



UL 484

STANDARD FOR SAFETY Room Air Conditioners

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UL Standard for Safety for Room Air Conditioners, UL 484

Ninth Edition, Dated February 7, 2014

Summary of Topics

The following revisions to ANSI/UL 484 have been made:

1. Editorial revisions to appendix references to correct typographical errors

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. Changes in requirements are marked with a vertical line in the margin and are followed by an effective date note indicating the date of publication or the date on which the changed requirement becomes effective.

The new requirements are substantially in accordance with Proposal(s) on this subject dated November 15, 2013.

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The requirements in this Standard are now in effect, except for those paragraphs, sections, tables, figures, and/or other elements of the Standard having future effective dates as indicated in the note following the affected item. The prior text for requirements that have been revised and that have a future effective date are located after the Standard, and are preceded by a "SUPERSEDED REQUIREMENTS" notice.

The following table lists the future effective dates with the corresponding reference.

Future Effective Dates	References
October 6, 2014	Paragraph 8.4.1



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The most recent designation of ANSI/UL 484 as an American National Standard (ANSI) occurred on February 6, 2014. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page, or effective date information.

The Department of Defense (DoD) has adopted UL 484 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 <http://csds.ul.com>.

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CONTENTS

INTRODUCTION

1 Scope	8
2 General	8
2.1 Units of measurement	8
2.2 Terminology	8
2.3 Undated references	9
3 Glossary	9

CONSTRUCTION

4 General	12
5 Assembly	13
6 Accessories	18
7 Enclosures	19
7.1 General	19
7.2 Enclosures exposed to weather	22
8 Polymeric Materials	24
8.1 General	24
8.2 Material classification	25
8.3 Ignition sources	25
8.4 Material application	26
9 Mounting Hardware	30
10 Field Supply Connections	30
10.1 Permanently-connected units	30
10.2 Cord-connected units	34
10.3 Grounding	35
11 Internal Wiring	36
11.1 General	36
11.2 High-voltage circuits	37
11.3 Low-voltage circuits	39
11.4 Wiring method	39
11.5 Short circuit protection	40
12 Secondary Circuits	41
12.1 General	41
12.2 Class 2 circuits	42
12.3 Limited voltage/current circuits	42
13 Separation of Circuits	43
14 Bonding for Grounding	44
15 Thermal Aisle Containment Systems	47
15.1 General	47
15.2 Equipment employing drop-out ceilings used beneath automatic sprinklers	47

ELECTRICAL COMPONENTS

16 Capacitors	49
17 Current-Carrying Parts	50
18 Electric Air Heaters	50
18.1 Heater elements	50
18.2 Heater overtemperature control	51

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Document Sharing Hub

18.3 Heater overcurrent protection	51
19 Fuseholders and Circuit Breakers	52
19.1 Fuseholders	52
19.2 Circuit breakers	53
20 Fuses and Supplementary Protectors	53
21 Insulating Material	54
22 Motors	54
23 Motor Protection	57
23.1 General	57
23.2 Protection of single-phase nonhermetic motors	57
23.3 Protection of three-phase motors	59
23.4 Protection of hermetic refrigerant motor-compressors	60
24 Switches and Controllers	60
25 Valves and Solenoids	65
26 Outlet Boxes, Electrical Cable, Conduit and Tubing	65
27 Electromagnetic Interference Filters	66
28 Relays and Contactors	66
29 Optical Isolators and Semiconductor Devices	66
30 Terminal Blocks	66
31 Transformer Protection	67
31.1 High-voltage transformer	67
31.2 Overcurrent protective device	69
32 High-Voltage Control Circuit Conductor Overcurrent Protection	69
32.1 General	69
32.2 Direct-connected high-voltage control circuit	70
32.3 Tapped high-voltage control circuit	70
32.4 Overcurrent protective device	71

ELECTRICAL SPACINGS

33 High-Voltage Circuits	72
34 Low-Voltage Circuits	74
35 Alternate Spacings – Clearances and Creepage Distances	74

REFRIGERATION SYSTEM

36 Refrigerant	75
37 Pump-Down Capacity	76
38 Refrigerant Tubing and Fittings	76
39 Refrigerant-Containing Parts	77
40 Pressure-Limiting Device	78
41 Pressure Relief	78
41.1 General	78
41.2 Relief valves	79
41.3 Fusible plugs or rupture members	79

PERFORMANCE

42 Instrumentation	79
42.1 Temperature measurements	79
42.2 Pressure measurements	80
43 Test Voltage	81
44 Leakage Current Test – Cord-Connected Room Air Conditioners	81

45	Rain Test	85
46	Test Conditions for Input Test and Temperature-Pressure Test	88
47	Input Test	89
47.1	General	89
47.2	Cooling load	89
47.3	Heating load (reverse cycle heat only)	90
47.4	Heating load (resistance heat only)	90
47.5	Heating load (combination reverse cycle and resistance heat)	90
48	Temperature and Pressure Test	91
49	Starting Test	94
50	Dielectric Voltage-Withstand Test	94
51	Condenser Fan Motor Failure Test	95
52	Condenser Water Failure Test	96
53	Temperature Test – Steam Or Hot Water Heat	97
54	Temperature Test – Resistance Heat	98
55	Abnormal Tests – Resistance Heat	98
55.1	General	98
55.2	Blocked outlet	98
55.3	Restricted inlet	99
55.4	Fan Failure	99
56	Static Loading Test	99
57	Stability Test	100
58	Overflow Test	100
59	Spillage Test	100
60	Heater Temperature-Limiting Control Tests	101
60.1	Endurance test	101
60.2	Calibration test	101
61	Maximum Continuous Current Test– Motor-Compressor Protection Devices	101
62	Limited Short-Circuit Test	103
62.1	General	103
62.2	Motor overload protective devices	104
62.3	Bonding conductors and connections	105
62.4	Motor circuit conductors and connections	105
63	Current Overload Test – Bonding Conductors and Connections	105
64	Overvoltage and Undervoltage Tests	106
65	Insulation Resistance Test	106
65.1	Sheath-type heaters	106
65.2	Thermal and acoustical insulation material	106
66	Accelerated Aging Test – Electric Heaters	107
67	Reliability Test – Heater Terminations	108
68	Accelerated Aging Tests On Gaskets Sealing Compounds, And Adhesives	108
69	Metallic Coating Thickness Test	110
70	Strength Tests – Pressure Containing Components	111
71	Fatigue Test Analysis	113
71.1	General	113
71.2	Test specifications	113
71.3	Material specifications	114
71.4	General test specifications	114
71.5	Test method	114
71.6	Test parameters	115
71.7	Cycle test pressure specification	115
72	Strain Relief Test	115
73	Burnout Tests – Electromagnetic Components	116

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POLYMERIC MATERIALS – PERFORMANCE

74 Heat Deflection or Mold Stress-Relief Test	116
75 Water Absorption Test	117
76 Environmental Exposure	118
76.1 Air oven aging	118
76.2 Ultraviolet light and water exposure	118
76.3 Water immersion	118
77 Tensile Strength Test	120
78 Flexural Strength Test	120
79 Izod Impact Test	120
80 Burnout Test – High-Voltage Transformers	121
81 Overload Test – High-Voltage Transformers	121
82 Tensile Impact Test	122
83 Impact Test	122
84 Volume Resistivity Test	123

MANUFACTURING AND PRODUCTION TESTS

85 Pressure Tests	123
86 Production Line Dielectric Voltage-Withstand Test	124
87 Production Line Grounding Continuity Test	126

MARKING

88 General	126
89 Permanently-Connected Units	131
90 Cord-Connected Units	137

INSTRUCTIONS

91 Installation and Operating Instructions	138
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SUPPLEMENT SA - REQUIREMENTS FOR ROOM AIR CONDITIONERS EMPLOYING A FLAMMABLE REFRIGERANT IN THE REFRIGERATING SYSTEM

SA1 Scope	SA1
SA2 Definitions	SA1
SA3 General	SA2
SA4 Construction	SA2
SA4.1 Refrigeration system	SA2
SA4.2 Resistance to corrosion	SA3
SA5 Performance	SA3
SA5.1 Leakage test	SA3
SA5.2 Ignition test	SA4
SA5.3 Temperature test	SA4
SA6 Marking, Installation and Operating Instructions	SA5
SA6.1 Marking	SA5
SA6.2 Installation and operating instructions	SA6

SUPPLEMENT SB - REQUIREMENTS FOR SMART ENABLED ROOM AIR CONDITIONERS

SB1 Scope	SB1
SB2 General	SB1
SB3 Functional Safety	SB3
SB4 Resistance to Electro Magnetic Phenomena (Immunity)	SB4
SB5 Marking and Instructions	SB5

Appendix A(normative)Selected information about refrigerants**Appendix B(informative)Transportation, marking and storage for units that employ flammable refrigerants**

B.1 Transport of Equipment Containing Flammable Refrigerants	B1
B.2 Marking of Equipment Using Signs	B1
B.3 Disposal of Equipment Using Flammable Refrigerants	B1
B.4 Storage of Equipment/Appliances	B1
B.5 Storage of Packed (Unsold) Equipment	B1

Appendix C(normative)Manuals

C.1 General	C1
C.2 Symbols	C1
C.3 Information in Installation and Operating Manuals	C1

Appendix D(normative)Leak simulation tests

D.1 General	D1
D.2 Test Methods	D1

Appendix E(normative)Charge limits

E.1 Requirements for Charge Limits	E1
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INTRODUCTION

1 Scope

1.1 These requirements cover room air conditioners rated not more than 600 volts alternating current (ac) and intended for installation in accordance with the National Electrical Code, ANSI/NFPA 70.

1.2 For the purposes of this standard, room air conditioners include packaged terminal air conditioners, special purpose air conditioners, and recreational vehicle air conditioners. They are factory-made encased assemblies designed as a unit primarily to provide free delivery of conditioned air to an enclosed space, room, or zone. This equipment is intended for installation in a window, through a wall, or as a console located in or adjacent to the room, zone, or space to be conditioned. These units employ hermetic refrigerant motor-compressors with factory-charged refrigeration systems and include means for circulating air. They may also have provision for heating and ventilation.

1.3 With regard to 1.2, a console or in-wall type air conditioner may additionally serve a single adjacent room. Such units employ cabinet or enclosure constructions permitting attachment of an air discharge adapter or duct which extends into the adjacent room. Recreational vehicle air conditioners may also employ a limited amount of ductwork.

1.4 These requirements do not cover equipment intended for connection to duct systems for the purpose of providing central cooling, heating, or both.

2 General

2.1 Units of measurement

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

2.2 Terminology

2.2.1 The terms “air conditioner” and “unit” are used interchangeably and refer to all room air conditioners or any part thereof covered by this standard unless specifically noted otherwise.

2.3 Undated references

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

3 Glossary

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

3.2 **ACCESSORY** – An optional electrical device or other component intended for installation in or connection to a room air conditioner for the purpose of modifying or supplementing the functions of the room air conditioner. It may be factory installed or intended for installation by the user or service personnel.

3.3 **AFCI** – A device intended to mitigate the effects of arcing faults by functioning to deenergize the circuit where an arc-fault is detected.

3.4 **BARRIER** – A partition for the insulation or isolation of electrical circuits or for isolation of electrical arcs or for isolation of moving parts or hot surfaces.

3.5 **CAPILLARY TUBE** – Device made of tubing with an outer diameter of less than 3/16 in. (4.7 mm) and used to reduce the pressure of the refrigerant between the condenser and evaporator. It also regulates the refrigerant flow.

