

## DATA

DATE \_\_\_\_\_

NO. OF PAGES

## REVISION

10-4-95

11

UL 1450

5-13-93

78



**Underwriters Laboratories Inc.®**

A not-for-profit organization dedicated to public safety  
and committed to quality service

**October 4, 1995**

**Revision pages for**

**Standard for**

**Motor-Operated Air Compressors, Vacuum Pumps, and Painting Equipment**

**UL 1450, Second Edition**

Attached to this transmittal notice is a revision of the Second edition of UL 1450.

A CHANGE ON A PAGE DATED OCTOBER 4, 1995 IS INDICATED BY A SMALL PRINT NOTE FOLLOWING THE AFFECTED ITEM, PRECEDED AND FOLLOWED BY AN ASTERISK.

THESE REVISED REQUIREMENTS ARE NOW IN EFFECT.

Attention is directed to the note on the title page of this standard outlining the procedure to be followed to retain the approved text of ANSI/UL 1450-1995.

Revised and/or additional pages may be issued from time to time.

With the inclusion of the accompanying material, the standard consists of pages dated as shown in the following checklist:

| <b>Page</b>           | <b>Date</b>                              |
|-----------------------|------------------------------------------|
| 1 . . . . .           | May 13, 1993 (Reprinted October 4, 1995) |
| 2 – 14 . . . . .      | May 13, 1993                             |
| 15, 16 . . . . .      | October 4, 1995                          |
| 17 – 39 . . . . .     | May 13, 1993                             |
| 40 . . . . .          | October 4, 1995                          |
| 41 – 62 . . . . .     | May 13, 1993                             |
| 63 . . . . .          | October 4, 1995                          |
| 64 – 66 . . . . .     | May 13, 1993                             |
| 67 . . . . .          | October 4, 1995                          |
| 68 – 72, A1 . . . . . | May 13, 1993                             |

**MAY 13, 1993**  
(Title Page Reprinted: October 4, 1995)



1

**UL 1450**

**Standard for**

**Motor-Operated Air Compressors, Vacuum  
Pumps, and Painting Equipment**

First Edition – February, 1981

**Second Edition**

**May 13, 1993**

Approval as an American National Standard (ANSI) covers the numbered paragraphs on pages dated May 13, 1993 and October 4, 1995. These pages should not be discarded when revised or additional pages are issued if it is desired to retain the ANSI approved text.

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc.

Approved as ANSI/UL 1450-1985, October 7, 1985  
Approved as ANSI/UL 1450-1995, August 2, 1995

Revisions of this standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest published set of revision pages.

**ISBN 1-55989-371-0**

**COPYRIGHT © 1981, 1995 UNDERWRITERS LABORATORIES INC.**

**CONTENTS****FOREWORD****INTRODUCTION**

|                                          |   |
|------------------------------------------|---|
| 1 Scope                                  | 5 |
| 2 Glossary                               | 5 |
| 3 Components                             | 6 |
| 4 Units of Measurement                   | 6 |
| 5 References                             | 6 |
| 6 Attachments                            | 6 |
| 7 Instructions Provided with the Product | 7 |

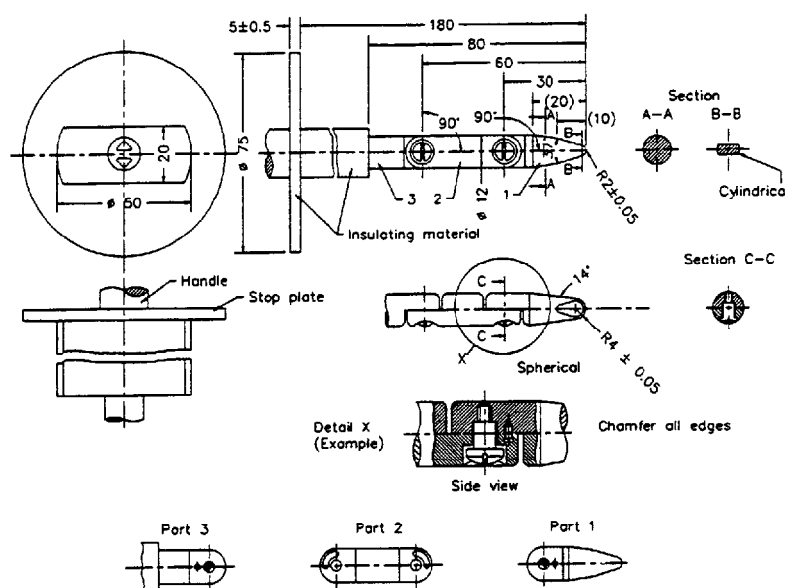
**CONSTRUCTION**

|                                                                 |    |
|-----------------------------------------------------------------|----|
| 8 General                                                       | 7  |
| 9 Enclosure                                                     | 7  |
| 10 Mechanical Assembly                                          | 10 |
| 11 Protection Against Corrosion                                 | 11 |
| 12 Accessibility of Uninsulated Live Parts and Film-Coated Wire | 11 |
| 13 Supply Connections                                           | 16 |
| 14 Current-Carrying Parts                                       | 21 |
| 15 Insulating Material                                          | 22 |
| 16 Internal Wiring                                              | 22 |
| 17 Separation of Circuits                                       | 24 |
| 18 Capacitors                                                   | 24 |
| 19 Grounding                                                    | 25 |
| 20 Double Insulation                                            | 26 |
| 21 Lampholders                                                  | 27 |
| 22 Motors                                                       | 27 |
| 23 Overload- or Thermal-Protective Devices                      | 29 |
| 24 Receptacles                                                  | 30 |
| 25 Switches and Controls                                        | 30 |
| 26 Spacings                                                     | 31 |

