

## Safety Agency Listing

### Introduction

Safety is a major concern when fans and blowers are designed and manufactured. Any product sold for use by the general public containing electrical components must carry the Underwriters Laboratories Inc. (UL) listing mark. Federal, state and local building codes also dictate that any electrically operated equipment sold for use on a new public building must carry the UL listing mark. Building inspectors will check for this mark on all electrically operated equipment. OSHA will look for this mark during safety inspections in the workplace. Since its founding in 1894, UL has played a key role in the U.S. safety system. The UL mark has become America's most familiar safety symbol.

As the primary North American product safety organization and the leading developer of U.S. product safety standards, UL participates internationally in the harmonization of national product safety standards used in countries around the world. UL is accredited by the Standards Council of Canada (SCC), the Canadian national organization responsible for accrediting product testing and certification organizations for Canada. The UL mark for Canada is officially accepted by authorities in all the provinces and territories of Canada. UL is an integral part of the Canadian safety system.

In December 1993, UL signed a landmark cooperative assistance agreement with the Association Nacional de Normalizacion y Certificacion del Sector Electrico (ANCE); the first government accredited private sector standards and product certification organization for electrical products in Mexico. UL can work with manufacturers anywhere in the world to help them obtain the NOM mark, the certification mark required by Mexican regulations and issued by ANCE for electrical products.

UL has been testing products for over 100 years. That is longer than any other certification organization in North America. UL marks have come to represent something unique, an organization that always puts public safety first. UL will never adopt a practice or short cut anything that may compromise product safety.

### UL Standards

Fans and blowers fall under several standards.

#### UL507 – Standard for Safety for Electric Fans

- 1) These requirements cover:
  - a) Fans and blowers that circulate air, such as desk, ceiling-suspended, and hassock fans;
  - b) Fans and blowers that ventilate air, such as attic, wall-insert, ceiling-insert, household hood and canopy types, and window fans;
  - c) Dryer type fans used for drying carpets or floors;
  - d) Evaporative coolers;
  - e) Air-filtering appliances;
  - f) Fan type deodorizers and air fresheners;
  - g) Component fans;
  - h) Low voltage component fans.

These products are rated 600 volts or less and are intended to be employed in accordance with the National Electrical Code, ANSI/NFPA 70.

- 2) These requirements do not cover air heaters incorporating fans, heating- ventilating units, or blowers comprising components of such equipment as furnaces, mechanical-refrigeration equipment, or air conditioners.
- 3) These requirements do not cover fusible links, and the like, provided to disconnect a fan or close shutters in the event of fire.
- 4) These requirements do not cover fans for use in cooking areas when the fan is intended for other than household use.
- 5) These requirements do not cover fans intended to be:
  - a) Used in hazardous locations as defined in the National Electrical Code, ANSI/NFPA 70;
  - b) Installed over solvents or chemically flammable liquids or vapors; or
  - c) Located in chemically corrosive environments.
- 6) These requirements do not cover humidifiers.

#### UL705 – Standard for Safety for Power Ventilators

- 1) These requirements cover power ventilators of the roof and wall mounted types and duct fans of the straight-through type intended for commercial or industrial use and for connection to permanently installed wiring systems in accordance with the National Electrical Code, NFPA 70.
- 2) These requirements do not cover the following:
  - a) Ventilating equipment such as attic, hood, or canopy fans or blowers;
  - b) Air moving equipment with integral air tempering means;
  - c) Ventilators rated more than 600 volts;
  - d) Ventilators employing universal motors rated more than 250 volts;
  - e) Air heaters equipped with fans;
  - f) Draft fans for furnaces;
  - g) Heating-ventilating units;
  - h) Blowers employed as components in equipment such as furnaces, mechanical refrigeration equipment or air conditioners;
  - i) Fusible links, and the like, that may be provided to disconnect a fan or close shutters in the event of fire;
  - j) Ventilators specifically intended for use in exhausting any of the following: gases other than air, atmospheres causing corrosion to the ventilator, air with water spray or flammable vapors;
  - k) Ventilators for the removal or conveyance of dust, stock or refuse.

### **UL762 – Power Roof Ventilators for Restaurant Exhaust Appliances**

1) These requirements cover roof or wall mounted ventilators for restaurant exhaust appliances.

2) Power ventilators for restaurant exhaust appliances covered by these requirements are intended for installation in accordance with the Standard of the National Fire Protection Association for the installation of Equipment for the removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment.

