UL 606

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Linings and Screens for Use with Burglar-Alarm Systems

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Summary of Topics

Revision pages have been issued to delete the ANSI approval information from the title page.

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The revisions dated October 27, 2006 include a reprinted title page (page1) for this Standard.

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

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INTRODUCTION

1 Scope

1.1 These requirements apply to protective wiring assemblies that, in combination with other burglar alarm equipment, are intended to signal a burglary entry when installed on openings, walls, ceilings and floors of mercantile premises and residences; doors, walls, ceilings and floors of vaults; and inside or outside safes.

1.2 Requirements covering the installation of linings and screens in burglar-alarm systems are published in the Standard for Installation and Classification of Burglar and Holdup Alarm Systems, UL 681, and the Standard for Installation and Classification of Residential Burglar Alarm Systems, UL 1641.

1.3 Linings and screens are designed to operate in remote control and signal circuits that are defined as Class 2 circuits in Article 725 of the National Electrical Code, NFPA 70.

1.4 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this Standard, 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 to determine that the level of safety as originally anticipated by the intent of this Standard is maintained. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this Standard shall not be judged to comply with this Standard. Where appropriate, revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this Standard.

2 General

2.1 Components

2.1.1 Except as indicated in 2.1.2, a component of a product covered by this Standard shall comply with the requirements for that component.

2.1.2 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.

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

2.1.4 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.

2.2 Units of measurement

2.2.1 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.

2.2.2 Unless otherwise indicated, all voltage and current values mentioned in this Standard are root-mean-square (rms).

2.3 Undated references

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

2.4 Terminology

2.4.1 The term ″product″ as used in this Standard refers to all types of linings and screens for use with other burglar-alarm equipment.

3 Glossary

3.1 For the purposes of this Standard, the following definitions apply.

3.2 CIRCUIT, DOUBLE – Protective wiring of opposite polarities, applied and arranged ″one and three″ or ″one and four.″ In the ″one and three″ arrangement, alternate protective conductors are of opposite polarity; in the ″one and four″ arrangement, the first and fourth conductors are one polarity and the second and third are the opposite polarity.

3.3 CIRCUIT, SINGLE – Protective wiring of a single polarity.

3.4 CONTACT – A device installed on a movable opening that, when actuated, opens, or closes, or both opens and closes electrical contacts.

3.5 EMBEDDED CABLE – Protective wiring set in a solid medium, such as concrete or plastic, that will open or cross or both open and cross the protective circuit if an opening (manhole or handhole size) is made through the medium.

3.6 FOIL – A thin metal conductor intended to be bonded to a protected surface so that the conductor will break when the protected surface is cut or broken.

3.7 OPENING, HANDHOLE SIZE – An opening 4 inches (102 mm) in diameter or larger, or an opening through which a 4-inch diameter sphere will pass.

3.8 OPENING, MANHOLE SIZE – An opening with a clear cross-sectional area of 96 square inches (619 cm^2) or more, and with the smallest dimension greater than 6 inches (152 mm).

3.9 SAFE CABINET – A wired enclosure, equipped with a door or doors, completely surrounding a safe, file cabinet or similar device constructed to open, or cross, or both open and cross the protective circuit when:

a) A door is opened,

b) A handhole size opening is made through any part of the enclosure, or

c) The cabinet is disassembled.

3.10 SCREEN – A fully framed assembly of grooved-wood dowels having fine wire secured in the grooves. Polymeric material or insect screening may be used to support the fine wire, and polymeric or metal may be used for the frame and cross members.

3.11 SUPERVISED – A two point electrical connection to the protection circuit arranged so that if either connection is opened the protection circuit will be opened and an alarm condition will be created.

3.12 TRAP – A conductor fastened between a building structure and a screen, foiled or wired panel, or similar device, such that the device cannot be separated from the building structure without breaking the conductor.

3.13 WIRE, FINE – Bare, hard-drawn, solid copper wire not larger than No. 24 AWG (0.21 mm^2) or enameled solid copper wire not larger than No. 26 AWG (0.13 mm^2).

3.14 WIRED PANEL – A panel that is provided with protective wiring and that is mounted and trapped to a surface to be protected. A form of lining.