**PROTECTION AGAINST INJURY TO PERSONS**

|                                                   |    |
|---------------------------------------------------|----|
| 27 General                                        | 33 |
| 28 Sharp Edges                                    | 33 |
| 29 Enclosures and Guards                          | 33 |
| 30 Materials                                      | 34 |
| 31 Surface Temperatures                           | 35 |
| 32 Stability                                      | 35 |
| 33 Strength of Handles                            | 36 |
| 34 Rotating or Moving Members                     | 36 |
| 35 Pressure Vessels and Parts Subject to Pressure | 37 |
| 36 Pressure Relief Means                          | 39 |
| 37 Pressure-Regulating Control Switches           | 40 |
| 38 High-Pressure Paint-Spraying Products          | 41 |
| 39 Switches, Controls, and Interlocks             | 41 |

**Figure 12.4**  
**International Electrotechnical Commission (IEC)**  
**articulate accessibility probe with stop plate**



SA1788A

\*Figure 12.4 revised October 4, 1995\*

12.3 The probes mentioned in 12.1 and 12.2 and illustrated in Figures 12.1 – 12.4 shall be applied to any depth that the opening will permit, and shall be rotated or angled before, during, and after insertion through the opening to any position that is necessary to examine the enclosure. The probes illustrated in Figures 12.1 and 12.4 shall be applied in any possible configuration; and if necessary, the configuration shall be changed after insertion through the opening.

12.4 The probes illustrated in 12.3 and 12.5 shall be used as measuring instruments to judge the accessibility provided by an opening, and not as instruments to judge the strength of a material; they shall be applied with the minimum force necessary to determine accessibility.

12.5 With reference to the requirements in 12.1 and 12.2, the minor dimension of an opening is the diameter of the largest cylindrical probe having a hemispherical tip that can be inserted through the opening.

12.6 With reference to the requirements in 12.2,

a) An indirectly accessible motor is a motor:

- 1) That is accessible only by opening or removing a part of the outer enclosure, such as a guard or panel, that can be opened or removed without using a tool, or
- 2) That is located at such a height or is otherwise guarded or enclosed so that it is unlikely to be contacted.

- b) A directly accessible motor is a motor:
  - 1) That can be contacted without opening or removing any part, or
  - 2) That is located so as to be accessible to contact.

12.7 During the examination of a product to determine whether it complies with the requirements in 12.1 or 12.2, a part of the enclosure that may be opened or removed by the user without using a tool (to attach an accessory, to make an operating adjustment, or for other reasons) is to be opened or removed.

### 13 Supply Connections

#### 13.1 Cord-connected products

13.1.1 A product intended to be connected to the power-supply circuit by means of a flexible cord shall be provided with a flexible cord and an attachment plug for connection to the supply circuit.

13.1.2 The attachment plug of a product intended to be connected to a nominal 120 volt circuit, and using devices required to be connected to a specific supply conductor as specified in 13.4.17, 24.2, and 25.3 shall be a polarized type. The connections to the attachment plug shall be in accordance with Figure 13.1. The polarity identification of the supply cord shall be in accordance with Table 13.1. See 64.6.

13.1.3 The flexible cord shall have a voltage rating not less than the rated voltage of the product, and shall have an ampacity that is not less than the current rating of the product.

13.1.4 Type SJ, SJT, SJO, SJO, SJTO, or SJTOO flexible cord, or a type at least equally serviceable for the application, shall be employed for the following products.

- a) A compressor or paint pump having a motor rated 3 horsepower (2.2 kW output) or less.
- b) A vacuum pump.
- c) A hand-held sprayer.
- d) A paint mixer and pigment dispenser.

*Exception: A paint sprayer having a paint capacity of 2 fluid ounces (62 mL) or less may be provided with Type SPT-2 cord.*

13.1.5 A compressor or paint pump having a motor rated more than 3 horsepower (2.2 kW output) or a tank larger than 30 gallons (113.4 L), or both, shall employ Type SO, SOO, ST, STO, or STOO flexible cord or a type at least equally serviceable for the application.

13.1.6 A cord or cord set employed on a compressor or sprayer intended for outdoor use and not marked in accordance with 62.13 shall be marked "W-A."

### 35.2 Parts subject to pressure

35.2.1 A part of a product other than a pressure vessel that is subject to air or vapor pressure during normal or anticipated abnormal operation shall withstand, without rupture, a pressure corresponding to five times:

- a) The start-to-discharge setting of the relief device provided in the system as determined in accordance with 36.7,
- b) The maximum pressure that can be developed in the system – but not greater than the relief valve setting, or
- c) The marked maximum pressure to which the system may be exposed by an external pressure source.