3) Power ventilators for restaurant appliances shall comply with ANSI/UL 705: Power Ventilators, modified in that wiring system shall not be located in the path of travel of exhaust products.

### **UL793 – Automatically Operated Roof Vents for Smoke and Heat**

1) These requirements cover automatically operated roof vents for smoke and heat that fall into two general categories: mechanically-opened and gravity-opened. Mechanically-opened vents consist primarily of a body frame, one or more damper covers and hatches, and operating mechanisms that generally include a heat responsive device and spring(s). The vents covered by these requirements are operated manually or automatically in the event of fire to remove smoke and heat from the building. Automatic operation does not depend on electrical power or other energy sources that may be interrupted during a fire, but rather depends upon operation of a heat responsive device or on the action of a plastic cover shrinking and falling from place due to fire exposure, or the like. These vents are not intended for use as general-purpose building ventilation devices. Fans use the mechanically-opened type installed on the discharge of a fan discharging air up and away from the building.

A product that contains features, characteristics, components, materials or systems new or different from those covered in these standards and involves a risk of fire, electric shock, or injury to persons shall be evaluated using the appropriate additional component and end product testing standards as determined necessary to maintain an acceptable level of safety as originally anticipated by the intent of the standards.

## **Canadian Standards**

### **CSA C22.2 No. 100-95 Motors and Generators**

1) This standard applies to electric motors and generators for installation and use, in accordance with the rules of the Canadian Electrical Code, Part 1, in nonhazardous locations.

2) Clause 7 – AC and DC motors (including universal motors), in IEC frame size 80 and smaller.

Clause 8 – AC motors (including universal motors) in IEC frame sizes 90 to 280 inclusive and rated 750 V and less. Clause 9 – AC motors rated over 750 V or in IEC frame size 315 and larger.

Clause 10 – all DC motors in IEC frame size 90 and larger.

Clause 12 – Inverter duty variable speed AC motors.

3) This standard provides basic requirements for motors and does not exclude any additional requirements given in other Standards of the Canadian Electrical Code.

4) This standard does not apply to:

- a) sealed (hermetic) type motors such as those used in refrigerant compressors

- b) electric motors for use in aircraft, marine service installations, drives for land transportation equipment or motors used in underground mining.

### **CSA C22.2 No. 113-M1984 Fans and Ventilators**

1) This standard applies to cord connected and permanently connected fans and ventilators intended to be connected to supply circuits of 600 V and less, for use in nonhazardous locations and intended to be used in accordance with the Rules of the Canadian Electrical Code, Part 1.

2) This Standard applies to fans and ventilators for ventilating or exhaust purposes and filter units consisting of an air circulating fan and a mechanical filter.

3) This standard applies to fans and ventilators of the air circulating type such as desk, pedestal, hassock, utility, suitcase and pendent ceiling fans.

4) This standard applies to fans and ventilators of the ventilating type such as wall insert, ceiling insert, attic, household hoods, or canopy and window fans.

5) This standard does not apply to air conditioning equipment, electric air heaters, fan coil units, humidifiers, evaporative coolers, or electrostatic air cleaners.

UL has developed more than 800 standards for safety. They also have been accredited by the Standards Council of Canada to test products to Canadian standards and authorize the use of the UL mark for Canada (cUL). UL tests more than 14,000 products every year.

UL uses many other agencies and standards to help guarantee safety in products. Some of those are NEMA (National Electrical Manufacturers Assoc.), NFPA (National Fire Protection Agency), IEC (International Electrotechnical Commission), IEEE (Institute of Electrical and Electronic Engineers), IBI (Intelligent Building Institute), ASME (American Society of Engineers), and so forth.

UL standards are developed using an open process that gives all interested parties the opportunity to comment as Standards are developed or revised. This process results in the development of Standards that are practical for the manufacturer, compatible with other standards and installation codes, and effective in addressing public safety issues.

## **Product Evaluations and Lab Testing per UL507 and 705**

UL Lists or Classifies products depending on the type of product and intended use. Listing, the most comprehensive UL service, means that samples of the product have been evaluated and found to comply with all applicable UL requirements. Products distributed in Canada are evaluated to Canadian standards and carry the listing mark for Canada (the cUL mark), which specifically indicates compliance with Canadian standards. Classification means that samples of the product have been evaluated with respect to standards of other organizations, specific properties of the product, a limited spectrum of hazards, suitability for certain uses, or other special conditions.

