

Subject 325

March 9, 2007

SUMMARY OF TOPICS

The following changes in requirements are being proposed:

- 1. Revision of commercial door operator requirements.**
- 2. Deletion of the reference to asbestos as an acceptable means of insulation.**

STP BALLOTS DUE: April 9, 2007

COMMENTS DUE: April 30, 2007

For your convenience in review, proposed additions to existing requirements are shown underlined and proposed deletions are shown ~~lined out~~.

1. Revision of commercial door operator requirements.

RATIONALE

Proposal submitted by: Christopher Johnson, DASMA

The DASMA Operator & Electronics Division proposes the following changes to UL 325, 5th Edition, Sections 3, 18, 25, 30, 36, 56, and 59. The changes are proposed in order to enhance the level of safety in commercial door operators.

These proposed changes would require a commercial/industrial door operator manufacturer:

a) To employ one (1) of the following entrapment protection systems:

- 1) Constant pressure control, or
- 2) Input for monitored external entrapment device;

b) To provide a field installed warning placard or label.

Because the proposal adds entrapment protection requirements, additional instructions regarding the evaluation of safety systems has been included as part of the proposed changes to paragraph 25.

Some editorial changes are described throughout the proposal, but include:

- a) Removing references to "door" as a tested product, and revise the statement references to "operator (or system)" requirements as applicable (see changes to the definitions (paragraph 3) and paragraph 30.

- b) Updating the reference to "Vehicular Door Operator" to read "Commercial/Industrial Door Operator (or System)" to allow for access doors, etc. that secure buildings and storefronts yet may not provide vehicular access.

As a result of comments received during preliminary review of this proposal, the following changes have been made:

- a) The current definition for light duty (commercial/industrial) vehicular door or gate operator (or system) has been split into 3.11 and 3.11.1 to provide clarification between door operators and gate operators.
- b) An exception was added to item a of 30.2.2 to clarify that a door operator is not required to return the door to the full open position when an alternate entrapment protection system senses an obstruction or a control is actuated to stop the door during the upward travel.
- c) Paragraph 59.5.3 was deleted because it no longer applied if the external entrapment protection was a supervised system. Paragraphs 59.5.4 and 59.5.5 were renumbered accordingly.

PROPOSALS

1.5 These requirements do not address active fire alarm functionality, which is addressed in NFPA 80.

3.11 LIGHT DUTY (COMMERCIAL/INDUSTRIAL) VEHICULAR DOOR OR GATE OPERATOR (OR SYSTEM) – A commercial or industrial vehicular door or Class II, III, or IV vehicular gate operator (or system) intended and marked for limited or restricted duty.

3.11.1 LIGHT DUTY (COMMERCIAL/INDUSTRIAL) DOOR OPERATOR (OR SYSTEM) – A commercial/industrial door operator (or system) intended and marked for limited or restricted duty. Doors used to secure store fronts and intended for pedestrian use, but usually operated only at the start and end of the business day are included. Doors used solely for pedestrian access and egress which open and close for each pedestrian or group of pedestrians are not covered by this definition.

3.20 VEHICULAR COMMERCIAL/INDUSTRIAL DOOR OPERATOR (OR SYSTEM) – A door operator (or system) that is intended for vehicular traffic and/or securing at entrances or exits to commercial or industrial buildings areas. Some examples include multi-family housing units (three or more single-family units), hotels, such as garages, retail stores, or loading docks, or parking lots including, but not limited to, sliding, swing, bifold, accordion, sectional, and rolling door systems. Doors used to secure store fronts and intended for pedestrian use, but usually operated only at the start and end of the business day are included. Doors used solely for pedestrian access and egress which open and close for each pedestrian or group of pedestrians are not covered by this definition.

18.1 A switch shall be located or protected so that it will shall not be normally exposed to mechanical damage during normal use.

18.13 If a three-button switch or control is provided with a commercial/industrial door operator (or system), one button shall be a stop button.

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25.10 The conditions specified in ~~paragraph 25.11~~ and 25.12 shall be used during the following:

- a) Failure-mode and effect analysis (FMEA),
- b) Investigation of performance during the Environmental Stress Test, and
- c) Power Cycling Tests in accordance with the Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991.

Exception: If the fault in a component results in a shutdown or inoperative unit (any case in which the operator will not complete a full cycle, open and close, of travel) the component is considered non-critical.

25.12 In the evaluation of entrapment protection circuits used in commercial/industrial door operators, the critical condition flow chart shown in Figure 25.2 shall be used.

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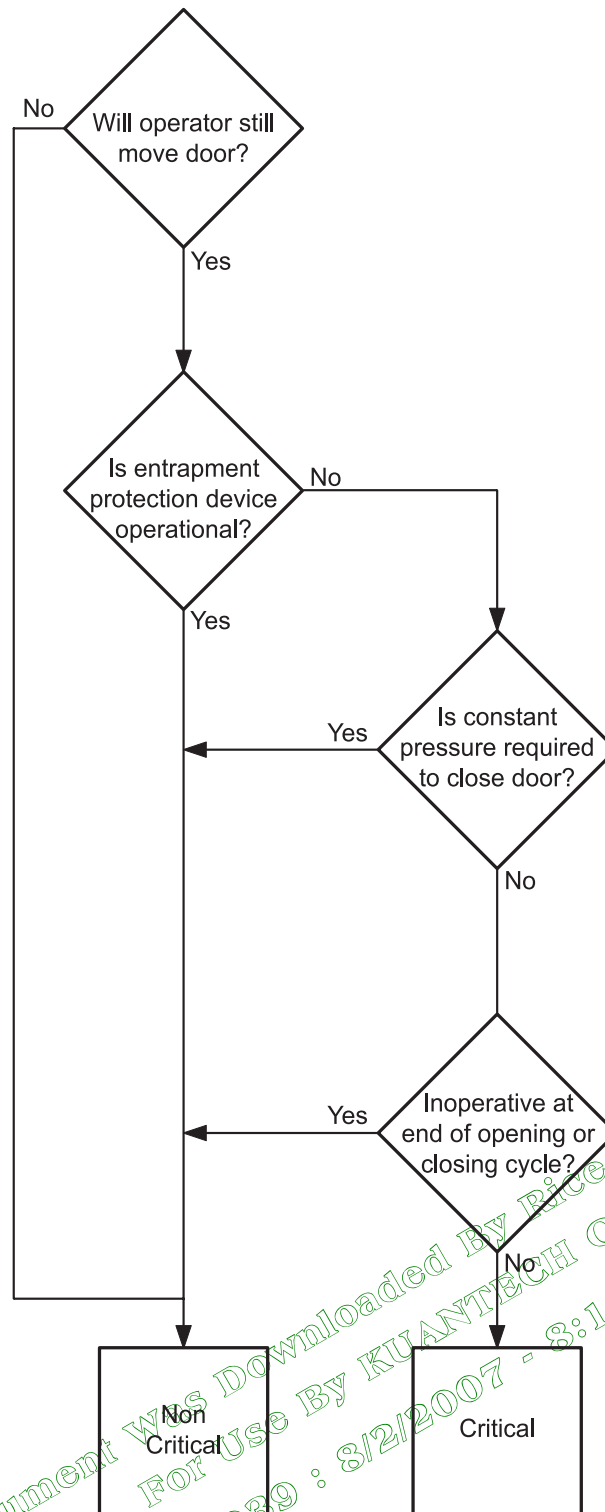
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Figure 25.2

Critical condition flow chart for commercial/industrial door operators entrapment protection devices and functions



