

Table 90.1
Ceiling-suspended fans from 2.1 meters (7 feet) to less than 3.05 meters (10 feet) above floor

Air flow	Maximum speed at tip of blades,		Minimum thickness of edges of blades,	
	m/s	(feet per minute)	mm	(inch)
Downward	16.3	(3200)	3.2	(1/8)
Downward	20.3	(4000)	4.8	(3/16)
Upward	16.3	(3200)	4.8	(3/16)
Upward	12.2	(2400)	3.2	(1/8)

90.2.3 The leading and trailing edges of the blades mentioned in [90.2.1](#) and [Table 90.1](#) shall be smooth and well-rounded with no projections.

90.2.4 The polymeric blades of a dry location ceiling-suspended fan shall comply with all the requirements specified in Section [99](#), Performance, except for the low temperature conditioning of [99.1.3](#) which is to be conducted at 0°C (32°F).

90.2.5 Glass shall not be used as a material for ceiling suspended fan blades.

90.3 Power supply connections

90.3.1 A cord-connected ceiling-suspended fan marked for commercial, industrial, or agricultural use in accordance with [92.3](#) shall be provided with a power supply cord in accordance with [Table 15.1](#) and shall:

- a) Have three conductors;
- b) Be Type SJ or heavier terminating in an acceptable grounding type attachment plug;
- c) Have a length of 0.305 – 0.46 m (12 – 18 inches);
- d) Be permanently attached to the fan; and
- e) Comply with the requirements of [15.1.3](#) and [15.2.1](#) – [15.2.5](#).

90.4 Wiring

90.4.1 Wiring leads provided in a ceiling-suspended fan for supplying power to an optional light kit installed in the field shall not have exposed bare ends. See [92.4](#) and [108.1](#).

90.4.2 Wiring leads terminating in single or multiple connectors provided in a ceiling-suspended fan for supplying power to an optional light kit installed in the field shall be constructed such that the single or multiple connectors physically cannot be mated to each other to create a short circuit.

90.5 Openings in canopy

90.5.1 An open hole in the fan canopy shall not exceed the dimension specified in [Table 90.2](#).

Table 90.2
Maximum size of open holes

Opening shape	Maximum area		Maximum Dimension	
	mm ²	(inch ²)	mm	(inch)
Slot ^a	967.7	(1-1/2)	9.5	(3/8)
Square	—		12.7	(1/2)
Round	—		12.7	(1/2)
Irregular	967.7	(1-1/2)	9.5	(3/8)

^a A slot between two assembled parts that does not exceed 0.8 mm (1/32 inch) in width is not required to comply with the area limitation.

90.5.2 The total area of one or more open holes shall not be more than 15 percent of the area of the surface in which it is located.

91 Performance

91.1 Static load test

91.1.1 Fans with other than ball-joint hanger means

91.1.1.1 The mounting means for a ceiling suspended fan having other than a ball-joint hanger means shall be tested as specified in [91.1.1.3](#). After the load is removed, the security of the mounting means to the building structure or outlet box and the security of the connection of the fan to the mounting means shall be as originally installed.

91.1.1.2 With reference to [90.1.3](#), for a fan intended to be suspended by a single "J" hook, the test specified in [91.1.1.3](#) shall be conducted:

- a) First with the fan installed as intended and supported by the "J" hook; and
- b) Second with the "J" hook removed and the fan suspended by the chain only.

