



UL 705

STANDARD FOR SAFETY

Power Ventilators

UL Standard for Safety for Power Ventilators, UL 705

Seventh Edition, Dated July 19, 2017

Summary of Topics

This revision of ANSI/UL 705 dated August 19, 2022 includes the following:

- Addition to Scope to add requirements to cover power ventilators for smoke control systems; [1.2.3](#)***
- Update internal wiring for hazardous voltage; [2.7](#), [11.1](#), [11.3](#)***
- Addition of solid state speed controller test requirements; Section [31A](#)***
- Correct [SC10.2.1](#) for maximum temperature rise.***
- Add new requirement for NEC Class 2 Marking; [36.22](#)***

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated April 1, 2022, July 8, 2022 and July 15, 2022

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UL 705

Standard for Safety for Power Ventilators

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July 19, 2017

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The most recent designation of ANSI/UL 705 as an American National Standard (ANSI) occurred on August 19, 2022. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

The Department of Defense (DoD) has adopted UL 705 on February 5, 1993. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at <https://csds.ul.com>.

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APPENDIX A Examples of Controls Performing as Operating or Protective Controls (Informative)

INTRODUCTION

1 Scope

1.1 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, residential fans intended for heated and conditioned air and for connection to permanently installed wiring systems in accordance with the National Electrical Code, NFPA 70.

1.2 These requirements also cover dryer exhaust duct power ventilators (DEDPV) for single residential dryers.

1.2.1 These requirements cover roof or wall-mounted ventilators and duct fans of the straight-through type for restaurant exhaust appliances.

1.2.2 These requirements cover power ventilators for restaurant exhaust appliances.

1.2.3 These requirements cover power ventilators for smoke control systems.

1.3 These requirements do not cover the following:

- a) Ventilating equipment such as attic, wall-insert, ceiling-insert, household hood, window fans, or canopy fans or blowers;
- b) Air-moving equipment with integral air-tempering means;
- c) Dryer type fans used for drying carpets or floors;
- d) Household and commercial blower inflator type fans;
- e) Evaporative coolers; Evaporative cooler pumps, including retrofit pumps;
- f) Air filtering appliances;
- g) Deodorizers and air fresheners;
- h) Component fans;
- i) Low voltage component fans;
- j) Fans and blowers that circulate air, such as desk, ceiling-suspended, and hassock fans;
- k) Ventilators rated more than 600 volts;
- l) Ventilators employing universal motors rated more than 250 volts;
- m) Air heaters equipped with fans;
- n) Draft fans for furnaces;
- o) Heating-ventilating units;
- p) Blowers employed as components in equipment such as furnaces, mechanical-refrigeration equipment, or air conditioners;
- q) Fusible links and similar equipment that may be provided to disconnect a fan or close shutters in the event of fire;

- r) 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; or
- s) Ventilators for the removal or conveyance of dust, stock, or refuse.
- t) Microwaves, ventilating and otherwise; and
- u) Ducted and non-ducted heat recovery units.

2 Glossary

2.1 For the purpose of this standard, the following definitions apply.

2.2 CAPACITOR, CLASS X – Capacitor or RC unit of a type suitable for use in situations where failure of the capacitor or RC unit would not lead to danger of electrical shock but could result in a risk of fire. Examples would be units connected phase to phase or phase to neutral.

Note 1 X1 capacitors are generally used in circuits of permanently connected appliances. However, if the appliance is provided with a separate surge protective device that limits the impulse voltage to $\leq 2.5\text{KV}$, an X2 capacitor is permitted.

Note 2 X2 capacitors are generally used in circuits of cord-connected appliances.

2.3 CAPACITOR, CLASS Y – Capacitor or RC unit of a type suitable for use in situations where failure of the capacitor could lead to danger of electric shock. Examples would be capacitors connected across the primary and secondary circuits where electrical isolation is required to prevent an electric shock or between hazardous live parts and accessible parts.

Note 1 Y1 capacitors are used in circuits where the prevention of electric shock is afforded solely by the isolation provided by the capacitor. Two Y2 capacitors connected in series is considered to provide the same level of protection as one Y1 capacitor.

Note 2 Y2 capacitors are used where the prevention of electric shock is provided by the combination of the capacitor and earth ground for circuits operating at voltages $\geq 150\text{V}$ and $\leq 300\text{V}$.

Note 3 Y4 capacitors are used where the prevention of electric shock is provided by the combination of the capacitor and earth ground for circuits operating at voltages $\leq 150\text{V}$.

2.4 CIRCUIT, CLASS 2 – An low voltage circuit with a power of 100 VA or less; or has 30 V dc supplied by a primary battery; or is supplied by a Class 2 transformer; or is supplied by a combination of a transformer and fixed impedance that, as a unit, complies with all the performance requirements for a Class 2 transformer, or is supplied by a power supply (such as a switching power supply) whose output meets the requirements of a Class 2 circuit. A circuit that is derived from a circuit that exceeds 30 V by connecting resistance or impedance, or both, in series with the supply circuit to limit the voltage and current, is not considered to be a class 2 circuit.

2.5 CIRCUIT, LOW-VOLTAGE – A circuit that has an ac potential of not more than 30 V rms (42.4 V peak or 30 V dc).

2.6 CIRCUIT, HAZARDOUS VOLTAGE – A circuit of any voltage exceeding those of an low-voltage circuit.

2.7 DUCT FAN – A ventilator installed within a duct or provided with flanges for connection to a duct and which may be used with heated air within the duct.

2.8 FIELD WIRING TERMINAL – A terminal to which a wire may be connected in the field, unless the wire and a means of making the connection – such as a pressure terminal connector, soldering lug,

soldered loop, or crimped eyelet – that is factory assembled to the wire or provided as part of the ventilator.

2.9 MOTORS –

- a) Open Motor – A motor having ventilating openings that permit passage of external cooling air over and around the windings of the motor.
- b) Totally Enclosed Motor – A motor that is enclosed so as to prevent the free exchange of air between the inside and outside of the case but not sufficiently enclosed to be termed airtight.
- c) Totally Enclosed Fan-Cooled Motor – A totally enclosed motor with external cooling by a fan or fans integral with the motor but external to the enclosing parts.
- d) Electronically Commutated Motor (ECM) – A motor assembly consisting of the motor and a control. The control provides an AC electric signal (typically non-sinusoidal) to the motor by an inverter/switching power supply. The sensors and other electronics on the control adjust waveform and output levels of the signal. The control is often used to provide protective functions to prevent overheating or mitigate other hazardous conditions.

2.10 POWER VENTILATOR – An air-moving appliance consisting of an impeller – which may be of the centrifugal, axial, or propeller type – and an integral driver. A power ventilator is:

- a) Installed in a weather-resisting base intended to fit, usually by a curb, over a wall or roof opening; or
- b) Provided with flanges for connection to a duct.

2.11 SAFETY CRITICAL FUNCTION – Control, protection and monitoring functions which are being relied upon to reduce the risk of fire, electric shock or casualty hazards.

2.12 VENTILATOR – A power ventilator or a duct fan.

3 Units of Measurement

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

4 Undated References

4.1 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.

CONSTRUCTION

5 Components

5.1 General

5.1.1 A component of a product covered by this standard shall:

- a) Comply with the requirements for that component as indicated in [5.2](#) – [5.6](#) or the individual component section;
- b) Be used in accordance with its rating(s) established for the intended conditions of use.