S5459

30 Commercial/Industrial Doors and Door Operators and Commercial Vehicular Door Operators Systems

30.1 Entrapment

30.1.1 A ~~door or~~ commercial/industrial door operator shall ~~be provided~~ comply with one of the following:

a) ~~An actuating device that requires continuous pressure by the person operating the door for door closing movement and reversing means or release mechanism; or~~ Shall be constructed so that:

- 1) The operator requires constant pressure on a control to close the door, and
- 2) The operator stops or reverses direction of the door when constant pressure on a control is removed prior to the operator reaching its close limit, and
- 3) The operator limits a portable transmitter or automatic actuation device, when supplied, to function only to cause the operator to open the door; and
- 4) It is not possible to make simple modifications by adding, suppressing or changing the connection of wires in the internal control circuit(s) to allow any other method of operation that does not require constant pressure on a control to close the door without also complying with 30.1.1 (b).

or,

b) ~~Means for connection of a reversing edge switch, or the equivalent, that will reverse the direction of the door upon striking an object during the closing cycle; or~~ Shall be constructed to comply with one of the following:

- 1) Shall require the connection of an external entrapment protection device as described in 30.2; or
- 2) Shall be provided with any other external device that provides entrapment protection equivalent to 1.

c) ~~A three-button control station — up, down, stop; open, close, stop; raise, lower, stop; or the equivalent — provided that the operator:~~

- ~~1) Does not incorporate an automatic closing control — such as a photoelectric cell — a pull rope actuator, or the like, and the installation instructions do not recommend use of such a control.~~
- ~~2) Is provided with a permanent placard carrying a warning not to start the door downward unless the doorway is clear. See 59.3.12.~~
- ~~3) Is provided with installation instructions that stress the need to mount the placard adjacent to the 3-button control station and the need to locate both the control station and the placard within sight of the doorway.~~

- 4) Is permanently marked, adjacent to the wiring compartment, to indicate that the control station is to be located so that the door will be within sight of the person operating the control and that the door is to be controlled by the 3-button control station only.

30.2 External entrapment protection

30.2.1 An external entrapment protection device provided with, or as an accessory to, a commercial/industrial door operator (or system) shall consist of:

- a) A contact type sensor (edge sensor or equivalent) installed on the leading edge of the door that when activated causes an operator closing a door to reverse direction of the door and prevents an operator from closing an open door, or

Exception: During the process of closing a door in response to a fire condition, commercial/industrial door operators (systems) are not required to comply with this provision.

- b) A non-contact type sensor (photoelectric sensor or equivalent) that when activated causes an operator closing a door to reverse direction of the door and prevents an operator from closing an open door, or

Exception: During the process of closing a door in response to a fire condition, commercial/industrial door operators (systems) are not required to comply with this provision.

- c) Any other device that provides entrapment protection equivalent to items (a) or (b).

30.2.2 For a commercial/industrial door operator to comply with 30.2.1, it shall monitor for the presence and correct operation of the device including the wiring to it, at least once during each close cycle. Should the device not be present, or a fault condition occur that precludes the sensing of an obstruction, including an open or short circuit in the wiring that connects the external entrapment device to the operator and the device's supply source, the operator shall function in one of the following conditions:

- a) A closing door shall open to the full open position or the user-defined normal open position and an open door shall not close for a period of more than 1 second from the initiation of the run, or

Exception: The door operator is not required to return the door to the full open position when an alternate entrapment protection system senses an obstruction or a control is actuated to stop the door during the upward travel.

- b) Shall function as described in 30.1.1 (a).

30.2.3 An external entrapment protection device as mentioned in 30.2.1 shall comply with the applicable requirements specified in Sections 34 through 36 of this standard.

36.1 Normal operation test

36.1.1 When installed on a representative residential door edge, an edge sensor shall actuate upon the application of a 15 lbf (66.7 N) or less force in the direction of the application. For an edge sensor intended to be used on a sectional door, the force is to be applied by the longitudinal edge of a 1-7/8 in (47.6 mm) diameter cylinder placed across the sensor so that the axis is perpendicular to plane of the door. For an edge sensor intended to be used on a one piece door, the force is to be applied so that the axis is at an angle 30 degrees from the direction perpendicular to the plane of the door. See Figure 36.1.

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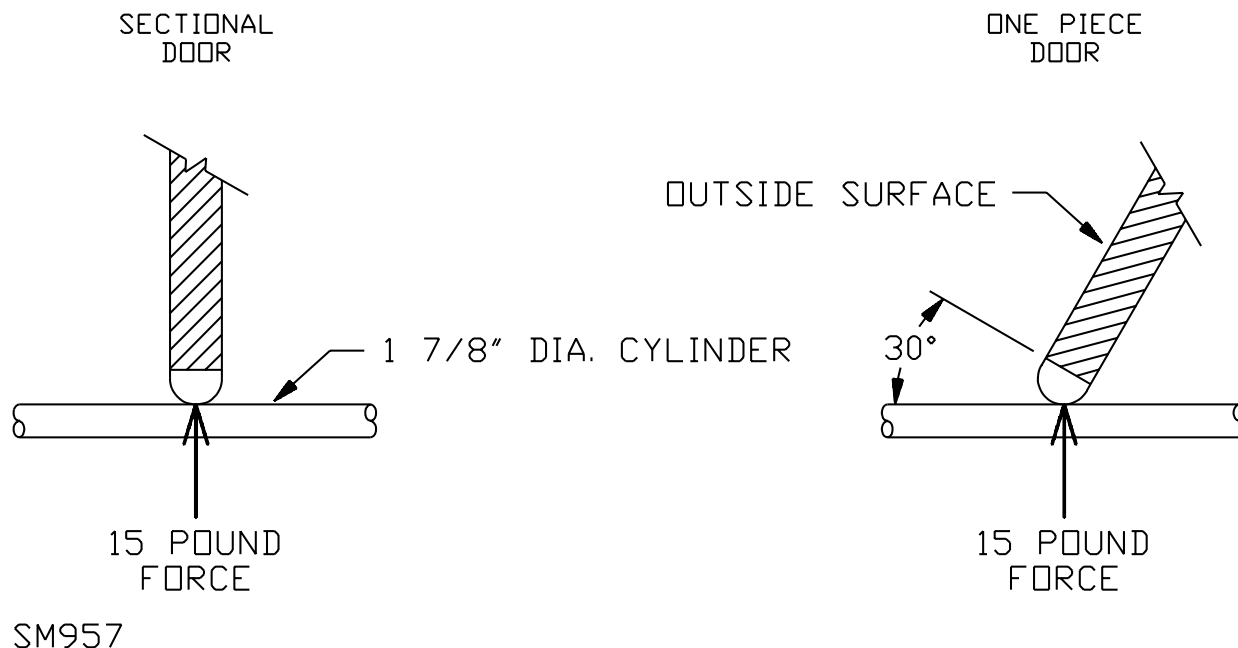
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36.1.1.1 When installed on a representative commercial door edge, an edge sensor shall actuate upon the application of a 15 lbf (66.7 N) or less force in the direction of the application. For an edge sensor intended to be used on a commercial door, the force is to be applied by the longitudinal edge of a 1-7/8 in (47.6 mm) diameter cylinder placed across the sensor so that the axis is perpendicular to plane of the door at a distance of 6 in (152.4 mm) from the fully closed position. See Figure 36.1.

(CURRENT)

Figure 36.1

Edge sensor normal operation test



SM957

(PROPOSED)

Figure 36.1

Edge sensor normal operation test

(To view figure, select Topic 1 in the CSDS work area home and then "Documentation" under the Action menu on the left-hand side.)