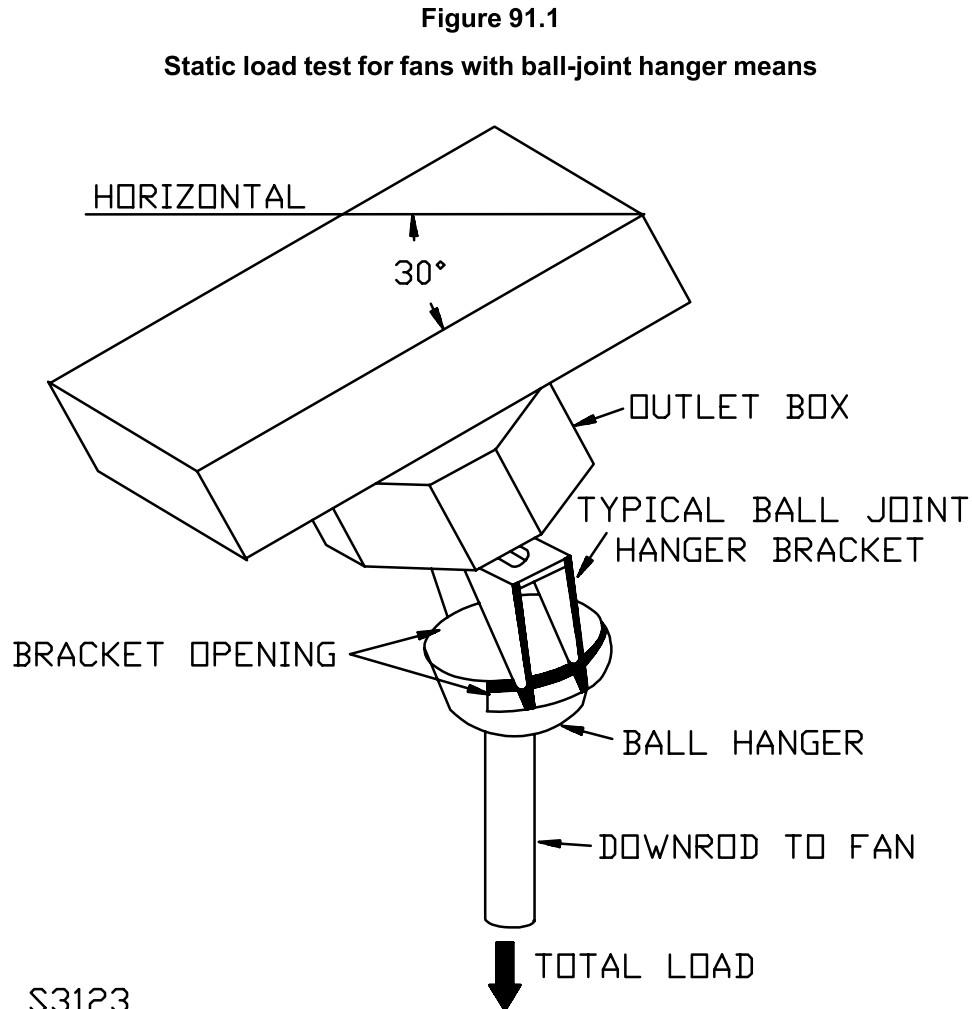
91.1.1.3 The mounting means of a fan is to be installed in accordance with the installation instructions provided by the manufacturer. The other parts of the fan are not to be installed. A static load of four times the maximum possible weight of the fan and accessories (including the considerations mentioned in [148.4](#)) is to be gradually applied and then supported for one minute by the installed mounting means.

91.1.2 Fans with ball-joint hanger means

91.1.2.1 After being tested as described in [91.1.2.2](#), a ball-joint hanger means shall comply with the requirements in [91.1.1.1](#). When a fan employs a polymeric ball-joint mounting means, the polymeric parts of the hanger are to be conditioned as described in [91.2.2.1](#) and [91.2.2.2](#) before testing in accordance with [91.1.2.2](#).

91.1.2.2 A mounting means for a fan provided with a ball-joint hanger means is to be mounted in accordance with the manufacturer's instructions using the mounting means provided with the fan. The mounting means is to be subjected to a static load of four times the weight of the fan and all accessories for 7 hours. The load is to be applied so as to transmit the maximum stress to the mounting means.

Mounting angle A illustrated in [Figure 91.1](#) is to be 30 degrees; however, the mounting angle may be less than 30 degrees, but not less than 10 degrees, if so recommended in the installation instructions. The load angle is to be in the direction of the hanger bracket opening. If the installation of a canopy could affect test results, the canopy is to be installed in accordance with the installation instructions.



91.2 Fans with polymeric mounting means

91.2.1 General

91.2.1.1 Three samples of a ball-joint hanger means incorporating polymeric material shall be installed on the down rods as intended for the ball hanger and shall be tested as described in [91.2.1.2](#).