- c) Be used within its established use limitations or conditions of acceptability; and
- d) Additionally comply with the applicable requirements of this end product standard.

Note – 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.

Exception No. 1: A component of a product covered by this standard is not required to comply with a specific component requirement that:

- a) Involves a feature or characteristic not required in the application of the component in the product, or*
- b) Is superseded by a requirement in this standard, or*
- c) Is separately investigated when forming part of another component, provided the component is used within its established ratings and limitations.*

Exception No. 2: A component complying with a UL component standard other than those cited in [5.2](#) – [5.6](#) or the individual component section is acceptable if:

- a) The component also complies with the applicable component standard of [5.2](#) – [5.6](#) or the individual component section; or*
- b) The component standard:*
 - 1) Is compatible with the ampacity and overcurrent protection requirements of the National Electrical Code, ANSI/NFPA 70, where appropriate;*
 - 2) Considers long-term thermal properties of polymeric insulating materials in accordance with the Standard for Polymeric Materials – Long Term Property Evaluations, UL 746B, and*
 - 3) Any use limitations of the other component standard is identified and appropriately accommodated in the end use application. For example, a component used in a household application, but intended for industrial use and complying with the relevant component standard may assume user expertise not common in household applications.*

5.1.2 A component that is also intended to perform other functions, such as over current protection, ground-fault circuit-interruption, surge suppression, any other similar functions, or any combination thereof, shall comply additionally with the requirements of the applicable UL standard(s) that cover devices that provide those functions.

Exception: Where these other functions are not required for the application and not identified as part of markings, instructions, or packaging for the appliance, the additional component standard(s) need not be applied.

5.1.3 A component not anticipated by the requirements of this standard, not specifically covered by the component standards of [5.2](#) – [5.6](#) or individual component sections and that involves a potential risk of electric shock, fire, or personal injury, shall be additionally investigated in accordance with the applicable UL standard, and shall comply with [5.1.1](#) (b) – (d).

5.1.4 With regards to a component being additionally investigated, reference to construction and performance requirements in another UL end product standard is appropriate where that standard anticipates normal and abnormal use conditions consistent with the application of this standard.

5.2 Connectors and terminals

5.2.1 Quick-connect terminals, both connectors and tabs, for use with one or two 22 – 10 AWG copper conductors, having nominal widths of 3.5, 3.2, 4.8, 5.2, and 6.3 mm (0.110, 0.125, 0.187, 0.205, and 0.250 in), intended for internal wiring connections in appliances, or for the field termination of conductors to the appliance, shall comply with the Standard for Electrical Quick-Connect Terminals, UL 310.

Exception: Other sizes of quick-connect terminals shall be investigated with respect to crimp pull out, insertion-withdrawal, temperature rise, and all tests shall be conducted in accordance with UL 310.

5.2.2 Single and multi-pole connectors for use in data, signal, control and power applications within and between electrical equipment, and that are intended for factory connection and for factory assembly to copper or copper alloy conductors, or for factory assembly to printed wiring boards, shall comply with the Standard for Component Connectors for Data, Signal, Control and Power Applications, UL 1977.

5.2.3 Wire connectors shall comply with the Standard for Wire Connectors, UL 486A-486B.

5.2.4 Splicing wire connectors shall comply with the Standard for Splicing Wire Connectors, UL 486C.

5.2.5 Multi-pole splicing wire connectors that are intended to facilitate the connection of hard-wired utilization equipment to the branch-circuit conductors of buildings or that are intended for consumer connection within and between parts of electrical equipment, shall comply with the Standard for Insulated Multi-Pole Splicing Wire Connectors, UL 2459.

5.2.6 Equipment wiring terminals for use with all alloys of copper, aluminum, or copper-clad aluminum conductors, shall comply with the Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors, UL 486E.

5.2.7 Terminal blocks shall comply with the Standard for Terminal Blocks, UL 1059, and, if applicable, be suitably rated for field wiring.

5.3 Electrical enclosures and raceways

5.3.1 Electrical enclosures and the associated bushings and fittings, and raceways, of the types specified in Chapter 3 of the National Electrical Code, ANSI/NFPA 70, and that comply with the relevant UL standard (such as UL 514A, UL 514C, UL 514D) and [5.1](#) are considered to fulfill the requirements of this Standard.

5.4 Overcurrent protection

5.4.1 Fuses shall comply with the Standard for Low-Voltage Fuses – Part 1: General Requirements, UL 248-1; and the applicable UL 248 Part 2 (e.g. UL 248-5). Defined use fuses that comply with UL 248-1 and another appropriate UL standard for the fuse are considered to fulfill this requirement.

5.4.2 Circuit breakers shall comply with the Standard for Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures, UL 489.

Exception: Circuit breakers used in telecommunications circuitry that comply with the Standard for Circuit Breakers For Use in Communications Equipment, UL 489A, need not comply with UL 489.

5.4.3 Circuit breakers having integral ground fault circuit interrupter capability for protection against electrical shock shall additionally comply with the Standard for Ground-Fault Circuit-Interrupters, UL 943.

5.4.4 Supplementary protectors shall comply with the Standard for Supplementary Protectors for Use in Electrical Equipment, UL 1077.

5.5 Power supplies

5.5.1 Class 2 power supply shall comply with one of the following:

- a) Standard for Class 2 Power Units, UL 1310; or
- b) Standard for Information Technology Equipment – Safety – Part 1: General Requirements, UL 60950-1, with an output marked "Class 2", or that complies with the limited power source (LPS) requirements and is marked "LPS".

Exception: This requirement does not apply to circuits that comply with Supplement [SB](#), UL 60335-1 Based Requirements for the Evaluation of Electronic Circuits.

5.5.2 A non-Class 2 power supply shall comply with one of the following:

- a) Standard for Power Units Other Than Class 2, UL 1012; or
- b) Standard for Information Technology Equipment – Safety – Part 1: General Requirements, UL 60950-1.

5.6 Supplemental insulation, insulated bushings, and assembly aids

5.6.1 The requirements for supplemental insulation (e.g. tape, sleeving or tubing) are not specified unless the insulation or device is required to fulfill a requirement of this standard. In such cases:

- a) Insulating tape shall comply with the Standard for Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape, UL 510;
- b) Sleeving shall comply with the Standard for Coated Electrical Sleeving, UL 1441;
- c) Tubing shall comply with the Standard for Extruded Insulating Tubing, UL 224.

5.6.2 Insulating bushings that comply with Components, General, [5.1](#) of this end product standard, and the Standard for Insulating Bushings, UL 635, are considered to comply with the requirements of this Standard.

6 Frame and Enclosure

6.1 General

6.1.1 A ventilator shall be formed and assembled so that it will have the strength and rigidity necessary to resist the abuses to which it may be subjected without increasing the risk of fire, electric shock, or injury to persons due to a total or partial collapse with a resulting reduction of spacings, loosening or displacement of parts, or other serious defects.

6.1.2 Among the factors taken into consideration when the acceptability of an enclosure is being judged are its:

- a) Mechanical strength;
- b) Resistance to impact;
- c) Moisture-absorptive properties;

- d) Combustibility;
- e) Resistance to corrosion; and
- f) Resistance to distortion at temperatures to which the enclosure may be subjected under conditions of normal or abnormal use.

6.1.3 A cast- or sheet-metal section of an enclosure shall have a thickness not less than that specified in [Table 6.1](#).