36.1.2 With respect to the test of 36.1.1 and 36.1.1.1, the test is to be repeated at various representative points of the edge sensor across the width of the door.

43.4 Light duty (~~commercial/industrial~~) vehicular doors and door operators

56.6 ~~Commercial/industrial and commercial vehicular doors and door operators (or systems)~~

56.6.1 An ~~door operator~~ shall be provided with an adjustable control mechanism and specific instructions describing that any necessary adjustment of the control mechanism that allows required for satisfactory operation of the ~~door operator~~. The instructions shall also indicate the need for periodic checking of the any control mechanism.

56.6.1.1 The installation instructions for commercial/industrial door operators shall include information on the types and sizes of doors for which the operator is intended including the type of entrapment protection suitable for each size and type of door for which the operator is intended.

56.6.2 An ~~door operator that is to be sold without the door~~ shall be provided with instructions in the instruction manual specifying the methods of installation, adjustment, and wiring of external controls or devices serving as required to maintain operation in accordance with 30.1.1: protection against entrapment. The following instructions or the equivalent shall also be supplied where applicable:

- a) Install the operator only when all openings of a horizontal slide door are guarded or screened from the bottom of the door to a minimum of 4 ft (1.22 m) above the ground to prevent a 2-1/4 in (57.2 mm) diameter sphere from passing through the openings anywhere in the door.
- b) All warning signs and placards must be installed where visible in the area of the door.
- c) For operators utilizing a non-contact sensor in accordance with 30.2.1:
 - 1) Instructions on the placement of non-contact sensors for each type of application shall be provided.
- d) For operators utilizing a contact sensor in accordance with 30.2.1:
 - 1) One or more contact sensors shall be located where the risk of entrapment or obstruction exists, such as at the leading edge or trailing edge of a horizontal slide door.
 - 2) One or more contact sensors shall be located at the bottom edge of a vertically moving door.

56.6.2.1 Installation instructions shall indicate that controls shall be far enough from the door, or positioned such that the user is prevented from coming in contact with the door while operating the controls.

56.6.3 ~~Clear instructions for the installation of a reversing edge switch shall be provided with the operator.~~

56.6.4 The instruction manual for a commercial/industrial door operator shall include the important instructions specified in 56.6.7 – 56.6.9. All required text shall be legible and contrast with the background. Uppercase letters of required text shall be no less than 5/64 in (2.0 mm) high and lowercase letters shall be no less than 1/16 in (1.6 mm) high. Headings such as "IMPORTANT INSTALLATION INSTRUCTIONS", "IMPORTANT SAFETY INSTRUCTIONS", "SAVE THESE INSTRUCTIONS," etc. and the words "WARNING – To reduce the risk of severe injury or death to persons:" shall be in letters no less than 3/16 in (4.8 mm) high.

56.6.5 The instructions listed in 56.6.7 and 56.6.9 shall be in the exact words specified or shall be in equally definitive terminology to those specified. The items may be numbered. The first and last items specified in 56.6.9 shall be first and last respectively. Other important and precautionary items considered appropriate by the manufacturer may be inserted.

56.6.6 The instructions listed in 56.6.7 shall be located immediately prior to the installation instructions. The instructions listed in 56.6.9 shall be located immediately prior to the user operation and maintenance instructions. In each case, the instructions shall be separate in format from other detailed instructions related to installation, operation and maintenance of the appliance. All instructions, except installation instructions, shall be a permanent part of the manual(s).

56.6.7 The Installation Instructions shall include the following instructions or their equivalent:

IMPORTANT INSTALLATION INSTRUCTIONS

WARNING – To reduce the risk of severe injury or death:

1) READ AND FOLLOW ALL INSTALLATION INSTRUCTIONS.

2) Install only on a properly operating and balanced door. A door that is operating improperly could cause severe injury. Have qualified service personnel make repairs to cables, spring assemblies, and other hardware before installing the operator.

3) Remove all pull ropes and remove, or make inoperative, all locks (unless mechanically and/or electrically interlocked to the power unit) that are connected to the door before installing the operator.

4) Install the door operator at least 8 feet or more above the floor if the operator has exposed moving parts.

5) Do not connect the door operator to the source of power until instructed to do so.

6) Locate the control station: (a) within sight of the door, (b) at a minimum height of 5 feet so small children cannot reach it, and (c) away from all moving parts of the door.

7) For products having a manual release, install the Entrapment Warning Placard next to the control station in a prominent location. Instruct the end user on the operation of the manual release.

56.6.8 The User Instructions shall include the following instructions or their equivalent, as applicable:

IMPORTANT SAFETY INSTRUCTIONS

WARNING – To reduce the risk of severe injury or death:

1) READ AND FOLLOW ALL INSTRUCTIONS

2) Never let children operate or play with door controls. Keep the remote control (where provided) away from children.

3) Personnel should keep away from a door in motion and keep the moving door in sight until it is completely closed or opened. NO ONE SHOULD CROSS THE PATH OF A MOVING DOOR.

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4) Test the door's safety features at least once a month. After adjusting either the force or the limit of travel, retest the door operator's safety features. Failure to adjust the operator properly may cause severe injury or death.

5) For products having a manual release, if possible, use the manual release only when the door is closed. Use caution when using this release when the door is open. Weak or broken springs may cause the door to fall rapidly, causing severe injury or death.

6) KEEP DOORS PROPERLY OPERATING AND BALANCED. See Door Manufacturer's Owner's Manual. An improperly operating or balanced door could cause severe injury or death. Have trained door systems technician make repairs to cables, spring assemblies, and other hardware.

7) SAVE THESE INSTRUCTIONS.

56.7 Light duty (commercial/industrial) vehicular doors and door operators

56.7.1 In addition to complying with the requirements in 56.6.1 – 56.6.3, a light-duty commercial vehicular door operator shall be provided with instructions at the beginning of the instruction manual, specifying that the unit is intended for light duty (limited duty, restricted duty, and the like, but not intermittent duty). If the motor protector opens during the Temperature Test, Section 43, the instructions shall include a statement that the rate of operation shall not exceed ____ cycles of opening and closing per hour. The value inserted in the blank space shall not exceed 50 percent of the number of complete opening and closing cycles noted during the test. See 43.4.1.

58.2 Commercial/Industrial door operator (or system)

58.2.1 A door or door operator as described in 30.1.1 shall be provided with a placard as shown in Figure 58.1. The word "WARNING" shall be marked in letters at least 1/4 in (6.4 mm) high. The placard shall be made of substantially rigid material such as vulcanized fiber, or the equivalent, to provide mechanical strength, and provided with at least two holes for wall mounting.

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Figure 58.1

Field installed placard for commercial/industrial door operator (or system)



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59.3.7 An industrial door operator shall be marked to indicate that the operator is to be mounted more than 8 ft (2.44 m) above the floor if it has exposed moving parts capable of causing injury to persons or employs a motor deemed indirectly accessible by 9.6 by virtue of its location above the floor.

59.3.8 A commercial or industrial door or window operator shall be marked to indicate the maximum power in foot-pounds per second or the maximum pull in pounds that it is intended to develop.

59.3.11 An industrial or commercial vehicular door or door operator provided with means for the connection of a reversing edge switch, or the equivalent, shall be marked in letters at least 1/2-in (12.7-mm) high where plainly visible from the floor when the operator is installed, calling attention to the need for the reversing edge switch. The marking shall include the word "CAUTION" and the following statement or the equivalent: "Connect reversing edge switch — see installation instructions."