91.2.1.2 The samples are to be subjected to the temperature conditioning test of [91.2.2](#). After the temperature conditioning test, one sample is to be subjected to the endurance test of [91.2.3](#), and one sample is to be subjected to the static load test of [91.1.2](#).

91.2.2 Temperature conditioning test

91.2.2.1 As a result of the conditioning described in [91.2.2.2](#), there shall be no softening, cracking, warping, or other deterioration that decreases the integrity of the polymeric mounting means.

91.2.2.2 Three samples of the polymeric mounting means are to be conditioned for seven hours at 0°C (32°F). For damp or outdoor location ceiling-suspended fans, low temperature conditioning is to be conducted at minus 35.0 ±1.0°C (minus 31 ±1.8°F). The same three samples are then to be conditioned for seven hours in an air-circulating oven maintained at a temperature of 70°C (158°F). The samples are to be cooled to room temperature.

91.2.3 Endurance test

91.2.3.1 After being tested as described in [91.2.3.2](#), the means used to prevent rotation or twisting between the fan assembly and the hanger assembly shall not be damaged such that it permits rotation or twisting between the assemblies.

91.2.3.2 The same sample of the ceiling-suspended fan, and a sample of the polymeric mounting means that has been conditioned in accordance with [91.2.2.2](#), are to be mounted in accordance with the manufacturer's instructions. The fan is to be connected to a 60-hertz electrical supply adjusted to the appropriate nominal test voltage specified in [Table 40.1](#). The fan is then to be subjected to 1000 cycles of operation. For a reversible fan, each cycle of operation is to consist of throwing the switch in one direction, allowing the blade to reach full operating speed in that direction; then, without a pause, throwing the switch to the position in which rotation is reversed, allowing the blade to reach full operating speed in that direction. For a unidirectional fan, each cycle of operation is to consist of starting the fan, allowing the blade to reach full maximum operating speed, shutting off the fan, allowing the blade to come to a complete stop.

91.3 Polymeric blades

91.3.1 Following the conditioning described in [91.3.3](#) – [91.3.6](#), the polymeric blade-bracket assembly, consisting of a blade attached to the blade brackets, of a ceiling-suspended fan intended for damp locations:

- a) Shall not show any signs of blade cracking including the area around the screwholes;
- b) Shall not result in the reduction of the minimum blade height allowed on the final installation due to blade warpage; and
- c) Shall not result in unacceptable blade warpage as determined by compliance with the Temperature Test, Section [46](#), using the entire appliance with the conditioned blade-bracket assemblies installed.

Exception: If the input values are within ± 10 percent of the before-conditioning values determined in Section [46](#), the Temperature Test need not be conducted.

91.3.2 The polymeric fan blades in the as-received condition are to be installed on their corresponding brackets with the flathead screws tightened to a maximum torque of 2.82 N·m (25 lbf·in.).

91.3.3 The polymeric blade with bracket assemblies then is to be conditioned at $0 \pm 1.0^{\circ}\text{C}$ ($32 \pm 1.8^{\circ}\text{F}$) for 7 hours. Following this conditioning, the assemblies are to be allowed to return to room temperature (a minimum of 4 hours).

91.3.4 The assemblies are then to be conditioned at $50.0 \pm 1.0^{\circ}\text{C}$ ($122 \pm 1.8^{\circ}\text{F}$) at a relative humidity of 80 percent for 7 hours and allowed to return to room temperature (a minimum of 4 hours). See [91.3.5](#). This sequence described in [91.3.3](#) and [91.3.4](#) constitutes one cycle.

91.3.5 Immediately following the conditioning described in [91.3.4](#), before allowing the samples to return to room temperature, the screws are to be tightened to the torque value applied in [99.1.2](#).

91.3.6 The cycle described in [91.3.3](#) and [91.3.4](#) is to be repeated twice for a total of 3 cycles.

91.4 Fan blade brackets

91.4.1 Static load test for ceiling-suspended fan blade brackets

91.4.1.1 A blade bracket to be used on a ceiling-suspended fan shall be subjected to the static load test described in [91.4.1.2](#). As a result of the load, the bracket shall have no cracks as determined by visual inspection with a 4-power magnifying glass.

