

PRODUCT APPLICATION GUIDE

A technical bulletin for engineers, contractors and students in the air movement and control industry.

New UL Test Standards for Life Safety Dampers

To address the changing requirements in building codes, system design, and product application, Underwriters Laboratories (UL) is continually revising and upgrading their Standards for Safety to assure end users that products will perform their intended function in a reliable and safe manner.

Evolution of UL 555 and UL 555S

The first edition of a UL Standard for Safety (UL 555) for fire dampers was published in 1968. It was not until 1983 that UL developed a Standard for Safety (UL 555S) for smoke dampers. Over the years there have been numerous changes to these standards. In July 2002 the 6th edition of UL 555 and the 4th edition of UL 555S will take effect.

JULY 1, 2002 is the deadline for all manufacturers of life safety fire, smoke and combination fire/smoke dampers to comply with new testing requirements for UL 555 (Fire Dampers) and UL 555S (Smoke Dampers). This article will review the new requirements dampers must comply with to retain their UL listings.

UL 555 - Fire Dampers

Fire Dampers are intended for use where air ducts penetrate or terminate at openings in walls or partitions, in air transfer openings in partitions, and where air ducts extend through floors as specified in the Standard for Installation of Air Conditioning and Ventilating Systems, NFPA 90A. In a fire emergency the fire damper is designed to close and prevent the spread of fire from one side of the wall or partition to the other.



Fire Dampers are evaluated for use as either:

- Fire Dampers for Static Systems – for HVAC systems that are automatically shut down in the event of a fire.
- Fire Dampers for Dynamic Systems – for HVAC systems that are operational in the event of a fire.
- Combination Fire and Smoke Dampers – for locations in HVAC systems where a fire damper and a smoke damper are required at a single location.

Testing/Rating Requirements

To meet the requirements for UL 555, dampers are subjected to the following battery of tests:

- Fire Endurance and Hose Stream Test
- Cycling Test
- Salt Spray Test
- Dynamic Closure Test (not required for Fire Dampers for Static Systems)
- Duct Impact Test

New and Revised Testing/Rating Requirements

There are significant changes between the 5th and 6th editions of UL 555 in the test procedures and published ratings. Manufacturers must meet the following new and revised testing requirements being implemented for fire dampers.

Dynamic Closure Test (not required for Fire Dampers for Static Systems)

The test evaluates a damper's ability to close against a given heated airflow and remain closed with a given pressure against the closed damper. As a result, a flow and pressure rating is obtained for the damper.

Testing Using Heated Air – The temperature of the air passing through the damper will be increased until the heat responsive device (typically a fusible link or electronic sensor) releases and allows the damper to close. This test will more closely simulate the mode of operation for the damper in a typical field application.

Minimum Airflow and Pressure Ratings – Minimum allowable airflow of 2,000 fpm; pressure rating of 4 in. wg for Dynamic Dampers. Airflow ratings exceeding the minimum 2,000 fpm must be in 1,000 fpm increments (i.e. 3,000 fpm, 4,000 fpm, etc.). Pressure ratings exceeding the minimum 4 in. wg must be in 2 in. wg increments (i.e. 6 in. wg, 8 in. wg).

Factor of Safety – To obtain a given airflow rating, a damper must function at an actual airflow rate at least 400 fpm higher than the given rating. To obtain a given pressure rating a damper must remain closed with an actual pressure against the closed damper at least 0.5 in. wg higher than the rating. For example, to achieve a dynamic closure rating of 2,000 fpm and 4 in. wg the damper must operate against an actual airflow rate of at least 2,400 fpm and pressure of at least 4.5 in. wg.

Bidirectional Ratings – To prevent the dampers from being installed incorrectly they must now be tested with airflow in both directions through the damper.

UL 555S - Smoke Dampers

Smoke Dampers are intended to restrict the spread of smoke in HVAC systems that are designed to be automatically shut down in the event of a fire, or assist with control of pressure differential across smoke barriers when the HVAC system is part of an engineered smoke control system. They are also intended to restrict the spread of smoke when the smoke control fans shut down.

Smoke Dampers 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.