59.3.12 A door or door operator as described in 30.1.1(c) shall be provided with a placard that is marked in letters at least 1/4-in (6.4-mm) high with the word "WARNING" and the following statement or the equivalent: "To Prevent Entrapment — Do not start door downward unless doorway is clear." The placard shall be made of substantially rigid material such as vulcanized fiber, or the equivalent, to provide mechanical strength, and provided with at least two holes for wall mounting.

59.3.13 If the motor protector opens during the Temperature Test, Section 43, on a light-duty, commercial vehicular door or door operator, the appliance shall be permanently marked with the following or equivalent: "To prevent the motor protector from tripping — Do not exceed ____ door operations per hour," "For light duty only," and "Not for residential use." The number of door operations inserted in the blank shall not exceed 50 percent of the completed opening and closing operations noted during the test. See 43.4.1.

59.3.14 If the motor protector opens during the Temperature Test, Section 43, on a light-duty, commercial vehicular door or door operator, the appliance shall be provided with a separate label or tag for permanent installation adjacent to the door. The label shall be legibly marked with the following or the equivalent: "This door is operated by a light duty operator. To prevent the motor protector from tripping — Do not exceed ____ operations per hour." The number of operations inserted in the blank shall not exceed 50 percent of the completed opening and closing operations noted during the test. See 43.4.1.

59.5 Commercial/Industrial door operators (or systems)

59.5.1 A commercial/industrial door operator shall be marked to indicate that the operator is to be mounted more than 8 ft (2.44 m) above the floor if it has exposed moving parts capable of causing injury to person or employs a motor deemed indirectly accessible by 9.6 by virtue of its location above the floor.

59.5.2 A commercial/industrial door operator shall be marked to indicate the maximum power in foot-pounds per second or the maximum pull in pounds that it is intended to develop.

59.5.3 If the motor protector opens during the Temperature Test, Section 43, on a light-duty, commercial operator, the appliance shall be permanently marked with the following or equivalent. "To prevent the motor protector from tripping — Do not exceed ____ door operations per hour," "For light duty only," and "Not for residential use." The number of door operations inserted in the blank shall not exceed 50 percent of the completed opening and closing operations noted during the test. See 43.4.1.

59.5.4 If the motor protector opens during the Temperature Test, Section 43, on a light-duty, commercial operator, the appliance shall be provided with a separate label or tag for permanent installation adjacent to the door. The label shall be legibly marked with the following or equivalent: "This door is operated by a light duty operator. To prevent the motor protector from tripping – Do not exceed ____ operations per hour." The number of operations inserted in the blank shall not exceed 50 percent of the completed opening and closing operations noted during the test. See 43.4.1.

2. Deletion of the reference to asbestos as an acceptable means of insulation.

RATIONALE

Proposal submitted by: Joel Hawk, UL

UL 325 currently contemplates the use of asbestos insulation in Paragraph 43.1.2. However, the use of asbestos is now restricted in the United States. Accordingly, UL is proposing to delete all references to asbestos in UL 325.

PROPOSAL

43.1.2 Ordinarily, coil or winding temperatures are to be measured by thermocouples unless the coil is inaccessible for mounting these devices – for example, a coil immersed in sealing compound – or unless the coil wrap includes thermal insulation, such as ~~asbestos~~ or more than two layers – 1/32 in (0.8 mm) maximum – of cotton paper, rayon, or the like. For a thermocouple-measured temperature of a coil of an alternating-current motor, other than a universal motor, having a diameter of 7 in (178 mm) or less – items 8 and 16 in Table 43.1 – the thermocouple is to be mounted on the integrally applied insulation on the conductor.

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UL 325

ISBN 0-7629-0762-2

Door, Drapery, Gate, Louver, and Window Operators and Systems

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SUMMARY OF TOPICS

The following topics are being recirculated:

1. Revision of commercial door operator requirements.

COMMENTS DUE: June 11, 2007

For your convenience in review, proposed additions to the previously proposed requirements are shown underlined and proposed deletions are shown ~~lined-out~~.

1. Revision of commercial door operator requirements.

RATIONALE

Responses to comments have been posted within the UL 325 Proposal Review Work Area dated March 9, 2007.

PROPOSAL

56.6.7 The Installation Instructions shall include the following instructions or their equivalent:

IMPORTANT INSTALLATION INSTRUCTIONS

WARNING – To reduce the risk of severe injury or death:

- 1) READ AND FOLLOW ALL INSTALLATION INSTRUCTIONS.
- 2) Install only on a properly operating and balanced door. A door that is operating improperly could cause severe injury. Have qualified service personnel make repairs to cables, spring assemblies, and other hardware before installing the operator.
- 3) Remove all pull ropes and remove, or make inoperative, all locks (unless mechanically and/or electrically interlocked to the power unit) that are connected to the door before installing the operator.
- 4) Install the door operator at least 8 feet or more above the floor if the operator has exposed moving parts.
- 5) Do not connect the door operator to the source of power until instructed to do so.
- 6) Locate the control station: (a) within sight of the door, (b) at a minimum height of 5 feet so small children cannot reach it, and (c) away from all moving parts of the door.
- 7) Install the Entrapment Warning Placard next to the control station in a prominent location.

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78) For products having a manual release, install the Entrapment Warning Placard next to the control station in a prominent location. Instruct the end user on the operation of the manual release.

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UL Standard for Safety for Door, Drapery, Gate, Louver, and Window Operators and Systems, UL 325
Fifth Edition, Dated June 7, 2002

Revisions: This Standard contains revisions through and including February 21, 2006.

Summary of Topics

The revisions dated February 21, 2006 were issued to incorporate the following new and revised requirements:

- Revisions to address the risk of injury to persons crawling under a stopped, partially open garage door.
- Clarifications regarding the use of a separate entrance for pedestrians with respect to a vehicular gate.
- Clarification of the location of controls with respect to a vehicular gate.
- Correction of the title of the Standard for Safety for Thermal-Links – Requirements and Application Guide, UL 60691 in Appendix A.

Text that has been changed in any manner 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 following table lists the future effective dates with the corresponding item.

Future Effective Date	References
February 21, 2008	32.2.1, 32.2.2, 32.2.6, 32.2.7, 34.1.1, 34.1.6, Section 46.3, and 56.8.4

The new and revised requirements are substantially in accordance with UL's Proposal(s) on this subject dated June 16, 2003, December 4, 2003, May 17, 2004, March 25, 2005, and November 11, 2005.

The revisions dated February 21, 2006 include a reprinted title page (page1) for this Standard.

As indicated on the title page (page 1), this UL Standard for Safety is an American National Standard. Attention is directed to the note on the title page of this Standard outlining the procedures to be followed to retain the approved text of this ANSI/UL Standard.

As indicated on the title page (page1), this UL Standard for Safety has been adopted by the Department of Defense.

The UL Foreword is no longer located within the UL Standard. For information concerning the use and application of the requirements contained in this Standard, the current version of the UL Foreword is located on ULStandardsInfoNet at: <http://ulstandardsinfonet.ul.com/ulforeword.html>

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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.

A change in an effective date is indicated by a note following the affected item, and giving both the previous effective date and the new date the requirement becomes effective.

New product submittals made prior to a specified future effective date will be judged under all of the requirements in this Standard including those requirements with a specified future effective date, unless the applicant specifically requests that the product be judged under the current requirements. However, if the applicant elects this option, it should be noted that compliance with all the requirements in this Standard will be required as a condition of continued Listing, Recognition, and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

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ANSI/UL 325-2006

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UL 325

Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems

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APPENDIX A

Standards for Components..... A1

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INTRODUCTION

1 Scope

1.1 These requirements cover electric operators for doors, draperies, gates, louvers, windows and other opening and closing appliances rated 600 V or less to be employed in ordinary locations in accordance with the National Electrical Code, NFPA 70.

