified air velocity for the multiple assembly with all other sections closed.

Exception: As an alternative to testing the multiple assembly incorporating individual sections, the individual sections are to be tested at the maximum specified air velocity for the multiple assembly.

11.3.2 revised January 11, 2002

11.3.3 When the multiple assembly incorporates individual sections operating from a common closure mechanism or actuator, this assembly is to be tested in accordance with 11.1.1 – 11.2.11.

12 Salt-Spray Exposure Test

12.1 Representative samples of a damper shall automatically close and latch when a latch is provided following exposure to salt spray for a period of 5 days when tested as described in 12.2 – 12.4.

12.2 Prior to the test, all grease or oil is to be removed from the damper, using organic solvents. Also prior to the test in cases where the salt creates interfering buildup of zinc chloride, galvanized steel parts are to be painted.

12.2 revised January 11, 2002

12.3 The damper is to be installed in a test chamber with the damper open and supported in the position of intended use and then exposed to salt spray for 120 hours, in accordance with the Practice for Operating Salt Spray (Fog) Testing Apparatus, ASTM B117-97; except that the salt solution is to consist of 20 percent by weight of common salt (sodium chloride) and distilled water. The pH value of this solution as collected after spraying in the test apparatus is to be between 6.5 and 7.2 and the specific gravity between 1.126 and 1.157 at 95°F (35°C).

Table 11.1
Test airflow and pressure conditions

Revised Table 11.1 effective July 1, 2002

Rated air velocity and pressure		Minimum test air velocity and pressure	
Air velocity, fpm (m/s)	Pressure, inches of water (kPa)	Air velocity, fpm (m/s)	Pressure, inches of water (kPa)
2000 (10.2)	4 (1.0)	2400 (12.2)	4.5 (1.12)
3000 (15.2)	4 (1.0)	3400 (17.3)	4.5 (1.12)
4000 (20.3)	4 (1.0)	4400 (22.3)	4.5 (1.12)
2000 (10.2)	6 (1.5)	2400 (12.2)	6.5 (1.62)
3000 (15.2)	6 (1.5)	3400 (17.3)	6.5 (1.62)
4000 (20.3)	6 (1.5)	4400 (22.3)	6.5 (1.62)
2000 (10.2)	8 (2.0)	2400 (12.2)	8.5 (2.12)
3000 (15.2)	8 (2.0)	3400 (17.3)	8.5 (2.12)
4000 (20.3)	8 (2.0)	4400 (22.3)	8.5 (2.12)

11.2.7 For air velocity and closed damper pressure ratings higher than those indicated in Table 11.1 the test air velocity is to be 400 fpm (2.0 m/s) higher than the rated air velocity and the test pressure is to be 0.5 inch water (0.12 kPa) higher than the rated pressure.

Revised 11.2.7 effective July 1, 2002

11.2.8 Dampers shall be fully-closed and fully-opened using the specified actuator. The closing time shall not exceed 75 seconds nor shall the reopening time of the damper exceed 75 seconds. The test pressure difference created in the closed position is to be recorded and shall not be less than the specified test pressure. This sequence is to be conducted for three complete cycles. For the ambient temperature rating the test is completed after the damper is cycled three times.

Effective date for 11.2.8 changed from June 1, 2001 to July 1, 2002

11.2.9 The test apparatus for the generation of airflow and heat is to be of the open loop construction. A natural gas flame is to be used as the heat source; or another heat source corrected such that the total mass flow rate across the damper is equivalent to that which occurs using a natural gas flame as the heat source.

Effective date for 11.2.9 changed from June 1, 2001 to July 1, 2002

11.2.10 After the conduct of three closing and opening cycles at ambient temperature, the test damper is to be returned to the full-open position and heat is to be introduced to the system at an average temperature rise rate of 30° to 50°F (17 to 28°C) per minute until the specified elevated temperature is attained. The system shall be maintained at the elevated temperature of up to a maximum 50°F (28°C) above the specified elevated temperature for a minimum of 15 minutes. At that time the damper is to be fully closed using the actuator. The closing time is to be recorded. The closing time shall not exceed 75 seconds. Once the damper fully-closes, the heat input into the system is to be discontinued. The test pressure difference created in the closed position is to be recorded and shall not be less than the specified test pressure. The damper is to then be fully opened using the actuator. The opening time is to be recorded. The reopening time of the damper shall not exceed 75 seconds.