3.6 CIRCUITS ELECTRICAL –

a) **High-Voltage** – A circuit involving a potential of not more than 600 volts and having circuit characteristics in excess of those of a low-voltage circuit.

b) **Low-Voltage** – A circuit involving a potential of not more than 30 volts ac (42.4 volts peak) or 30 volts direct current (dc), and supplied by:

- 1) A primary battery,
- 2) A National Electrical Code, ANSI/NFPA 70, standard Class 2 transformer, or
- 3) A combination of a transformer and fixed impedance which, as a unit, complies with all performance requirements for a Class 2 transformer, or
- 4) A Class Power Supply.

3.7 **COMPONENT** – A device or fabricated part of the appliance covered by the scope of a safety standard dedicated to the purpose. When incorporated in an appliance, equipment otherwise typically field installed (e.g. luminaire) is considered to be a component. Unless otherwise specified, materials that compose a device or fabricated part, such as thermoplastic or copper, are not considered components.

3.8 **COMPUTER ROOM AIR CONDITIONER (CRAC)** – An air-cooled or water-cooled, special purpose air conditioner, factory assembled as a portable package, which is a self-contained combination of cooling and optional heating components. This equipment is intended to provide supplemental cooling only for Information Technology Equipment (ITE) and may contain network connections to ITE. It is intended to condition a single equipment room or space. It may contain condenser intake/exhaust grill(s)

or separate ducts; and contain return air plenum with duct(s), filter, or grill(s) but is not designed for connection to an HVAC system. This equipment is to be installed in accordance with Article 645 of NFPA 70 (National Electrical Code) or in similar such locations.

3.9 CONSOLE-TYPE ROOM AIR CONDITIONER – An assembly designed for installation in or adjacent to the room, zone, or space to be conditioned. It may provide free air delivery or air distribution by means of collars, sleeves, or the like, having a single air inlet and single air discharge opening. Air-cooled units may be provided with collars or sleeves extending through a wall, floor, or roof for condenser air inlet and discharge.

3.10 DESIGN PRESSURE – The maximum allowable working pressure for which the room air conditioner is designed.

3.11 ENCLOSURE – That part of a room air conditioner which by itself or in conjunction with barriers:

- a) Renders inaccessible all or any parts of the unit that may otherwise present risk of electric shock,
- b) Reduces the risk of contact with parts which may cause injury to persons, and/or
- c) Prevents propagation of flame initiated by electrical disturbances occurring within the unit.

3.12 ENCLOSURE AIR CONDITIONER – A type of air-cooled or water-cooled air conditioner; factory assembled as a single, package. This equipment is intended for exterior mounting on or adjacent interior to an enclosure and may be suitable for outdoor use.

3.13 FUNCTIONAL PART – A part other than an enclosure or structural part which is necessary for the intended operation of the unit.

3.14 IN-WALL TYPE ROOM AIR CONDITIONER – An assembly designed for installation in and extending through a prepared wall opening.

3.15 LCDI – A device provided in a power-supply cord that senses leakage current flowing between or from the integral cord conductors and interrupts the circuit at a predetermined level of leakage current.

3.16 MODULAR CONSTRUCTION – A type of design used with in-wall and console room air conditioners which permits individual sections of the unit, such as the enclosure, cooling system, heater-blower assembly, and the like, to be shipped separately from the factory as needed at the point of installation. See also 4.3.

3.17 PACKAGED TERMINAL AIR CONDITIONER – A wall sleeve and a separate unencased combination of heating and cooling assemblies specified by the manufacturer and intended for mounting through the wall. It includes refrigeration components, separable outdoor louvers, forced ventilation, and heating availability by purchaser's choice of, at least, hot water, steam, or electric resistance heat.

3.18 PACKAGED TERMINAL HEAT PUMP – A separate unencased refrigeration system installed in a cabinet of similar function and configuration to that of a packaged terminal air conditioner. It utilizes reverse cycle refrigeration as its prime heat source and generally has other supplementary heat source available to purchasers with the choice of, at least, hot water, steam, or electric resistance heat.

3.19 PORTABLE AIR CONDITIONER (SPOT COOLER) – An air-cooled or water-cooled, package air conditioner; factory assembled as a portable package, which is an encased combination of cooling and optional heating components. This equipment is intended for providing supplemental cooling; and is

powered by single or three phase current. It may be suitable for outdoor use; provide dehumidifying; air cleaning; contain condenser intake/exhaust grill(s) or separate ducts; contain supply air nozzles or duct(s); contain return air plenum with duct(s), filter, or grill(s); and various ventilation options.

3.20 PRESSURE VESSEL – Any refrigerant-containing receptacle of a refrigerating system other than evaporators [each separate section of which does not exceed 1/2 cubic feet (0.014 m³) of refrigerant containing volume], evaporator coils, compressors, condenser coils, controls, headers, pumps, and piping.

3.21 RECREATIONAL VEHICLE AIR CONDITIONER (RVAC) – A type of air-cooled package air conditioner and heating equipment; factory assembled as a two piece system, an upper unit which consists of an exterior cover and a separate unencased cooling assembly and a ceiling unit which contains controls, vents, and optional heating components. The upper unit is intended for exterior mounting on, or through, an outside roof system; the ceiling unit is intended for interior mounting; and is powered by single phase current. It may contain separate indoor grille(s), outdoor louvers, various ventilation options, indoor free air discharge, or limited ductwork. Heating components may include electrical resistance, but may not include reverse cycle refrigeration as a heating means.

3.22 RECREATIONAL VEHICLE HEAT PUMP – A recreational vehicle air conditioner that utilizes reverse cycle refrigeration as its primary heat source, with secondary supplemental heating by means of electrical resistance.

3.23 SPECIAL PURPOSE AIR CONDITIONER – An air conditioner designed for special purposes, such as a spot cooler or environmental control of an electronic enclosure.

3.24 THERMAL AISLE CONTAINMENT SYSTEM – An HVAC method deployed in the occupied area of an air-cooled ITE space utilizing physical separation of hot exhaust air from cooler intake air between equipment cabinets, rows of ITE, or associated power and cooling infrastructure. Containment is typically above, and at both ends of a hot aisle or cold aisle, in whole or in part. Dropout ceilings for use beneath automatic sprinklers may be employed along with any necessary power supplies and/or other electrical devices and hardware.

3.25 STRUCTURAL PART – A part used in such manner that failure of the part may present a risk of electric shock or unintentional contact with moving parts.

3.26 ULTIMATE STRENGTH – The highest stress level which a refrigerant-containing component can tolerate without rupture.

3.27 WINDOW-TYPE ROOM AIR CONDITIONER – An assembly provided with mounting hardware designed for installation in a window.

3.28 OPERATING CONTROL – A control intended to start, regulate, or operate the appliance during normal operation. An example would be a thermostat or temperature controller.

3.29 PROTECTIVE (SAFETY) CONTROL – A control intended to prevent the risk of electric shock, fire, or injury to persons, typically during abnormal operation of the appliance. An example would be a pressure limiting control.

CONSTRUCTION

4 General

4.1 Ferrous metal parts used to support or retain electrical components in position shall be protected against corrosion by metallic and nonmetallic coatings, such as plating or painting.

Exception: This requirement does not apply to parts, such as washers, screws, bolts, or the like, where corrosion of such unprotected parts would not affect compliance with the requirements of this standard.

4.2 Exposed unimpregnated asbestos material shall not be used in an air handling compartment. The unprotected edge of a gasket sandwiched between two parts is considered to be exposed.

4.3 The condensing and evaporating sections of split-system room air conditioners shall be provided with means that permit the field connection of the sections in a manner that results in a completely factory-charged system.

4.4 A component shall:

- a) Comply with the safety standard covering that component;
- 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) Comply with the applicable requirements of this end product standard.

Exception: 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.*

4.5 A component that is also required to perform other necessary functions, such as overcurrent protection, ground-fault circuit interruption, surge suppression, any other similar functions, or any combination thereof, shall comply additionally with the requirements of the applicable standard(s) covering products 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.

4.6 Components shall not contain liquid mercury.

5 Assembly

5.1 Openings in the enclosure of a room air conditioner shall be designed or located to reduce the risk of unintentional contact with:

- a) Uninsulated high-voltage live parts;
- b) Moving parts, such as fan blades and blower wheels; and
- c) Parts within the enclosure which exceed the temperature permitted by Table 48.1, E4.

The minor dimension of such openings shall not permit passage of a 1 inch (25.4 mm) diameter hemispherically-tipped rod, applied with a force of 5 pounds (22.2 N). In evaluating openings, parts of the enclosure, such as covers, panels, and grilles are to be removed unless tools are required for their removal or when exposed, a moving part is made inoperative or an uninsulated part is de-energized through the use of interlocking devices.

Exception: The requirement of (c) does not apply to parts, such as refrigerant tubing located in the outdoor section of the unit, provided that openings adjacent to the parts will not permit passage of a rod as described above.

5.2 An opening is acceptable if the probe illustrated in Figure 5.1 cannot contact uninsulated high-voltage live parts, moving parts, or hot parts. The probe shall be applied:

- a) With a force of 2.5 pounds (11.1 N) along the major axis of the probe and
- b) In any possible configuration and to any depth that the size of an opening will permit.

The probe shall be rotated or angled to any possible position before, during, or after insertion through the opening; and, if necessary, the configuration shall be changed after the probe has been inserted through the opening.

Exception No. 1: For film-coated wire, an opening which will not permit passage of 3/4 inch (19 mm) diameter rod is acceptable if the probe illustrated in Figure 5.2 cannot contact the wire.

Exception No. 2: A moving part is not to be considered when judging compliance with this requirement if:

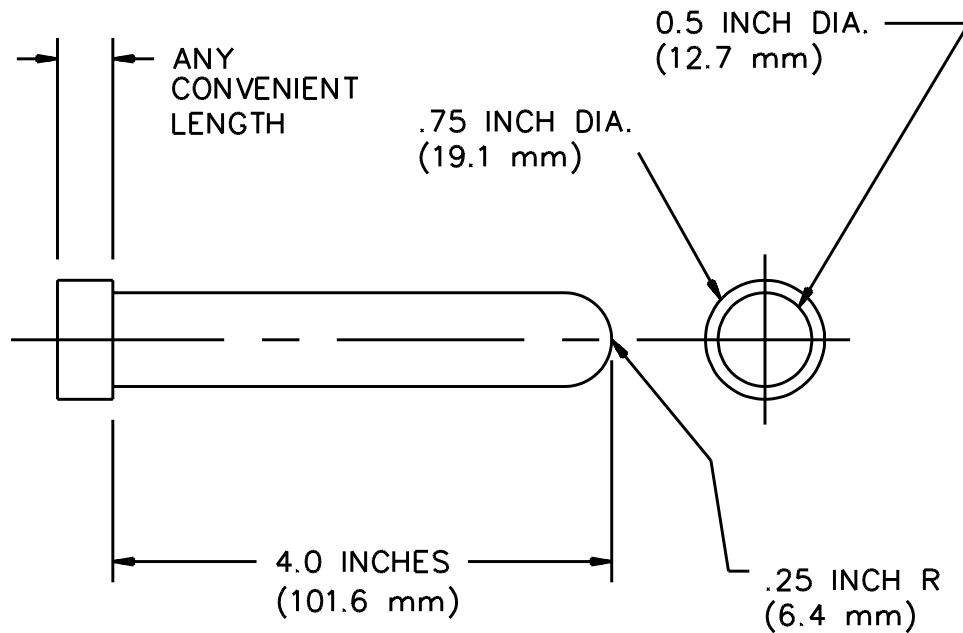
- a) The part is unlikely to be contacted through the opening because of the location of fixed components, such as baffles, water and refrigerant tubing, drain tubes, and the like, or*
- b) The unit chassis of a slide-out type construction must be withdrawn from the enclosure to expose the moving part.*

Exception No. 3: In evaluating moving parts and hot surfaces, openings of less than 1/4 inch (6.3 mm) in guards are not to be considered if application of the probe illustrated in Figure 5.2 with a force of 5 pounds (22.2 N) does not result in:

- a) Penetration to a depth permitting contact with the guarded part,*
- b) Breakage of the guard, or*

c) Permanent distortion or permanent displacement which would defeat the purpose of the guard.