*Exception: A section of a pressure system constructed of continuous tubing or of lengths of tubing connected by conventional tubing fittings or hard-soldered, brazed, or welded joints provided the wall thickness of the tubing is not less than the value specified in Table 35.2.*

**Table 35.2**  
**Wall thickness for copper and steel tubing**

| Outside diameter,<br>Inch (mm) | Minimum wall thickness,<br>Inch (mm) | Maximum pressure to which tubing is subjected, psig (mPa) |                   |                |
|--------------------------------|--------------------------------------|-----------------------------------------------------------|-------------------|----------------|
|                                |                                      | Seamless copper                                           | Butt-welded steel | Seamless steel |
| 3/8 or smaller (9.5)           | 0.016 (0.41)                         | 500 (3.45)                                                | 600 (4.14)        | 1000 (6.90)    |
| 1/2 (12.7)                     | 0.016 (0.41)                         | 400 (2.76)                                                | 480 (3.31)        | 800 (5.52)     |
| 5/8 (15.9)                     | 0.016 (0.41)                         | 320 (2.21)                                                | 384 (2.65)        | 640 (4.42)     |
| 5/8 (15.9)                     | 0.021 (0.53)                         | 420 (2.90)                                                | 504 (3.48)        | 840 (5.80)     |
| 3/4 (19.0)                     | 0.021 (0.53)                         | 360 (2.48)                                                | 432 (2.98)        | 720 (4.97)     |
| 3/4 (19.0)                     | 0.025 (0.64)                         | 420 (2.90)                                                | 504 (3.48)        | 840 (5.80)     |
| 1 (25.4)                       | 0.021 (0.53)                         | 260 (1.79)                                                | 312 (2.15)        | 520 (3.59)     |
| 1 (25.4)                       | 0.025 (0.64)                         | 320 (2.21)                                                | 384 (2.65)        | 640 (4.42)     |

35.2.2 If a test is necessary to determine whether a part complies with the requirement in 35.2.1, two samples of the part are to be subjected to the hydrostatic strength test described in 35.1.15 and 35.1.16. The results are not acceptable if either sample bursts.

*Exception: Rupture of a nonmetallic fluid transfer line and its connections, or at a gasket is acceptable if repeated tests conducted with media they are intended to contain show no evidence of presenting a risk of electric shock or injury to persons.*

### 36 Pressure Relief Means

36.1 A means for relieving pressure shall be provided for a part in which pressure might be generated by an external source of heat.

36.2 A means for relieving pressure – a pressure relief device, a fusible plug, a soldered joint, nonmetallic tubing, or other equivalent means – shall be employed to comply with the requirement in 36.1.

36.3 A pressure-relief device is considered to be a pressure-actuated valve or rupture member designed to relieve excessive pressures automatically.

36.4 There shall be no shutoff valve between the pressure-relief means and the parts that it is intended to protect.

36.5 A vessel having an inside diameter of more than 3 inches (76 mm) and subject to air or steam pressure generated or stored within the product shall be protected by a pressure-relief device.

\*36.5 revised October 4, 1995\*

36.6 The start-to-discharge pressure setting of a pressure-relief device shall not be higher than the working pressure marked on the ASME coded vessel.

36.7 To determine the start-to-discharge pressure setting of a pressure-relief device, each of three samples of the device is to be subjected three times to a gradually increasing air pressure, and the pressure at which the device begins to open is to be recorded. The start-to-discharge pressure setting of each sample is considered to be the average value of the three trials; the start-to-discharge value mentioned in 36.6 is considered to be the highest average of the three samples tested.

36.8 A pressure-relief device shall:

- a) Be connected as close as possible to the pressure vessel or part of the product that it is intended to protect;
- b) Be installed so that it is readily accessible for inspection and repair, and cannot be readily rendered inoperative so that it will not perform its intended function;
- c) Have its discharge opening located and directed so that:
  - 1) Operation of the device will not deposit moisture on bare live parts or on insulation or components detrimentally affected by moisture, and
  - 2) The likelihood of scalding persons is reduced; and
- d) Have a discharge rate adequate to relieve the pressure.

\*36.8 revised October 4, 1995\*

36.9 A pressure-relief device having an adjustable setting is judged on the basis of the maximum setting unless the adjusting means is reliably sealed at a lower setting.

### 37 Pressure-Regulating Control Switches

37.1 A compressor system with an air-holding tank shall be provided with:

- a) A pressure-regulating control switch that complies with the requirements in 37.2, to limit pressure build-up within the tank;

*Exception: A switch need not be provided on a product that uses other means of limiting tank pressure, such as an air dumping valve or a compressor design that inherently limits pressure.*

**Table 61.1**  
**Outlet-box marking**

| Temperature rise attained during test in terminal box or compartment | Temperature marking |
|----------------------------------------------------------------------|---------------------|
| 36 – 50°C (64 – 90°F)                                                | 75°C (167°F)        |
| 51 – 65°C (91 – 117°F)                                               | 90°C (194°F)        |

61.2.2 A product intended for permanent connection to a wiring system other than rigid metal conduit or armored cable shall be permanently marked to indicate the system or systems for which it is acceptable. The marking shall be located so that it will be visible when power-supply connections to the product are being made.

61.2.3 If a specific spacing is necessary between a permanently-installed product and the surfaces of the test alcove described in 46.2.7 to prevent the attainment of excessive temperatures within the product or an adjacent surface, the product shall be permanently marked in a location that will be readily visible after installation "Mount at least ... inches from side walls (and floor or ceiling)." See 64.5.

### 61.3 Cord-connected products

61.3.1 If a product is provided with a power-supply cord 18 inches (457 mm) or less long or with a motor-attachment plug in accordance with the exception to 13.1.8, a statement advising of the availability of an extension cord and the importance of using such a cord shall be marked on the product. See 64.3.

### 61.4 Household type products

61.4.1 A product evaluated in accordance with the Exception to 9.4 shall be marked "Household Use Only." The lettering shall not be less than 3/32 inch (2.4 mm) high.

\*61.4.1 revised (date of publication)\*

61.4.2 A carton (individual marketing container) for a product evaluated in accordance with the Exception to 9.4 shall be marked "Household Use Only." The marking shall:

- Be located on at least one outside surface, and
- Appear in lettering not less than the height specified in Table 61.2.