Table 6.1
Minimum acceptable thickness of enclosure metal

Metal	Minimum thickness, inch (mm)		
	At small, flat, unreinforced surfaces and at surface of a shape or size to ensure adequate mechanical strength	At surfaces to which a wiring system is to be connected in the field	At relatively large unreinforced flat surfaces
Die-cast metal	3/64 (1.2)	– –	5/64 (2.0)
Cast malleable iron	1/16 (1.6)	– –	3/32 (2.4)
Other cast metal	3/32 (2.4)	– –	1/8 (3.2)
Uncoated sheet steel	0.026 (0.66)	0.032 ^a (0.81)	0.026 (0.66)
Galvanized sheet steel	0.029 (0.74)	0.034 ^a (0.86)	0.029 (0.74)
Nonferrous sheet metal	0.036 (0.91)	0.045 (1.14)	0.036 (0.91)

^a A sheet-steel wall of thickness less than that specified is acceptable if the area surrounding the knockout has a thickness not less than 0.053 inch (1.35 mm).

6.1.4 The enclosure of an appliance shall prevent molten metal, burning insulation, flaming particles, and other ignited material from falling onto flammable materials, including the surface upon which the appliance is supported when the appliance is:

- a) Installed in a remote location or unattended area.
- b) Thermostatically controlled.

6.1.5 The requirements in [6.1.4](#) necessitate the use of a metal barrier or a non-metallic barrier of a material having a zero flame spread rating when tested as described in the Standard for Test for Surface Burning Characteristics of Building Materials, UL 723:

- a) Under a motor unless:
 - 1) The structural parts of the motor or of the appliance provide the equivalent of such a barrier (such as the use of metal louvers as bottom barriers);
 - 2) The protection provided with the motor is such that no burning insulation or molten material falls to the surface that supports the appliance or into the wiring compartment when the motor is energized under each of the following fault conditions:
 - i) Open main winding;
 - ii) Open auxiliary winding;
 - iii) Starting switch short-circuited; and

iv) Capacitor of a permanent-split capacitor motor short-circuited and the rotor locked - the short circuit is to be applied before the motor is energized;

3) The motor complies with the requirements for impedance-protected motors in the Standard for Overheating Protection for Motors, UL 2111, or the Standard for Rotating Electrical Machines – General Requirements, UL 1004-1, and the Standard for Thermally Protected Motors, UL 1004-3, and the temperature of the motor winding does not exceed 150°C (302°F) during the first 72 hours of operation with the rotor of the motor locked; or

4) The motor is provided with a thermal motor protector that prevents the temperature of the motor windings from exceeding 125°C (257°F) under the maximum load under which the motor runs without causing the protector to cycle and from exceeding 150°C (302°F) with the rotor of the motor locked.

Exception: A direct drive fan motor is required to only be subjected to the locked rotor test.

b) Under wire, unless the wire:

1) Is thermoplastic wire which complies with the requirements of the Vertical Wires test in the Reference Standard for Electrical Wires, Cables, and Flexible Cords, UL 1581 and is marked VW-1; or

2) Has at least equivalent characteristics as determined in the flame tests specified in the Standard for Thermoplastic-Insulated Wires and Cables, UL 83.

c) Under a switch, relay, solenoid, or similar component unless:

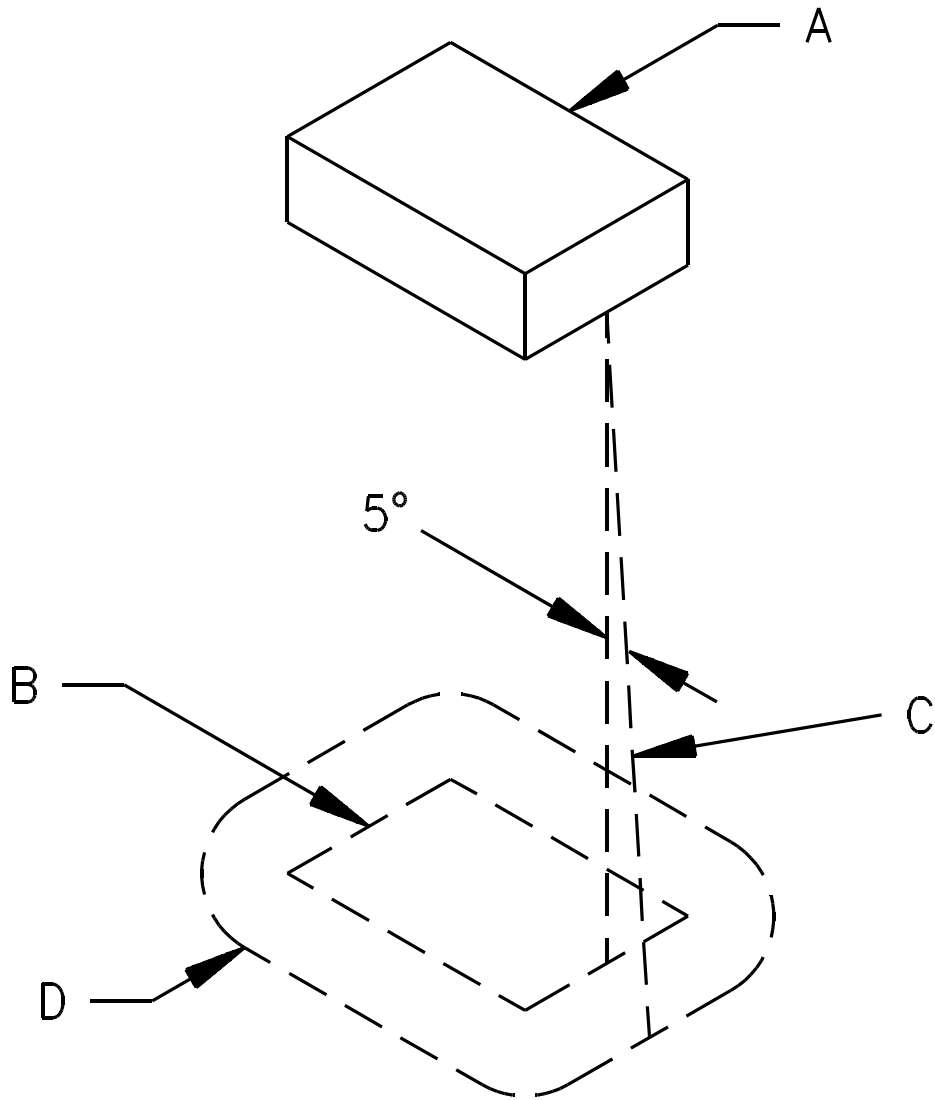
1) A short circuit or overload in the component does not result in a risk of fire; or

2) There are no openings in the enclosure through which molten metal, burning insulation, flaming particles, or other ignited material can fall.

Exception: A terminal is not required to have a barrier.

6.1.6 The barrier mentioned in [6.1.5](#) shall be horizontal, shall be located as illustrated in [Figure 6.1](#), and shall have an area in accordance with the illustration. Openings for drainage, ventilation, and the like, shall not be employed in the barrier unless such openings do not permit molten metal, burning insulation, or similar material, to fall onto flammable material.

Figure 6.1
Barrier



EB120A

A – Region to be shielded by barrier. This will consist of the entire component if it is not otherwise shielded and will consist of the unshielded portions of a component that is partially shielded by the component enclosure or equivalent.

B – Projection of outline of component on horizontal plane.