Figure 5.2
Probe for film-coated wire



PA145

5.3 A heater element, as installed in the complete room air conditioner, shall be protected against mechanical damage. A heater element employing a copper or steel sheath that is at least 0.016 inch (0.41 mm) thick is considered to be protected against mechanical damage.

5.4 Open-type heater elements used in room air conditioners having air discharge from other than a vertical plane of the cabinet shall be protected by a screen, hardware cloth, or equivalent having openings no greater than 0.0156 square inch (0.1 cm²), located above the heater element and any uninsulated terminals to reduce the risk of objects falling through the air discharge grille onto or near these uninsulated parts.

5.5 Uninsulated live parts and film-coated wire located:

- a) In the room-side of a unit and
- b) Below air openings in other than the vertical surface of the cabinet, shall be mounted or guarded so that spillage of liquid through the air opening will not result in a risk of fire or electric shock. See Spillage Test, Section 59.

Exception: The test is not applicable to units if, when installed in accordance with the manufacturer's instructions, the minimum dimension of a horizontal top surface of the cabinet is 3 inches (76.2 mm) or less.

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5.6 Electrical controls:

- a) Located in the room-side of a unit and
- b) With the actuating member(s) extending through other than a vertical surface of the cabinet, shall be mounted or guarded so that spillage of liquid will not result in a risk of fire or electric shock. See Spillage Test, Section 59.

Exception: The test is not applicable to units if, when installed in accordance with the manufacturer's instructions, the minimum dimension of a horizontal top surface of the cabinet is 3 inches (76.2 mm) or less.

5.7 In addition to the requirements of 5.1 and 5.2, uninsulated high-voltage live parts inside the enclosure which are likely to be contacted by persons performing service operations, such as replacing fuses, resetting manual-reset devices, replacing air filters, oiling motors, or the like, shall be located, guarded, or enclosed to reduce the risk of unintentional contact unless tools are required to expose the live part. See 88.16.

5.8 Except as permitted in the Rain Test, Section 45, electrical components shall be located or enclosed so that accumulation or overflow of water will not wet uninsulated live parts.

5.9 A condensate pan shall be constructed and located so that overflow due to a blocked drain will not wet live parts or film-coated wire. An overflow spout, drain hole, cutout, or the like, in the condensate pan may be acceptable for preventing dripping of water on electrical parts. An Overflow Test, Section 58, is to be conducted if it is not evident that the room air conditioner complies with this requirement.

5.10 A switch, an attachment-plug receptacle, a motor-attachment plug, or similar component shall be secured in position and shall be prevented from turning.

Exception No. 1: The requirement that a switch be prevented from turning will be waived if all of the following conditions are met:

- a) The switch is of 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 turn the switch during the operation of the switch;*
- b) Means of mounting the switch make it unlikely that operation of the switch will loosen it;*
- c) Electrical spacings shall not be reduced below the minimum required values if the switch rotates; and*
- d) Operation of the switch is to be by mechanical means rather than direct contact by persons.*

Exception No. 2: A lampholder of a type 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 electrical spacings below the minimum acceptable values. See Electrical Spacings, Sections 33 and 34.

5.11 The means for preventing rotation mentioned in 5.10 is to consist of more than friction between surfaces. A toothed lock washer that provides both spring take-up and an interference lock is acceptable as means for preventing a small stem-mounted switch or other device having a single-hole mounting means from turning.

5.12 An uninsulated current-carrying part and a part that supports a live part shall be secured so that it will be prevented from turning or shifting in position if such motion may result in a reduction of spacings below the minimum acceptable values. See Electrical Spacings, Sections 33 and 34. Friction between surfaces is not acceptable as a means to prevent shifting or turning of a live part, but a lock washer as described in 5.11 is acceptable.

5.13 Flammable or electrically conductive thermal or acoustical insulation shall not contact uninsulated live parts.

6 Accessories

6.1 A room air conditioner having provisions for the use of accessories to be attached in the field shall comply with the requirements of this section, and shall comply with the requirements of this standard with or without the accessory installed.

6.2 Installation of accessories by the user shall be restricted to an arrangement that can be accomplished by means of receptacles and plug-in connectors.

Exception: Low-voltage accessories may be connected to existing wiring terminals if the accessory leads terminate with connectors that will maintain electrical spacings.

6.3 Installation of accessories by service personnel shall be by means of receptacles, plug-in connectors, insulated wire connectors, or by connection to existing wiring terminals.

6.4 Installation of an accessory that requires the cutting of wiring or the soldering of connections by the installer is not acceptable. Installation of an accessory by the user shall not require cutting, drilling, or welding. Installation of an accessory by service personnel that requires cutting, drilling, or welding is not acceptable in electrical enclosures and in other areas where such operations may damage electrical or refrigeration components and wiring within the enclosure. Installation of an accessory shall not require relocation of factory-installed components.

6.5 Strain-relief means shall be provided for the wiring in the accessory if there is a possibility of transmitting stress to the terminal connections during installation. See Strain Relief Test, Section 72.

6.6 All terminals and wiring intended to be field-connected shall be identified on the accessory, on the room air conditioner if connections are made between the accessory and the room air conditioner, and on the wiring diagram(s).

6.7 The mounting location of the accessory shall be indicated on the room air conditioner.

Exception: If the mounting location is fixed due to the function of the accessory and arrangement of the room air conditioner, and instructions are provided covering the installation and location for the accessory, the mounting location of the accessory need not be indicated on the room air conditioner.

6.8 As part of the investigation, accessories are to be trial-installed to determine that their installation is feasible and that the instructions are detailed and correct.

7 Enclosures

7.1 General

7.1.1 Enclosures shall be formed and assembled so that they will have the strength and rigidity necessary to resist total or partial collapse resulting in a risk of electric shock, injury to persons, or damage to components in the refrigeration and electrical systems. Enclosures for individual components, outer enclosures, and combinations of the two are considered in determining compliance with this requirement.

7.1.2 Among the factors which are taken into consideration when evaluating an enclosure are:

- a) Mechanical strength,
- b) Resistance to impact,
- c) Moisture-absorptive properties,
- d) Flammability,
- e) Resistance to distortion at temperatures to which the material may be subjected under conditions of use, and
- f) Resistance to corrosion.

For a nonmetallic enclosure or part of an enclosure, all of these factors, including the effect of exposure to weathering if for outdoor use, are considered with respect to aging. See Polymeric Materials, Section 8.

7.1.3 The enclosure(s) of a room air conditioner shall reduce the risk of mechanical damage to wiring, electrical components, and refrigerant tubing.

7.1.4 The enclosure shall reduce the risk of emission of molten metal, burning insulation, flaming particles, or the like, from falling through openings onto flammable material, including surfaces over which the room air conditioner is mounted.

7.1.5 An in-wall type room air conditioner shall be provided with an enclosure by the room air conditioner manufacturer. If marked in accordance with 88.11, the enclosure may be supplied separately.

7.1.6 The enclosure, including the base pan and other structural sections, such as bulkheads and partitions of window-type room air conditioners, shall be formed and assembled so that the complete unit will comply with the requirements of the Static Loading Test, Section 56, and Stability Test, Section 57.

7.1.7 The enclosure for a window-type room air conditioner having a slide-out chassis shall prevent the chassis from being pushed through the outdoor-end of the enclosure.

7.1.8 Wall sleeves for in-wall air conditioners shall have provision for securing the sleeve in the wall opening. The unit chassis shall be prevented from being pushed through the outdoor-end of the sleeve.

7.1.9 Sheet metal to which a wiring system is to be connected in the field shall have a thickness not less than 0.032 inch (0.81 mm) if uncoated steel, not less than 0.034 inch (0.86 mm) if galvanized steel, and not less than 0.045 inch (1.14 mm) if nonferrous.

7.1.10 If threads for the connection of conduit are tapped all the way through a hole in an enclosure wall, or if an equivalent construction is employed, there shall be not less than three nor more than five threads in the metal, and the construction shall be such that a conduit bushing can be attached. If threads for the connection of conduit are not tapped all the way through a hole in an enclosure wall, conduit hub, or the like, there shall be not less than 3-1/2 threads in the metal and there shall be a rounded inlet hole for the conductors which shall:

- a) Afford protection to the conductor equivalent to that provided by a standard conduit bushing and
- b) Have an internal diameter approximately the same as that of the corresponding trade size of rigid conduit.

7.1.11 A knockout in a sheet metal enclosure shall be secured in place, but shall be capable of being removed without deformation of the enclosure which would result in damage to electrical components or reduction in electrical spacings.

7.1.12 A knockout shall remain in place when a force of 10 pounds (44.5 N) is applied at right angles to the knockout by a 1/4 inch (6.4 mm) diameter mandrel with a flat end. The mandrel shall be applied at the point most liable to cause movement of the knockout.

7.1.13 A knockout shall be provided with a flat surrounding surface for seating of a conduit bushing and shall be located so that installation of a bushing at any knockout likely to be used during installation will not result in spacings between uninsulated live parts and the bushing of less than those required by this standard.

7.1.14 In measuring a spacing between an uninsulated live part and a bushing installed in a knockout, it is to be assumed that a bushing having the dimensions indicated in Table 7.1 is in place, in conjunction with a single locknut installed on the outside of the enclosure.

Table 7.1
Knockout or hole sizes and dimensions of bushings

Trade size of conduit		Nominal knockout or hole diameter		Bushing dimensions			
				Overall diameter		Height	
Inches	(mm O.D.)	Inches	(mm)	Inches	(mm)	Inches	(mm)
1/2	(21.3)	7/8	(22.2)	1	(25.4)	3/8	(9.5)
3/4	(26.7)	1-3/32	(27.8)	1-15/64	(31.4)	27/64	(10.7)
1	(33.4)	1-23/64	(34.5)	1-19/32	(40.5)	33/64	(13.1)
1-1/4	(42.3)	1-23/32	(43.7)	1-15/16	(49.2)	9/16	(14.3)
1-1/2	(48.3)	1-31/32	(50.0)	2-13/64	(56.0)	19/32	(15.1)
2	(60.3)	2-15/32	(62.7)	2-45/64	(68.7)	5/8	(15.9)

7.1.15 Steel enclosures shall be protected against corrosion by metallic or nonmetallic coatings, such as plating or painting. Also see 7.2.1 – 7.2.6 for enclosures exposed to weather.

7.1.16 To reduce the risk of electric shock or injury to persons, a hinged panel or cover shall be positioned or arranged so that, when it is in an open position to facilitate service operations, it is not subject to falling or swinging due to gravity or vibration.

7.1.17 The assembly shall be arranged so that an overcurrent protective device, such as a fuse, can be replaced and manual-reset devices can be reset without removing parts other than a service cover(s) or panel(s), and the cover or door enclosing the device.

7.1.18 A required protective device shall not be accessible from outside the enclosure except by opening a door or cover.

Exception: The operating handle of a circuit breaker, the reset button of a manually resettable motor protector, the reset button of a manually resettable pressure switch, and similar parts may project outside the enclosure.