\*61.4.2 revised (date of publication)\*

**Table 61.2**  
**Lettering height**

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

## 62 Cautionary

62.1 A product having a hidden or unexpected risk of injury to persons shall be marked to inform the user of the risk.

62.2 A cautionary marking shall be permanent and legible and shall be located on a permanent part of the product.

62.3 A cautionary marking intended to instruct the operator shall be legible and visible from the position normally assumed by the operator when starting the product or from the position normally assumed for the specific operation involved. Other such markings for servicing or making settings and adjustments shall be legible and visible to the individual when such work is being accomplished.

62.4 A cautionary marking on a paint sprayer or paint gun shall be in lettering raised not less than 0.020 inches (0.51 mm) above the surrounding surface, or of a similar type not likely to become unreadable with several layers of paint covering it.

*Exception: The cautionary marking on a paint sprayer having a motor rated 3 horsepower (2.2 kW output) or less may be on a tag if the tag complies with the requirements in 62.5.*

62.5 A tag used for a cautionary marking in accordance with the exception to 62.4 or 62.12 – shall:

- a) Be permanently affixed to a hose or an attached power-supply cord,
- b) Be located not more than 6 inches (152.4 mm) from the attachment plug, if on a cord,
- c) Be made of substantial material such as cloth, plastic, or the equivalent that provides the necessary mechanical strength and prevents easy removal, and
- d) Comply with the requirements in 55.2 – 55.6. The tag shall be of a size that facilitates legibility of the required markings, and all exposed surfaces shall have a clear plastic overlay, or the equivalent, to protect the markings. The tag shall be either of the following forms:
  - 1) A flag-type tag having a hole to permit securement to the power-supply cord or hose by a plastic strap or equivalent means. The strap shall not be removable without cutting; or
  - 2) A flag-type tag with a adhesive back. The tag is to be wrapped tightly once around and is to adhere to the supply cord or hose. The ends of the tag are to adhere to each other and project as a flag. The required markings are to be positioned on the projecting flag portion of the tag.

62.6 A marking intended to inform the user of a risk of injury to persons shall be prefixed by a signal word "CAUTION," "WARNING," or "DANGER." The marking shall be in letters not less than 3/32 inch (2.4 mm) high. The signal word shall be more prominent than any other required marking on the product.

*Exception: For a hand-supported air brush type sprayer intended for connection to an air compressor, on which space precludes the full size marking:*

- a) Uppercase letters shall not be less than 5/64 inch (1.9 mm), and
- b) Lowercase letters shall not be less than 1/16 inch (1.6 mm).

63.7 A product evaluated in accordance with the Exception to 9.4 shall have the statement "Household Use Only" appearing in the instruction manual.

\*63.7 revised October 4, 1995\*

63.8 With reference to the requirement in 7.3, a tank-type compressor that does not employ a pressure vessel marked with the code symbol of "U" or "UM" of the American Society of Mechanical Engineers (ASME) shall not include reference to a horsepower rating of more than 3 horsepower (2.23 kW output) on the product or in the instruction manual provided with the product.

## 64 Operating and Installation Instructions

64.1 The operating and installation instructions shall include all information needed to operate and install the product as intended.

64.2 If a product is packaged with an attachment, the operating and installation instructions shall identify the attachment and provide instructions for its use.

64.3 With reference to the requirement in 13.1.8, and as an alternative to the requirement in 61.3.1, a statement advising of the availability of an acceptable extension cord and the importance of using such a cord may be included in the operating and installation instructions.

64.4 Instructions shall be provided with a product that is intended to be secured in place to indicate when it is necessary to fasten equipment to a floor or other part of a building in order to obtain proper stability.

64.5 A statement equivalent to that required in 61.2.3 shall also be included in the operating and installation instructions.

64.6 A product provided with a 2-blade polarized attachment plug shall be provided with the following instructions or the equivalent: This appliance has a polarized plug (one blade is wider than the other). This plug will fit in a polarized outlet only one way. If the plug does not fit fully in the outlet, reverse the plug. If it still does not fit, contact a qualified electrician to install the proper outlet. Do not change the plug in any way.

## 65 User-Maintenance Instructions

65.1 User-maintenance instructions shall include:

- a) Instructions for cleaning and user maintenance operations recommended by the manufacturer, such as lubrication or nonlubrication; and a statement to the user that any other servicing should be performed by an authorized service representative or that the product has no user serviceable parts.
- b) For a product employing an automatically reset thermal limiter, which shuts off the entire product, instructions to the user of what to expect in the event the thermal limiter operates.
- c) Specific instructions for the proper method of cord storage, total product storage, and the like when the product is not in use; and for cord care while in use (such as for hand-supported products, untwisting, or the like).

## 66 Grounding Instructions

66.1 The grounding instructions shall include those instructions in (a) – (e) applicable to the product, or the applicable instructions in (a) – (e) may be included in the operating instructions. See 63.2.

- a) For all grounded, cord-connected products:

### GROUNDING INSTRUCTIONS

This product should be grounded. In the event of an electrical short circuit, grounding reduces the risk of electric shock by providing an escape wire for the electric current. This product is equipped with a cord having a grounding wire with an appropriate grounding plug. The plug must be plugged into an outlet that is properly installed and grounded in accordance with all local codes and ordinances.

**DANGER** – Improper installation of the grounding plug can result in a risk of electric shock. If repair or replacement of the cord or plug is necessary, do not connect the grounding wire to either flat blade terminal. The wire with insulation having an outer surface that is green with or without yellow stripes is the grounding wire.