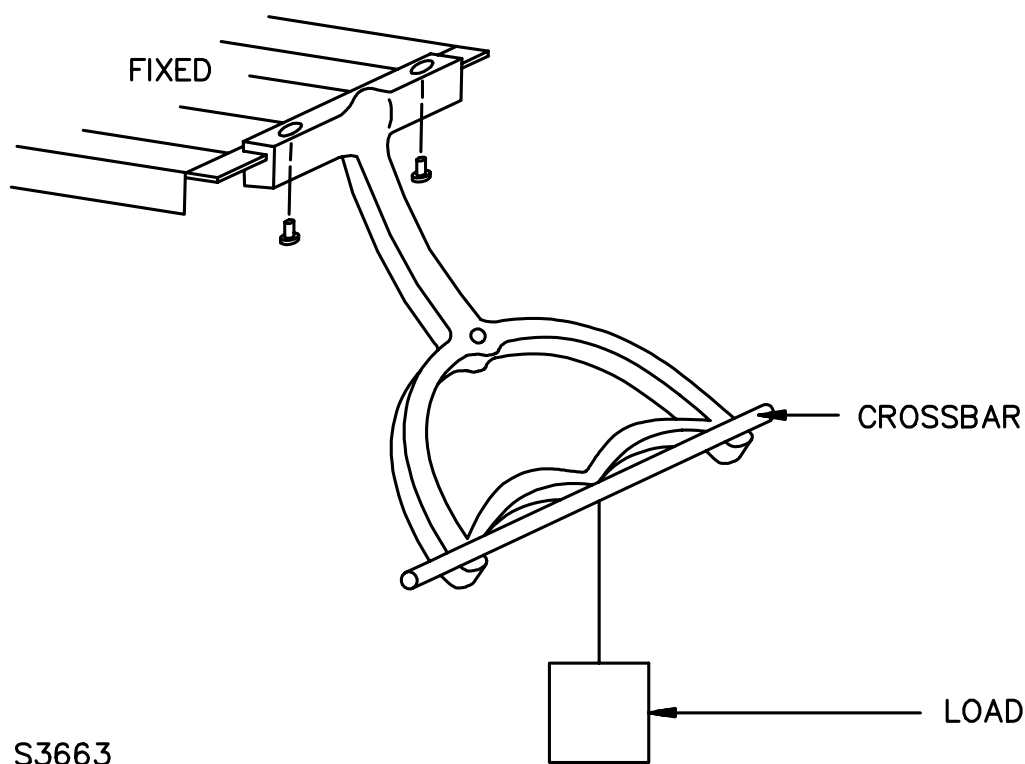
91.4.1.2 The mounting feet of the blade bracket are to be fixed by a support, vise, or other securing means. The bracket is to be oriented as intended for actual use as illustrated in [Figure 91.2](#). After securing the bracket mounting feet, a crossbar is to be secured across the top of the two outermost blade mounting holes. The load is to be suspended from the center of the crossbar for one minute as illustrated in [Figure 91.2](#). The combined weight of the crossbar, load, and means of load suspension is to be in accordance with [Table 91.1](#).

Exception: If the blade bracket construction is such that it is integral to the motor enclosure and attached to the overall motor assembly upon shipment, the blade brackets/motor enclosure can remain attached to the motor assembly during testing.

Table 91.1
Static loads for blade brackets

Diameter of ceiling fan ^a	Total static load on sample blade bracket ^b
Less than 1.14 m (45 inches)	9.07 kg (20 pounds)
1.14 m (45 inches) or greater	15.88 kg (35 pounds)
^a Fan blade span.	
^b Includes weight of crossbar and means of load suspension.	

Figure 91.2
Static load test for fan blade brackets



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91.4.2 Dynamic load test for ceiling-suspended fan blade brackets

91.4.2.1 A blade bracket to be used on a ceiling-suspended fan shall be subjected to the dynamic load test described in [91.4.2.2](#) – [91.4.2.4](#). As a result of the test, the bracket shall have no cracks as determined by visual inspection with a 4-power magnifying glass.