7.1.19 An opening in an outer enclosure around a handle, reset button, or other control member is acceptable if the clearance between the control member and the edge of the opening is not more than 1/8 inch (3.2 mm) for any setting or position of the control member.

7.1.20 Covers for enclosures of fuses in high-voltage circuits shall be hinged. Covers for enclosures of manual-reset overload protective device shall be hinged if it is necessary to open the cover to reset the device.

Exception: A hinged cover is not required where the only fuses enclosed are:

- a) Supplementary type control circuit fuses, provided the fuses and control circuit loads, other than a fixed control circuit load, such as a pilot lamp, are within the same enclosure;*
- b) Supplementary type fuses of 2 amperes or less for auxiliary resistance heaters, such as crankcase heaters with a maximum rating of 100 watts;*
- c) An extractor-type fuse with its own enclosure; or*
- d) Fuses in low-voltage circuits.*

7.1.21 Hinged covers, where required, shall not depend solely upon screws or other similar means to hold them closed, but shall be provided with a latch or the equivalent.

7.1.22 A spring latch, a magnetic latch, a dimple, or any other mechanical arrangement that will hold the door in place and will require some effort on the user's part to open, is considered to be means for holding the door in place as required in 7.1.21. When provided as the sole means for securing the cover or panel, a cover interlocking mechanism is considered to comply with the requirement of 7.1.21.

7.1.23 A door or cover giving direct access to fuses in other than low-voltage circuits shall shut closely against a 1/4 inch (6.4 mm) rabbet or shall have either turned flanges for the full length of four edges or angle strips fastened to it. Flanges or angle strips shall fit closely with the outside of the wall of the box proper and shall overlap the edges of the box not less than 1/2 inch (12.7 mm). A special construction, such as a fuse enclosure located within an outer enclosure, or a flange and rabbet combination, is acceptable.

7.1.24 Strips used to provide rabbets or angle strips fastened to the edges of a door shall be secured at not less than two points, not more than 1-1/2 inches (38.1 mm) from each end of each strip and at points between these end fastenings, not more than 6 inches (152 mm) apart.

7.2 Enclosures exposed to weather

7.2.1 Sheet steel cabinets and electrical enclosures exposed to the effects of weathering shall be protected against corrosion by the following means or by other metallic or nonmetallic coatings which provide equivalent protection as follows:

Type of cabinet and enclosure	0.053 inch (1.35 mm) and heavier as specified by clause:	Lighter than 0.053 inch (1.35 mm) as specified by clause:
Outer cabinets which protect motors, wiring or enclosed current-carrying parts	7.2.3	7.2.4
Inside enclosures which protect current-carrying parts other than motors	7.2.3	7.2.4
Outer cabinets which are the sole enclosure of current-carrying parts	7.2.4	7.2.4

7.2.2 Clause 7.2.1 is not applicable to a metal part, such as a decorative grille, which is not required for conformance with this standard.

7.2.3 To comply with the requirement of 8.2.1, 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 1 of the Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process, ASTM A653/A653M, with not less than 40 percent of the zinc on any side, based on the minimum single spot test requirement in the ASTM specification. The weight of zinc coating may be determined by any recognized laboratory 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 and Steel Articles with Zinc or Zinc-Alloy Coatings, ASTM A90/A90M. An A60 (alloyed) coating shall also comply with the requirement of 7.2.5;

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 (0.0104 mm) on each surface with a minimum thickness of 0.00034 inch (0.0086 mm). The thickness of the coating shall be established by the Metallic Coating Thickness Test, Section 69. An annealed coating shall also comply with the requirement of 7.2.5; or

c) Two coats of an organic finish of the epoxy or alkyd-resin type or other outdoor paint on both surfaces. The acceptability of the paint may be determined by consideration of its composition or by corrosion tests.

7.2.4 To comply with the requirement of 7.2.1, one of the following coatings shall be used:

a) Hot dipped mill galvanized sheet steel conforming with the Coating Designation G90 and Table 1 of ASTM A653/A653M with not less than 40 percent of the zinc on any side, based on the minimum single spot test requirements in the ASTM specification. The weight of zinc coating may be determined by any recognized laboratory method. However, in case of question, the weight of coating shall be established in accordance with the test method of ASTM A90/A90M;

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 (0.0155 mm) on each surface with a minimum thickness of 0.00054 inch (0.0137 mm). The thickness of the coating shall be established by the Metallic Coating Thickness Test, Section 69. An annealed coating shall also comply with the requirement of 7.2.5;

c) A cadmium coating of not less than 0.001 inch (0.025 mm) in thickness on both surfaces. The thickness of coating shall be established by the Metallic Coating Thickness Test, Section 69;

d) A zinc coating conforming with 7.2.3 (a) or (b), with one coat of outdoor paint as specified in 7.2.3 (c); or

e) A cadmium coating of not less than 0.00075 inch (0.0191 mm) in thickness on both surfaces with one coat of outdoor paint on both surfaces; or of not less than 0.0005 inch (0.013 mm) in thickness on both surfaces with two coats of outdoor paint on both surfaces. The thickness of the cadmium coating shall be established by the Metallic Coating Thickness Test, Section 69, and the paint shall be as specified in 7.2.3 (c).

7.2.5 An annealed zinc coating which is bent or similarly formed after annealing shall additionally be painted in the bent or formed area if the bending or forming process damages the zinc coating. If flaking or cracking of the zinc coating at the outside radius of the bent or formed section is visible at 25 power magnification, the zinc coating is considered damaged. Simple sheared or cut edges and punched holes are not considered to be formed, but extruded and rolled edges and holes shall comply with this requirement.

7.2.6 With reference to the requirement in 7.2.1, other finishes, including paints, special metallic finishes, and combinations of the two, may be accepted if comparative tests with galvanized sheet steel without annealing, wiping, or other surface treatment conforming with 7.2.3 (a) or 7.2.4 (a), as applicable, indicate they provide equivalent protection. Among the factors which 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.

7.2.7 Nonferrous enclosures may be employed without special corrosion protection. See 7.1.2.

7.2.8 If gaskets are required to seal electrical enclosures against the entrance of rain and condensate, they shall be held in place by mechanical fasteners or adhesives, except as indicated in 7.2.7, and shall comply with the requirements of 68.2 – 68.6. Sealing compounds required to seal electrical enclosures shall comply with the requirements of 68.7. Adhesives required to secure gaskets shall comply with the requirements of 68.8. Gaskets shall be neoprene, rubber, or thermoplastic. Other materials may be used if they have equivalent properties.

7.2.9 Gaskets which are held captive either by their location or placement of other components in the enclosure when the cover is removed and which would be reengaged in the intended manner when the cover is replaced are not required to be held by mechanical fasteners or adhesives. Consideration shall be given to the intended mounting of the gasket in the application.

8 Polymeric Materials

8.1 General

8.1.1 The requirements in 8.1.2 – 8.4.16 cover polymeric materials used to form outer enclosures, structural or functional parts, thermal and acoustical insulation, and miscellaneous parts of a room air conditioner. Table 8.1 indicates the properties to be evaluated, depending on the material application. These requirements do not apply to materials used as electrical insulation nor to small parts, such as control knobs, buttons, insulating bushings, resilient mounts, clamps, and wiring straps.

8.1.2 If electrical spacings between uninsulated live parts and a polymeric material are less than required by Sections 33 and 34, the material shall comply with requirements of the Volume Resistivity Test, Section 84.

Table 8.1
Evaluation of properties of polymeric materials

Characteristics to be evaluated	Enclosures	Structural parts	Thermal and acoustical insulation	Functional parts	Clause references
Flammability:					
Source of ignition					
External	Yes				8.1.3
Internal	Yes	Yes	Yes	Yes	8.4.1 – 8.4.16;
Heat deflection or Mold Stress-Relief	Yes	Yes			Section 74
Water absorption	Yes	Yes			Section 75
Environmental Exposure:					
Air oven aging	Yes	Yes			76.1.1, 76.1.2
Ultraviolet light and water exposure	Yes	Yes ^a			76.2.1, 76.2.2
Water immersion	Yes	Yes ^b			76.3.1 – 76.3.3
Tensile strength	Yes	Yes			Section 77
Flexural strength	Yes	Yes			Section 78
Izod or tensile impact strength	Yes	Yes			Section 79 or 82
Impact	Yes	Yes			Section 83
Volume resistivity ^c	Yes	Yes	Yes	Yes	8.1.2; Section 84

Table 8.1 Continued

Characteristics to be evaluated	Enclosures	Structural parts	Thermal and acoustical insulation	Functional parts	Clause references
^a Where exposed to the effects of weathering. ^b Where parts are exposed to water. ^c In lieu of volume resistivity, compliance with the end-product leakage-current requirements (Section 44) is acceptable. Leakage current measurement shall be taken from accessible surfaces of the polymeric materials in question. If the polymeric part in question is not accessible, the leakage current shall be measured in accordance with 44.3 and 44.4.					

8.1.3 In addition to evaluating the material from the standpoint of possible ignition by sources within the room air conditioner, nonmetallic outer enclosures of air conditioners extending through the wall or window are also to be evaluated with regard to the effects of ignition by external sources. This generally involves intermittent flame tests and burning brand tests in accordance with Standard Test Methods for Fire Tests of Roof Coverings, UL 790.

Exception No. 1: Intermittent flame tests may be waived if the enclosure material has a flame-spread index of 200 or less as determined by the Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source, ASTM E162 (Current Method).

Exception No. 2: Intermittent flame tests and burning brand tests may be waived if the enclosure material has a 5V flammability rating.

Exception No. 3: The intermittent flame and burning brand tests need not be conducted on RV type roof top air conditioners.

8.2 Material classification

8.2.1 Materials are classified with respect to flammability characteristics that are established by the tests specified in the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94. Materials are assigned flammability ratings based on greatest to least resistance to flame and are identified as 5VA, 5VB, V-0, V-1, V-2, HF-1, HF-2, HB, and HBF.

8.3 Ignition sources

8.3.1 Ignitions sources within the unit are considered to be:

- a) High voltage uninsulated terminals,
- b) High voltage printed circuit board traces,
- c) High voltage open coils/windings,
- d) High voltage open contacts, and
- e) High voltage wiring not employing VW-1 insulation.

Exception No. 1: Thermally protected motors having openings in their enclosures need not be separated from flammable materials if they comply with the requirements in 32.3.

Exception No. 2: Transformers complying with the requirements in Section 31 need not be separated.

8.3.2 Except as indicated in 8.4.10, heater elements need not be separated from flammable materials if the heating elements comply with the test requirements of Section 55.