Check with a qualified electrician or serviceman if the grounding instructions are not completely understood, or if in doubt as to whether the product is properly grounded. Do not modify the plug provided; if it will not fit the outlet, have the proper outlet installed by a qualified electrician.

- b) For a grounded, cord-connected product rated less than 15 amperes and intended for use on a nominal 120 volt supply circuit, the instructions in either (1) or (2):

1) This product is for use on a nominal 120-volt circuit, and has a grounding plug that looks like the plug illustrated in sketch A in Figure 66.1. A temporary adapter that looks like the adapter illustrated in sketches B and C may be used to connect this plug to a 2-pole receptacle as shown in sketch B if a properly grounded outlet is not available. The temporary adapter should be used only until a properly grounded outlet (sketch A) can be installed by a qualified electrician. The green colored rigid ear, lug, or the like extending from the adapter must be connected to a permanent ground such as a properly grounded outlet box cover. Whenever the adapter is used, it must be held in place by a metal screw.

2) This product is for use on a nominal 120-volt circuit and has a grounding plug that looks like the plug illustrated in sketch A in Figure 66.1. Make sure that the product is connected to an outlet having the same configuration as the plug. No adapter should be used with this product.

## ● Motor-Operated Air Compressors, Vacuum Pumps, and Painting Equipment

Northbrook, Illinois • (708) 272-8800  
Melville, New York • (516) 271-6200  
Santa Clara, California • (408) 985-2400  
Research Triangle Park,  
North Carolina • (919) 549-1400



**Underwriters Laboratories Inc.®**

Underwriters Laboratories Inc., founded in 1894, is chartered as a not-for-profit organization without capital stock, under the laws of the State of Delaware, to establish, maintain, and operate laboratories for the examination and testing of devices, systems and materials to determine their relation to hazards to life and property, and to ascertain, define and publish standards, classifications and specifications for materials, devices, products, equipment, constructions, methods, and systems affecting such hazards.

UL Standards for Safety are developed under a procedure which provides for participation and comment from the affected public as well as industry. The procedure takes into consideration a survey of known existing standards and the needs and opinions of a wide variety of interests concerned with the subject matter of the standard. Thus manufacturers, consumers, individuals associated with consumer-oriented organizations, academicians, government officials, industrial and commercial users, inspection authorities, insurance interests and others provide input to UL in the formulating of UL Standards for Safety, to keep them consonant with social and technological advances.

A not-for-profit organization  
dedicated to public safety and  
committed to quality service



**Underwriters Laboratories Inc.®**

An independent, not-for-profit organization testing for public safety

**May 13, 1993**

**Standard for**

**Motor-Operated Air Compressors, Vacuum Pumps, and Painting Equipment**

**UL 1450, Second Edition**

Accompanying this transmittal notice is a copy of the Second edition of UL 1450.

THIS EDITION OF THE STANDARD IS NOW IN EFFECT.

Revised and/or additional pages may be issued from time to time.

**MAY 13, 1993**

**1**

**UL 1450**

**Standard for**

**Motor-Operated Air Compressors, Vacuum  
Pumps, and Painting Equipment**

Prior to the first edition, the requirements for the products covered by this standard were included in the Standard for Motor-Operated Appliances, UL 73.

First Edition – February 9, 1981

**SECOND EDITION**

**MAY 13, 1993**

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc.

Revisions of this standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest published set of revision pages.

**ISBN 1-55989-371-0**

**COPYRIGHT © 1981, 1993 UNDERWRITERS LABORATORIES INC.**

UL's Standards for Safety are copyrighted to protect UL's publication rights, not to restrict their use in product design or evaluation. See paragraph E of the Foreword.

(1 – 5/13/93 – 5/13/93)

**CONTENTS****FOREWORD****INTRODUCTION**

|                                                |   |
|------------------------------------------------|---|
| 1 Scope .....                                  | 5 |
| 2 Glossary .....                               | 5 |
| 3 Components .....                             | 6 |
| 4 Units of Measurement .....                   | 6 |
| 5 References .....                             | 6 |
| 6 Attachments .....                            | 6 |
| 7 Instructions Provided with the Product ..... | 7 |

**CONSTRUCTION**

|                                                                       |    |
|-----------------------------------------------------------------------|----|
| 8 General .....                                                       | 7  |
| 9 Enclosure .....                                                     | 7  |
| 10 Mechanical Assembly .....                                          | 10 |
| 11 Protection Against Corrosion .....                                 | 11 |
| 12 Accessibility of Uninsulated Live Parts and Film-Coated Wire ..... | 11 |
| 13 Supply Connections .....                                           | 16 |
| 14 Current-Carrying Parts .....                                       | 21 |
| 15 Insulating Material .....                                          | 22 |
| 16 Internal Wiring .....                                              | 22 |
| 17 Separation of Circuits .....                                       | 24 |
| 18 Capacitors .....                                                   | 24 |
| 19 Grounding .....                                                    | 25 |
| 20 Double Insulation .....                                            | 26 |
| 21 Lampholders .....                                                  | 27 |
| 22 Motors .....                                                       | 27 |
| 23 Overload- or Thermal-Protective Devices .....                      | 29 |
| 24 Receptacles .....                                                  | 30 |
| 25 Switches and Controls .....                                        | 30 |
| 26 Spacings .....                                                     | 31 |