91.4.2.2 The fan blades and blade brackets are to be installed on the test fan in accordance with the manufacturer's installation instructions. The fan blade length and fan speed are to be considered so as to test the fan and blade combinations that represent the most severe dynamic forces that are induced by the 10 gram (0.022 pounds) imbalance described in [91.4.2.3](#).

91.4.2.3 A 10 gram (0.022 pounds) flat weight is to be secured to the fan blade that will result in the most change in the vertical distance of the blade imbalance. The weight is to be secured to the fan blade at the outermost point from the center of the fan, but not on the edge of the fan blade.

91.4.2.4 The fan is to be operated at maximum normal speed rpm for 24 hours. A reversible fan is to be operated in the upward airflow direction.

92 Marking

92.1 A ceiling-suspended fan shall be marked where readily visible during installation of the fan with the word "CAUTION" and the following or the equivalent: "To Reduce The Risk Of Injury To Persons, Install Fan So That The Blade Is At Least 3.05 Meters (10 Feet) Above The Floor."

Exception: A fan constructed in accordance with the Exception to [90.2.1](#) shall either be marked as 2.1 m (7 feet) or 3.05 m (10 feet).

92.2 A ceiling-suspended fan which is intended to be supported solely by an outlet box in accordance with [90.1.2](#) (a) shall be permanently marked with the word "WARNING" and the following or equivalent wording: "To Reduce The Risk Of Fire, Electric Shock, Or Personal Injury, Mount To Outlet Box Marked (a) And Use Mounting Screws Provided With The Outlet Box. Most Outlet Boxes Commonly Used For The Support of Luminaires Are Not Acceptable For Fan Support And May Need To Be Replaced. Consult A Qualified Electrician If In Doubt." This marking shall be readily visible during installation. The warning shall also be marked on the carton. See [92.8](#). Refer to [Table 92.2](#) for appropriate outlet box marking.

92.3 A cord-connected ceiling-suspended fan as mentioned in [90.3.1](#) shall be marked with the following or the equivalent:

- a) Commercial or Industrial Fans are marked "For Commercial or Industrial Use Only," or Agricultural Fans are marked "For Use in Agricultural Buildings"; and
- b) "Do not use an extension cord with this fan."

92.4 When a ceiling-suspended fan having provision for installation of an optional, field-installed light kit has leads to be used in the installation, the leads shall be marked or identified as lamp supply leads.

Exception: The leads are not required to be marked or identified when they are the only electrical parts exposed when installing the kit.

92.5 For a ceiling-suspended fan intended to be mounted to the building structure, the mounting bracket shall be marked "WARNING – Support Directly From Building Structure." The marking shall be located on the downward facing side of the mounting bracket and may be on a non-permanent label such as a tag or any type of removable label. The warning shall also be marked on the carton. See [92.8](#).

92.6 For a ceiling-suspended fan provided with two forms of mounting means in accordance with [90.1.2](#) (b), the mounting bracket shall be marked "WARNING – To Reduce The Risk Of Fire, Electric Shock, Or Personal Injury, Mount To Outlet Box Marked (a) And Use Mounting Screws Provided With The Outlet Box and/or Support Directly From Building Structure." The marking shall be located on the downward facing side of the mounting bracket and may be on a non-permanent label such as a tag or any type of removable label. The following or equivalent warning shall be marked on the carton: "WARNING – Risk Of Fire, Electric Shock, Or Personal Injury. The Fan In This Box May Be Either Directly Supported From A Structural Framing Member Of A Building And/Or May Be Mounted To An Outlet Box Marked (a). Most Outlet Boxes Commonly Used For The Support of Luminaires May Not Be Acceptable For Fan Support And May Need To Be Replaced. Consult A Qualified Electrician If In Doubt.". Where (a) is the outlet box marking per [Table 92.2](#).

92.7 When the maximum ampere rating for a permanently connected ceiling suspended fan is more than 50 percent of the rating of the branch circuit to which the ceiling suspended fan is intended to be connected, it shall be marked with the following or the equivalent: "Connect Only To A Dedicated Branch Circuit." It shall also be marked on the carton. See [92.8](#).