Effective date for 11.2.10 changed from June 1, 2001 to July 1, 2002

11.1.3 The minimum air velocity and closed damper pressure rating for dampers shall be 2000 fpm (10.2 m/s) and 4 inches of water (1.0 kPa). Air velocity and pressure ratings higher than the minimum are established in increments of 1000 fpm (5.1 m/s) and in increments of 2 inches of water (0.5 kPa).

Revised 11.1.3 effective July 1, 2002

11.2 Method

11.2.1 When a damper is subjected to the heated air operation test, a representative damper sample is to be mounted, as intended, inside the duct connected to the test chamber. When the damper is subjected to the ambient air operation test, a representative damper sample is to be mounted, as intended, to the test chamber or inside the duct connected to the test chamber.

Effective date for 11.2.1 changed from June 1, 2001 to July 1, 2002

11.2.2 Dampers provided with electric actuators are to be connected to the intended power supply. The test voltage is to be the minimum specified on the electric motor actuator. Dampers provided with pneumatic actuators are to be connected to the intended air supply line. The supply line pressure is to be at the minimum pressure specified on the actuator manufacturer's pneumatic device.

Revised 11.2.2 effective July 1, 2002

11.2.3 All airflow measurements are to be taken at ambient conditions and the tests are to be conducted at an ambient temperature between 50°F (10°C) and 104°F (40°C) prior to introduction of heat into the system.

Effective date for 11.2.3 changed from June 1, 2001 to July 1, 2002

11.2.4 Dampers are to be tested using the airflow measuring equipment, instruments, apparatus, and setups specified in the Airflow Movement and Control Association, Inc. (AMCA) Standard 500-D-98, Laboratory Methods for Testing Dampers for Rating.

Revised 11.2.4 effective July 1, 2002

11.2.5 The airflow generating equipment is to be capable of producing the prescribed airflow and pressure conditions without the use of pressure relief devices.

Effective date for 11.2.5 changed from June 1, 2001 to July 1, 2002

11.2.6 With the damper in the open position, the airflow velocity is to be established at the rate indicated in Table 11.1.

Effective date for 11.2.6 changed from June 1, 2001 to July 1, 2002

10.9 There shall be no extrapolations above the maximum test pressures.

Effective date for 10.9 changed from June 1, 2001 to July 1, 2002

10.10 When the leakage obtained on the maximum – maximum size under heated air test conditions is less than the leakage obtained on the maximum – maximum size under ambient conditions, the resultant leakage classification shall be the highest leakage rate of the three samples conducted at ambient conditions following the parameters described in Table 16.1. When the leakage rate obtained on the maximum – maximum size under heated air conditions is higher than the leakage obtained on the maximum – maximum size under ambient conditions, the resultant leakage obtained on the minimum – maximum and maximum – minimum sizes shall be increased by the same percentage. The leakage classification is then to be determined from the highest computed leakage rate following the parameters of Table 16.1. The values of all test results are to be corrected to standard air density.

Revised 10.10 effective July 1, 2002

10.11 The damper area is to be determined from the nominal outside frame dimensions of the damper for an internal mounted damper and from the nominal inside frame dimensions for a flange-mounted damper.

10.12 The damper under test is to be mounted in the plane in which it is intended to be used and in accordance with the manufacturer's installation instructions. A flange-mounted damper is to be either mounted to a short section of ductwork or flange-mounted directly to the test chamber wall. For an internal-mounting damper, the test chamber wall is to be fitted with a short section of ductwork for mounting the damper. Ductwork is not to extend more than 9 inches (229 mm) beyond the damper frame and is not to interfere with the test. A sealing means is to be used to resist air leakage around the ductwork or damper frame. Mounting holes on the damper that are not used are to be plugged when they provide a path for air leakage around the damper.