**PROTECTION AGAINST INJURY TO PERSONS**

|                                                         |    |
|---------------------------------------------------------|----|
| 27 General .....                                        | 33 |
| 28 Sharp Edges .....                                    | 33 |
| 29 Enclosures and Guards .....                          | 33 |
| 30 Materials .....                                      | 34 |
| 31 Surface Temperatures .....                           | 35 |
| 32 Stability .....                                      | 35 |
| 33 Strength of Handles .....                            | 36 |
| 34 Rotating or Moving Members .....                     | 36 |
| 35 Pressure Vessels and Parts Subject to Pressure ..... | 37 |
| 36 Pressure Relief Means .....                          | 39 |
| 37 Pressure-Regulating Control Switches .....           | 40 |
| 38 High-Pressure Paint-Spraying Products .....          | 41 |
| 39 Switches, Controls, and Interlocks .....             | 41 |

**PERFORMANCE**

|                                                               |    |
|---------------------------------------------------------------|----|
| 40 General .....                                              | 42 |
| 41 Leakage Current Test .....                                 | 42 |
| 42 Leakage Current Test Following Humidity Conditioning ..... | 45 |
| 43 Starting Current Test .....                                | 46 |
| 44 Loaded Starting Test .....                                 | 46 |
| 45 Input Test .....                                           | 46 |
| 46 Temperature Test .....                                     | 46 |
| 47 Grounding Continuity Test .....                            | 51 |
| 48 Dielectric Voltage Withstand Test .....                    | 51 |
| 49 Resistance to Moisture Test .....                          | 52 |
| 50 Paint Entry Test .....                                     | 55 |
| 51 Test on Switches and Controls .....                        | 55 |
| 52 Strain Relief Test .....                                   | 56 |
| 53 Abnormal Operation Test .....                              | 56 |
| 54 Accelerated Aging Test .....                               | 56 |
| 55 Permanence of Marking Tests .....                          | 57 |

**MANUFACTURING AND PRODUCTION TESTS**

|                                                       |    |
|-------------------------------------------------------|----|
| 56 Dielectric Voltage Withstand .....                 | 58 |
| 57 Grounding Continuity .....                         | 59 |
| 58 Pressure Vessel Assembly .....                     | 60 |
| 59 Start-to-Discharge of Pressure-Relief Device ..... | 60 |

**RATING**

|                  |    |
|------------------|----|
| 60 Details ..... | 60 |
|------------------|----|

**MARKING**

|                     |    |
|---------------------|----|
| 61 Details .....    | 61 |
| 62 Cautionary ..... | 64 |

**INSTRUCTION MANUAL**

|                                                  |    |
|--------------------------------------------------|----|
| 63 General .....                                 | 66 |
| 64 Operating and Installation Instructions ..... | 67 |
| 65 User-Maintenance Instructions .....           | 67 |
| 66 Grounding Instructions .....                  | 68 |
| 67 Double-Insulation Instructions .....          | 70 |

**BATTERY-OPERATED PRODUCTS**

|                       |    |
|-----------------------|----|
| 68 Scope .....        | 70 |
| 69 Construction ..... | 71 |
| 70 Performance .....  | 72 |

**APPENDIX A**

|                                |    |
|--------------------------------|----|
| Standards for Components ..... | A1 |
|--------------------------------|----|

## FOREWORD

A. This Standard contains basic requirements for products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Standard. These requirements are based upon sound engineering principles, research, records of tests and field experience, and an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. They are subject to revision as further experience and investigation may show is necessary or desirable.

B. The observance of the requirements of this Standard by a manufacturer is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which complies with the text of this Standard will not necessarily be judged to comply with the Standard if, when examined and tested, it is found to have other features which impair the level of safety contemplated by these requirements.

D. A product employing materials or having forms of construction differing from those detailed in the requirements of this Standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be judged to comply with the Standard.

E. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed. UL shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

F. Many tests required by the Standards of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

## INTRODUCTION

### 1 Scope

1.1 These requirements cover household, commercial, and industrial air compressors, vacuum pumps, paint sprayers, paint mixers, and paint pigment dispensers intended for indoor or outdoor use or both in accordance with the National Electrical Code, NFPA 70.

1.2 These requirements do not cover products:

- a) Rated more than 600 volts,
- b) Employing a universal motor rated more than 250 volts, or
- c) Intended for installation and use in a hazardous location.

1.3 These requirements do not cover household air compressors rated more than 3 horsepower (2.25 kW output) or more than 150 psi (1034 kPa).

1.4 These requirements do not cover medical and dental products; products intended to be used in heating, air conditioning, or refrigeration systems; paint heaters; electrostatic paint spraying products; or other products covered by separate requirements.

1.5 A product that contains features, characteristics, components, materials, or systems new or different from those in use when the standard was developed, and that involves a risk of fire, electric shock, or injury to persons shall be evaluated using the appropriate additional component and end-product requirements as determined necessary to maintain the level of safety for the user of the product as originally anticipated by the intent of this standard.

### 2 Glossary

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

2.2 **AUTOMATICALLY CONTROLLED PRODUCT** – A product is considered to be automatically controlled under any one or more of the following conditions if:

- a) The repeated starting of the product, beyond one complete predetermined cycle of operation to the point where some form of limit switch opens the circuit, is independent of any manual control.
- b) During any single predetermined cycle of operation, the motor is caused to stop and restart one or more times.
- c) Upon energizing the product, the initial starting of the motor may be intentionally delayed beyond normal, conventional starting.
- d) During any single predetermined cycle of operation, automatic changing of the mechanical load may reduce the motor speed sufficiently to reestablish starting-winding connections to the supply circuit.

2.3 **HAND-HELD PRODUCT, HAND-GUIDED PRODUCT** – A portable product that during use is contacted by the hand of the user for purposes of electrical or physical control but not for complete support.