Fans and blowers are tested in accordance with the testing requirements listed in the Standards that pertain to their intended usage. Those standards are listed previously in sections II and III. The tests and testing processes are as follows:

**Starting Current Test**

A ventilator shall start and attain normal running speed without opening a fuse when energized on a circuit protected by a fuse of other than the time delay type. The fuse is to have a current rating corresponding to that of the motor branch circuit to which the ventilator may be connected in accordance with NEC, ANSI/NFPA 70 – 1993. The ventilator is to be started three times when connected to a circuit of minimum rated voltage. The motor is allowed to come to a rest then must be restarted immediately.

**Input Test**

The current input to a ventilator shall not be more than 110 percent of the rated value when the ventilator is operated under conditions of actual service and connected to a supply circuit of maximum rated voltage and rated frequency. Unless otherwise specified, each ventilator is to be tested at the appropriate potential voltage.

*Table 1. Input Test Voltage*

RATED VOLTAGE	TEST VOLTAGE
110 - 120	120
200 - 208	208
220 - 240	240
254 - 277	277
440 - 480	480
550 - 600	600

For the input test, the ventilator is to be connected to a structure that can be adjusted to uniformly restrict the air supply. The input is considered to be the maximum input measured while restricting the ventilator inlet to not more than one-half the cross sectional area of the inlet.

**Temperature Test**

A ventilator shall be tested and shall not reach temperatures high enough to cause a risk of fire, to damage materials used, or to exceed the temperature rises specified. A protection device shall not operate when the ventilator is tested. See Table 2 below.

All values of temperature rise are based on an ambient of 86°F. however, tests may be conducted at any ambient within the range of 50° – 104°F.

A thermocouple is to be used for determining temperature of the winding if it can be mounted without removal of the encapsulating compound of the integrally applied insulation on the motor. The change of resistance method is to be used if the thermocouple measurement cannot be conducted.

The standard covers the attachment, placement, size of wires to be used, calibration of the instrumentation used, and the procedure for running the tests.

The ventilator is to be operated under load conditions. Multiple speed motors are to be tested at each speed.

*Table 2. Temperature Test Values*

METHOD	MOTOR TYPE	CLASS A INSULATION MOTORS		CLASS B INSULATION MOTORS	
		DIA. > 7"	DIA. ≤ 7"	DIA. > 7"	DIA. ≤ 7"
Resistance	Open Motor	126°F	126°F	162°F	162°F
	Totally Enclosed	135°F	135°F	171°F	171°F
	Totally Enclosed Fan Cooled	126°F	—	162°F	—
Thermocouple	Open Motor	108°F	126°F	144°F	162°F
	Totally Enclosed	117°F	135°F	153°F	171°F
	Totally Enclosed Fan Cooled	117°F	—	153°F	—

Reversible ventilators are to be tested in both directions. This is to be done until a constant motor temperature is attained. The test voltages are also dictated.

**Undervoltage Test**

The ventilator shall start and operate continually with a restricted inlet as described previously, which produce maximum loading, but with the voltage reduced to 85 percent of the rated voltage of the motor.

**Dielectric Voltage Withstand Test**

A ventilator shall withstand for one minute without breakdown the application of a 60 Hz electrical charge between live parts and dead metal parts with the ventilator at the maximum temperature reached in normal use. The test voltage shall be:

- a) One thousand volts for a ventilator employing a motor rated ½ hp or less and 250 volts or less.
- b) One thousand volts plus twice the rated voltage for a ventilator employing a motor rated more than ½ hp or more than 250 volts.

To determine if the ventilator complies with the requirements, it is tested with a 500-volt ampere or larger capacity transformer in which the output voltage can be varied. The applied load is increased gradually from zero to the required test voltage and is held at that value for one minute. The increase in load is to be at a uniform rate and as rapid as is consistent with correct indication of its value by a voltmeter.

**Water Spray Test**

A ventilator is to be mounted as in actual service and is to be subjected to a water spray as described in the standard for a period of 4 hours. If the ventilator draws air into the unit for motor cooling then the unit must be operating during the test period. An insulation resistance and dielectric test are to be performed immediately upon conclusion of exposure to the water spray and are to be repeated ½ hour later.