1.2 These requirements also cover complete doors, gates, and other such assemblies that include electric opening and closing appliances.

1.3 These requirements also cover accessories, such as external entrapment protection devices, for use with appliances covered by this standard.

1.4 Doors and door operators intended for exit use as defined in the Life Safety Code, NFPA 101 and codes such as the BOCA National Building Code, the Standard Building Code, and the Uniform Building Code, are additionally subject to design requirements specific to such use.

2 Terminology

2.1 In the following text, a requirement that only applies to a specific type or types of equipment is identified by a specific reference in the requirement to the type or types of equipment covered by the requirement. In the absence of a specific reference, or if the term "appliance" or "operator" is used, it is understood that the requirement applies to all types of equipment within the scope of this Standard.

3 Glossary

3.1 CLASS 2 CIRCUIT – An isolated secondary circuit involving a potential of not more than 30 V (42.4 V peak) supplied by:

- a) An inherently-limited Class 2 transformer;
- b) A combination of an isolated transformer secondary winding and a fixed impedance or regulating network that together comply with the performance requirements for an inherently-limited Class 2 transformer;
- c) A dry-cell battery having output characteristics not greater than those of an inherently-limited Class 2 transformer;
- d) Any combination of (a), (b), and (c) above that together comply with the performance requirements for an inherently-limited Class 2 transformer; or
- e) One or more combinations of a Class 2 transformer and an overcurrent protective device that together comply with the performance requirements for a noninherently-limited Class 2 transformer.

A line-connected circuit connected in series with an impedance as a means of limiting the voltage and current is not a Class 2 circuit.

3.2 COMBINATION RIGID ONE-PIECE OVERHEAD GARAGE DOOR OPERATOR SYSTEM – A door and operator combination where the door is constructed in one rigid piece.

3.2.1 COMBINATION SECTIONAL OVERHEAD GARAGE DOOR OPERATOR SYSTEM – A door and operator combination where the door is an integral part of the operator, the operator does not exert a driving force on the door in the closing direction, and provides for inherent secondary entrapment protection for compliance with the requirements of this Standard.

3.2.1 added March 14, 2003

3.3 COMMERCIAL/GENERAL ACCESS VEHICULAR GATE OPERATOR – CLASS II – A vehicular gate operator (or system) intended for use in a commercial location or building such as a multi-family housing unit (five or more single family units), hotel, garages, retail store, or other building servicing the general public.

3.4 DOOR – A moving barrier such as a swinging, sliding, raising, lowering, rolling, or the like, barrier, that closes an opening for entrance and/or egress by persons or vehicles into or out of a building.

3.5 DRAPERY (or BLINDS, SHADES AND THE LIKE) OPERATOR (OR SYSTEM) – An operator (or system) for opening or closing of window drapery, blinds, shade, or other window coverings, other than louver or shutter operators and systems.

3.6 ENTRAPMENT – The condition when an object is caught or held in a position that increases the risk of injury.

3.7 EXTERNAL ENTRAPMENT PROTECTION DEVICE – A device, examples being an edge sensor, a photoelectric sensor, or similar entrapment protection device, which provides protection against entrapment when activated and is not incorporated as a permanent part of an operator.

3.8 GATE – A moving barrier such as a swinging, sliding, raising, lowering, rolling, or the like, barrier, that is a stand-alone passage barrier or is that portion of a wall or fence system that controls entrance and/or egress by persons or vehicles and completes the perimeter of a defined area.

3.9 INDUSTRIAL/LIMITED ACCESS VEHICULAR GATE OPERATOR – CLASS III – A vehicular gate operator (or system) intended for use in an industrial location or building such as a factory or loading dock area or other locations not intended to service the general public.

3.10 INHERENT ENTRAPMENT PROTECTION SYSTEM – A system, examples being a motor current or speed sensing system, which provides protection against entrapment upon sensing an object and is incorporated as a permanent and integral part of an operator.

3.11 LIGHT DUTY (COMMERCIAL/INDUSTRIAL) VEHICULAR DOOR OR GATE OPERATOR (OR SYSTEM) – A commercial or industrial vehicular door or Class II, III, or IV vehicular gate operator (or system) intended and marked for limited or restricted duty.

3.12 LOUVER OPERATOR (OR SYSTEM) – An operator (or system) intended to open and close louvers or shutters used for ventilation or as window coverings.

3.13 PEDESTRIAN DOOR OR GATE OPERATOR (OR SYSTEM) – A swinging, sliding, bi-parting, folding, or rotating door or gate operator (or system) that is used at pedestrian entrances or exits to buildings or other pedestrian traffic ways. They are not used for vehicular traffic.

3.14 RESIDENTIAL GARAGE-DOOR OPERATOR – A vehicular door operator serving a residential building of one to four single family units.

3.15 RESIDENTIAL VEHICULAR GATE OPERATOR – CLASS I – A vehicular gate operator (or system) intended for use in a home of one-to four single family dwelling, or a garage or parking area associated therewith.

3.16 RESTRICTED ACCESS VEHICULAR GATE OPERATOR – CLASS IV – A vehicular gate operator (or system) intended for use in a guarded industrial location or building such as an airport security area or other restricted access locations not servicing the general public, in which unauthorized access is prevented via supervision by security personnel.

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3.17 SYSTEM – In the context of these requirements, a system refers to a group of interacting devices intended to perform a common function.

3.18 TWO SEQUENTIAL ACTIVATIONS – Two activations of an entrapment protection device that are not interrupted by an open or close limit device.

3.19 VEHICULAR BARRIER (ARM) OPERATOR (OR SYSTEM) – An operator (or system) that controls a cantilever type device (or system), consisting of a mechanical arm or barrier that moves in a vertical arc, intended for vehicular traffic flow at entrances or exits to areas such as parking garages, lots or toll areas.

3.20 VEHICULAR DOOR OPERATOR (OR SYSTEM) – A door operator (or system) that is intended for vehicular traffic at entrances or exits to commercial or industrial buildings areas such as garages, loading docks, or parking lots.

3.21 VEHICULAR HORIZONTAL SLIDE-GATE OPERATOR (OR SYSTEM) – A vehicular gate operator (or system) that controls a gate which slides in a horizontal direction that is intended for use for vehicular entrance or exit to a drive, parking lot, or the like.

3.22 VEHICULAR SWING-GATE OPERATOR (OR SYSTEM) – A vehicular gate operator (or system) that controls a gate which swings in an arc in a horizontal plane that is intended for use for vehicular entrance or exit to a drive, parking lot, or the like.

3.23 VEHICULAR VERTICAL LIFT-GATE OPERATOR (OR SYSTEM) – A vehicular gate operator (or system) that controls a gate which moves in the vertical direction and is intended for use at a vehicular entrance or exit to a drive, parking lot, or similar location.

3.24 VEHICULAR VERTICAL PIVOT-GATE OPERATOR (OR SYSTEM) – A vehicular gate operator (or system) that controls a gate that moves in an arc in a vertical plane that is intended for use for vehicular entrances or exits to a drive, parking lot, or the like.

3.25 WINDOW OPERATOR (OR SYSTEM) – An operator (or system) for opening casement, sliding, or other types of windows including skylights.