**2.4 HAND-SUPPORTED PRODUCT** – A product that is physically supported by any part of the body of the user during the performance of its intended electrically-operated functions, such as a portable paint sprayer with an integral motor.

**2.5 LINE-VOLTAGE CIRCUIT** – A circuit involving a potential of not more than 600 volts and having circuit characteristics in excess of those of a low-voltage circuit.

**2.6 LOW-VOLTAGE CIRCUIT** – A circuit involving a peak open-circuit potential of not more than 42.4 volts supplied by a primary battery, by a Class 2 transformer, or by a combination of a transformer and a fixed impedance that as a unit, complies with all performance requirements for a Class 2 transformer. A circuit derived from a line-voltage circuit by connecting a resistance in series with the supply circuit, as a means of limiting the voltage and current, is not considered to be a low-voltage circuit.

**2.7 REMOTELY CONTROLLED PRODUCT** – A product that is out of sight of the operator who is at the starting device.

### 3 Components

**3.1** Except as indicated in 3.2, a component of a product covered by this standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

**3.2** A component need not comply with a specific requirement that:

- a) Involves a feature or characteristic not needed in the application of the component in the product covered by this standard, or
- b) Is superseded by a requirement in this standard.

**3.3** A component shall be used in accordance with its recognized rating established for the intended conditions of use.

**3.4** Specific components are recognized as being incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits and shall be used only under those specific conditions for which they have been recognized.

### 4 Units of Measurement

**4.1** If a value for measurement is followed by a value in other units in parentheses, the second value may be only approximate. The first stated value is the requirement.

### 5 References

**5.1** 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.

### 6 Attachments

**6.1** A functional attachment that is made available or is packaged with a product by the manufacturer for use with a product shall be included in the evaluation of the product.

## 7 Instructions Provided with the Product

7.1 A copy of the operating, user-maintenance, and other instructions intended to accompany a product as produced shall be used as a guide in the examination and test of the product. For this purpose, a final printed copy is not required.

7.2 The instructions shall include such directions and information as deemed by the organization responsible for the product to be necessary to cover the operation, intended use, and maintenance of the product, and shall comply with the requirements for instruction manuals in Sections 63 – 67.

7.3 A tank-type compressor that does not employ a pressure vessel marked with the code "U" or "UM" of the American Society of Mechanical Engineers (ASME) shall comply with the requirements in 63.8.

## CONSTRUCTION

### 8 General

8.1 A product shall employ materials found by investigation to be acceptable for the intended application.

### 9 Enclosure

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

9.2 Cast and sheet-metal portions of an enclosure shall not be thinner than the applicable values specified in Table 9.1.

*Exception: An enclosure investigated and judged acceptable with respect to the factors mentioned in 9.3 and any additional requirements applicable to the product under investigation.*

9.3 Among the factors that shall be considered when judging the acceptability of a nonmetallic enclosure or an enclosure of magnesium are:

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

9.4 An enclosure of polymeric material shall comply with the applicable requirements for products that are not categorized as household use only as contained in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

*Exception: An attended, intermittent duty portable product can be evaluated for compliance with the household use requirements of UL 746C if it is marked in accordance with 61.4.1, 61.4.2, and 63.7. A tank-type compressor with an automatic pressure-regulating control is not considered to be an attended, intermittent duty product.*

9.5 The enclosure of a remotely or automatically controlled product shall prevent molten metal, burning insulation, flaming particles, or the like from falling on flammable materials, including the surface upon which the product is supported.

**Table 9.1**  
**Thickness of enclosure metal**

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

9.6 The requirement in 9.5 will necessitate that a switch, a relay, a solenoid, or the like be individually and completely enclosed, except for terminals, unless it can be shown that malfunction of the component would not result in a risk of fire, or there are no openings in the bottom of the product enclosure. It will also necessitate the use of a barrier of nonflammable material:

a) Under a motor unless:

- 1) The structural parts of the motor or of the product provide the equivalent of such a barrier;
- 2) The protection provided with the motor is such that no burning insulation or molten material falls to the surface that supports the product when the motor is energized under each of the following fault conditions:
  - i) Open main winding,
  - ii) Open starting winding,
  - iii) Starting switch short-circuited, and
  - iv) Capacitor of permanent-split capacitor motor short circuited – the short-circuit is to be applied before the motor is energized, and the rotor is to be locked;

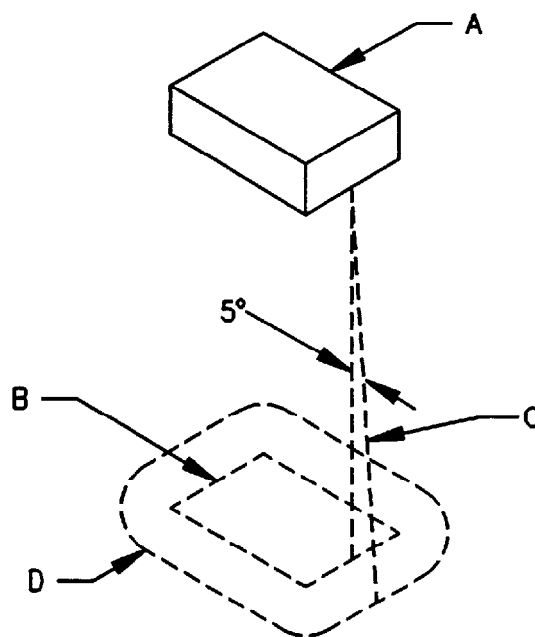
3) The motor is provided with a thermal motor protector – a protective device that is sensitive to temperature and current – that will prevent the temperature of the motor windings from exceeding 125°C (257°F) under the maximum load under which the motor will run without causing the protector to cycle and from exceeding 150°C (302°F) with the rotor of the motor locked; or

4) The motor complies with the requirements for impedance-protected motors in the Standard for Motor-Operated Appliances, UL 73, and the temperature of the motor winding will not exceed 150°C (302°F) during the first 72 hours of operation with the rotor of the motor locked.

b) Under wiring, unless it is neoprene- or thermoplastic-insulated.