4 Instructions and Drawings

4.1 A copy of the installation instructions and drawings shall be furnished with the sample submitted for investigation to be used as a guide in the examination and test of the product, and for this purpose need not be in final printed form. The information may be included in a manual.

4.2 The instructions and drawings shall include such directions and information as deemed by the manufacturer to be necessary for the intended installation, maintenance, and operation of the product.

CONSTRUCTION

5 Circuit Arrangement

5.1 The protective wiring of a lining or screen shall be arranged in a double circuit. Screens shall be wired with the ″one and three″ arrangement only.

Exception: Products designated for residential burglar alarm systems only may be single circuit.

5.2 Single-circuit protective wiring may be used for products using glass to support the protective circuit.

5.3 The distance between conductors used for protective wiring of products that are intended to be used in mercantile premises, and in mercantile and bank vaults, shall not exceed 4 inches (102 mm).

5.4 The distance between conductors used for protective wiring of products that are intended to be used in mercantile or bank safes, or in any device requiring detection of a handhole-size opening, shall not exceed 2 inches (51 mm).

5.5 If a solid sheet of conductor is used, it shall be connected in only one side of the circuit and shall be supervised. The other side of the circuit shall comply with the applicable requirements in 5.3 or 5.4.

6 Contacts and Connectors

6.1 A contact shall transfer the protection circuit or circuits into the alarm condition before the product to which it is attached has been moved more than 2 inches (51 mm).

6.2 The protective circuit shall be carried from a fixed to a movable surface by means of a contact or flexible connector.

6.3 A contact or flexible connector shall comply with the Standard for Connectors and Switches for Use With Burglar-Alarm Systems, UL 634. Contacts mounted outside the protected area shall be determined to be acceptable for operation in the environment in which they are installed.

7 Foil

7.1 Foil used on glass surfaces shall not be more than 1/2 inch (12.7 mm) wide, and shall not be more than:

a) 0.0015 inch (0.038 mm) thick when used on plain glass or

b) 0.003 inch (0.076 mm) thick when used on wired glass.

7.2 Foil used on surfaces other than glass shall not be less than 3/8 inch (9.5 mm) nor more than 1 inch (25.4 mm) wide, and shall not be more than 0.003 inch (0.076 mm) thick.

Exception: Foil used for safe and vault protection may be maximum 2-1/2 inches (63.5 mm) wide.

8 Protective Wiring

8.1 Conductors used for protective wiring and trap loops shall be fine wire or shall provide performance that has been determined to be equivalent to fine wire.

8.2 Wiring embedded in concrete shall be No. 18 AWG (0.82 mm^2) or larger lead sheathed cable or Type UF or USE cable.

8.3 The protective wiring shall not be visible unless an attempt to remove the wiring from the lining or screen will open, cross, or both open and cross, the circuit.

9 Field-Wiring Connections

9.1 General

9.1.1 A product shall be provided with wiring terminals or leads for connection to the interconnecting wiring of a burglar-alarm system.

9.1.2 A wiring terminal shall be prevented from turning.

9.1.3 A field-wiring terminal shall comply with 9.2.1 – 9.3.2; with the Standard for Electrical Quick-Connect Terminals, UL 310; with the Standard for Wire Connectors and Soldering Lugs for Use With Copper Conductors, UL 486A; with the Standard for Equipment Wiring Terminals for Use With Aluminum and/or Copper Conductors, UL 486E; or with the Standard for Terminal Blocks, UL 1059. The current-carrying parts shall be silver, copper, a copper alloy, or a similar nonferrous conductive material. Securing screws and the like may be plated steel. Equipment provided with quick-connect terminals intended for field

termination of electrical conductors to the equipment and complying with UL 310 shall be provided with strain relief, and the installation instructions shall include instructions for effecting the strain relief and include reference to the specific connectors to be used.

9.2 Terminals – general application

9.2.1 Terminal plates with wire-binding screws may be used for field-wiring connections. A terminal plate tapped for a wire-binding screw shall be of a nonferrous metal not less than 0.050 inch (1.27 mm) thick if intended for use with a No. 8 (4.2 mm diameter) or larger screw, and not less than 0.030 inch (0.76mm) thick for a No. 4 or 6 (2.8 or 3.5 mm diameter) screw. The plate shall not have less than two full threads in the metal (the terminal plate may be extruded to provide the two full threads) and shall have upturned lugs, clamps, or other means that have been determined to be equivalent, to hold the wires in position.