10.12 revised January 11, 2002

11 Operation Test

11.1 General

11.1.1 Under conditions of maximum specified air velocity, smoke dampers and combination fire and smoke dampers (including any actuators) shall function without damage to the dampers or their components and shall completely close and open under the conditions described herein. The test pressure difference created in the closed position is to be recorded and shall be not less than that specified in Table 11.1 and Table 16.1. The dampers are to be tested using the air flow measuring equipment, instruments, apparatus, and setups specified in the Air Movement and Control Association, Inc. (AMCA) Standard 500-D-98, Laboratory Methods for Testing Dampers for Rating. The tests are to be conducted at an ambient temperature between 50 – 104°F (10 – 40°C).

Revised 11.1.1 effective July 1, 2002

11.1.2 Dampers are to be tested first in one direction. Another test sample is to be then mounted such that the airflow is in the opposite direction and tested.

Effective date for 11.1.2 changed from June 1, 2001 to July 1, 2002

10.4 This test is to be conducted on the maximum width – maximum height, maximum width – minimum height, and minimum width – maximum height damper sizes for square and rectangular shaped dampers. The test is to be conducted on the maximum and minimum diameter sizes of round dampers. The leakage classification shall be determined by Table 16.1 from the highest leakage value obtained from the specimens tested.

Exception: This test procedure is not required when the leakage classification is determined using the correlation method as specified in 10.5 – 10.10. The correlation method involves measuring the leakage through the largest size under heated air and comparing with leakage obtained on the largest size following the methods described in 10.5 – 10.10. The leakage measurement described in 10.7 is conducted at ambient temperature. The ambient leakage through the minimum-maximum and maximum-minimum sizes are determined. The required computations are specified in 10.10.

Effective date for 10.4 changed from June 1, 2001 to July 1, 2002

10.5 A sample of the maximum width – maximum height square or rectangular damper or maximum diameter round damper is to be subjected to the heated air leakage test as described in 10.1 – 10.3. The resultant heated air leakage is to be recorded.

Effective date for 10.5 changed from June 1, 2001 to July 1, 2002

10.6 The leakage of the maximum width – maximum height, maximum width – minimum height, and minimum width – maximum height damper sizes for square and rectangular shaped dampers and the maximum and minimum diameter sizes of round dampers is to be determined from the procedures specified in 10.7.

Effective date for 10.6 changed from June 1, 2001 to July 1, 2002

10.7 The dampers specified in 10.6 are to be subjected to the Cycling Test, Section 8, and to the Temperature Degradation Test, Section 9. After completion of the temperature degradation test, each damper is to be sealed against one face of an air flow measurement apparatus. For smoke dampers, the dampers are to be cycled open and close three times against the test airflow and damper closure pressure. For combination fire and smoke dampers, the dampers are to be first cycled open and close three times at the test airflow and closure pressure conditions. For the third closure, the heat responsive device is to be manually released and the damper shall close by the fire response mechanism. The resultant air leakage through the damper, corrected to standard temperature and pressure conditions, is to be determined using the test procedures, air flow measuring equipment, instruments, apparatus and setups specified in the Air Movement and Control Association, Inc. (AMCA) Standard 500-D-98, Laboratory Methods for Testing Dampers for Rating. The dampers shall be tested on both sides.

Revised 10.7 effective July 1, 2002

10.8 The minimum air velocity and closed damper pressure rating for dampers shall be 2000 fpm (10.2 m/s) and 4 inches of water (1.0 kPa). Air velocity and pressure ratings higher than the minimum are established in increments of 1000 fpm (5.1 m/s) and in increments of 2 inches of water (0.5 kPa). For the leakage test, first the test velocity is to be established at a minimum of 400 fpm (2.0 m/s) higher than the rated air velocity with the damper in the open position; secondly, the test pressure is to be established at a minimum 0.5 inch water column (0.12 kPa) higher than the rated pressure when the damper is in the closed position.

Revised 10.8 effective July 1, 2002

8 Cycling Test

8.1 A damper intended for use with an actuator (that is, the electric, pneumatic, or hydraulic device used to operate the damper) shall function as intended after being operated for 20,000 full-stroke (that is, close and reopen) operations, or 100,000 full-stroke operations when the damper is also intended for use as a volume control damper, while using the specified damper actuator and while operating without duct system pressure. The closing time shall not exceed 75 seconds nor shall the reopening time of the damper exceed 75 seconds. All dampers are to be cycled while mounted in the position intended for installation.