9.7 The barrier mentioned in 9.6 shall be horizontal, shall be located as indicated in Figure 9.1, and shall not have an area less than that described in that illustration. Openings for drainage, ventilation, and the like may be employed in the barrier, provided such openings would not permit molten metal, burning insulation, or the like to fall on flammable material.

**Figure 9.1**  
**Location and extent of barrier**



SA0604-1

A – Region to be shielded by barrier. This will consist of the entire component if it is not otherwise shielded and will consist of the unshielded portion of a component that is partially shielded by the component enclosure or equivalent. B – Projection of outline of component on horizontal plane. C – Inclined line that traces out minimum area of barrier. The line is always (1) tangent to the component, (2) 5 degrees from the vertical, and (3) oriented so that the area traced out on a horizontal plane is maximum. D – Location (horizontal) and minimum area for barrier. The area is that included inside the line of intersection traced out by the inclined line C and the horizontal plane of the barrier.

9.8 A paint sprayer or compressor shall be constructed so that the accumulation of paint on any uninsulated live part is unlikely when tested as described in Section 50, Paint Entry Test.

*Exception No. 1: A paint sprayer having a separate compressor or pump, a hose at least 6 feet (1.83 m) long, and a maximum paint capacity of 6 fluid ounces (186 mL) need not be tested.*

*Exception No. 2: A tank-type compressor having a tank capacity greater than 1 gallon (3.78 L) need not be tested.*

*Exception No. 3: A compressor that:*

*a) Is provided with a hose at least 15 feet (9.57 m) long and is marked in accordance with 61.1.11; or*

*b) Either cannot be carried in one hand during use, or weighs 20 pounds (9.07 kg) or more and is marked in accordance with 61.1.10, need not be tested.*

9.9 In determining whether a paint sprayer or compressor is capable of being carried in one hand as mentioned in Exception No. 3 to 9.8, consideration shall be given to such factors as the weight of the compressor, the number and location of handles, and the like.

9.10 A door or a cover of an enclosure that provides access to any overload-protective device that requires resetting or renewal shall be hinged or otherwise attached in an equivalent manner.

9.11 Means shall be provided for holding the door or cover over a fuseholder in a closed position, and the door or cover shall be tight-fitting.

## 10 Mechanical Assembly

10.1 A product shall be assembled so that it will not be adversely affected by the vibration of operation. Brush caps shall be tightly threaded or otherwise constructed to prevent loosening.

10.2 A switch other than a through-cord switch, a lampholder, an attachment-plug receptacle, a motor-attachment plug, or similar component shall be mounted securely and shall be prevented from turning. See 10.4.

*Exception No. 1: A switch need not be prevented from turning if all four 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 operation of the switch;*

*b) The means for mounting the switch make it unlikely that operation of the switch will loosen it;*

*c) The spacings are not reduced below the minimum required values if the switch rotates; and*

*d) The operation of the switch is by mechanical means rather than by direct contact by persons.*

*Exception No. 2: A lampholder of the 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 or shifting in position, if such motion may result in a reduction of spacings below the minimum acceptable values.*

10.3 Uninsulated live parts shall be secured to the base or mounting surface so that they will be prevented from turning or shifting in position, if such motion may result in a reduction of spacings below the minimum required values.

10.4 The means for preventing the turning or shifting mentioned in 10.2 and 10.3 shall consist of more than friction between surfaces – for example, a properly applied lock washer, is acceptable as the means for preventing a small stem-mounted switch or other device, having a single-hole mounting means, from turning.

## 11 Protection Against Corrosion

11.1 Iron and steel parts shall be protected against corrosion by enameling, galvanizing, plating, or other equivalent means, if corrosion of such unprotected parts would be likely to result in a risk of fire, electric shock, or injury to persons.

*Exception No. 1: Surfaces of sheet-steel and cast-iron parts within an enclosure may not be required to be protected against corrosion if the oxidation of the metal due to the exposure to air and moisture is not likely to be appreciable. The thickness of metal and temperature are also to be considered.*

*Exception No. 2: Bearings, laminations, or minor parts of iron or steel, such as washers, screws, and the like.*

11.2 If deterioration of a liquid container provided as a part of a product would result in a risk of fire or electric shock, the container shall be of a material that is resistant to corrosion by the liquid intended to be used therein.

## 12 Accessibility of Uninsulated Live Parts and Film-Coated Wire

12.1 To reduce the likelihood of unintentional contact that may involve a risk of electric shock from an uninsulated live part or film-coated wire, an opening in an enclosure shall comply with either (a) or (b).

a) For an opening that has a minor or dimension (see 12.5) less than 1 inch (25.4 mm), such a part or wire shall not be contacted by the probe illustrated in Figure 12.1.

b) For an opening that has a minor dimension of 1 inch or more, such a part or wire shall be spaced from the opening as specified in Table 12.1.

*Exception: A motor other than one used in either a hand-held product or a hand-supported portion of a product need not comply with these requirements if it complies with the requirements in 12.2.*

**Figure 12.1**  
**Articulate probe with web stop**