9.2.2 A wire-binding screw used at a wiring terminal shall be of nonferrous metal or of plated steel and shall not be smaller than No. 8 (4.2 mm diameter) for No. 10 AWG (5.3 mm^2) or smaller wires.

Exception: A No. 6 (3.5 mm diameter) screw may be used for the connection of a single No. 14 AWG (2.1 mm^2) or smaller conductor and a No. 4 (2.8 mm diameter) screw may be used for the connection of a single No. 19 AWG (0.65 mm^2) or smaller conductor. Other constructions may be used if they have been determined to provide equivalent strength terminal plate and thread security for the wire-binding screw.

9.2.3 If two or more conductors are intended to be connected by wrapping under the same screw, a nonferrous intervening metal washer shall be used for each additional conductor. If the wires protrude above terminal barriers, the nonferrous separator shall include means, such as upturned tabs or sides, to retain the wire.

9.2.4 If two conductors are separated and intended to be secured under a common clamping plate, a separator washer is not required.

9.3 Terminals – qualified applications

9.3.1 Any of the following terminal configurations may be used for connection of field wiring if the configuration complies with the requirements in 9.3.2, and with the requirements in the Tests on Special Terminal Assemblies, Section 24.

a) Push-In Terminals – Nonferrous (screwless) push-in terminals of the type used on some switches and receptacles, wherein solid conductors are pushed into slots containing spring-type contacts. The leads can be removed by means of a tool inserted to relieve the spring tension on the conductor. Push-in terminals shall not be used with aluminum conductors, and a marking adjacent to the terminal shall indicate that only copper conductors are to be used.

b) Quick-Connect Terminals – Nonferrous push-type terminals consisting of male posts permanently secured to the device and provided with compatible female connectors for connection to field wiring. A special tool is required for crimping of field wires. Mating terminals shall be shipped with the product with instructions for their installation.

c) Solder Terminals – Conventional nonferrous solder terminals.

d) Solderless Wrapped Terminals – Nonferrous terminals that require a special wire connection tool and terminal post design.

e) Telephone Type Terminals – Nonferrous terminal plates using a narrow V-shaped slot for securing of a conductor in a special post design. A special tool is required for wire connection.

f) Other Terminals – Other terminal connections may be used if they have been investigated and determined to be equivalent to the terminals described in (a) – (e), and have the same restrictions.

Exception: Terminals complying with the requirements in any of the standards specified in 9.1.3 are not required to be subjected to the Tests on Special Terminal Assemblies, Section 24.

9.3.2 Any of the terminal configurations described in 9.3.1 may be used for connection of field wiring if they comply with all of the following:

a) If a special tool is required for connection, its use shall be indicated either on the installation wiring diagram or instructions. The tool shall be referenced by name of manufacturer and by model number or equivalent designation along with information as to where the tool may be obtained.

b) The range of wire sizes shall be indicated on the installation wiring diagram or instructions. The minimum wire size to be used shall be No. 22 AWG (0.32 mm^2).

c) The wire size has been determined acceptable for carrying the current drawn by the circuit in which it is used.

d) If a lead is to be disconnected for testing or routine servicing it shall comply with the requirements in 24.2.1.

9.4 Leads

9.4.1 Leads provided for splice connections shall:

a) Not be less than 6 inches (152 mm) long;

b) Be provided with strain relief;

c) Not be smaller than No. 22 AWG (0.32 mm^2) copper wire; and

d) Be provided with insulation rated not less than 300 volts and not less than 1/64 inch (0.4 mm) thick.

Exception No. 1: A lead may be less than 6 inches long if it is evident that the use of a longer lead may result in damage to the lead insulation or product; result in a risk of fire, electric shock, or injury to persons; or is not required for the intended operation of the product.

Exception No. 2: Solid copper leads as small as No. 26 AWG (0.13 mm^2) may be used if:

a) The current does not exceed 1 ampere for lengths up to 2 feet (61 cm) and the current does not exceed 0.4 ampere for lengths up to 10 feet (3.05 m),

b) There are two or more conductors and they are covered by a common jacket or the equivalent,

c) The assembled conductors comply with the requirement of 23.1 for strain relief, and

d) The installation instructions shall indicate that the lead shall be spliced to a conductor larger than No. 18 AWG (0.82 mm^2).