8.4 Material application

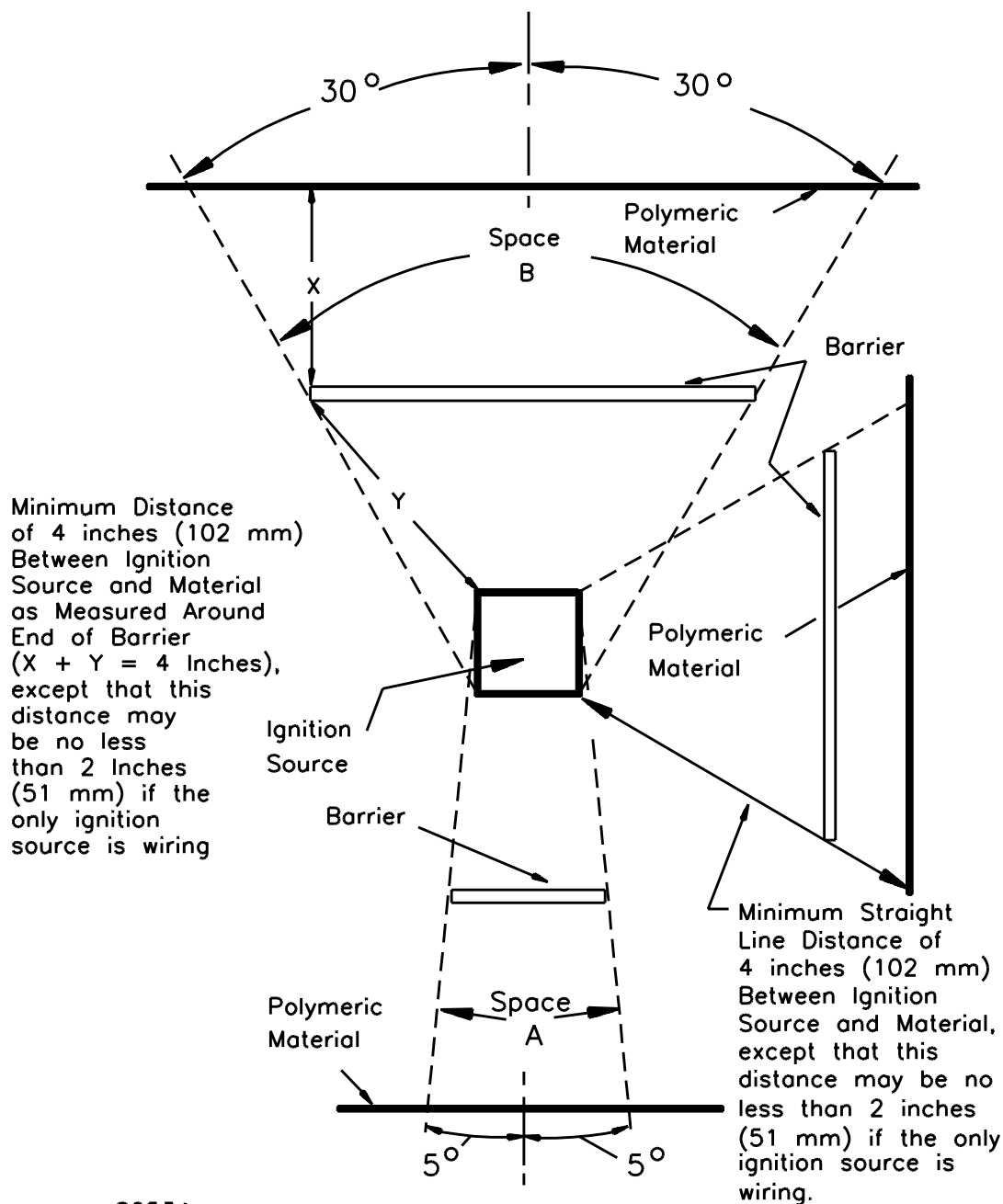
8.4.1 Polymeric parts, including the enclosure of the LCDI or AFCI, which are depended upon for the direct support or isolation of electrical components and parts which are exposed to ignition sources within the unit shall be a 5V material.

8.4.1 effective October 6, 2014

8.4.2 Except as indicated in 8.4.7 – 8.4.9, a polymeric material which does not comply with the flammability requirements for 5V materials shall be V-0, V-1, or V-2. Such materials shall not be used for direct support or isolation of wiring or electrical components.

8.4.3 A V-0 or V-1 material may be used if it is not exposed to ignition sources. See 8.4.4 and 8.4.5. A V-2 material may be used if, in addition to being isolated from ignition sources in the same manner as V-0 and V-1 materials, there are no flammable materials, openings in the unit enclosure, or both, below the V-2 material within a volume defined by Space A of Figure 8.1.

Figure 8.1
Exposure to ignition



S2534

Space A – Represents the volume below the ignition source determined by a straight line that moves about the ignition source while remaining at an angle of 5° from the vertical and is always so oriented that the volume is maximum.

Space B – Represents the volume above the ignition source determined in the same manner as Space A, except that the angle is 30° from the vertical.

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8.4.4 A material located below the ignition source and within Space A of Figure 8.1 may be isolated by means of a horizontal barrier, extending at least to the boundary surface of the space. A material located above the ignition source and within Space B of Figure 8.1 may be isolated by means of a barrier, extending at least to the boundary surface of the space, and so located that the minimum distance between the material and ignition source is 2 inches (50.8 mm) for wiring and 4 inches (102 mm) for electrical components.

8.4.5 A material located essentially in the vertical plane and adjacent to an ignition source is considered isolated from the ignition source if it is separated from wiring by a distance of 2 inches (50.8 mm) and from electrical components by a distance of 4 inches (102 mm). A barrier may be used for isolation provided the size of the barrier is such that the minimum straight-line distance between the material and ignition source is 2 inches (50.8 mm) for wiring and 4 (102 mm) inches for electrical components. See Figure 8.1.

8.4.6 If required by 8.4.4 or 8.4.5, a barrier shall be formed of metal or of a 5V material and shall be mechanically secured in place.

8.4.7 The requirements of 8.4.2 – 8.4.5 do not apply to polymeric materials completely enclosed in metal at least 0.010 inch (0.254 mm) thick nor to materials classified as V-0, V-1, V-2, HF-1, HF-2, HB, or HBF which are laminated between two metal surfaces if:

- a) The thickness of the metal of each surface is not less than 0.010 inch (0.254 mm); and
- b) The exposed vertical surface of the material has a width of no more than 3/8 inch (9.5 mm).

8.4.8 In the outdoor section of the unit, HB, HBF, and HF-1 materials may be used if:

- a) They are isolated from ignition sources in accordance with 8.4.4 and 8.4.5, whichever is applicable, and
- b) The distance between an ignition source and ventilation opening in the bulkhead is not less than 4 inches (102 mm).

When this requirement is applied to vent doors and vent door seals comprised of HB, HBF, or HF-1 materials, isolation from the ignition sources to the material is to be maintained for all normal positions of the vent door.

8.4.9 HB, HBF, and HF-1 materials may be used in the room air handling section of the unit only if all ignition sources in this section are completely enclosed in or isolated by metal or 5V material. The supply cord of a cord-connected unit is excluded. Heater elements are excluded, except as indicated in paragraph 8.4.10. If ventilation openings are provided in the bulkhead, HB and HBF materials in the room air handling section are to be additionally isolated from ignition sources in the outdoor section by a minimum distance of 4 inches (102 mm).

8.4.10 Polymeric materials located beneath an open-coil heater element, within space A as illustrated in Figure 8.1, shall be rated 5V.

8.4.11 With regards to paragraph 8.4.9, uninsulated leads to an electric air heater including leads to its thermal protective device, and the thermal protective device need not be enclosed provided that:

- a) Individual uninsulated lead lengths do not exceed 4 inches (102 mm) and
- b) A metal or 5V material is interposed between the lead or thermal protective device and HB and HBF material to provide isolation.

A metal heat transfer surface may afford such isolation if it provides a minimum distance of 4 inches (102 mm), as measured through the heat transfer surface, between the heater lead or thermal protective device and HB and HBF material. Leads for other components need not be enclosed provided they are isolated as indicated above and the individual lengths of such leads do not exceed 1 inch (25.4 mm).

8.4.12 With reference to 8.4.11, if an automatic-reset thermal protective device has met the endurance test requirement of 100,000 cycles (see 60.1.2), the device need not be enclosed or isolated.

8.4.13 In the applications described in 8.4.8 – 8.4.11, HF-2 material may be used if there are no flammable materials, openings in the unit enclosure, or both, below the HF-2 material within a volume defined by Space A of Figure 8.1.

8.4.14 With reference to paragraphs 8.4.8 – 8.4.11, air filters and air filter materials are considered acceptable if they comply with the requirements in the Standard for Air Filter Units, UL 900.

8.4.15 With reference to 8.4.9 and 8.4.11, the acceptability of openings in a control compartment, other than those of minimum size for the passage of power supply cords and control shafts or rods, shall be judged on the basis of the necessity for their existence. On any one surface, the minor dimension of an opening shall not exceed 3/8 inch (9.5 mm) and the maximum area shall not exceed 0.25 square inch (161 mm²). The area may be increased to a maximum of 1.0 square inch (645 mm²) if a barrier of metal or 5V material is secured in place and interposed between ignition sources and flammable material. In any case, the maximum aggregate area of all openings in any one surface shall not exceed 1.0 square inch.

8.4.16 With reference to 8.4.15, wiring in the control compartment shall be routed away from any openings which expose the wire to flammable materials. In judging the need for barriers, consideration is to be given to grouped openings which have an aggregate area exceeding 0.25 square inch (161 mm²).

8.4.17 With regards to 8.4.1, 8.4.2, 8.4.6, 8.4.9, 8.4.10, 8.4.11, and 8.4.15, the 127 mm (5 inch) end-product flame test in the Standard for Polymeric Materials – Use In Electrical Equipment Evaluations, UL 746C, may be conducted in place of the 5V flame test.

9 Mounting Hardware

9.1 Each window-type room air conditioner shall be provided with mounting hardware to support the unit in the window. The mounting hardware shall be painted or otherwise protected against corrosion.

9.2 The mounting hardware and installation instructions for a window-type unit shall be shipped with the room air conditioner from the factory.

Exception: The mounting hardware and installation instructions may be shipped in a kit separate from the room air conditioner provided the kit is identified in accordance with 88.19 and 88.20.

10 Field Supply Connections

10.1 Permanently-connected units

10.1.1 Room air conditioners of the following types shall have provision for permanent connection to the power supply:

- a) Units that have a rated-load current exceeding 40 amperes. The largest sum of concurrent loads shown on the nameplate is used to determine the rating;
- b) Units requiring plumbing connections;

Exception No. 1: Units designed to be easily moved from one place to another in use.

Exception No. 2: Units that:

- 1) *Require removal of the cooling chassis from the cabinet for servicing,*
- 2) *Require disconnection of the branch circuit wiring connections for removal of the cooling chassis, and*
- 3) *Permit removal of the cooling chassis without disassembly of plumbing.*

- c) Polyphase units;

Exception No. 1: Three-phase special purpose air conditioners of the spot-cooler type provided with wheels or casters are not prohibited from being cord-connected.

Exception No. 2: Three-phase special purpose air conditioners, of the enclosure air conditioner type, where the electrical wiring and connections are made within the tool access only area within the special purpose air conditioner and the tool access electrical cabinet.

- d) Units rated in excess of 250 volts;

Exception No. 1: Special purpose air conditioners rated up to 480 volts are not prohibited from being cord connected if they are of the portable, spot-cooler type and provided with wheels or casters.

Exception No. 2: Special purpose air conditioners rated up to 480 volts are not prohibited from being cord connected if they are enclosure air conditioner type, where the electrical wiring and connections are made using a polarized connector inside a permanently-connected junction box, or a plug terminated power cord.

e) Units intended for duct or plenum connection;

Exception: Units that:

- 1) Require removal of the cooling chassis from the cabinet for servicing,
- 2) Require disconnection of the branch circuit wiring connections for removal of the cooling chassis, and
- 3) Permit removal of the cooling chassis without disassembly of ducts.

f) Units requiring line voltage field-wired controls;

g) Units provided with means for interconnection of the condensing and evaporating sections in the field; and

h) Units requiring 120/208 or 120/240 volts, 3-wire supply circuits.

10.1.2 A room air conditioner that is intended for permanent connection to the power supply shall have provision for connection of one of the wiring systems that, in accordance with the National Electrical Code, ANSI/NFPA 70, would be acceptable for it.