C – Inclined line that traces out minimum area of barrier. The line is always:

- 1) Tangent to the component,
- 2) 5 degrees from the vertical, and
- 3) So oriented that the area traced out on a horizontal plane is maximum.

D – Location (horizontal) and minimum area for barrier. The area is that included inside the line of intersection traced out by the inclined line C and the horizontal plane of the barrier.

6.1.7 A ventilating opening provided in the enclosure of an appliance or an externally mounted component of an appliance where the appliance is intended to be recessed into a wall or false ceiling shall not vent into a concealed space where the spread of a fire occurs undetected.

6.2 Non-metallic enclosures

6.2.1 A non-metallic enclosure shall comply with the applicable mechanical and electrical property considerations, flammability, and thermal requirements as specified in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C. A 6.8 J (5 ft·lbf) impact value shall apply to all appliances when determining the impact resistance of polymeric enclosures. This impact value shall also be used for cold impact testing of appliances intended to be used or stored in cold environments, such as fans mounted in the crawl space or attic and outdoor use products.

Exception: A polymeric grille used in a fan intended to be mounted at least 2.4 m (8 feet) above the floor is not required to comply with the Resistance to Impact Test of UL 746C.

6.3 Non-metallic parts other than enclosures

6.3.1 Polymeric material used to enclose a metal housing that encloses insulated or uninsulated live parts, or used as a decorative part, shall be classed either 5VA, 5VB, V-0, V-1, V-2, or HB by the burning tests described in the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

Exception No. 1: Decorative parts are not required to be made of a material classed 5VA, 5VB, V-0, V-1, V-2, or HB when the part does not occupy a volume greater than 2 cubic centimeters (0.122 cubic inch), does not have any dimension greater than 3 cm (1.18 inch), and is located so it does not propagate flame from one area to another or bridge between a possible source of ignition and other ignitable parts.

Exception No. 2: A material is determined to be equivalent when it complies with the 12-mm (0.47 inch) flame test, the 19-mm (0.75-inch) flame test, or 127-mm (5-inch) flame test of the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, when flame tested as used in the equipment. The use of a flame-retardant coating applied to the inside of a polymeric enclosure is not considered to comply with this requirement unless the coating/material interface is found to be compliant by separate investigation.

6.3.2 An impeller of polymeric material outside a motor shall not be located within 25.4 mm (1 inch) of an opening in the motor housing.

Exception:

a) The material is classed as V-2, V-1, V-0, or 5V in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94. The coil wrap that complies with the 127 mm (5 inches) end product flame test as described in the Standard for Polymeric Materials – Use in Electric Equipment Evaluations, UL 746C does not need to possess a 5VA flame rating;

b) The material complies with the requirements for enclosure flammability using a 19-mm (3/4-inch) flame, in accordance with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C;

c) No motor opening within 25.4 mm of the blade has a dimension more than 6.75 mm (17/64 inch) or an area more than 35.48 mm² (0.055 square inch), and no more than six such openings are provided; or

d) The material has a hot wire ignition rating of at least 7 seconds as described in the Standard Test Method for Ignition of Materials by Hot Wire Sources, ASTM D3874-1990a.

6.3.3 Foamed thermoplastic shall be classed HF-2 or HF-1.

6.3.4 A thermoplastic damper shall be classed HB, V-2, V-1, V-0, or 5V.

6.3.5 A thermoplastic part that is not decorative and that does not serve as an enclosure shall be classed HB, V-2, V-1, V-0, or 5V.

6.4 Flame spread and smoke developed requirements for non-metallic enclosures and other parts of permanently connected equipment

6.4.1 Materials in a compartment handling conditioned air for circulation through a duct system shall have a flame spread rating of not more than 25, and a smoke developed rating of not more than 50, when tested as specified in the requirements for the Standard for Test for Surface Burning Characteristics of Building Materials, UL 723. This requirement does not apply to the following:

- a) Air filters, drive belts, wire insulation, paint applied for corrosion protection, or tubing of material equivalent to one of the types of wire insulation permitted by this Standard;
- b) Gaskets forming air or water seals between metal parts;
- c) Miscellaneous small parts such as refrigerant line bushings or insulating bushings, resilient or vibration mounts, wire ties, clamps, labels, or drain line fittings having a total exposed surface area not exceeding 161.29 cm² (25 in²);
- d) An adhesive that, when tested in combination with the specific insulating material, complies with the requirement;
- e) Moulded or formed components (not liners) of polymeric materials in such quantities that their total exposed surface area within the compartment does not exceed 0.93 m² (10 ft²); or
- f) Materials in a compartment handling air for circulation through a duct supplying only one room.

6.4.2 Polymeric materials exempted by [6.4.1\(e\)](#) shall have a flame spread rating of not more than 25, or shall comply with the requirements of the vertical burning test for classifying materials 5VA in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

6.5 Accessibility of moving parts

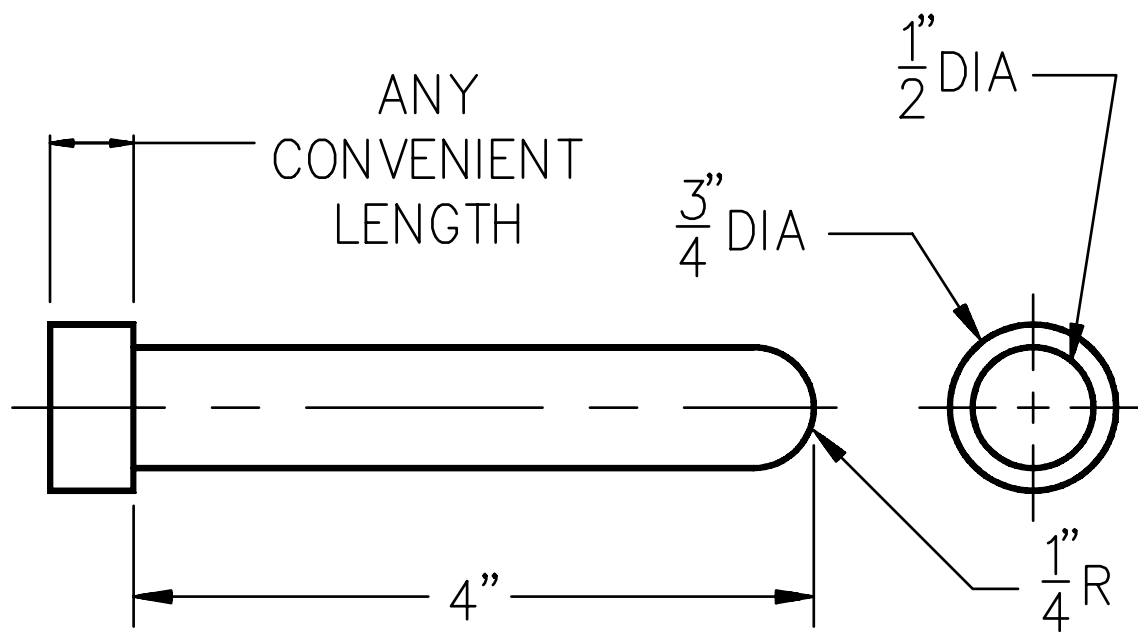
6.5.1 Electrical parts of a ventilator shall be located or enclosed so that protection against unintentional contact with uninsulated live parts will be provided.