10 Spacings

10.1 Spacings between uninsulated live parts and dead-metal parts, uninsulated current-carrying parts of opposite polarity, and uninsulated parts and a mounting surface shall not be less than those indicated in Table 10.1.

Table 10.1
Minimum spacings

Point of application	Minimum spacings[a,b]			
	Through air,		Over surface,	
	inch	(mm)	inch	(mm)
Between installation wiring terminals:				
with barriers	1/8	3.2	1/4	6.4
without barriers	1/4	6.4	1/4	6.4
Between other parts and to mounting surface	1/8	3.2	1/4	6.4

[a] An insulating liner or barrier of vulcanized fiber, varnished cloth, mica, phenolic composition, or similar material used where spacings would otherwise be insufficient, shall not be less than 0.028 inch (0.71 mm) thick. However, a liner or barrier not less than 0.013 inch (0.33 mm) thick may be used in conjunction with an air spacing of not less than one-half of the through air spacing required. The liner shall be located so that it will not be impaired by arcing. Insulating material having a thickness less than that specified may be used if it has been investigated and determined to be acceptable for the particular application.

[b] Measurements are to be made with solid wire of adequate ampacity for the applied load connected to each terminal. In no case is the wire to be smaller than No. 18 AWG (0.82 mm^2).

11 Screens

11.1 General

11.1.1 Screens shall be constructed so that the dowels are arranged on centers of not more than 4 inches (102 mm) and are supported by wired cross and frame members that are on centers of not more than 18 inches (457 mm).

11.1.2 Fine wire shall be embedded and secured in grooves of the dowels, cross members and frame, and circuits of the same polarity shall terminate at diagonally opposite corners.

11.1.3 The grooves in the dowels, cross members and frame shall all be on the side of the screen that is intended to be mounted toward the protected area.

11.1.4 Lattice screens shall have wired strips arranged on centers of not more than 4 inches (102 mm) in each direction, or of a construction determined to be the equivalent. They shall be constructed so that if the strips are spread to a manhole-size opening, an alarm is actuated.

11.1.5 Screens shall be coated with varnish or equivalently treated to resist moisture.

11.2 Removable screens

11.2.1 Removable screens shall be provided with all of the following:

a) Contacts at each corner,

b) Means for securing the screen over the protected area, and

c) Means for connecting the protective circuit to the screen conductors.

11.3 Fixed screens

11.3.1 Fixed screens shall be provided with a trap at each corner arranged with the same polarity at diagonally opposite corners.

12 Wired Panels

12.1 Wiring, general

12.1.1 The protective wiring of a wired panel shall be fine wire or foil or that which has been determined to be the equivalent, and shall be covered with material equivalent to the material to which it is attached.

12.2 Panel material

12.2.1 The protective wiring shall be attached to hard-board, wood or similar nonconductive material that is inherently moisture-resistant or is treated to be moisture-resistant.

12.3 Traps

12.3.1 A wired panel shall be provided with a trap at each corner arranged with the same polarity at diagonally opposite corners.

12.4 Foil

12.4.1 Foil shall be applied with asphaltum paint, varnish, shellac, or similar moisture-resisting insulating adhesive.

Exception: Additional securing is not required for foil permanently embedded in the panel material.

12.5 Fine wire

12.5.1 Fine wire shall be attached to the panel material by staples or similar devices at intervals not exceeding 8 inches (203 mm).

Exception: Additional securing is not required for fine wire permanently embedded in the panel material.

13 Glass Panels

13.1 Protective wiring shall be permanently attached to the glass surface or embedded in the glass.

14 Safe Cabinets

14.1 General

14.1.1 The doors, sides, top, and bottom of a safe cabinet shall comply with the requirements in 5.1; in either 5.4 or 5.5; and in Wired Panels, Section 12.

14.2 Frames

14.2.1 Frame members shall be provided with protective wiring if the width of the frame member or the combined width of adjacent frame members is greater than 3 inches (76 mm).