Revised 8.1 effective July 1, 2002

8.2 A damper employing position devices that enable the damper to remain in positions other than fully open or fully closed is defined to be a volume control damper.

9 Temperature Degradation Test

9.1 When tested as specified in 9.2 and 9.3, each damper shall remain functional during the test.

9.2 The dampers used for this test are to be those previously subjected to the Cycling Test, Section 8, prior to subjecting them to the leakage test. The elevated temperatures are to be in increments of 100°F (56°C), and the minimum temperature is to be 250°F (121°C). The damper is to be exposed to the elevated temperature, ± 5 percent, for 30 minutes in the completely closed position.

9.2 revised April 30, 2003

9.3 After the 30-minute period and while at the elevated temperature, the damper shall function as intended while being operated through three complete operation cycles. The closing time shall not exceed 75 seconds nor shall the reopening time of the damper exceed 75 seconds. The damper is to be cycled by using the actuator that has also been subjected to the test temperature.

9.3 revised January 11, 2002

10 Leakage Tests

10.1 The amount of leakage measured during this test shall determine the leakage class of the damper, in accordance with the limitations in Table 16.1.

10.2 For smoke dampers the leakage test is a continuation of the operation test. For combination fire and smoke dampers, the leakage test is a continuation of the dynamic closure test.

Effective date for 10.2 changed from June 1, 2001 to July 1, 2002

10.3 At the conclusion of the operation test or dynamic closure test, as appropriate (see 10.2), while the damper is in the closed position, the duct section downstream of the damper is to be converted to the duct section with measuring plane. The pressure and test temperature are to be maintained against the closed damper. The resultant leakage through the damper, corrected to standard temperature and pressure conditions, is to be determined using the test procedures, airflow measuring equipment, instrument, apparatus and setup specified in the heated air leakage test section of the Air Movement and Control Association, Inc. (AMCA) Laboratory Methods for Testing Dampers for Rating, 500-D-98.

Revised 10.3 effective July 1, 2002

Table 7.2
Correlation method: samples required and test sequence

Revised Table 7.2 effective July 1, 2002

Samples	Test sequence
Square or rectangular dampers	
Max. Width-Max. Height	Cycling – Operation – Dynamic Closure ^a – Leakage
Max. Width-Max Height	Cycling – Temp. Degradation – Operation ^b – Dynamic Closure ^{a, b} – Leakage ^b
Max. Width-Min. Height	Cycling – Temp. Degradation – Operation ^b – Dynamic Closure ^{a, b} – Leakage ^b
Min. Width-Max. Height	Cycling – Temp. Degradation – Operation ^b – Dynamic Closure ^{a, b} – Leakage ^b
Round dampers	
Max. Diameter	Cycling – Operation – Dynamic Closure ^a – Leakage
Max. Diameter	Cycling – Temp. Degradation – Operation ^b – Dynamic Closure ^{a, b} – Leakage ^b
Min. Diameter	Cycling – Temp. Degradation – Operation ^b – Dynamic Closure ^{a, b} – Leakage ^b
Notes ¹ This table applies to smoke dampers and combination fire and smoke dampers being tested using the correlation method of testing as specified in the Exception to 10.4. See also 7.1. ² "Max." refers to maximum, and "Min." refers to minimum. ^a The dynamic closure test applies only to combination fire and smoke dampers, not to smoke dampers, and is specified in the Standard for Fire Dampers, UL 555. ^b This test is conducted at ambient temperature.	

7.2 In addition, two dampers, consisting of the largest (except as noted in the next sentence) and smallest sizes, are to be subjected to the salt-spray exposure tests. For the salt spray exposure testing, the overall size of the sample used including the actuator is not to exceed 42 inches high by 46 inches wide (1.07 m by 1.15 m) for vertical fire dampers and 46 inches long by 28 inches wide (1.15 m by 0.71 m) for horizontal dampers.

7.3 A damper incorporating nonmetallic or organic components such as gaskets, sealants, adhesives, blade position indicators, and similar materials which are exposed to the air stream, is to be subjected to the Fire Exposure Test, Section 13. The representative sample used is to be size 24 by 24 inches (610 by 610 mm), or 24 inches in diameter, or the maximum size damper produced when the maximum size damper is smaller. In addition, a representative sample of the nonmetallic or organic component such as a gasket, sealant, adhesive and similar material used in the damper is to be subjected to the Accelerated Aging Test, Section 14.