After the test there shall be no water at any point that may be contacted by a splice in field-installed wiring and on uninsulated live parts or on film-coated wire other than motor windings.

**Metallic Coating Thickness Test**

This test is used for determining the thickness of zinc and cadmium coatings to ensure against the effects of damaging rust and corrosion on metal surfaces.

**Permanence of Marking Testing**

These series of tests were developed to insure that any labels used for identification or warnings on a UL listed product demonstrate good adhesion and resists defacement or removal by scraping. These tests include oven aging, immersion, standard atmosphere, unusual condition exposure and outdoor exposure tests.

### Capacitor Tests

Capacitor burnout and leakage current testing are used to force a breakdown in the insulation surrounding a capacitor. If the capacitor attains a temperature during the test hot enough to ignite the testing material, then it fails. If the capacitor exceeds a certain leakage current, it fails.

### Overload Testing of Switches and Controls

These tests are used to ensure that no electrical or mechanical breakdown or undue pitting or burning of the contacts of a motor switch or control occurs during repeated cycling.

## Manufacturing and Production Testing per UL 507 & 705

### Production Dielectric Voltage-Withstand Test

Each ventilator shall withstand without electrical breakdown as a routine production line test, the application of an electrical charge as previously described. The test is conducted with the ventilator fully assembled.

### Rating

A ventilator shall be rated in volts, amps, horsepower, frequency in hertz, the number of phases and a code letter, in accordance with the NEC, ANSI/NFPA 70-1993, indicating the locked rotor motor input.

### Marking

A ventilator shall be legibly and permanently marked, where visible after installation, with the manufacturer's name, trademark, trade name or other descriptive marking which may identify the product manufacturer. The product must also contain a date code, distinctive catalog or model number, and the electrical rating.

A ventilator that incorporates motor-overload protection shall be marked to indicate the presence of such protection. A ventilator that does not incorporate motor-overload protection must be marked to indicate that the unit should be installed with remote overload protection and the motor rating data shall be listed so that proper protection may be determined.

Other typical markings are as follows: A wiring diagram for connecting the motor to the field supplied power or other voltages. A direction of rotation arrow. A distinctive marking for point of manufacture when multiple facilities are involved. A ventilator not intended for outdoor use shall be so marked. Pertinent warning and mounting labels shall also be used.

A ventilator is intended to be shipped from the point of manufacture fully assembled and labeled. A ventilator that is shipped without the motor and drives assembled shall be permanently and plainly labeled with all of the motors suitable for installation on that ventilator. This marking must identify the motors requiring remote overload protection and the ones containing overload protection. A provision for marking the unit to indicate which motor has been installed must also be provided. This becomes a very complex system for the manufacturer and the installer with ventilators containing hundreds of combinations of motors. It is generally intended for fans where just one or two motors are involved. These are usually shipped in a box or boxes broken down and field assembled.

## Product Evaluations and Lab Testing per UL 762

A ventilator to be used for restaurant exhaust must first be listed under UL705. This means that it has already

undergone a battery of testing. UL subject 762 is basically a test procedure for elevated temperature testing.

### Normal Temperature Test

A representative sample of a ventilator is installed in accordance with the manufacturer's instructions. A gas-fired generator is used to supply hot gases to a 4-foot duct connected to the ventilator. When the generator is fired it will establish and maintain a minimum temperature through the duct of 300°F or higher if specified by the manufacturer. Thermocouple grids are placed at points all over the fan and in the duct leading to the ventilator. The ventilator and gas-fired generator are started to simulate a restaurant exhaust. During the test, the maximum temperature at any portion of the ventilator shall not exceed the maximum specified in the standard.

### Abnormal Flare Up Test

Once the ventilator reaches equilibrium conditions during the normal temperature test, one pint of liquified refined pork lard is then placed in a shallow pan in the center of the inlet duct. The grease is heated to 600°F and ignited. No attempts are made to extinguish the fire. The fire is allowed to burn out normally.

The temperature rise attained by any part of the ventilator during the test shall not be more than permitted by the UL standard. Parts of the ventilator shall not warp, deteriorate or become damaged to any extent which would cause unsafe operation.

## Product Listing

Once the product testing is completed, you will hear from your project engineer about whether or not your product complies with UL's requirements. For products meeting the requirements, the project engineer will develop a formal report based on the test results. These test results will also be used to develop a Follow-Up Services program and will serve as a basis of a Follow-Up Services Procedure.