6.5.2 To reduce the likelihood of unintentional contact that may involve a risk of electric shock from an uninsulated live part or film-coated wire, or injury to persons from a moving part, the enclosure shall comply with the following:

- a) A probe as illustrated in [Figure 6.2](#) shall not touch film-coated wire when inserted through an opening;
- b) A probe as illustrated in [Figure 6.3](#) shall not touch any uninsulated live part when inserted through an opening; and

c) A probe as illustrated in [Figure 6.4](#) shall not contact a moving part when inserted through an opening.

Figure 6.2
Probe for film-coated wire



SB0612

Figure 6.3
Probe
(Other than moving parts)

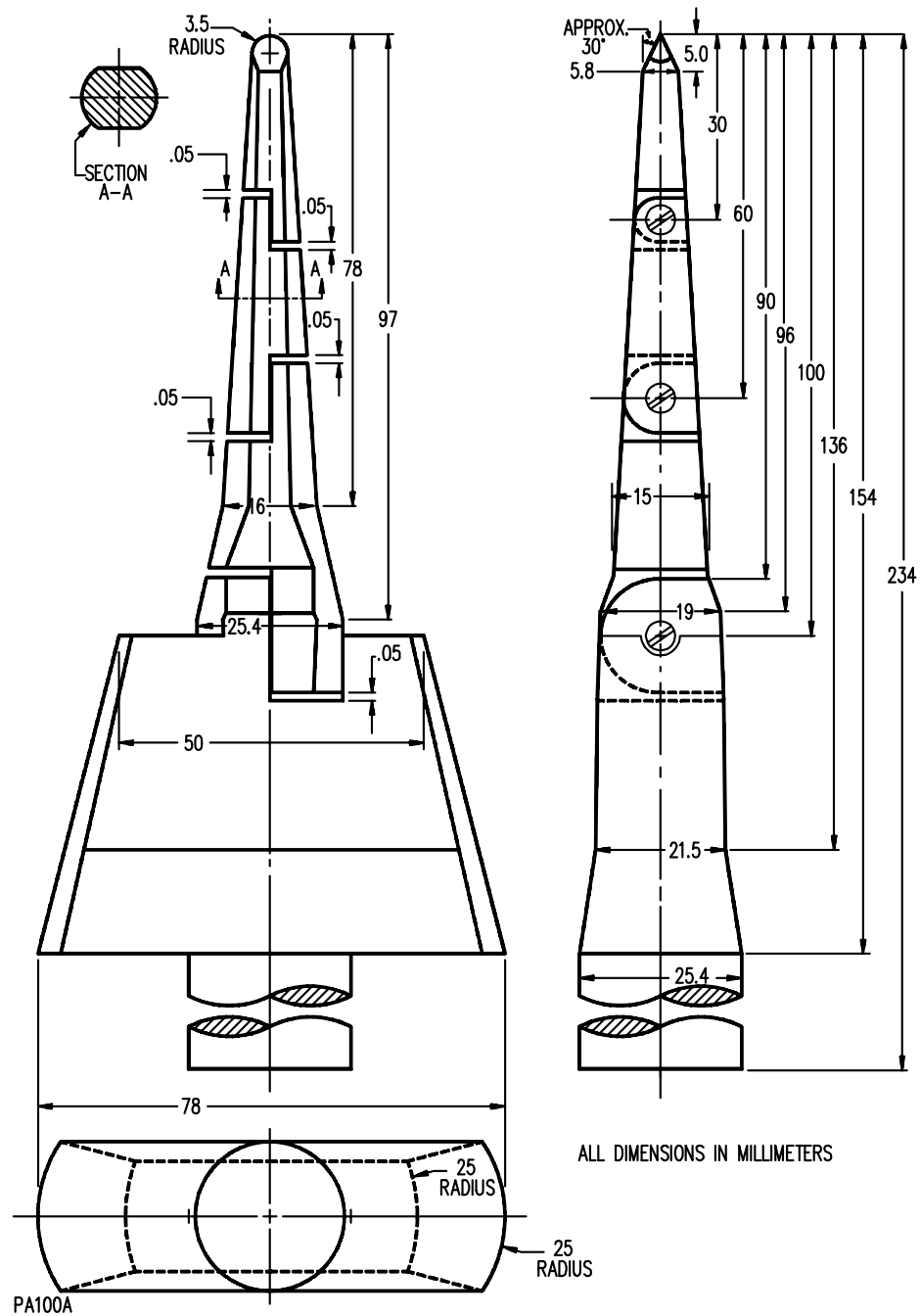
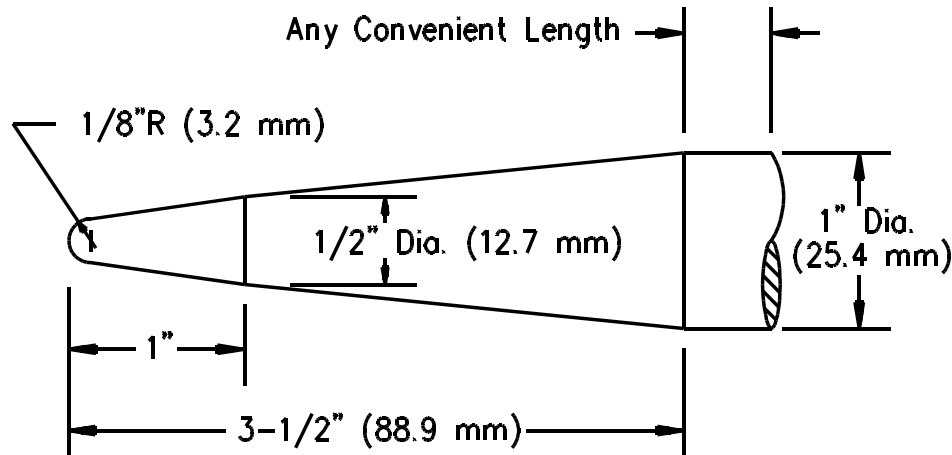


Figure 6.4
Probe
(Moving parts)



PA 160

6.5.3 With reference to [6.5.2\(b\)](#), the probe is to be applied in any possible configuration; and, if necessary, the configuration may be changed after insertion through the opening.

6.5.4 Uninsulated live parts shall be located, guarded, or enclosed so as to reduce the likelihood of unintentional contact that may involve a risk of electric shock to persons performing operations such as oiling motors, replacing filters, or adjusting belts, sheaves, or controls. Parts of the enclosure that would be removed in the performance of these operations and are removable without the use of tools are to be removed to determine whether the ventilator complies with the requirements in [9.5](#) and [9.6](#). A warning marking is to be disregarded when determining compliance with these requirements.

6.5.5 The rotor of a motor, pulleys, belts, gears, fan blades, impellers, and the like, of an assembled ventilator shall be enclosed or guarded so as to reduce the risk of injury to persons. See [Figure 6.4](#).

6.5.6 With reference to the requirement in [6.5.5](#), the degree of protection required of an enclosure depends upon the general configuration and intended use of the ventilator. Among the factors to be taken into consideration in judging the acceptability of exposed moving parts are:

- a) The degree of exposure;
- b) The sharpness of the moving parts;
- c) The likelihood of unintentional contact with the moving parts;
- d) The speed of moving parts; and

e) The likelihood of fingers, arms, or clothing being drawn into the moving parts – such as at points where gears mesh, where belts travel onto a pulley, or where moving parts close in a pinching or shearing action.

6.5.7 An overall enclosure for electrical components of a ventilator intended for outdoor exposure shall have provision for drainage. See Section [27](#), Water Spray Test.