Testing/Rating Requirements

To meet the requirements for UL 555S dampers are subjected to the following battery of tests:

- Cycling Test
- Temperature Degradation Test
- Salt Spray Test
- Flame Spread Test
- Smoke Develop Test
- Accelerated Aging Test
- Operation Test
- Leakage Test

Revised Testing/Rating Requirements

To improve reliability, safety and application of smoke dampers, testing requirements for the Cycling Test, Temperature Degradation Test, Operation Test and Leakage Test have been revised.

Cycle Test

The purpose of this test is to assure dampers will remain functional after expected cycling over the life of a building. As smoke control systems have evolved, many smoke dampers serve a dual purpose – ventilation control during regular operation of a building's HVAC system and as a traditional smoke damper role in a fire emergency. To address this, dampers with two position actuators must now cycle open and closed 20,000 times. This is a significant increase over the 5,000 cycles required by the 3rd edition of UL 555S.

Operation Test

Smoke dampers and combination fire and smoke dampers are subjected to an airflow operation test at the rated temperature of the damper. Temperature ratings range from ambient and upward starting at 250°F and rising in increments of 100°F.

The third edition of UL 555S required operational testing using ambient temperature air, regardless of the temperature rating. The fourth edition requires operational testing at levels equal to the temperature degradation rating of the damper. (Typically 250°F or 350°F.) In addition, effective June 2000 actuators were required to be factory installed.

Testing Using Heated Air – The temperature of the air passing through the damper will be increased until it reaches the same temperature used to establish a Temperature Degradation Rating for the damper. The damper and its actuator will remain exposed to this heated air for 15 minutes to allow all components to come to temperature. After 15 minutes the damper will be cycled closed, the pressure against the closed damper measured and the damper reopened. The damper is allowed to cool and the procedure will be repeated three times at ambient temperature. The heat is re-introduced and one additional cycle is conducted at the rated elevated temperature.

Minimum Airflow and Pressure Ratings – A minimum allowable airflow of 2,000 fpm and pressure rating of 4 in. wg must be achieved. Airflow ratings exceeding the minimum 2,000 fpm must be in 1,000 fpm increments (i.e. 3,000 fpm, 4,000 fpm, etc.). Pressure ratings exceeding the minimum 4 in. wg must be in 2 in. wg increments (i.e. 6 in. wg, 8 in. wg).

Factor of Safety – To obtain a given airflow rating a damper must function at an actual airflow rate at least 400 fpm higher than the given rating. To obtain a given pressure rating a damper must remain closed with an actual pressure against the closed damper at least 0.5 in. wg higher than the rating. For example, to achieve a dynamic closure rating of 2,000 fpm and 4 in. wg the damper must operate against an actual airflow rate of at least 2,400 fpm and pressure of at least 4.5 in. wg.

Bidirectional Ratings – To prevent the dampers from being installed incorrectly they must now be

tested with airflow in both directions through the damper.

Leakage Test

The 3rd edition of UL 555S allowed dampers to be closed against no airflow and then leakage tested using ambient (room) temperature air. To simulate real life conditions, dampers must now meet required leakage performance after an Operational Test for smoke dampers or Dynamic Closure Test for combination fire/smoke dampers. In addition, the damper leakage must be determined while the damper is exposed to the same temperature air as the damper's temperature degradation rating.

Bidirectional Ratings – To prevent the dampers from being installed incorrectly they must now be tested with airflow in both directions through the damper.

Greenheck's commitment

We are committed to providing engineers, contractors and building owners equipment they can rely on. We have exceeded industry standards for many years by establishing our own requirements for bidirectional Operational and Leakage ratings, minimum Temperature ratings, minimum Flow ratings and minimum Pressure ratings for our fire, smoke and combination fire smoke dampers.

Greenheck has invested heavily in a state-of-the-art testing laboratory. A special test chamber and furnace were developed to conduct elevated temperature damper tests. The facility and laboratory personnel meet or exceed AMCA and UL requirements. As a result of our commitment to performance safety and quality, Greenheck is the first manufacturer in the industry to comply with these new UL testing requirements.