3.26 WIRED CONTROL – A control implemented in a form of fixed physical interconnections between the control, the associated devices, and an operator to perform predetermined functions in response to input signals.

3.27 WIRELESS CONTROL – A control implemented in means other than fixed physical interconnections (such as radio waves or infrared beams) between the control, the associated devices, and an operator to perform predetermined functions in response to input signals.

4 Components

4.1 Except as indicated in 4.2, 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.

4.2 A component is not required to comply with a specific requirement that:

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

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

4.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

5 Units of Measurement

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

6 References

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

CONSTRUCTION

7 General

7.1 An appliance shall employ materials that are acceptable for the use and shall be made and finished with the degree of uniformity and grade of workmanship practicable in a well-equipped factory.

7.2 An appliance 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 increasing its 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 serious defects.

8 Frame and Enclosure

8.1 For an unreinforced flat surface, cast metal shall not be less than 1/8-in (3.2-mm) thick, except that malleable iron may be not less than 3/32-in (2.4-mm) thick, and die-cast metal may be not less than 5/64-in (2.0-mm) thick. Corresponding thicknesses of not less than 3/32, 1/16, and 3/64 in (2.4, 1.6, and 1.2 mm), respectively, may be acceptable if the surface under consideration is curved, ribbed, or otherwise reinforced, or of a shape or size that provides mechanical strength equivalent to that required.

8.2 An enclosure of sheet metal shall be evaluated with respect to size, shape, thickness of metal, and acceptability for the application considering the intended use of the complete appliance. The use of sheet steel having a thickness of less than 0.026 in (0.66 mm) if uncoated or 0.029 in (0.74 mm) if galvanized or of nonferrous sheet metal having a thickness of less than 0.036 in (0.91 mm) is not acceptable.

Exception: Minimum thickness is not specified for an area that is relatively small or a surface that is curved or otherwise reinforced.

8.2 revised March 14, 2003

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

8.4 The effects of the following factors shall be determined for compliance of a nonmetallic enclosure or an enclosure of magnesium with 7.2:

- 1) Mechanical strength,
- 2) Resistance to impact,
- 3) Moisture-absorption properties,
- 4) Combustibility, and
- 5) Resistance to distortion at temperatures to which the material is subjected under conditions of normal or abnormal use.

8.5 The enclosure of an appliance shall prevent molten metal, burning insulation, flaming particles, or the like from falling on combustible materials, including the surface upon which the appliance is supported.

8.6 The requirement in 8.5 will necessitate the use of a barrier of noncombustible material:

a) Under a motor unless:

- 1) The structural parts of the motor or of the appliance 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 appliance when the motor is energized under each of the following fault conditions:
 - i) Open main winding,
 - ii) Open auxiliary winding,

iii) Starting switch short-circuited, and

iv) Capacitor of a permanent-split capacitor motor short-circuited – 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 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 is provided with impedance protection that complies with the requirements in the Standard for Overheating Protection for Motors, UL 2111, and the temperature of the motor winding will not exceed 150°C (302°F) during the first 72 h of operation with the rotor of the motor locked.

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

8.6 revised March 14, 2003

8.7 The requirements in 8.5 will also 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 breakdown or malfunction of the component would not result in a risk of fire, or there are no openings in the bottom of the appliance enclosure.

8.8 The barrier mentioned in 8.6 shall be horizontal, shall be located as illustrated in Figure 8.1, and shall have an area in accordance with that illustration. Openings for drainage, ventilation, and the like may be employed in the barrier if such openings would not permit molten metal, burning insulation, or the like to fall on combustible material.

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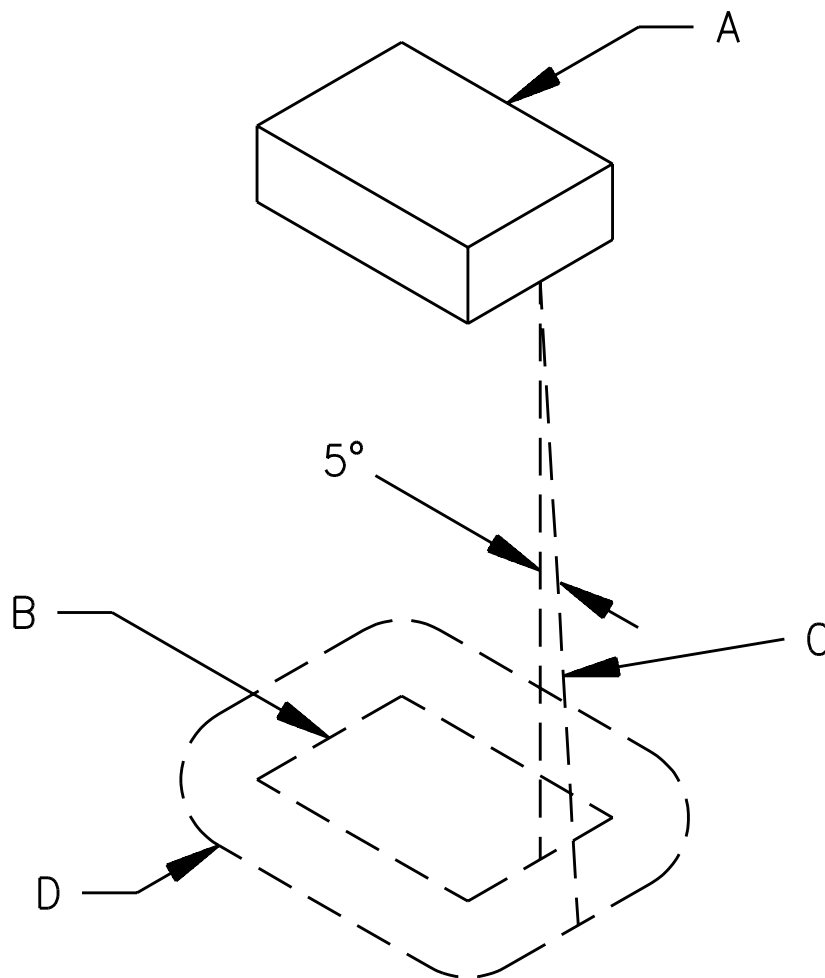
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Figure 8.1
Location and extent of barrier



EB120A

A – Region to be shielded by barrier. This will consist of the entire component if it is not otherwise shielded and will consist of the unshielded 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:

- a) tangent to the component,
- b) 5 degrees from the vertical, and
- c) 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.

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9 Accessibility of Uninsulated Live Parts and Film-Coated Wire

9.1 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). See 14.4.2.

- a) For an opening that has a minor dimension (see 9.5) less than 1 in (25.4 mm), such a part or wire shall not be contacted by the probe illustrated in Figure 9.1.
- b) For an opening that has a minor dimension of 1 in or more, such a part or wire shall be spaced from the opening as specified in Table 9.1.

Exception: A motor need not comply with these requirements if the integral enclosure of the motor complies with the requirements in 9.2.

9.2 With respect to an integral enclosure of a motor as mentioned in the exception to 9.1:

- a) An opening that has a minor dimension (see 9.5) less than 3/4 in (19.1 mm) is acceptable if:
 - 1) Film-coated wire cannot be contacted by the probe illustrated in Figure 9.3;
 - 2) In a directly accessible motor (see 9.6), an uninsulated live part cannot be contacted by the probe illustrated in Figure 9.4; and
 - 3) In an indirectly accessible motor (see 9.6), an uninsulated live part cannot be contacted by the probe illustrated in Figure 9.2.
- b) An opening that has a minor dimension of 3/4 in or more is acceptable if a part or wire is spaced from the opening as specified in Table 9.1.