7.4 The Salt-Spray Exposure Test, Section 12, is intended to simulate debris that accumulates on a damper mounted in a duct within a building, and to investigate the performance of the damper while subjected to such accumulations.

PERFORMANCE

7 General

7.1 Representative samples of each design or design variation, including all operational components, are to be subjected to the Cycling Test, Section 8; Temperature Degradation Test, Section 9; Leakage Tests, Section 10; and Operation Test, Section 11. Combination fire and smoke dampers are also to be subjected to the Dynamic Closure Test in the Standard for Fire Dampers, UL 555. The testing sequence and representative samples required (which are intended to cover a range of damper sizes for one specific design) is to be as specified in Table 7.1, except as noted in the following sentence. Representative samples, tested in accordance with the Exception to 10.4 (that is, using a correlation method) are to be test sequenced as specified in Table 7.2 using the samples specified in Table 7.2.

Revised 7.1 effective July 1, 2002

Table 7.1
Samples required and test sequence for dampers

Revised Table 7.1 effective July 1, 2002

Samples required	Test sequence
Square or rectangular dampers	
Max. Width-Max. Height	Cycling – Operation – Dynamic Closure ^a – Leakage
Max. Width-Min. Height	Cycling – Operation – Dynamic Closure ^a – Leakage
Min. Width-Max. Height	Cycling – Operation – Dynamic Closure ^a – Leakage
Round dampers	
Max. Diameter	Cycling – Operation – Dynamic Closure ^a – Leakage
Min. Diameter	Cycling – Operation – Dynamic Closure ^a – Leakage
<p>Notes</p> <p>¹ This table applies to smoke dampers and combination fire and smoke dampers; dampers tested using the correlation method specified in the Exception to 10.4 are to be tested as specified in Table 7.2 rather than as specified in Table 7.1.</p> <p>² "Max." refers to maximum, and "Min." refers to minimum.</p> <p>^a The dynamic closure test applies only to combination fire and smoke dampers, not to smoke dampers, and is specified in the Standard for Fire Dampers, UL 555.</p>	

d) Two coats of an organic finish of the epoxy or alkyd-resin type or other outdoor paint on each surface. The acceptability of the paint is to be determined by its composition or by corrosion tests, as specified in the Standard for Organic Coatings for Steel Enclosures for Outdoor Use Electrical Equipment, UL 1332.

5.2 Coated or uncoated metals used in the assembly of dampers shall be galvanically compatible.

5.3 Component springs and bearings used in the assembly of dampers shall be of material having resistance to atmospheric corrosion equivalent to brass or bronze.

5.4 A hot-dipped mill galvanized A60 (alloyed) coating or an annealed zinc coating that is bent or similarly formed after annealing and that is not otherwise required to be painted shall be painted in the bent or formed area as specified in 5.1(d) when the bending or forming process damages the zinc coating as described in 5.5.

5.5 When flaking or cracking of the zinc coating at the outside radius of the bent or formed section is visible at 25 power magnification, the zinc coating is to be identified as damaged. Simple sheared or cut edges and punched holes are not to be defined as formed. Extruded edges and rolled edges and holes shall comply with the requirements of 5.5.

6 Actuators

6.1 An actuator shall be formed and assembled to have the strength and rigidity required to resist the abuses to which it is subjected, without the loosening or displacement of any parts, or other serious defects.

6.2 Actuators shall be factory-mounted securely in position. Bolts, screws, or other parts used for mounting an actuator shall be independent of those used to secure components of the actuator to the frame, base, or panel.

6.2 effective June 1, 2000

6.3 A pneumatic actuator shall comply with the requirements of the Hydrostatic Pressure Test for Pneumatic Actuators, Section 15.

6.4 An electric actuator, position indicator switch, and similar materials, shall comply with the applicable requirements of the Standard for Temperature-Indicating and -Regulating Equipment, UL 873, for their intended use.