14.3 Doors

14.3.1 Doors shall be provided with contacts that comply with the requirements in Contacts and Connectors, Section 6.

14.3.2 Latches shall be provided to prevent unintentional opening of the door.

14.4 Traps

14.4.1 The doors, sides, top, bottom, panels, and frames shall be trapped to each other so as to open, cross, or both open and cross the protective circuit if they are separated more than 2 inches (51 mm).

15 Embedded Cable

15.1 A safe, file cabinet, or similar device, protected by embedded cable shall provide protection for all sides.

15.2 Doors shall be provided with a contact and with complete protective wiring of embedded cable or other material that has been determined to be equivalent.

PERFORMANCE

16 General

16.1 Test units and data

16.1.1 Products that are fully representative of production units are to be used for test, unless otherwise specified.

16.1.2 A device used for testing is to be the device specified by the wiring diagram of the product.

Exception: A substitute device may be used if it produces functions and load conditions equivalent to those of the device intended to be used with the product in service.

16.2 Test samples and miscellaneous data

16.2.1 The following samples are to be provided for testing:

a) Two or more assembled products;

b) For each encapsulated or sealed product, one or more samples of each product in the unencapsulated or unsealed condition;

c) Installation and operating instructions as described in 4.1 and 4.2.

16.2.2 Test samples shall be 2 by 3 feet (0.61 by 0.91 m), unless a smaller or larger size is more representative of the product.

16.2.3 Test samples of a screen shall have the cross member located to provide an unsupported dowel length of 18 inches (457 mm) on one side of the screen. See 11.1.1.

16.3 Test voltage and current

16.3.1 The test voltage and current for each test of a product is to be 130 volts, 0.050 ampere, 1.0 power factor, DC.

Exception: If the product is rated at a lower voltage, current, or both, the product is to be tested at the rated value.

17 Variable Ambient Test

17.1 During and immediately following a minimum of 4 hours of exposure to each of the ambient temperatures specified in 17.2 or 17.3, as applicable:

a) The product shall detect an alarm condition, as intended;

b) There shall not be open or cross circuits in the product;

c) The conductors of the protective wiring shall not be loosened; and

d) The product shall function as intended.

17.2 A product intended for indoor use is to be exposed to ambient temperatures of 0 and 49°C (32 and 120°F).

17.3 A product intended for outdoor use is to be exposed to ambient temperatures of minus 35 and plus 66°C (minus 30 and plus 150°F).

18 Humidity Test

18.1 During and after exposure for 24 hours to air having a relative humidity of 85 ±5 percent and a temperature of 30 ±2°C (86 ±3°F):

a) The product shall detect an alarm condition, as intended;

b) There shall not be open or cross circuits in the product;

c) The conductors of the protective wiring shall not be loosened;

d) The product shall function as intended; and

e) The product shall comply with the requirements of the Dielectric Voltage-Withstand Test, Section 20.

19 Rain Test

19.1 A product intended to be exposed to weather shall:

a) Operate as intended,

b) Not create a risk of electric shock, or

c) Not display evidence of loosening of the conductors of the protective wiring.

19.2 After the exposure, the unit shall have an insulation resistance of not less than 50,000 ohms measured between the circuits, the circuits and dead-metal parts, and the circuits and a metal mounting surface. The insulation resistance is to be measured 1 minute after application of the voltage obtained by using the series-voltmeter method or other means determined to be equivalent, and a DC circuit. After measurement of the insulation resistance, the complete product is to be subjected to the Dielectric Voltage-Withstand Test, Section 20.

19.3 The rain test apparatus is to consist of three spray heads mounted in a water supply rack as shown in Figure 19.1. Spray heads are to be constructed in accordance with Figure 19.2. The water pressure for all tests is to be maintained at 5 psi (34.5 kPa) at each spray head. The distance between the center nozzle and the product is to be approximately 3 feet (0.9 m). The product is to be brought in to the focal area of the three spray heads with the spray directed at an angle of 45 degrees from the vertical.

20 Dielectric Voltage-Withstand Test

20.1 A product and related accessories shall withstand for 1 minute, without breakdown, the application of an essentially sinusoidal AC potential of a frequency within the range of 40 – 70 hertz, or a DC potential between live parts and an enclosure of conductive material, between live parts and exposed dead-metal parts, and between live parts of circuits and a metal mounting surface. The test potential is to be:

a) 500 volts (707 volts, if a DC potential is used), for a unit rated 30 volts AC rms (42.2 volts DC or AC peak) or less or

b) 1000 volts (1414 volts, if a DC potential is used), for a unit rated between 31 and 250 volts AC rms.