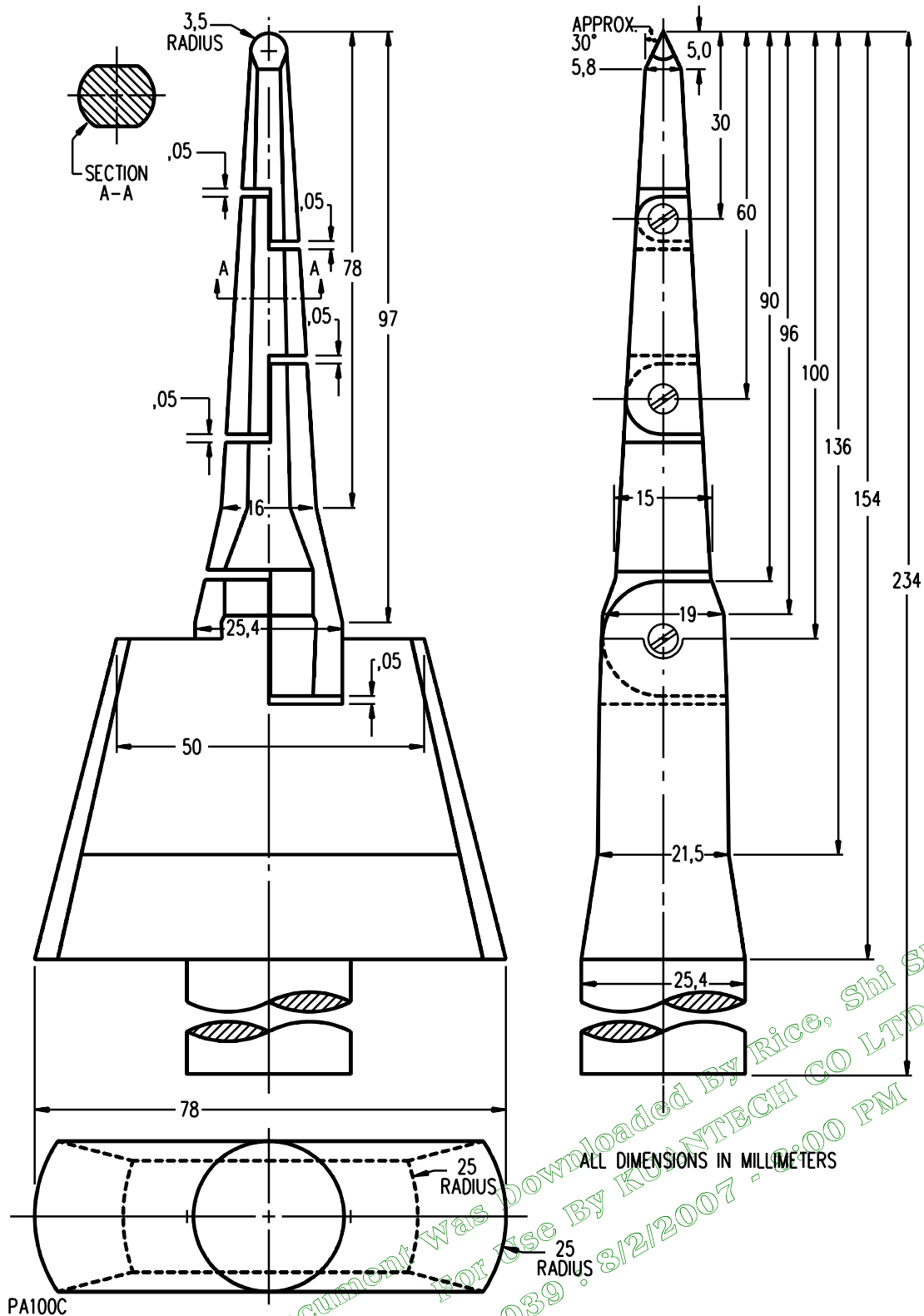
9.3 The probes mentioned in 9.1 and 9.2 and illustrated in Figures 9.1, 9.2, 9.3, and 9.4 shall be applied to any depth that the opening will permit; and shall be rotated or angled before, during, and after insertion through the opening to any position that is necessary to examine the enclosure. The probes illustrated in Figures 9.1 and 9.4 shall be applied in any possible configuration; and, if necessary, the configuration shall be changed after insertion through the opening.

9.4 The probes mentioned in 9.1 and 9.2 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.

9.5 With reference to the requirements in 9.1 and 9.2, 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.

9.6 With reference to the requirements in 9.2, an indirectly accessible motor is a motor that is accessible by the probe illustrated in Figure 9.1 only by opening or removing a part of the outer enclosure, such as a guard or panel, that can be opened or removed with or without using a tool under the conditions noted in 9.7 (a) and (b), or will be located higher than 8 ft (2.44 m) above the floor when the operator is installed as intended and is marked in accordance with 59.3.7. A directly accessible motor is a motor that can be contacted by the probe illustrated in Figure 9.1 without opening or removing any part and will be located 8 ft (2.44 m) or less above the floor when the operator is installed as intended.

Figure 9.1
Articulate probe with web stop



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9.7 During the examination of a product to determine whether it complies with the requirements in 9.1 or 9.2, a part of the enclosure that may be opened or removed by the user (to attach an accessory, to make an operating adjustment, relamping, or for other reasons) is to be opened or removed if:

- a) The enclosure can be removed without tools, or
- b) The enclosure can only be removed using a tool, but it is necessary that the appliance be connected to the source of supply or instructions specify it be connected to the supply during user servicing operations.

9.8 With reference to the requirements in 9.1 and 9.2, insulated brush caps are not required to be additionally enclosed.

Table 9.1
Minimum acceptable distance from an opening to a part that may involve a risk of electric shock

Minor dimension ^a of opening,		Minimum distance from opening to part,	
In ^b	(mm)	In ^b	(mm)
3/4 ^c	(19.1)	4-1/2	(114)
1 ^c	(25.4)	6-1/2	(165)
1-1/4	(31.8)	7-1/2	(190)
1-1/2	(38.1)	12-1/2	(318)
1-7/8	(47.6)	15-1/2	(394)
2-1/8	(54.0)	17-1/2	(444)
d		30	(762)

^a See 9.5.
^b Between 3/4 in and 2-1/8 in, interpolation is to be used to determine a value between values specified in the table.
^c Any dimension less than 1 in applied to a motor only.
^d More than 2-1/8 in, but not more than 6 in (152 mm).

