

UL 1002

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Electrically Operated Valves For Use In Hazardous (Classified) Locations

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Summary of Topics

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SA1-SA2	November 30, 2006
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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 cover electrically operated valves for installation and use in hazardous (classified) locations, Class I, Division 1, Groups A, B, C, and D, and Class II, Division 1, Groups E, F, and G, in accordance with the National Electrical Code, NFPA 70.

1.2 These requirements also cover explosion-proof electrical equipment for installation and use in Class I, Zone 1, Groups IIA, IIB, IIB plus Hydrogen, and IIC hazardous (classified) locations.

1.3 The requirements in this standard also apply to motor-operated valves and to magnetically-operated devices such as solenoids for use in hazardous (classified) locations, Class I, Division 1, Groups A, B, C, and D, and Class II, Division 1, Groups E, F, and G.

1.4 These requirements cover products for use only under the following atmospheric conditions:

- a) A minimum ambient temperature of minus 70°C (minus 94°F),
- b) An oxygen concentration not greater than 21 percent by volume, and
- c) A nominal barometric pressure of one atmosphere.

1.5 These requirements do not cover valves for a fluid-power system, which is a system that transmits and controls power through use of a pressurized fluid within an enclosed circuit.

1.6 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 as determined necessary to maintain the acceptable level of safety as originally anticipated by the intent of this standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this standard cannot be judged to comply with this standard. Where considered 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 General

2.1.1 These devices shall also comply with the applicable requirements that are specified in the Standard for Electrically Operated Valves, UL 429, and other standards for similar devices for use in ordinary locations.

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.

2.3 Undated references

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

2.4 Components

2.4.1 Except as indicated in 2.4.2, a component of a product covered by this standard shall comply with the requirements for that component.

2.4.2 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.

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

2.4.4 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.

3 Class I, Zone, and Group Equivalency

3.1 Class I, Zone 1, Group IIA

3.1.1 Explosion-proof electrical equipment intended to be marked in accordance with 19.2 shall comply with all the requirements for explosion-proof electrical equipment for use in Class I, Group D hazardous (classified) locations.

3.2 Class I, Zone 1, Group IIB

3.2.1 Explosion-proof electrical equipment intended to be marked in accordance with 19.3 shall comply with all the requirements for explosion-proof electrical equipment for use in Class I, Group C hazardous (classified) locations.

3.3 Class I, Zone 1, Group IIB plus Hydrogen

3.3.1 Explosion-proof electrical equipment intended to be marked in accordance with 19.4 shall comply with all the requirements for explosion-proof electrical equipment for use in Class I, Group B hazardous (classified) locations.

3.4 Class I, Zone 1, Group IIC

3.4.1 Explosion-proof electrical equipment intended to be marked in accordance with 19.5 shall comply with all the requirements for explosion-proof electrical equipment for use in both Class I, Group A and Class I, Group B hazardous (classified) locations.

CONSTRUCTION

4 Enclosure

4.1 Material

4.1.1 The enclosure housing the electrical components of a valve shall be made of iron, steel, copper, brass, bronze, aluminum or an aluminum alloy containing not less than 80 percent aluminum, or an acceptable nonmetallic material. A metal such as zinc or magnesium, or their alloys, is not acceptable.

4.1.2 Copper shall not be used for an enclosure for use in Class I, Group A locations. A copper alloy shall not be used for an enclosure unless it is coated with tin, nickel, or other acceptable coating, or unless the copper content of the alloy is not more than 30 percent.

4.1.3 Among the factors that shall be taken into consideration when determining the acceptability of a nonmetallic material are:

- a) Mechanical strength,
- b) Resistance to impact,
- c) Moisture-absorptive properties,
- d) Resistance to fungus,
- e) Combustibility,

- f) Resistance to repeated explosions,
- g) Resistance to solvents as covered by the hazardous location group or groups under consideration,
- h) Resistance to accumulation of electrostatic charges, and
- i) Resistance to distortion at temperatures to which the enclosure may be subjected under all conditions of use.

All of these factors are to be considered with respect to thermal aging. See Parts I and II of Supplement SB for tests on polymeric enclosures and parts of enclosures.

4.2 Thickness

4.2.1 Other than as noted in 4.2.2, the thickness of an enclosure wall shall not be less than that specified in Table 4.1.