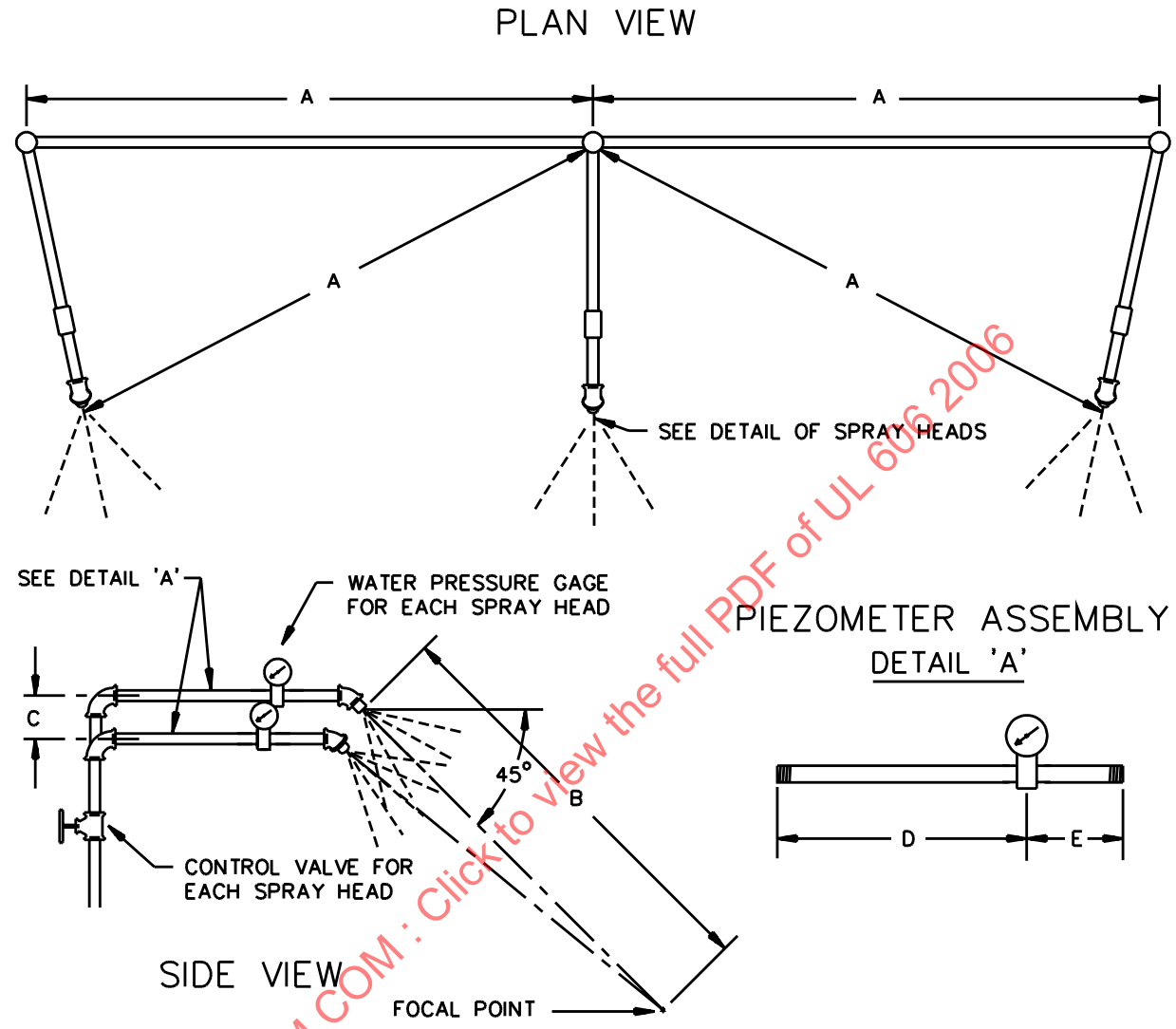
20.2 The test potential may be obtained from any convenient source having sufficient capacity to maintain the specified voltage. The output voltage of the test apparatus is to be monitored. Starting at zero, the potential is to be increased at a rate of approximately 200 volts per minute until the required test value is reached and is to be held at that value for 1 minute.