10.1.3 A knockout for connection of a field-wiring system to a field-wiring compartment shall accommodate conduit of the trade size determined by applying Table 10.1.

Table 10.1
Trade size of conduit in inches

Wire size		Number of wires				
AWG	(mm ²)	2	3	4	5	6
14	(2.1)	1/2	1/2	1/2	1/2	1/2
12	(3.3)	1/2	1/2	1/2	3/4	3/4
10	(5.3)	1/2	1/2	1/2	3/4	3/4
8	(8.4)	3/4	3/4	1	1	1-1/4
6	(13.3)	3/4	1	1	1-1/4	1-1/4
4	(21.2)	1	1	1-1/4	1-1/4	1-1/2
3	(26.7)	1	1-1/4	1-1/4	1-1/2	1-1/2
2	(33.6)	1	1-1/4	1-1/4	1-1/2	2
1	(42.4)	1-1/4	1-1/4	1-1/2	2	2
1/0	(53.5)	1-1/4	1-1/2	2	2	2-1/2

NOTES

1 This table is based on the assumption that all conductors will be of the same size and there will be no more than six conductors in the conduit. If more than six conductors will be involved or if all of them are not of the same size, the internal cross-sectional area of the smallest conduit that may be used is determined by multiplying by 2.5 the total cross-sectional area of the wires, based on the cross-sectional area of Type THW wire.

2 1 inch equals 25.4 mm.

10.1.4 The location of a terminal box or compartment in which power supply connections are to be made shall be such that these connections may be inspected after the unit is installed. The connections shall be accessible without removing parts other than a service cover(s) or panel(s) and the cover of the outlet box or compartment in which the connections are made. The connections shall not be located on the removable cover or panel.

10.1.5 A wiring compartment intended for the connection of a supply raceway shall be secured in position and shall be prevented from turning.

10.1.6 Space shall be provided in the field-wiring compartment or outlet box for installation of the number and size of conductors required by 10.1.8 using Type TW or THW wire, when at least a 6 inch (150 mm) length of each conductor is brought into the wiring compartment. If necessary, a trial installation is to be made.

Exception: Conductors other than Type TW or THW may be used if specified in the installation instructions.

10.1.7 As used in 10.1.8 – 10.1.21, field-wiring terminals or leads are considered to be the terminals or leads to which power supply, control, or equipment grounding connections will be made in the field when the room air conditioner is installed.

10.1.8 A room air conditioner shall be provided with field-wiring terminals or leads for the connection of conductors having an ampacity of not less than that indicated in 89.6. It is assumed that branch circuit conductors rated 140°F (60°C) will be used when the required circuit ampacity is 100 amperes or less and that conductors rated 167°F (75°C) will be used when the required ampacity is more than 100 amperes.

10.1.9 If field-installed power supply conductors are to be connected to the terminals or integral leads of a wiring device which has a marked electrical rating, such as a general-use receptacle, the wiring device shall have a marked rating not less than the circuit to which it will be connected.

10.1.10 A field-wiring terminal shall be secured in position by means other than friction between surfaces if turning or shifting of the terminal may result in reduction of electrical spacings to less than those required by Sections 33 and 34. This may be accomplished by means such as two screws or rivets; by square shoulders or mortices; by a dowel pin, lug, or offset; or by a connecting strap or clip fitted into an adjacent part.

10.1.11 For 8 AWG (8.4 mm²) and larger conductors, pressure wire connectors shall be used. For 10 AWG (5.3 mm²) and smaller conductors, the parts to which wiring connections are made may consist of clamps or wire binding screws with cupped washers, terminal plates, or the equivalent, to hold the wire in position.

10.1.12 A wire binding screw at a field-wiring terminal shall be not smaller than No. 8 (4.2 mm diameter).

Exception: A No. 6 (3.5 mm diameter) screw may be used for the connection of one 14, 16, or 18 AWG (2.1, 1.3, or 0.82 mm²) conductor.

10.1.13 It should be noted that according to the National Electrical Code, ANSI/NFPA 70, 14 AWG (2.1 mm²) is the smallest conductor which the installer may use for branch circuit wiring and thus is the smallest conductor that may be anticipated at a terminal for the connection of a power supply wire.

10.1.14 A terminal plate for a wire binding screw shall be metal not less than 0.030 inch (0.76 mm) thick for 14 AWG (2.1 mm²) or smaller wire and not less than 0.050 inch (1.27 mm) thick for a wire larger than 14 AWG. In either case, there shall be not less than two full threads in the metal.

10.1.15 A terminal plate formed from stock having the minimum required thickness may have the metal extruded at the tapped hole for the binding screw to provide two full threads.

Exception: Two full threads are not required if a lesser number of threads results in a connection in which the threads will not strip when tightened in accordance with the torques indicated in the Standard for Wire Connectors, UL 486A-486B.

10.1.16 Upturned lugs or a cupped washer shall be capable of retaining a conductor of the size mentioned in 10.1.8, but no smaller than 14 AWG (2.1 mm²), under the head of the screw or the washer.

10.1.17 A wire binding screw shall thread into metal.

10.1.18 A field-wiring terminal intended for the connection of a grounded conductor shall be of a metal, or plated with a metal, which is substantially white in color and shall be readily distinguishable from other terminals, or identification of that terminal shall be shown in some other manner, such as on an attached wiring diagram. A lead intended for the connection of a grounded conductor shall be finished to show a white or gray color, shall be readily distinguishable from other leads, and no other lead shall be so identified.

10.1.19 The length of a lead inside an outlet box or wiring compartment shall be 6 inches (152 mm) or more if the lead is intended for field connection to an external circuit.

Exception: The lead may be less than 6 inches in length if it is evident that the use of a longer lead might result in damage to the lead insulation.

10.1.20 Leads intended for connection to an external circuit shall be provided with strain relief if stress on the lead may be transmitted to terminals, splices, or internal wiring. See Strain Relief Test, Section 72.

10.1.21 Leads provided for spliced connections to an external high-voltage circuit shall not be connected to wire binding screws or pressure wire connectors located in the same compartment as the splice unless the screws or connectors are rendered unusable for field-wiring connections or the leads are insulated at the unconnected ends.

10.2 Cord-connected units

10.2.1 A room air conditioner intended for cord connection to the power supply shall be equipped with a flexible cord having an equipment grounding conductor and with a grounding-type attachment plug.

10.2.2 A cord-connected single phase room air conditioner shall be provided with a factory installed LCDI or AFCI protection to reduce the risk of fire due to arcing faults in the power-supply cord. The LCDI or AFCI shall be installed as an integral part of the attachment plug or located in the supply cord within 300 mm (12 in.) of the attachment plug.

Exception No. 1: Computer room air conditioners are not required to have LCDI or AFCI protection.

Exception No. 2: When a packaged terminal air conditioner (PTAC) is provided with a subbase that encloses the supply cord and attachment plug, AFCI or LCDI protection is not required.

10.2.3 Compliance with 10.2.2 shall be accomplished by the use of an integral protective device that de-energizes all current-carrying parts when arcing faults are detected within the power supply cord. The AFCI and LCDI shall comply with the Standard for Arc-Fault Circuit-Interrupters, UL 1699.

10.2.4 The attachment plug configuration rating shall not be less than 125 percent of the marked rating of the room air conditioner and not less than the total current measured during the Temperature and Pressure Test, Section 48, and the Temperature Test – Resistance Heat, Section 54. The total current shall include the current drawn by accessories intended for use with the room air conditioner.

10.2.5 A cord-connected air conditioner shall employ a grounding-type attachment plug that complies with the Standard for Wiring Devices-Dimensional Requirements, ANSI/NEMA WD6. See Table 10.2 for typical plugs used.

Table 10.2
Attachment plugs

Attachment Plug Rating		ANSI Designation
Amperes	Volts	
15	125	5-15P
20	125	5-20P
15	250	6-15P
20	250	6-20P
30	250	6-30P
50	250	6-50P

10.2.6 A cord-connected room air conditioner shall employ a Type S, SE, SEO, SEOO, SEW, SEOW, SEOWW, SO, SOO, SOW, SOOW, ST, STO, STOO, STW, STOW, STOOW, SJ, SJE, SJEO, SJEOO, SJEW, SJEOW, SJEOOW, SJO, SJOO, SJOW, SJOOW, SJO, SJTO, SJTOO, SJTW, SJTOW, SJTOOW, SP-3, SPE-3, or SPT-3 power supply cord having a voltage rating not less than that of the room air conditioner. The ampacity of the cord, as given in the National Electrical Code, ANSI/NFPA 70, shall be not less than that required by the ampere input measured in the Temperature and Pressure Test, 48, and the Temperature Test – Resistance Heat, 54. The ampere input value shall include the current drawn by accessories intended for use with the room air conditioner.

Exception: A power supply cord, other than the Types identified in 10.2.4, may be employed if it has comparable mechanical and electrical properties and the same voltage and ampacity as the cord Type it is replacing.

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10.2.7 The length of a power supply cord shall be as follows:

Unit Rating		Cord length			
Volts	Amperes	Minimum		Maximum	
		feet	(m)	feet	(m)
0 – 125	7.5 or Less	6	(1.8)	10	(3)
0 – 125	7.6 or More	4	(1.2)	10	(3)
126 – 250	All	4	(1.2)	6	(1.8)

The length is to be measured between any point at which the cord exits the room air conditioner cabinet and the attachment plug.

Exception No. 1: For a room air conditioner intended only for in-wall installation, the length of the power supply cord shall be not less than 18 inches (457 mm).

Exception No. 2: Special purpose air conditioners may have a power supply cord of up to 20 feet (6 m) in length.

10.2.8 The power supply cord shall be provided with strain relief means so that a stress on the cord will not be transmitted to terminals, splices, or internal wiring. See Strain Relief Test, Section 72. If the strain relief is metallic, it shall not contact uninsulated live parts or reduce spacings within the enclosure if the cord is moved inward.

10.2.9 The edges of the entry hole for the power supply cord, including the cord entry hole in a bushing, shall be rounded and without burrs, fins, or sharp edges which might damage the cord insulation. Within the unit, the power supply cord shall be routed to reduce the risk of damage to the cord insulation.

10.3 Grounding

10.3.1 A room air conditioner shall have provision for grounding as follows:

- a) In a permanently connected room air conditioner, an equipment grounding terminal or lead; or
- b) In a cord-connected room air conditioner, an equipment grounding conductor in the power supply cord.

10.3.2 On a permanently-connected room air conditioner, a terminal solely for connection of an equipment grounding conductor shall be capable of securing a conductor of the size required by the National Electrical Code, ANSI/NFPA 70.

10.3.3 A soldering lug, a push-in connector, a screwless connector, or a quick-connect or similar friction fit connector shall not be used for a terminal intended for the connection of a field-installed grounding conductor or for connection of the grounding wire in a power supply cord.

10.3.4 On a permanently-connected room air conditioner, a wire binding screw intended for the connection of an equipment grounding conductor shall have a green-colored head that is hexagonal, slotted, or both. Except as indicated in 10.3.5, a pressure wire connector intended for connection of such a conductor shall be plainly identified such as by being marked G, GR, GROUND, or GROUNDING, or by a marking on a wiring diagram provided on the room air conditioner. The wire binding screw or pressure

wire connector shall be secured to the frame or enclosure of the room air conditioner and shall be located so that it is unlikely to be removed during service operations, such as replacing fuses, resetting manual-reset devices, or oiling motors.

10.3.5 If a pressure wire connector intended for grounding is located adjacent to connectors intended for supply conductors involving the neutral conductor of a grounded supply, it shall be identified by a marking EQUIPMENT GROUND, by a green color, or by both.