92.8 A marking which is required to be located on a carton containing a ceiling-suspended fan shall:

- a) Be located on at least one outside surface other than the bottom. The outside surface of a carton for a ceiling-suspended fan is capable of being any side excluding the bottom or may be the top of the carton. When the top of the carton consists of two flaps, the marking is not prohibited from being located only on one flap and the smallest dimension of the carton panel is the size of the flap with the marking; and
- b) Appear in lettering not less than the height specified in [Table 92.1](#). The minimum lettering height applies to the capital letters.

Table 92.1
Lettering height

Smallest dimension of the carton panel to be marked in mm (inches)		Minimum height of capital lettering in mm (inches)
More than	Less than or equal to	
0	152 (6)	3.2 (1/8)
152 (6)	254 (10)	4.8 (3/16)
254 (10)	—	6.4 (1/4)

Table 92.2
Outlet Box Marking

Fan Weight	Required Marking
≤ 15.9 kg (≤ 35 lbs)	"Acceptable for Fan Support of 15.9 kg (35 lbs) or less"
≤ 22.7 kg (≤ 50 lbs)	"Acceptable for Fan Support of 22.7 kg (50 lbs) or less"
≤ 31.8 kg (≤ 70 lbs)	"Acceptable for Fan Support of 31.8 kg (70 lbs) or less"

93 Installation Instructions

93.1 The important safety instructions for ceiling-suspended fans shall include the word "WARNING" and the following or equivalent wording: "To Reduce The Risk Of Personal Injury, Do Not Bend The Blade Brackets When Installing The Brackets, Balancing The Blades, Or Cleaning The Fan. Do Not Insert Foreign Objects In Between Rotating Fan Blades."

93.2 The installation instructions for a ceiling-suspended fan shall indicate the method to be used for mounting the fan in accordance with [90.1.2](#).

93.3 For a ceiling-suspended fan that is intended to be secured to the ceiling by a single screw and is provided with a reversing switch, or has a starting torque that tends to unscrew its single mounting screw, the installation instructions shall indicate that:

- a) A lubricant should not be used on the single mounting screw; and
- b) The pilot hole should be drilled no larger than the minor diameter of the mounting screw threads, and at least 38 mm (1-1/2 inches) of the threaded part of the mounting screw should be secured into a structural wood joist to provide secure mounting.

93.4 The installation instructions for a ceiling-suspended fan intended to be mounted by a "J" hook shall warn against risk of fire, electric shock, or injury to persons that results from improper installation, and include instructions to attach the chain or locking bar required by [90.1.3](#).

93.5 Recommendations for the pilot hole for mounting screws shall be provided with the installation instructions. The instructions shall specify that a single "J" hook mounting shall have means to prevent rotation after assembly to the joist through the center of the ceiling box if it is employed with a reversible fan or a fan that operates in a manner that tends to loosen the screws. Reference to this information shall be in accordance with [93.3](#).

93.6 The installation instructions for a fan which is intended to be supported solely by an outlet box in accordance with [90.1.2](#) (a) shall state "WARNING" and the following or equivalent wording: "To Reduce The Risk Of Fire, Electric Shock, Or Personal Injury, Mount To Outlet Box Marked (a) And Use Mounting Screws Provided With The Outlet Box." Where (a) is the outlet box marking per [Table 92.2](#).

93.7 The installation instructions for a fan which is intended to be mounted to either an outlet box or directly to a structural framing member, in accordance with [90.1.2](#) (b) shall state "WARNING" and the following or equivalent wording: "To Reduce The Risk Of Fire, Electric Shock, Or Personal Injury, Mount Directly To A Structural Framing Member Or To An Outlet Box Marked (a). For Outlet Box Mounting, Use Mounting Screws Provided With The Outlet Box." Where (a) is the outlet box marking in accordance with [Table 92.2](#).