4.2.2 A machined or threaded joint in the wall of a cast-metal enclosure shall have a thickness through the overlap of not less than that specified in Table 4.1.

Table 4.1
Thickness of metal for enclosure

External enclosure dimensions				Minimum thickness, inch (mm)					
Length or diameter,		Area of any one surface, square		Cast brass, bronze, copper, or malleable iron		Cast iron and aluminum ^a		Sheet steel	
Inches	(m)	Inches	(m ²)						
22	(0.56)	480	(0.31)	0.093	(2.36)	0.125	(3.18)	0.067	(1.70)
30	(0.76)	620	(0.39)	0.093	(2.36)	0.125	(3.18)	0.093	(2.36)
60	(1.5)	1500	(0.97)	0.125	(3.18)	0.187	(4.75)	0.125	(3.18)
Over 60	(Over 1.5)	Over 1500	(Over 0.97)	0.187	(4.75)	0.250	(6.55)	0.187	(4.75)

^a Includes sand-cast, permanent-mold, and die-cast aluminum and sheet aluminum.

4.2.3 A component that closes an opening in the enclosure, such as a guide tube, that is necessary to permit proper operation of a magnetically operated part may have a wall thickness less than specified in Table 4.1 if:

- a) The thinner component is shielded from any electrical component that is subject to arcing by an insulation barrier at least 0.028 inch (0.70 mm) thick or a grounded metal barrier of such construction that an arcing fault between the electrical component and the barrier will prevent the arc from reaching the thinner section of the enclosure, or other equivalent means. Consideration is to be given to overcurrent protection that may be provided in the circuit, and, for an insulating material barrier, consideration is to be given to moisture absorptive properties, combustibility, resistance to distortion at temperatures to which it may be subjected, and thermal aging;
- b) Internal wiring cannot contact the thinner component;
- c) Mechanical protection is provided, such as by location within the equipment, to reduce the likelihood of mechanical damage to the thinner component; and

- d) The thinner component is formed of stainless steel, brass, or other acceptable inherently corrosion-resistant metal.

5 Joints in Enclosure

5.1 General

5.1.1 A joint in an enclosure shall be of the metal-to-metal, metal-to-polymeric, or polymeric-to-polymeric type. A joint surface shall have an arithmetical average roughness of not more than 250 microinches (0.0064 mm), in accordance with the Standard for Surface Texture, ANSI/ASME B46.1-1985.

5.1.2 A polymeric-to-polymeric joint shall be a labyrinth or threaded type.

5.1.3 An electrical enclosure having a free internal volume less than the smaller limits specified may have joint dimensions specified for enclosures with larger free internal volumes.

5.1.4 The free internal volume is the total internal volume of an electrical enclosure minus the volume of internal components. Potting compounds, except as used for coil encapsulation or insulation, or both, are not to be considered in the determination of the free internal volume.

5.1.5 A feeler gauge utilized to measure the clearance specified in these requirements is to be 1/8 to 1/2 inch (3.2 to 12.7 mm) wide.

5.1.6 A joint of a serrated type with a thread contour shall not have more than 20 serrations per inch and shall have at least five fully engaged and tightly clamped serrations.

5.1.7 The joint requirements specified in 5.1.1 – 5.1.6 shall apply to all joints in an electrical enclosure including any joints leading from the inside of the electrical enclosure to the inside of the valve body.