6.4 revised January 11, 2002

3 Glossary

3.1 For the purpose of this standard the following definitions apply.

3.2 DYNAMIC CLOSURE – The closure of a fire damper under conditions of airflow and heat upon activation of the heat responsive device.

3.3 HEATED AIR OPERATION – The operation of a smoke damper by means of the actuator when the damper is subjected to a condition of airflow and heat.

3.4 SMOKE CONTROL SYSTEM – An engineered system that uses mechanical fans to produce airflows and pressure differences across smoke barriers to limit (see Table 16.1, Leakage classifications) and direct smoke movement.

3.4 revised January 11, 2002

CONSTRUCTION

4 General

4.1 All electrical components, damper actuators, fusible links, and heat responsive devices shall be examined and tested, as required, for their intended function.

4.2 A heat responsive device provided with a combination fire and smoke damper shall have a temperature rating which is equal to or less than the temperature rating of the damper.

Effective date for 4.2 changed from June 1, 2001 to July 1, 2002

5 Protection Against Corrosion

5.1 A ferrous metal part used in the damper assembly shall be one of the 300 Series of stainless steel or shall have one of the following corrosion-protection systems:

a) A coating of hot-dipped mill galvanized sheet steel complying with the coating Designation G60 or A60 in Table I of the Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process, ASTM A653/A653M-97, with not less than 40 percent of the zinc on any side, based on the minimum single spot test requirement in this ASTM Designation. The weight of the zinc coating is to be established in accordance with the Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings, ASTM A90/A90M-95. An A60 (alloyed) coating shall also comply with the requirements of 5.4.

b) A zinc coating, other than that provided on hot-dipped mill galvanized sheet steel, uniformly applied to an average thickness of not less than 0.00041 inch (0.01041 mm) on each surface with a minimum thickness of 0.00034 inch (0.00864 mm). The thickness of the coating is to be established in accordance with the test method in the Standard Guidelines for Measurement of Electrodeposited Metallic Coating Thicknesses by the Dropping Test, ASTM B555-86(R1997). An annealed coating shall also comply with the requirements of 5.4.

c) A cadmium coating not less than 0.0005 inch (0.0127 mm) thick on both surfaces. The thickness of coating is to be established in accordance with the test method in the Standard Guidelines for Measurement of Electrodeposited Metallic Coating Thicknesses by the Dropping Test, ASTM B555-86(R1997).

2 General

2.1 Components

2.1.1 Except as indicated in 2.1.2, a component of a product covered by this standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

2.1.1 revised January 11, 2002

2.1.2 A component is not required to comply with a specific requirement that:

- a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or
- b) Is superseded by a requirement in this standard.

2.1.2 revised October 27, 2000

2.1.3 A component shall be used in accordance with its rating established for the intended conditions of use.

2.1.3 revised October 27, 2000

2.1.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

2.1.4 revised October 27, 2000

2.2 Units of measurement

2.2.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

2.2.1 revised October 27, 2000

2.3 Undated references

2.3.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

INTRODUCTION

1 Scope

1.1 These requirements cover smoke dampers intended for use in heating, ventilating, and air conditioning (HVAC) systems. Smoke dampers are intended:

- a) To restrict the spread of smoke in HVAC systems that are designed to be automatically shut down in the event of a fire, or
- b) To assist with the control of pressure differentials across smoke barriers when the HVAC system is part of an engineered smoke control system.

1.1 revised January 11, 2002

1.2 Dampers covered by these requirements are evaluated for use as either:

- a) Smoke Dampers – For use in HVAC systems where ducts pass through smoke barriers.
- b) Combination Fire and Smoke Dampers – For locations in HVAC systems where a fire damper and a smoke damper are required at a single location.

1.2 revised January 11, 2002

1.3 Smoke dampers are used for the protection of openings in smoke barriers or in engineered smoke control systems in accordance with the Standard for Installation of Air Conditioning and Ventilating Systems, NFPA 90A. These damper assemblies are intended for installation in accordance with codes such as the BOCA National Mechanical Code, the SBCCI Standard Mechanical Code, the ICBO Uniform Mechanical Code, and the International Mechanical Code.