10.3.6 On a permanently-connected room air conditioner, the surface of an insulated lead intended solely for the connection of an equipment grounding conductor shall be finished in a continuous green color or a continuous green color with one or more yellow stripes, and no other lead shall be so identified.

10.3.7 On a cord-connected room air conditioner, the grounding conductor of the power supply cord shall be finished with a continuous green color or with a continuous green color with one or more yellow stripes, and no other conductor shall be so identified. The grounding conductor shall be secured to the frame or enclosure of the room air conditioner by a positive means, such as clamping, bolting, or screw connection, that is not likely to be removed during any servicing operation not involving the power supply cord. The grounding conductor shall be connected to the grounding blade of the attachment plug.

11 Internal Wiring

11.1 General

11.1.1 Wiring shall have insulation rated for the potential involved and the temperatures to which it may be subjected. Compliance is to be judged on the basis of the temperatures measured during the applicable temperature tests specified in Sections 48, 53, and 54.

Exception: If it can be determined that the wiring will not be exposed to heat from radiating sources or heated components, and if the ampacity of the conductors is in accordance with Table 11.1 and 11.2, the temperature tests on the wiring may be waived.

11.1.2 With reference to the exception in 11.1.1, high-voltage circuit conductors supplying one motor shall have an ampacity not less than 125 percent of the motor full load current rating. Conductors supplying more than one motor shall have an ampacity not less than 125 percent of the full load current rating of the largest motor plus the full load current rating of any other motors supplied. Conductors supplying a motor load and other loads shall have any ampacity not less than 125 percent of the motor full load current rating plus the marked current ratings or measured inputs of the additional loads supplied.

11.1.3 Wiring which is color-coded green or green with one or more yellow stripes shall be used only for grounding conductors. Wiring used for other purposes shall not be identified with the above color codes.

11.2 High-voltage circuits

11.2.1 Internal wiring shall comply with the Standard for Thermoplastic-Insulated Wires and Cables, UL 83; the Standard for Thermoset-Insulated Wires and Cables, UL 44; the Standard for Appliance Wiring Material, UL 758; or the Standard for Flexible cord and Fixture Wire, UL 62. The insulation of wires or cords connected to fan motors and other auxiliary motors that require lubrication shall be of an oil resistant type, such as Type SJO, SJT, SPT-3, or appliance wiring materials having oil resistant insulation.

Table 11.1
Typical wiring materials

Group	Type of wire cord, or cable ^a	Wire size		Insulation thickness (nominal)	
		AWG	(mm ²)	Inch	(mm)
A	Thermoplastic appliance wiring material, with insulation thicknesses shown at the right corresponding to wire sizes indicated; or Type AC, ACL, ACT, RF-2, FF-2, FFH-2, TF, TFF, TFN, TFFN, SF-2, SFF-2, RH, RHH, RHW, THW, XHHW, MTW, THW-MTW, THWN, PF, PGF, PFF, PGFF, TW	10 and smaller	(5.3)	2/64	(0.8)
		8	(8.4)	3/64	(1.2)
		6	(13.3)	4/64	(1.6)
		4	(21.2)	4/64	(1.6)
		3	(26.7)	4/64	(1.6)
		2	(33.6)	4/64	(1.6)
B	Appliance wiring material ^a having thermoplastic, rubber, or neoprene insulation, with insulation thicknesses shown at right corresponding to the wire sizes indicated; or cord Types S, SE, SO, SOO, ST, STO, STOO, SJ, SJE, SJO, SJOO, SJT, SJTO, SJTOO, SP-3, SPE-3, SPT-3	18	(0.82)	4/64	(1.6)
		16	(1.3)	4/64	(1.6)
		14	(2.1)	5/64	(2.0)
		12	(3.3)	5/64	(2.0)
		10	(5.3)	5/64	(2.0)
		8	(8.4)	6/64	(2.4)
		6	(13.3)	8/64	(3.2)
		4	(21.2)	9/64	(3.6)
		2	(33.6)	10/64	(4.0)

^a Appliance wiring material acceptable for refrigeration use.

11.2.2 Wiring of the type indicated in Group A of Table 11.1, shall be enclosed in conduit, electrical metallic tubing, metal raceways, control boxes, or the like. Fittings shall be constructed for use with the type of wiring enclosure employed in the application.

Exception: Neoprene or thermoplastic insulated wiring material in Group A of Table 11.1 need not be enclosed as indicated above, if all of the following conditions are met:

- a) Wiring is not subject to movement by air or vibration. See 11.4.1;*
- b) Where practicable, individual leads are bunched together to form a cable;*
- c) Wiring is secured to fixed panels or other surfaces at intervals to assure proper routing and to reduce the likelihood of hooking of slack during routine service, such as replacing air filters, operating reset mechanisms, oiling motors, replacing fuses, adjusting the settings of controls, or the like;*
- d) Wiring is located in a compartment which is provided with a complete base pan or similar bottom closure;*

e) Wiring cannot be contacted through openings in the outer enclosure or cabinet by the probe illustrated in Figure 5.2; and

f) Wiring is not located in a compartment where plumbing connections are made at the point of installation.

11.2.3 Cords or appliance wiring material of a type indicated in Group B of Table 11.1, may be employed if the wiring is enclosed by the cabinet to reduce the risk of damage to the wiring, ignition of flammable material, or emission of flame or molten metal through openings in the cabinet.

11.2.4 Parallel conductor appliance wiring material of the integral type shall not be ripped more than 3 inches (76.2 mm) unless the thickness of conductor insulation after ripping is at least 0.058 inch (1.47 mm). If the material has conductor insulation not less than 0.028 inch (0.71 mm) after ripping and is within a separate metal enclosure, conduit, electrical metallic tubing, or metal raceway, the length of rip is not limited.

Table 11.2
Wiring materials ampacities

Wire size		
mm ²	AWG	Ampacity
0.41	22	4
0.66	20	7
0.82	18	10
1.3	16	13
2.1	14	18
3.3	12	25
5.3	10	30
8.4	8	40
13.3	6	55
21.2	4	70
33.6	2	95
42.4	1	110

NOTE – The ampacities shown apply to appliance wiring materials. For types of wires other than appliance wiring materials, the ampacity shall be determined from Table 310-16 and 310-17 in the National Electric Code, ANSI/NFPA 70, for the type of wire employed. The correction factors of the referenced tables need not be applied.

11.3 Low-voltage circuits

11.3.1 If grounding, short-circuiting, or damaging of low-voltage wiring may cause malfunctioning of a pressure-limiting device, motor overload protective device or other protective device that may result in a risk of fire, electric shock, or injury to persons, such wiring shall be enclosed as indicated in 11.2.2 or shall be Type SPT-2 or SP-2 cord or one of the types indicated in Group B of Table 11.1. Wires of types indicated in Group A of Table 11.1 or low-energy safety control wire, may be used if such wiring is located in a cavity or compartment of the air conditioner and is shielded against damage.

11.4 Wiring method

11.4.1 All wires and cords shall be routed and supported to reduce the risk of damage due to:

- a) Sharp edges,
- b) Surfaces and parts which operate at temperatures in excess of that for which the wire insulation is rated,
- c) Moving parts, and
- d) Parts which can be expected to vibrate, such as motors, refrigerant lines, and the like.

Clamping means shall have smooth, rounded surfaces.

Exception: Wires and cords may contact a vibrating part if:

- a) The wiring is securely fastened to the part at the point of contact so as to restrict movement,*
- b) The part does not have burrs, fins, or sharp edges which might abrade the insulation, and*
- c) Vibration does not place a strain on the wiring or wiring connections.*

11.4.2 All wires and cords shall be routed and supported so that they will not be immersed in water unless the insulation is rated for this purpose. Wiring shall be arranged to prevent water caused by condensation or rain exposure from entering wiring enclosures and electrical enclosures.

11.4.3 A wiring enclosure shall provide a smooth wireway with no sharp edges or projecting screws which might damage the wire insulation.

11.4.4 Holes for passage of wires or cords through walls, panels, or barriers shall have one of the following:

- a) Smooth, rounded surfaces; or
- b) Be provided with smoothly rounded bushings shall be fabricated from material such as ceramic, phenolic, cold-molded composition, or fiber; or
- c) Be provided with wire insulating bushings that comply with the Standard for Insulating Bushings, UL 635.

11.4.5 All splices and connections shall be mechanically secured and electrically bonded. A soldered connection shall be made mechanically secure before being soldered.

11.4.6 Splices shall be located within the unit enclosure. They shall be secured to a fixed member or located in a separate enclosure if they are subject to flexing, motion, or vibration due to air movement, or are likely to be moved during service operations, such as replacing fuses, resetting manual-reset devices, or oiling motors.

11.4.7 A splice shall be provided with electrical insulation equivalent to that of the conductors if permanence of spacing between the splice and other metal parts cannot be maintained. Thermoplastic tape wrapped over the sharp ends of the wires is not acceptable.

11.4.8 Splicing devices such as pressure-type wire connectors may be employed if they comply with the Standard for Wire Connectors UL 486A-486B.

11.4.9 Quick-connecting assemblies shall:

- a) Comply with the Standard for Electrical Quick-Connect Terminals, UL 310; or
- b) Form a secure electrical connection, such as by detents in the mating parts, and shall be capable of carrying the current involved during the Temperature and Pressure Test, Section 52. Securement of connections may be determined by engagement/disengagement tests as specified in the Standard for Electrical Quick-Connect Terminals, UL 310.

11.4.10 Wire binding screws shall thread into metal. At terminals, stranded conductors shall be secured by soldered or pressure-type terminal connectors or the conductors shall be soldered or otherwise assembled to prevent loose strands after assembly. Soldered connections shall be made mechanically secure before being soldered. Open-slot type connectors shall not be used unless they prevent disconnection resulting from loosening of the clamping means. The shanks of terminal connectors shall be protected by electrical insulation if the spacings may be reduced below the minimum acceptable values by loosening of the clamping means. The insulating material shall be secured in position. The thickness of the insulation on the shanks shall be not less than 0.028 inch (0.71 mm) except as permitted by 33.6.

11.5 Short circuit protection

11.5.1 Conductors of motor circuits in permanently-connected room air conditioners having two or more thermal- or overcurrent-protected motors wired for connection to one supply shall withstand the conditions of the Limited Short Circuit Test, Section 62.

Exception: Conductors which comply with one or more of the following are considered acceptable without test:

- a) *Conductors that have an ampacity of not less than one-third the ampacity of the branch circuit conductors as determined in 89.6;*
- b) *Conductors that are 18 AWG (0.82 mm²) or larger and not more than 4 feet (1.2 m) in length and provided that the circuit will be protected by a fuse or circuit breaker rated not more than 60 amperes;*
- c) *Conductors that serve as jumper leads between controls, provided that:*
 - 1) *The length of each lead does not exceed 3 inches (76.2 mm), or*

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2) *The conductors are located in an electrical control enclosure; or*

d) A conductor connected in a circuit with a fixed impedance on each side of the conductor so that high fault current is not likely to occur in it (such as a lead from a motor running capacitor to the start winding of a permanent-split-capacitor motor).

12 Secondary Circuits

12.1 General

12.1.1 Each secondary circuit shall comply with the requirements for high-voltage circuits.

Exception: A secondary circuit is not required to comply with the requirements for high-voltage circuits when all of the following conditions are met:

- a) The circuit is not relied upon to reduce the risk of fire, electric shock, or injury to persons;*
- b) The circuit complies with the requirements for one of the types of secondary circuits referenced in 12.2 and 12.3; and*
- c) The circuit is separated from other circuits as required in Section 13, Separation of Circuits.*

12.1.2 A secondary circuit is a circuit that is isolated at all points from the high-voltage primary branch circuit. This isolation shall be provided by means of a transformer, optical isolator, limiting impedance, or electromechanical relay.