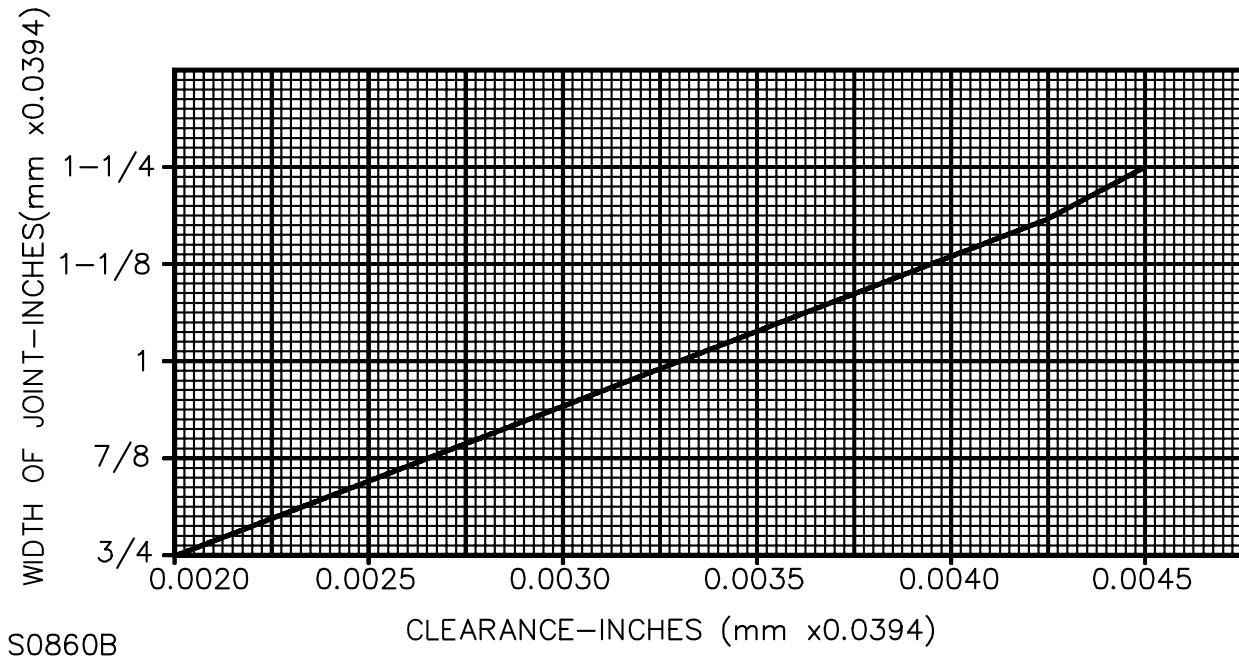
5.2 Class I, Groups C and D locations

5.2.1 Flat and rabbet joints

5.2.1.1 Other than as noted in 5.2.1.2 – 5.2.2.1, the width of a joint and the clearance, when assembled, shall be as specified in Figure 5.1, and the width of the joint shall not be less than 3/4 inch (19.1 mm).

5.2.1.2 A rabbet joint may have a diametrical clearance at the axial section of not more than twice the clearance specified in Figure 5.1 if neither the axial nor the radial section of the joint is less than 1/16 inch (1.6 mm) wide.

Figure 5.1
Relation between clearance and width of joint
 (See 5.2.1.1 and 5.2.1.2)



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5.2.1.3 An enclosure having a free internal volume of 300 cubic inches (4920 cm³), or less, may have a 1/2 inch (12.7 mm) wide rabbet joint or a 3/8 inch (9.5 mm) wide flat joint if other details comply with item (a) or (b), respectively.

a) One-half inch rabbet joint (see Figure 5.2):

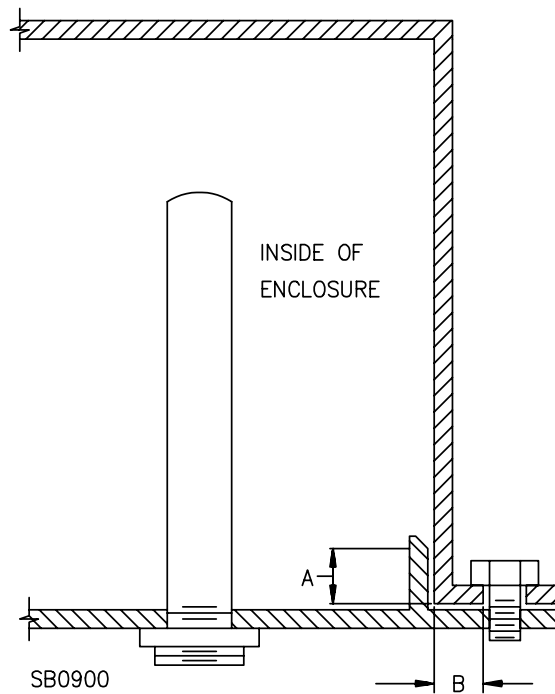
- 1) Neither the axial nor the radial section of the joint is less than 3/64 inch (1.2 mm) wide,
- 2) The diametrical clearance of the axial section and the clearance of the radial section of the joint is not more than 0.002 inch (0.05 mm), and
- 3) The joint width measured from the inside of the enclosure to the nearest edge of each bolt clearance hole and elsewhere is not less than 1/2 inch with the cover in the most unfavorable position.