7 Mechanical Assembly

7.1 A ventilator shall be assembled so that it will not be adversely affected by the vibration of normal operation. A brush cap shall be tightly threaded or have other provision so that it is unlikely to become loose.

7.2 A switch, lampholder, attachment plug receptacle, motor attachment plug, or similar component shall be mounted securely and shall be prevented from turning or shifting.

Exception No. 1: A switch need not be prevented from turning if all four of the following conditions are met:

- a) The switch is a plunger or other type that does not tend to rotate when operated. A toggle switch is considered to be subject to forces that tend to rotate the switch during the normal operation of the switch;*
- b) Means of mounting the switch make it unlikely that operation of the switch will loosen it;*
- c) Spacings are not reduced below the minimum acceptable values if the switch rotates, (see Section [19](#), Spacings) and*
- d) Normal operation of the switch is by mechanical means rather than direct contact by persons.*

Exception No. 2: A lampholder in which the lamp cannot be replaced, such as a neon pilot or indicator light in which the lamp is sealed in a nonremovable jewel, need not be prevented from turning if rotation cannot reduce spacings below the minimum acceptable values. See Section [19](#), Spacings.

7.3 The means for preventing the turning specified in [7.2](#) shall consist of more than friction between surfaces. For example, a properly applied lock washer is an acceptable means for preventing a small stem-mounted switch or other component having a single hole mounting means from turning.

7.4 An uninsulated live part shall be secured to the surface on which it is mounted and supporting insulating materials shall be secured in place so that the part will be prevented from turning or shifting in position if such motion may result in a reduction of spacings below the minimum acceptable values specified in Spacings, Section [19](#).

7.5 Friction between surfaces is not acceptable as a means to prevent shifting or turning of a live part; but a properly applied lock washer is acceptable.

7.6 A ventilator shall be completely assembled when shipped from the factory.

Exception No. 1: A ventilator marked in accordance with [36.15](#) need not be completely assembled when shipped from the factory.

Exception No. 2: A roof mounted or wall mounted ventilator may be shipped from the factory without the motor and drive assembly when all of the following conditions are met.

- a) The motor is the only electrical load for the ventilator.*

- b) The motor construction complies with the Standard for Rotating Electrical Machines – General Requirements, UL 1004-1.*
- c) The motor employs thermal protection as referenced in accordance with the Standard for Overheating Protection for Motors, UL 2111, or the Standard for Rotating Electrical Machines – General Requirements, UL 1004-1, and the Standard for Thermally Protected Motors, UL 1004-3, if inherently protected.*
- d) The motor includes an integral field wiring compartment which complies with the applicable paragraphs of Power-Supply Connections, Section [9](#).*
- e) The ventilator is marked in accordance with [36.20](#).*

7.7 If a part is shipped disassembled from the ventilator and if it is necessary to make field connections to that part:

- a) The ventilator shall be designed so that it can be permanently connected to one of the wiring systems that would be acceptable for the ventilator;
- b) Wiring terminals or leads to which the field connections are to be made shall comply with the requirements for field-wiring terminals, including those for spacing;
- c) The information required by [36.17](#) shall be provided; and
- d) Means for mounting a disconnect switch assembly that is part of the ventilator shall be provided.

7.8 A disconnect switch assembly that is shipped mounted on the ventilator:

- a) Shall be factory-wired to the remainder of the ventilator; or
- b) Shall comply with the requirements in [7.7](#) (a), (b), and (c) and those in [36.17](#).

8 Protection Against Corrosion

8.1 Metal shall not be used in combinations that may cause galvanic action that will adversely affect an enclosure.

8.2 An iron or steel part shall be protected against corrosion by enameling, galvanizing, plating, or other equivalent means.

Exception: The following parts need not be protected against corrosion:

- a) A shaft, bearing, lamination, or minor part, such as a washer, screw, and similar parts.*
- b) A cast-metal part that derives inherent protection by virtue of its thickness.*
- c) A part, such as a decorative grille, that is not required to form a part of an enclosure.*

8.3 A hinge and other attachment shall be resistant to corrosion.

8.4 A sheet steel enclosure shall be protected against corrosion as specified in [Table 8.1](#).

Exception: An enclosure for a duct fan not intended for outdoor exposure shall comply with the requirement in [8.2](#).

Table 8.1
Protection against corrosion

Enclosure use	Thickness of sheet steel and paragraph reference for type of protection required	
	0.053 inch (1.35 mm) or more	Less than 0.053 inch
Outer enclosure protecting motors, wiring, or enclosed live parts	8.8 or 8.9	8.8
Outer enclosure that is the sole enclosure of live parts	8.8	8.8
Outer enclosure that does not enclose electrical parts	8.8 or 8.9	8.8 or 8.9
Interior enclosure protecting live parts other than motors	8.8 or 8.9	8.8

8.5 Aluminum, brass, copper, or stainless steel may be used without additional protection against corrosion.

8.6 A nonmetallic enclosure intended to be used outdoors shall be judged on the basis of the effect of exposure to ultraviolet light and water.

8.7 An enclosure of cast iron at least 1/8 inch (3.2 mm) thick is considered to be protected by one coat of an organic finish of the epoxy or alkyd-resin type or other outdoor paint on each surface. The acceptability of the paint may be determined by consideration of its composition or by corrosion tests if such tests are considered necessary.

8.8 To comply with [Table 8.1](#) referenced to this, one of the following coatings shall be used:

a) Hot-dipped mill-galvanized sheet steel conforming with the Coating Designation G90 in Table I of the Standard for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process, ASTM A653 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 zinc coating may be determined by any method; however, in case of question, the weight of coating shall be established in accordance with the Standard Test Method for Weight (Mass) of Coating on Iron or Steel Articles with Zinc or Zinc-Alloy Coatings, ASTM A90.

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 0.00061 inch (0.015 mm) on each surface with a thickness at least 0.00054 inch (0.014 mm). The thickness of the coating shall be established by the Metallic Coating Thickness Test, Section [28](#). An annealed coating shall also comply with [8.12](#).

c) A zinc coating conforming with [8.9](#) (a) or (b) with one coat of an organic finish of the epoxy or alkyd-resin type or other outdoor paint applied after forming on each surface. The acceptability of the paint may be determined by consideration of its composition or by corrosion tests if such tests are considered necessary.

d) A cadmium coating not less than 0.001 inch (0.025 mm) thick on both surfaces. The thickness of coating shall be established in accordance with the Metallic Coating Thickness Test, Section [28](#).

e) A cadmium coating not less than 0.00075 inch (0.019 mm) thick on both surfaces with one coat of outdoor paint on both surfaces, or not less than 0.00051 inch (0.013 mm) thick on both surfaces with two coats of outdoor paint on both surfaces. The thickness of the cadmium coating shall be established in accordance with the Metallic Coating Thickness Test, Section [28](#) and the paint shall be as specified in (c).

8.9 To comply with [Table 8.1](#) referenced to this paragraph, one of the following coatings shall be used:

- a) Hot-dipped mill-galvanized sheet steel conforming with the Coating Designation G60 or A60 in Table I of the Standard for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process, ASTM A653 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 zinc coating may be determined by any method; however, in case of question, the weight of coating shall be established in accordance with the Standard Test Method for Weight (Mass) of Coating on Iron Steel Articles with Zinc or Zinc-Alloy Coatings, ASTM A90.
- 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 (0.010 mm) on each surface with a minimum thickness of 0.00034 inch (0.009 mm). The thickness of the coating shall be established by the Metallic Coating Thickness Test, Section [28](#).
- c) 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 consideration of its composition or by corrosion tests if such tests are considered necessary.