12.1.3 Moving parts are to be evaluated with regard to their potential for personal injury regardless of the circuit in which they are located.

12.1.4 When a secondary circuit is connected to the frame of the appliance, the connection shall be made at only one point in the appliance or system.

Exception: A Class 2 circuit (see 12.2) and a Limited Voltage/Current Circuit (see 12.3) are not prohibited from being connected to the frame at more than one point.

12.1.5 A waveform is considered to be direct-current (dc) when the amplitude of the voltage ripple is not more than 10 percent of the peak voltage.

12.2 Class 2 circuits

12.2.1 A Class 2 circuit shall be supplied by an isolating source that complies with the following:

- a) The Standard for Class 2 Power Units, UL 1310;
- b) The requirements for Class 2 transformers in the Standard for Low Voltage Transformers – Part 1: General Requirements, UL 5085-1, and the Standard for Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers, UL 5085-3; or
- c) The requirements for a Limited Power Source as described in Clause 2.5 in the Standard for Information Technology Equipment, UL 60950-1.

12.2.2 A Class 2 transformer that is not inherently limited shall be provided with a means to limit the available power in accordance with 12.3.2.

12.3 Limited voltage/current circuits

12.3.1 A limited voltage/current circuit shall be supplied by an isolating source (for example, the secondary winding of an isolating type transformer) having a maximum open circuit voltage potential available to the circuit of not more than 30 volts rms/42.4 volts peak, or 60 volts dc; and having at least one of the following means that limits the power available to the levels specified for a Class 2 transformer:

- a) A fixed impedance;
- b) A fuse;
- c) A nonadjustable manual reset circuit protector; or
- d) A regulating network.

12.3.2 When a secondary fuse or other such secondary circuit protective device is used to limit the available current in accordance with 12.3.1, it shall be rated in accordance with Table 12.1.

Table 12.1
Rating for fuse or circuit protective device

Maximum available voltage (rms) ^a	Amperes
0 – 20	5.0
Over 20 – 30	100/V ^b
^a Includes open circuit voltage.	
^b V is defined as the maximum available rms voltage, including open circuit voltage.	

12.3.3 When a primary circuit protective device is used to limit the available current in accordance with 12.3.1, there are no restrictions on the current rating of the protective device as long as it limits the available secondary current in accordance with Table 12.1.

12.3.4 A fuse used in accordance with 12.3.2 and 12.3.3 shall be one of the following:

- a) A non-interchangeable fuse;
- b) The largest fuse that fits in the fuseholder provided; or
- c) Not subject to user servicing and marked as indicated in 12.3.5.

12.3.5 When a protective device is used as specified in 12.3.2 or 12.3.3, the device shall comply with the requirements of this Standard and shall be provided with an adjacent replacement marking in accordance with 88.21.

12.3.6 An impedance or regulating network used to limit the power in accordance with 12.3.1 shall limit the current under short-circuit conditions to not more than 8.0 amperes measured after 2 minutes.

12.3.7 When a fixed impedance (such as a component or grouping of components in the same circuit) or a regulating network (such as used in a switching type power supply) is provided to limit the voltage and/or the available current in accordance with 12.3.1, the fixed impedance or regulating network shall function to limit the voltage to the values given in 12.3.1 and limit the current to the value given in 12.3.6 under single fault conditions.

12.3.8 The impedance, the fuse, the protector, or the regulating network, and the wiring between it and the isolating transformer mentioned in 12.3.1 shall be judged as if it were a part of a high-voltage circuit.

12.3.9 Wires and cables that are part of a low-voltage circuit shall be provided with strain relief if stress on the wire or cable would cause the internal wiring of the circuits to contact an uninsulated live part of another circuit.

13 Separation of Circuits

13.1 Unless provided with insulation rated for the highest voltage involved, insulated conductors of different circuits (internal wiring including wires in a wiring compartment) shall be separated by barriers or shall be segregated; and shall, in any case, be separated or segregated from uninsulated live parts connected to different circuits.

13.2 Segregation of insulated conductors may be accomplished by clamping, routing, or other means which assures permanent separation from insulated or uninsulated live parts of a different circuit.

13.3 Field-installed conductors of any circuit shall be segregated or separated by barriers from field- and factory-installed conductors connected to any other circuit unless the conductors of both circuits are or will be insulated for the maximum voltage of either circuit.

13.4 Field-installed conductors of a high-voltage circuit or a low-voltage circuit with National Electrical Code, ANSI/NFPA 70, Class 1 wiring shall be segregated or separated by barriers as follows:

- a) From uninsulated live parts connected to a different circuit, other than wiring terminals; and
- b) From any uninsulated live parts, except at wiring terminals, of electrical components, such as a pressure-limiting device, motor overload protective device, or other protective device, where short-circuiting or grounding may result in a risk of fire, electric shock, or other injury to persons.

13.5 Field-installed conductors of a low-voltage circuit with National Electrical Code, ANSI/NFPA 70, Class 2 wiring shall be segregated or separated by barriers as follows:

- a) From uninsulated live parts connected to a high-voltage circuit; and
- b) From wiring terminals and any other uninsulated live parts of low-voltage electrical components, such as a pressure-limiting device, motor overload protective device, or other protective device, where short-circuiting or grounding may result in a risk of fire, electric shock, or injury to persons.

13.6 If a barrier is used to provide separation between the wiring of different circuits, it shall be made of metal or rigid insulating material and shall be secured in place.

14 Bonding for Grounding

14.1 A room air conditioner shall have provision for the grounding of all exposed or accessible noncurrent-carrying metal parts which are likely to become energized and which may be contacted by the user or by service personnel during service operations likely to be performed while the room air conditioner is energized.

14.2 Uninsulated metal parts, such as cabinets, electrical enclosures, motor frames and mounting brackets, controller mounting brackets, heater element sheaths, capacitors and other electrical components, interconnecting tubing and piping, valves and plumbing accessories, and refrigerant-containing parts are to be bonded for grounding if they may be contacted by the user or service personnel.

Exception: The following metal parts need not be grounded:

- a) Adhesive-attached metal-foil markings, screws, handles, or the like, which are located on the outside of enclosures or cabinets and isolated from electrical components or wiring by grounded metal parts so that they are not likely to become energized;*
- b) Isolated metal parts, such as motor controller magnet frames and armatures, or small assembly screws, which are positively separated from wiring and uninsulated live parts;*
- c) Cabinets, panels, and covers which do not enclose uninsulated live parts, if wiring is positively separated from the cabinet, panel or cover so that such parts are not likely to become energized; and*
- d) Panels and covers which are insulated from electrical components and wiring by an insulating barrier of vulcanized fiber, varnished cloth, phenolic composition, or similar materials not less than 0.028 inch (0.71 mm) thick and secured in place. If material having a lesser thickness is used, consideration is to be given to such factors as its electrical, mechanical, and flammability properties when compared with materials in thicknesses specified above.*

14.3 The metal enclosure of a room air conditioner having a slide-out chassis is considered to be acceptably grounded if the resistance between the point of connection of the equipment grounding means and enclosure does not exceed 0.1 ohm. Unless a separate grounding conductor is used, this will require penetration of nonconductive coatings between the enclosure and equipment grounding means when the chassis is inserted in the enclosure. In such cases, metal-to-metal contact shall be maintained at any point of insertion or withdrawal of the chassis.

14.4 Metal-to-metal hinge bearing members for a door or cover are considered to be a means for bonding a door or cover for grounding if a multiple-bearing pin-type hinge(s) is employed.

14.5 A separate component bonding conductor shall be made of copper, a copper alloy, or other material acceptable for use as an electrical conductor. Ferrous metal parts in the grounding path shall be protected against corrosion by metallic or nonmetallic coatings, such as painting or plating. A separate bonding conductor or strap shall:

- a) Be protected from mechanical damage or be located within the confines of the outer enclosure or frame and
- b) Not be secured by a removable fastener used for any purpose other than bonding for grounding unless the bonding conductor is unlikely to be omitted after removal and replacement of the fastener.

14.6 The bonding shall be by a positive means, such as clamping, riveting, bolted or screwed connection, brazing, or welding. The bonding connection shall penetrate nonconductive coatings, such as paint or vitreous enamel. Bonding around a resilient mount shall not depend on the clamping action of rubber or other nonmetallic material, except as indicated in 14.9.

14.7 With reference to 14.6, a bolted or screwed connection that incorporates a star washer under the screwhead or a serrated screwhead is acceptable for penetrating nonconductive coatings. If the bonding means depends upon screw threads, two or more screws or two full threads of a single screw shall engage the metal.

14.8 An internal connection for bonding internal parts to the enclosure for grounding, but not for a field-installed grounding conductor or for the grounding wire in a power supply cord, may employ a quick-connect terminal of the dimensions specified below if the connector is not likely to be displaced and the component is limited to use on a circuit having a branch circuit protective device rated as indicated in Table 14.1.

14.9 A connection that depends upon the clamping action exerted by rubber or other nonmetallic material may be acceptable if it complies with the provisions of the Limited Short-Circuit Test, Section 62, and the Current Overload Test – Bonding Conductors and Connections, Section 63, under any normal degree of compression permitted by a variable clamping device and also following exposure to the effects of oil, grease, moisture, and thermal degradation, which may occur in service. A clamping device is to be considered with particular emphasis on the likelihood of the clamping device being reassembled in its intended fashion.

Table 14.1
Internal terminal connections for bonding

Terminal dimensions		Maximum rating of protective device, amperes
inches	(mm)	
0.020 by 0.187 by 0.250	(0.51 by 4.75 by 6.4)	20
0.032 by 0.187 by 0.250	(0.81 by 4.75 by 6.4)	20
0.032 by 0.205 by 0.250	(0.81 by 5.2 by 6.4)	20
0.032 by 0.250 by 0.312	(0.81 by 6.4 by 7.9)	60

14.10 Except as permitted by 14.13 and 14.14, a bonding conductor or strap on a cord-connected room air conditioner shall have a cross-sectional area not less than that of the grounding conductor of the supply cord.

14.11 On a permanently-connected room air conditioner, the size of a conductor employed to bond an electrical enclosure or motor frame shall be based on the rating of the branch circuit overcurrent device to which the unit will be connected. Except as permitted by 14.13 and 14.14, the size of the conductor or strap shall be in accordance with Table 14.2.

14.12 A conductor, such as a clamp or strap, used in place of a separate wire conductor as indicated in 14.11, is acceptable provided the minimum cross-sectional conducting area is equivalent to the wire sizes indicated in Table 14.2.

14.13 With regard to 14.10 and 14.11, a smaller conductor may be used if the bonding conductor and connection comply with the provisions of the Limited Short-Circuit Test, Section 62, and the Current Overload Test – Bonding Conductors and Connections, Section 63.

14.14 A bonding conductor to a motor or other electrical component need not be larger than the size of the motor-circuit conductors or the size of the conductors supplying the component.

14.15 Splices shall not be employed in wire conductors used to bond electrical enclosures, motor frames, or other electrical components.

14.16 If more than one size of branch circuit overcurrent device is involved, the size of the bonding conductor is to be based on the rating of the overcurrent device intended to provide ground-fault protection for the component bonded by the conductor. For example, if a motor is individually protected by a branch circuit overcurrent device smaller than other overcurrent devices used with the equipment, a bonding conductor for that motor is sized on the basis of the overcurrent device intended for ground-fault protection of the motor.