Figure 9.2
Probe for uninsulated live parts

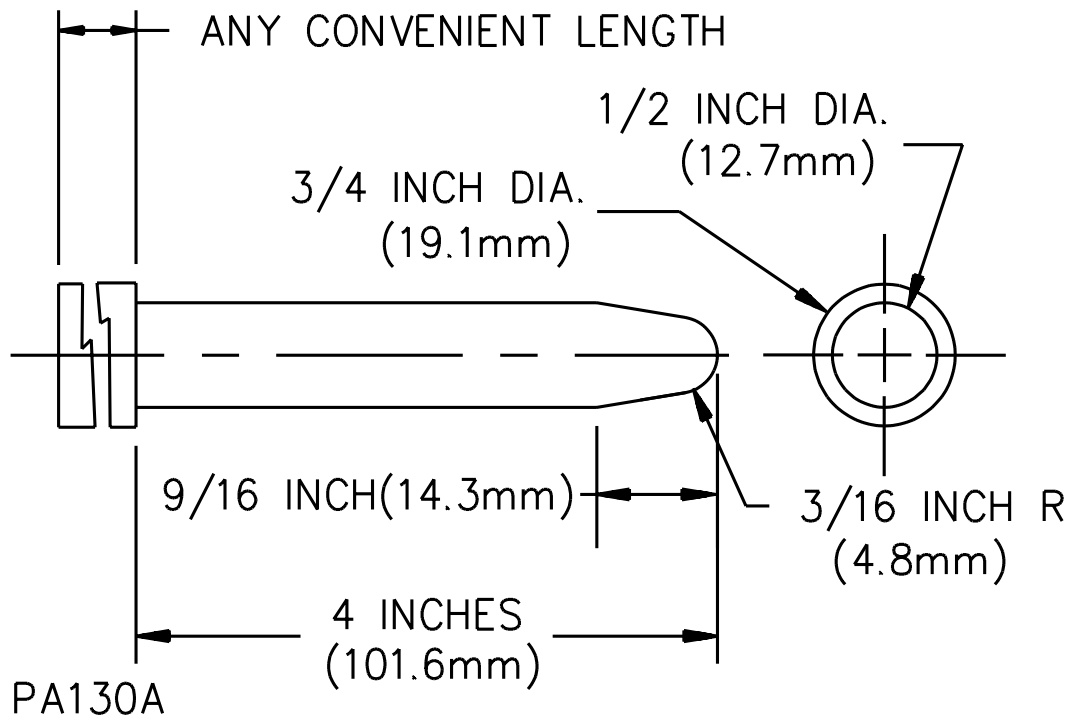
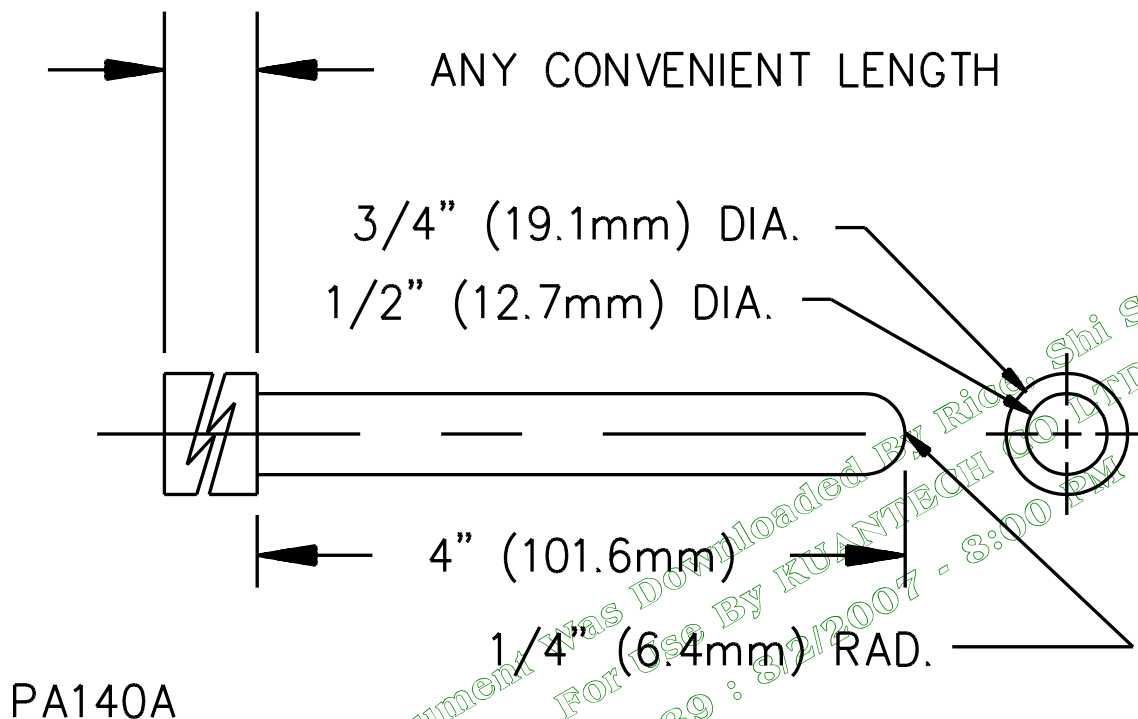


Figure 9.3
Probe for film-coated wire



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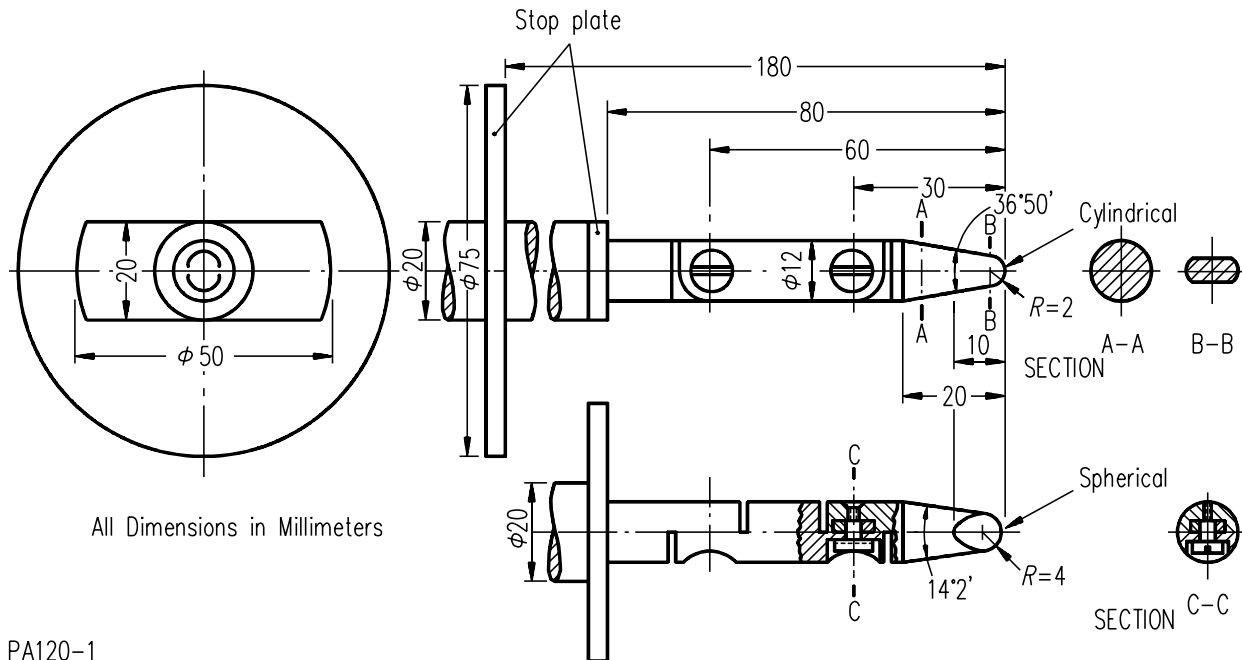
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Figure 9.4
International electrotechnical commission (IEC) articulate accessibility probe with stop plate
 Courtesy of IEC



10 Mechanical Assembly

10.1 An appliance shall be assembled so that it will not be adversely affected by the vibration of normal operation. Brush caps shall be tightly threaded or otherwise designed to prevent loosening.

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

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 normal operation of the switch.*
- b) Means for mounting the switch make it unlikely that operation of the switch will loosen it.*
- c) Spacings are not reduced below the minimum acceptable values if the switch rotates.*
- d) Normal operation of the switch is by mechanical means rather than 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 if rotation cannot reduce spacings below the minimum acceptable values.