The UL requirements will become mandatory for all dampers manufactured after JULY 1, 2002. As new product requirements are met, Greenheck and your local Greenheck representative will keep you informed. We are ready to provide the products you need and help you update your specifications so you too can meet tomorrow's requirements today.

Use the chart on page 4 as a quick reference to compare the old UL test standards to the standards that will take effect in July 2002.

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Old UL 555 Test Standards for Fire Dampers (5th Edition)	New UL Test 555 Standards for Fire Dampers (6th Edition, effective July 2002)		
DYNAMIC CLOSURE TEST			
<ul style="list-style-type: none"> • Tested with ambient temperature air utilizing a manual release 	<ul style="list-style-type: none"> • Temperature sensor must release to close damper 		
<ul style="list-style-type: none"> • No minimum airflow requirement • No safety factor built into ratings 	<ul style="list-style-type: none"> • Airflow Ratings: 2,000, 3,000, and 4,000 fpm Minimum test requirements: 2,400, 3,400, and 4,400 fpm 		
<ul style="list-style-type: none"> • No minimum pressure requirement 	<ul style="list-style-type: none"> • Pressure ratings: 4 in., 6 in., and 8 in. wg Minimum test requirements: 4.5 in., 6.5 in., and 8.5 in. wg 		
<ul style="list-style-type: none"> • Unidirectional ratings 	<ul style="list-style-type: none"> • Bidirectional testing required 		
<table border="0" style="width: 100%;"> <tr> <td data-bbox="228 831 691 947">Old UL 555S Test Standards for Smoke Dampers (3rd Edition)</td> <td data-bbox="906 831 1382 947">New UL 555S Test Standards for Smoke Dampers (4th Edition, effective July 2002)</td> </tr> </table>		Old UL 555S Test Standards for Smoke Dampers (3rd Edition)	New UL 555S Test Standards for Smoke Dampers (4th Edition, effective July 2002)
Old UL 555S Test Standards for Smoke Dampers (3rd Edition)	New UL 555S Test Standards for Smoke Dampers (4th Edition, effective July 2002)		
CYCLING TEST			
<ul style="list-style-type: none"> • Two position actuators - 5,000 cycles 	<ul style="list-style-type: none"> • Two position actuators - 20,000 cycles 		
OPERATION TEST			
<ul style="list-style-type: none"> • Tested with ambient temperature air 	<ul style="list-style-type: none"> • Tested at rated temperature for 15 minutes prior to test 		
<ul style="list-style-type: none"> • No minimum airflow requirement • No safety factor built into ratings 	<ul style="list-style-type: none"> • Airflow Ratings: 2,000, 3,000, and 4,000 fpm Minimum test requirements: 2,400, 3,400, and 4,400 fpm 		
<ul style="list-style-type: none"> • No minimum pressure requirement 	<ul style="list-style-type: none"> • Pressure ratings: 4 in., 6 in., and 8 in. wg Minimum test requirements: 4.5 in., 6.5 in., and 8.5 in. wg 		
<ul style="list-style-type: none"> • Unidirectional ratings 	<ul style="list-style-type: none"> • Bidirectional testing required 		
<ul style="list-style-type: none"> • Actuators may be field mounted 	<ul style="list-style-type: none"> • All actuators must be factory installed (effective June 2000) 		
LEAKAGE TEST			
<ul style="list-style-type: none"> • Tested with ambient temperature air 	<ul style="list-style-type: none"> • Tested with air at rated temperature 		
<ul style="list-style-type: none"> • Tested with a unit that has not been exposed to the Operation and/or Dynamic Closure Test 	<ul style="list-style-type: none"> • Tested after Operation Test and/or Dynamic Closure Test 		
<ul style="list-style-type: none"> • Four leakage classifications 	<ul style="list-style-type: none"> • 4th Leakage classification eliminated 		
<ul style="list-style-type: none"> • Unidirectional ratings 	<ul style="list-style-type: none"> • Bidirectional testing required 		
<ul style="list-style-type: none"> • No actuation required 	<ul style="list-style-type: none"> • Test with actuator holding damper closed 		