The Follow-Up Services Procedure is a document that describes in detail the construction of the product tested and found to meet the UL requirements. UL's field representatives use this as a guide when conducting their quarterly examinations of UL certified products in the factory.

Before UL's engineering staff will issue your testing report, you must agree to participate in UL's Follow-Up Services Agreement.

If, for some reason, your product does not meet UL's requirements, you will receive a letter from UL describing the specific requirements your product did not meet. If you choose, you can modify the product and have it retested.

A product that has been produced under UL's Listing and Follow-Up Service program in accordance with the terms of UL's Service Agreement may bear the UL Listing Mark as the manufacturer's declaration that the product complies with all the UL requirements.

Only the components that were approved by UL in the test samples are permitted to be used on the manufactured product. Any deviation from the electrical or mechanical construction of the unit must be approved by UL. Some additional testing may be required.

Listing of the product can only take place in the facility that is specified in the Follow-Up Services procedure. A product cannot be listed until the electrical components intended for use on that product are mounted and wired if applicable. The only exception is listed in the Manufacturing and Production Testing section above under Marking.

## UL Marks and Descriptions

As mentioned above, there are several types of UL marks. Each has its own specific meaning and significance. The only way to determine if a product has been certified by UL is to look for the UL mark on the product itself or, in a few instances, on the product packaging.

The UL marks are registered certification marks of Underwriters Laboratories Inc. The UL marks may only be used on or in connection with products certified by UL and under the terms of written agreement with UL.

Below are some of the most common UL marks, along with a description of their meaning:



### UL Listing Mark

This is one of the most common UL Marks. If a product carries this mark, it means UL found that samples of this product met UL's safety requirements. These requirements are primarily based on UL's own published Standards for Safety. This type of mark is seen commonly on appliances and computer equipment, furnaces and heaters, fuses, electrical panelboards, smoke and carbon monoxide detectors, fire extinguishers and sprinkler systems, personal flotation devices such as life jackets and life preservers, bullet resistant glass, and thousands of other products.



### C-UL Listing Mark

This mark is applied to products for the Canadian market. The products with this type of mark have been evaluated to Canadian safety requirements, which may be somewhat different from U.S. safety requirements. You will see this type of Mark on appliances and computer equipment, vending machines, household burglar alarm systems, lighting fixtures, and many other types of products.



### C-UL US Listing Mark

UL introduced this new Listing Mark in early 1998. It indicates compliance with both Canadian and U.S. requirements. The Canada/U.S. UL Mark is optional. UL encourages those manufacturers with products certified for both countries to use this new, combined Mark, but they may continue using separate UL Marks for the United States and Canada.



### Classification Mark

This mark appears on products that UL has also evalu-

ated. Products carrying this mark have been evaluated for specific properties, a limited range of hazards, or suitability for use under limited or special conditions. Typically, products Classified by UL fall into the general categories of building materials and industrial equipment. Examples of types of equipment Classified by UL include immersion suits, fire doors, protective gear for fire fighters and industrial trucks.



### C-UL Classification Mark

This Classification marking is used for products intended for the Canadian marketplace. It indicates that UL has used Canadian standards to evaluate the product for specific hazards or properties. Examples of C-UL Classified products include air filter units, firestop devices, certain types of roofing systems, and others.



### C-UL US Classification Mark

UL introduced this new Classification Mark in early 1998. It indicates compliance with both Canadian and U.S. requirements. The Canada/U.S. UL Mark is optional. UL encourages those manufacturers with products certified for both countries to use this new, combined Mark, but they may continue using separate UL Marks for the United States and Canada.



### Recognized Component Mark and Canadian Recognized Component Mark

Consumers rarely see these marks because they are specifically used on component parts that are part of a larger product or system. These components may have restrictions on their performance or may be incomplete in construction. The Component Recognition marking is found on a wide range of products, including some switches, power supplies, printed wiring boards, some kinds of industrial control equipment and thousands of other products. Products intended for Canada carry the Recognized Component mark "C."



### Recognized Component Mark for Canada and the United States

This new UL Recognized Component Mark, which became effective April 1, 1998, may be used on components certified by UL to both Canadian and U.S. requirements. Although UL had not originally planned to introduce a combined Recognized Component Mark, the popularity of the Canada/U.S. Listing and Classification Marks among clients with UL certifications for both Canada and the United States has led to the new Mark.



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