8.10 With reference to [8.8](#) and [8.9](#), other finishes, including paints, metallic finishes, and combinations of the two may be accepted when comparative tests with galvanized sheet steel – without annealing, wiping or other surface treatment – conforming with [8.8\(a\)](#) or [8.9\(a\)](#), as applicable, indicate they provide equivalent protection. Among the factors that are taken into consideration when judging the acceptability of such coating systems are exposure to salt spray, moist carbon dioxide-sulphur dioxide-air mixtures, moist hydrogen sulphide-air mixtures, ultraviolet light and water.

8.11 If the paint is to be tested, the test specimens of a finish as described in [8.7](#) or [8.10](#), [8.8\(c\)](#), or [8.9\(c\)](#), are to be consistent with the finish that is to be used in production with respect to the base metal, cleaning or pretreatment method, application method, number of coats, curing method, thickness, and the like.

8.12 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 if the bending or forming process damages the zinc coating, except that such areas on the inside surface of an enclosure that water does not enter during the rain test need not be painted. The zinc coating is considered to be damaged if flaking or cracking of the zinc coating at the outside radius of the bent or formed section is visible at 25 power magnification. Simple sheared or cut edges and punched holes are not considered to be formed.

9 Power-Supply Connections

9.1 A ventilator shall be constructed so that it can be permanently connected to one of the wiring systems that would be acceptable for the ventilator.

9.2 An outlet or terminal box in which power-supply connections are to be made shall be located so that such connections may be inspected after the ventilator has been installed as intended.

9.3 An outer cover or panel that must be removed in order to inspect field-wiring connections to a roof- or wall-mounted ventilator shall be constructed so that it may be removed with an ordinary tool, such as a screwdriver or pliers.

9.4 It shall not be necessary to dismount an electrical component or disconnect a duct to gain access to a wiring compartment to inspect field-wiring connections.

9.5 An electrical component shall not be mounted on a part, such as the cover of a wiring-terminal compartment, that must be removed to permit field-wiring connections to be inspected.

Exception: A component that has been investigated and found to be acceptable for such mounting may be mounted on a part that must be so removed.

9.6 A terminal compartment intended for the connection of a power-supply raceway that is mounted to the ventilator shall be attached so as to be prevented from turning with respect thereto.

9.7 A conduit opening in an outer enclosure for power-supply or external-control-circuit connection shall be threaded. The metal at a threaded opening for conduit shall not be less than 1/4 inch thick.

Exception No. 1: A conduit opening need not comply if it is on a duct fan that is not intended for outdoor exposure.

Exception No. 2: A conduit opening need not comply if it is located wholly below the lowest uninsulated live part within the enclosure or if its location prevents drainage into the enclosure.

9.8 If threads for the connection of conduit in the exterior of the enclosure are tapped all the way through the hole in a wall of a box or if an equivalent construction is employed, there shall not be less than 3-1/2 threads nor more than that specified in [Table 9.1](#), and the construction shall be such that a conduit bushing can be properly attached. If threads for the connection of conduit are not tapped all the way through a hole in a wall of a box, conduit hub, or the like, there shall not be less than five full threads in the metal and there shall be a smooth, rounded inlet hole for the conductors that provides protection for the conductors equivalent to that provided by a standard conduit bushing. The opening shall have an internal diameter in accordance with [Table 9.2](#).

Table 9.1
Maximum number of threads in a conduit opening

Conduit size, inch	Number of threads per inch	Maximum number of threads
1/2, 3/4	14	7
1, 1-1/4, 1-1/2, 2	11-1/2	8
2-1/2, 3, 3-1/2, 4	8	9

Table 9.2
Dimensions associated with openings for conduit

Trade size of conduit, inches	Unthreaded openings		Threaded openings			
	Nominal knockout diameter, inches (mm)	Minimum diameter of flat surface at knockout, inches (mm)	Throat diameter, inches (mm)			
			Minimum		Maximum	
1/2	7/8 (22.2)	1.152 (29.26)	0.591 (15.01)		0.622 (15.80)	
3/4	1-3/32 (27.8)	1.450 (36.83)	0.783 (19.89)		0.824 (20.93)	
1	1-23/64 (34.5)	1.804 (45.82)	0.997 (25.32)		1.049 (26.64)	
1-1/4	1-23/32 (43.7)	2.309 (58.65)	1.311 (33.3)		1.380 (35.05)	

9.9 The diameter of a knockout shall be such that it will accommodate conduit of the trade size for which the knockout is intended as specified in [Table 9.2](#).

9.10 There shall be a flat surface surrounding a knockout. The flat surface shall have a minimum diameter in accordance with [Table 9.2](#).

9.11 The space provided at terminals or leads intended for the connection of supply conductors, or other conductors to be connected at the time of installation, shall be sufficient for acceptable installation including the accommodation of the necessary splices. A trial installation may be performed to determine compliance with these requirements. See [9.12](#).

9.12 An acceptable installation shall:

- a) Be possible using ordinary tools suitable for the installation; and
- b) Not require installed conductors to be forced into contact with uninsulated live parts, or with noncurrent-carrying parts likely to be grounded.

9.13 The area of all open holes in a terminal compartment other than one integral with a motor or as noted in [9.14](#) shall not be more than 1/4 square inch (160 mm²) in any one side and not more than 3/8 square inch (240 mm²) in the bottom surface. The total area of such holes shall not be more than 1/2 square inch (320 mm²).

9.14 A terminal compartment of a duct fan that is exposed to the main air stream shall not have any open holes.

9.15 The overall enclosure of a roof- or wall-mounted ventilator may serve as the compartment for field-wiring terminals if:

- a) No part that requires service access – an oil hole, belt, or the like – is located in that compartment; and
- b) The total area of openings in the enclosure is not more than 2-1/4 square inches (14.5 cm²) and no slot is wider than 1/32 inch (0.8 mm).

9.16 A ventilator shall be provided with field-wiring terminals for the connection of conductors having an ampacity acceptable for the ventilator; or it shall be provided with acceptable leads for such connection.

9.17 A field-wiring terminal shall be provided with a pressure terminal connector securely fastened in place; for example, firmly bolted or held by a screw.

Exception: A wire-binding screw or stud-and-nut combination may be employed at a wiring terminal intended to accommodate a 10 AWG (5.3 mm²) or smaller conductor if upturned lugs or the equivalent are provided to hold the wire in position.

9.18 A field-wiring terminal shall be prevented from turning.

9.19 A wire-binding screw or stud-and-nut combination shall not be smaller than No. 10 (4.8 mm diameter).

Exception No. 1: A No. 8 (4.2 mm diameter) screw may be used at a terminal intended only for connection of a 14 AWG (2.1 mm²) conductor.

Exception No. 2: A No. 6 (3.5 mm diameter) screw may be used at a terminal intended only for connection of a 16 or 18 AWG (1.3 or 0.82 mm², respectively) control-circuit conductor.

9.20 A wire-binding screw shall thread into a metal terminal plate not less than 0.050 inch (1.27 mm) thick. There shall not be less than two full threads in the metal of the plate.

9.21 A terminal plate formed from stock not less than 0.050 inch (1.27 mm) thick may have the metal extruded at the tapped hole to provide the two full threads for the wire-binding screw.