93.8 The installation instructions for a ceiling-suspended fan shall include the information in (a) – (g):

- a) A diagram showing the fan, intended mounting means, and ceiling outlet box with fan canopy covering the outlet box;
- b) A statement that the installation is to be in accordance with the National Electrical Code, ANSI/NFPA 70 and local codes;
- c) A warning to make sure power is off before attempting installation;
- d) Instructions that after making the wire connections, the wires should be spread apart with the grounded conductor and the equipment-grounding conductor on one side of the outlet box and the ungrounded conductor on the other side of the outlet box;
- e) Instructions that the splices after being made should be turned upward and pushed carefully up into the outlet box;
- f) Instructions for supply connections: conductor of a fan identified as grounded conductor to be connected to a grounded conductor of power supply, conductor of fan identified as ungrounded conductor to be connected to an ungrounded conductor of power supply, conductor of fan identified for equipment grounding to be connected to an equipment-grounding conductor; and
- g) All instruction sheets shall indicate fan model designation or model series.

93.9 A ceiling-suspended fan which is intended to be supported solely by an outlet box shall have instructions to check that the outlet box is securely installed in place such that it is able to support at least the fan weight.

93.10 Swag kit, light kit, and external motor controller instructions shall not be included unless they are part of the kit that has been investigated for the purpose. Reference may be made in the fan instructions pertaining to proper light or controller accessories by model designation or that they are accessories that have been investigated and found acceptable for use with the fan and that instructions packed with such are to be followed during the installation of the accessory.

93.11 There shall be no illustration of a hanger bracket mounted directly to a ceiling joist, unless located within or over a ceiling outlet-box.

Exception: This requirement does not apply to swag-connected fans and swag kits investigated for the purpose.

93.12 There shall be no illustration of an equipment-grounding lead of a fan connected to a ceiling outlet-box.

93.13 All circuit diagrams shall indicate switching in the ungrounded circuit conductor.

93.14 Instructions shall not include illustrations of hanger assemblies that have not been investigated with the fan.

93.15 When a remote "on-off" wall switch is specified for fan control, instructions shall indicate that the switch used shall have been investigated and found acceptable for use as a general-use switch, as a speed control, or the like.

93.16 The installation instructions for a ceiling-suspended fan shall include the total weight of the fan plus any accessories packaged with the fan.

Exception: The weight is not required to be in the instructions for ceiling-suspended fans that are mounted directly to the building structure.

93.17 If an accessory is not packaged with the ceiling-suspended fan, the installation instructions for the accessory shall include the weight of the accessory.

93.18 A ceiling suspended fan relying on Exception No. 4 of [27.15](#) or [86.3](#) to comply with this Standard, shall include the following safety instruction: "WARNING" – To Reduce The Risk Of Electric Shock, This Fan Must Be Installed With An Isolating Wall Control/Switch.

DAMP LOCATION CEILING-SUSPENDED FANS

94 General

94.1 In addition to the applicable requirements in Part 1 of this Standard, a ceiling-suspended fan that is intended for use in damp locations shall also comply with the requirements in Sections [89](#) – [93](#), and [167.3](#). Damp location ceiling-suspended fans are suitable for installation in interior locations protected from weather and subject to moderate degrees of moisture, such as some basements, barns, cold storage warehouses, and similar locations, and also partially protected locations such as under canopies, marquees, roofed open porches, and similar locations.

95 Construction – Protection Against Corrosion

95.1 All inside and outside surfaces of sheet steel or other mechanical parts of iron or steel shall be zinc coated, cadmium plated, enameled, painted, or provided with equivalent protection against corrosion on all surfaces.

Exception: Punched holes and cut edges in ferrous material are not required to be protected against corrosion.

95.2 Hinges, bolts, and fasteners made of ferrous materials shall be protected against corrosion as described in [95.1](#).

Exception: Hinge pins are not required to be provided with protection against corrosion.

95.3 Sheet steel or other metal that is painted to comply with [95.1](#) shall be properly cleaned of grease and the like prior to painting.

95.4 Welds in iron or steel (other than stainless steel) shall be painted or provided with equivalent protection against corrosion. Copper, aluminum, alloys of copper and aluminum, stainless steel, and similar materials having inherent resistance to atmospheric corrosion are not required to be provided with additional protection against corrosion.

95.5 Vitreous enamel may be used as the only protective coating for sheet steel having a thickness of 0.66 mm (0.026 inch) or more.