1.3 revised January 11, 2002

1.4 Deleted January 11, 2002

1.5 Deleted January 11, 2002

1.6 Combination fire and smoke dampers shall also comply with the applicable requirements in the Standard for Fire Dampers, UL 555.

1.7 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this standard, and that involves a risk of fire or of electric shock or injury to persons shall be evaluated using appropriate additional component and end-product requirements to maintain the level of safety as originally anticipated by the intent of this standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this standard does not comply with this standard. Revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

1.7 revised October 27, 2000

FOREWORD

A. This Standard contains basic requirements for products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Standard. These requirements are based upon sound engineering principles, research, records of tests and field experience, and an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. They are subject to revision as further experience and investigation may show is necessary or desirable.

B. The observance of the requirements of this Standard by a manufacturer is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which complies with the text of this Standard will not necessarily be judged to comply with the Standard if, when examined and tested, it is found to have other features which impair the level of safety contemplated by these requirements.

D. A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this Standard, and that involves a risk of fire or of electric shock or injury to persons shall be evaluated using appropriate additional component and end-product requirements to maintain the level of safety as originally anticipated by the intent of this Standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this Standard does not comply with this Standard. Revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this Standard.

E. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed. UL shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

F. Many tests required by the Standards of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

CONTENTS

FOREWORD	4
-----------------------	---

INTRODUCTION

1 Scope	5
2 General	6
2.1 Components	6
2.2 Units of measurement	6
2.3 Undated references	6
3 Glossary	7

CONSTRUCTION

4 General	7
5 Protection Against Corrosion	7
6 Actuators	8

PERFORMANCE

7 General	9
8 Cycling Test	11
9 Temperature Degradation Test	11
10 Leakage Tests	11
11 Operation Test	13
11.1 General	13
11.2 Method	14
11.3 Multiple assembly	16
12 Salt-Spray Exposure Test	16
13 Fire Exposure Test	16A
14 Accelerated Aging Test	16A
15 Hydrostatic Strength Test for Pneumatic Actuators	16B

CLASSIFICATION

16 General	16B
------------------	-----

MARKING

17 General	17
------------------	----

INSTALLATION AND OPERATING INSTRUCTIONS

18 General	18
------------------	----

APPENDIX A

Standards for Components	A1
--------------------------------	----

No Text on This Page

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ANSI/UL 555S-2001

1

UL 555S

Standard for Smoke Dampers

The first, second and third editions were titled Leakage Rated Dampers for Use in Smoke Control Systems.

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Second Edition – November, 1993
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Fourth Edition

June 1, 1999

The most recent designation of ANSI/UL 555S as an American National Standard (ANSI) occurred on October 3, 2001.

This ANSI/UL Standard for Safety, which consists of the fourth edition (with revisions through April 30, 2003), is under continuous maintenance, whereby each revision is ANSI approved upon publication. Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Written comments are to be sent to the UL Northbrook Standards Department, 333 Pfingsten Road, Northbrook, IL 60062.

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc. and is not part of the ANSI Standard.

The Department of Defense (DoD) has adopted UL 555S on July 29, 1994. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

Revisions of this Standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest set of revised requirements.

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No Text on This Page

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Page	Date
1	April 30, 2003
2	January 11, 2002
3-4	April 30, 2003
5-10	January 11, 2002
11	April 30, 2003
12-16B	January 11, 2002
17	April 30, 2003
18-20	January 11, 2002
A1-A2	April 30, 2003

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Underwriters Laboratories Inc. (UL)
333 Pfingsten Road
Northbrook, IL 60062-2096

UL Standard for Safety for Smoke Dampers, UL 555S

Fourth Edition, Dated June 1, 1999

Revisions: This Standard contains revisions through and including April 30, 2003.

Summary of Topics

This revision of UL 555S is being issued to correct a temperature rise conversion in paragraph 9.2.

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The revisions dated April 30, 2003 include a reprinted title page (page1) for this Standard.

As indicated on the title page (page 1), this UL Standard for Safety is an American National Standard. Attention is directed to the note on the title page of this Standard outlining the procedures to be followed to retain the approved text of this ANSI/UL Standard.

As indicated on the title page (page1), this UL Standard for Safety has been adopted by the Department of Defense.

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UL 555S

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Smoke Dampers