9.22 Upturned lugs or a cupped washer shall be capable of retaining a supply conductor of the size specified in [9.16](#) under the head of the screw or washer.

9.23 A field-wiring terminal intended for the connection of a grounded power-supply conductor shall be of or plated with a metal substantially white in color and shall be readily distinguishable from the other terminals, or proper identification of that terminal shall be clearly shown in some other manner, such as on an attached wiring diagram.

9.24 A lead intended to be connected to a grounded power-supply conductor shall be finished to show a white or gray color, and shall be readily distinguishable from the other leads.

9.25 The surface of a lead intended for field connection of an equipment-grounding conductor shall be green with or without one or more yellow stripes, and no other lead shall be so identified.

9.26 The requirements in [9.23](#) – [9.25](#) relating to color coding do not apply to internal wiring that is not visible in a field-wiring compartment.

9.27 The free length of a lead inside an outlet box or wiring compartment shall not be less than 6 inches (152 mm) nor more than 8 inches (203 mm).

Exception: A lead may be less than 6 inches long if it is evident that a longer lead might result in a risk of fire or electric shock.

10 Current-Carrying Parts

10.1 A current-carrying part shall be silver, copper, a copper alloy, or other material acceptable for the application.

10.2 Plated iron or steel may be used for a current-carrying part if it is acceptable in accordance with [5.1.1](#) or within a motor or associated governor, but the use of iron or steel for current-carrying parts elsewhere in the ventilator is not acceptable.

Exception: Stainless steel may be used anywhere in the ventilator as a current-carrying part.

11 Internal Wiring

11.1 Hazardous voltage internal wiring, connections between parts of a ventilator, and wiring which is part of a safety critical function shall be protected or enclosed.

11.2 Type SE, SJE, SJT, SJO, SJOO, SJTO, SJTOO, SO, SOO, ST, STO, STOO cord or appliance wiring material of equivalent construction may be used in a roof- or wall-mounted ventilator without protection other than that provided by the outer enclosure of the ventilator.

11.3 All wiring is considered to be suitably enclosed when the cabinet or compartment enclosing the wiring has:

a) No louver or openings that will permit the probe of [Figure 6.3](#), when applied in a straight line, to contact wiring, and

b) No openings in the bottom, unless a U-shaped channel or trough is located beneath the wiring, and the wires do not project through the plane of the top of the channel or trough.

Exception: Hazardous voltage and safety circuit wiring, in which the flame test, UL VW-1, or the vertical flame test as described in the Standard for Electrical Wires, Cables, and Flexible Cords, UL 1581, is conducted, is considered to comply with [11.3\(b\)](#) and need not be isolated by the barriers described.

11.4 Internal wiring consisting of wire or cord other than that specified in [11.2](#) shall be enclosed in metal, such as conduit, metal-clad cable, or the like. The assembly shall be mechanically secure and shall provide an electrical bond between parts.

11.5 Internal wiring in a duct fan shall not be exposed to the main air stream, and shall be installed in accordance with the requirements for wiring in ducts in the National Electrical Code, ANSI/NFPA 70.

11.6 Internal wiring consisting of individual insulated conductors – either separate or in a harness – shall be protected as though it were enameled wire in accordance with [6.5.2](#).

11.7 The internal wiring and connections of a ventilator shall be acceptable for the application with respect to:

- a) Temperature and voltage;
- b) Exposure to oil, grease, or moisture; and
- c) Other conditions of service to which they are likely to be subjected.

11.8 Wiring shall be protected from sharp edges, screw threads, burrs, fins, moving parts, and other agents that might abrade the insulation on conductors.

11.9 A hole through which insulated wires pass in a sheet-metal wall within the overall enclosure of a ventilator shall be provided with a smooth, rounded bushing or shall have a smooth, rounded surface upon which the wires may bear to prevent abrasion of the insulation.

11.10 Insulated wires may be bunched and passed through a single opening in a metal wall within an enclosure.

11.11 Each splice in wiring shall be located, enclosed, and supported so that it is not subject to damage, flexing, motion, or vibration. A splice is considered to be acceptably enclosed when installed in a junction box, control box, or other enclosed compartment in which the wiring materials, as specified in [Table 11.1](#), may be employed. A splice in an enclosed machinery compartment shall be secured to a fixed member in the compartment so that it is not subject to movement or damage during servicing.

Table 11.1
Typical wiring materials

Type of wire, cord, or cable ^{a,b}	Wire size		Insulation thickness	
	mm ²	AWG	mm	inch
Thermoplastic appliance wiring material, with insulation thickness shown at the right corresponding to wire sizes indicated; or Type T, TW, or Type ^c AC, ACL, ACT, FFH-2, TF, TFF, TFN, TFFN, SF-2, SFF-2, RH, RHH, RHW, RUH, RUW, THW, XHHW, MTW, THW-MTW, THWN, PF, PGF, PFF, PGFF	5.3 to 0.41	10 to 22	0.8	2/64
	8.4	8	1.2	3/64
	13.3	6	1.6	4/64
	21.2	4	1.6	4/64
	26.7	3	1.6	4/64
	33.6	2	1.6	4/64

Table 11.1 Continued on Next Page

Table 11.1 Continued

Type of wire, cord, or cable ^{a,b}	Wire size		Insulation thickness	
	mm ²	AWG	mm	inch
	42.4	1	2.0	5/64
	54.0	1/0	2.0	5/64
	67.0	2/0	2.0	5/64
	85.0	3/0	2.0	5/64
	107.2	4/0	2.0	5/64
^a The designated cord or cable, or types of wire other than appliance wiring material, may be used without regard to the values specified in the Table.				
^b Type CL wire may be used within a separate material enclosure as leads of components.				
^c Wire types included only in the National Electrical Code, ANSI/NFPA 70.				

11.12 A soldered connection shall be mechanically secured before being soldered.

11.13 A splice shall be provided with insulation equivalent to that of the wires involved if permanence of spacing between the splice and other metal parts may not be maintained.

11.14 In determining if splice insulation consisting of coated-fabric, thermoplastic, or other type of tubing is acceptable, consideration shall be given to such factors as dielectric properties and resistance to deterioration due to temperature and moisture exposure. Thermoplastic tape wrapped over a sharp edge is not acceptable. An insulated splicing device is acceptable within the limits of its voltage and temperature ratings.

11.15 Wiring shall be located so that it will not be immersed in water as a result of exposure to the weather.

11.16 The means of connecting stranded internal wiring to a wire-binding screw shall be such that loose strands of wire will be prevented from contacting other live parts not always of the same polarity as the wire and from contacting dead metal parts. This may be accomplished by using pressure terminal connectors, soldering lugs, crimped eyelets, soldering all strands of the wire together, or other equivalent means.

11.17 Internal wiring composed of insulated conductors shall comply with the Standard for Appliance Wiring Material, UL 758.

Exception No. 1: Insulated conductors need not comply with UL 758 if they comply with one of the following:

- a) Standard for Thermoset-Insulated Wires and Cables, UL 44;*
- b) Standard for Thermoplastic-Insulated Wires and Cables, UL 83;*
- c) Standard for Fixture Wire, UL 66; or*
- d) The appropriate UL standard(s) for other insulated conductor types specified in Chapter 3 (Wiring Methods and Materials) of the National Electrical Code, ANSI/NFPA 70.*

Exception No. 2: Insulated conductors for specialty applications (e.g. data processing or communications) and located in a low-voltage circuit not involving the risk of fire or personal injury need not comply with UL 758.