21 Temperature Test

21.1 The materials used in the construction of a product shall not attain a temperature rise greater than 35°C (63°F), under any condition of intended operation.

21.2 The temperature rise specified in 21.1 is based on an assumed ambient temperature of 25 ±15°C (77 ±27°F), and tests are to be conducted at an ambient temperature within that range. A temperature is to be considered constant when three successive readings taken at intervals of 10 percent of the previously elapsed duration of the test, but not less than 5 minute intervals, indicate no change.

Figure 19.1
Rain test apparatus



Item	inch	mm
A	28	710
B	55	1400
C	2–1/4	55
D	9	230
E	3	75

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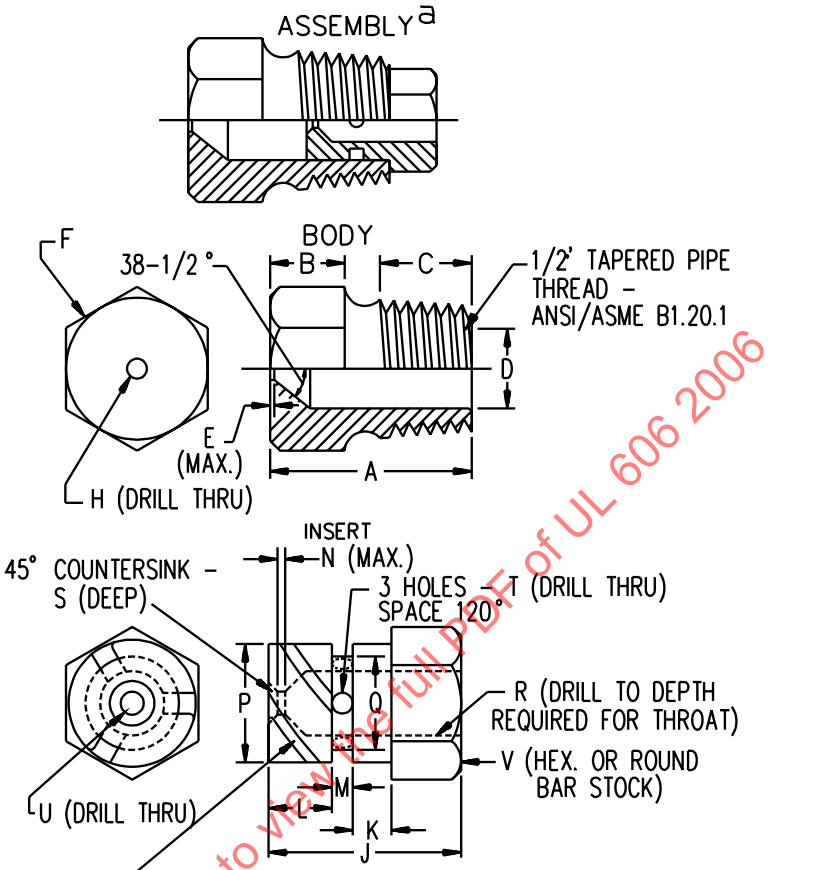
Figure 19.2
Rain test spray head



Item	inch	mm	Item	inch	mm
A	1-7/32	31.0	N	1/32	0.80
B	7/16	11.0	P	.575	14.61
C	9/16	14.0		.576	14.63
D	.578	14.68	Q	.453	11.51
	.580	14.73		.454	11.53
E	1/64	0.40	R	1/4	6.35
F	c	c	S	1/32	0.80
G	.06	1.52	T	(No. 35)[b]	2.80
H	(No.9)[b]	5.0	U	(No. 40)[b]	2.50
J	23/32	18.3	V	5/8	16.0
K	5/32	3.97	W	0.06	1.52
L	1/4	6.35			
M	3/32	2.38			

[a] Nylon Rain-Test Spray Heads are available from Underwriters Laboratories

[b] ANSI B94.11M Drill Size

[c] Optional - To serve as a wrench grip.

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