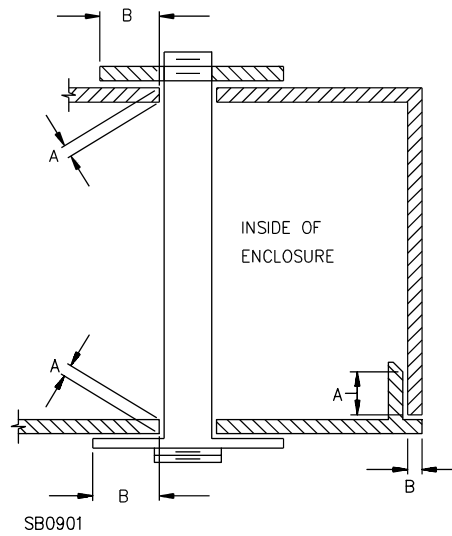
b) Three-eighths inch wide flat joint (see Figure 5.3):

- 1) The clearance between the joint surfaces is less than 0.0015 inch (0.038 mm) and such that a 0.0015 inch feeler gauge will not enter the joint more than 1/8 inch (3.2 mm) at any point,
- 2) The thickness of the cover at the joint width is not less than 3/8 inch, unless stiffened or reinforced metal of a lesser thickness has been found to be acceptable based on its mechanical strength and resistance to opening of the joint clearance under internal pressures, and

- 3) The joint width measured from the inside of the enclosure to the nearest edge of each bolt clearance hole and elsewhere is not less than $\frac{3}{8}$ inch with the cover in the most unfavorable position.

Figure 5.2
Rabbet joints
(See 5.2.1.3(a) and 5.3.1.2)

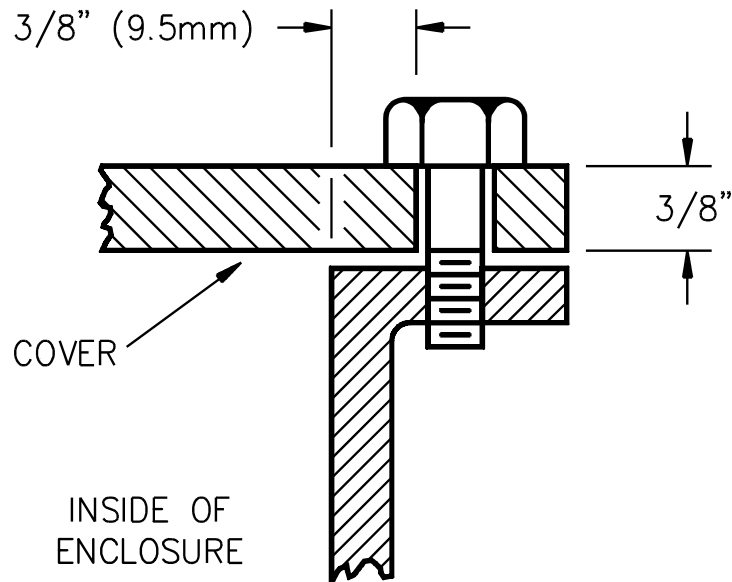




$A + B = 1/2$ inch (12.7 mm) minimum for Class I, Groups C and D enclosures having free internal volume not more than 300 cubic inches (4920 cm³).

$A + B = 7/8$ inch (22.2 mm) minimum for Class I, Group B enclosures having free internal volume not more than 100 cubic inches (1640 cm³).

Figure 5.3
3/8 inch (9.5 mm) Wide flat joint for a device having free internal volume not more than 300 cubic inches (4920 cm³)
 (See 5.2.1.3(b) and 5.3.1.1)



5.2.1.4 The width of a joint in an enclosure having a free internal volume of not more than 6 cubic inches (0.1 dm³) shall not be less than 1/4 inch (6.4 mm). The clearance between the joint surfaces shall not be more than 0.004 inches (0.10 mm) for a Group C enclosure or 0.006 inches (0.15 mm) for a Group D enclosure.

5.2.2 Labyrinth joints

5.2.2.1 A joint of the labyrinth type shall be investigated in accordance with the requirements in 14.12.

5.2.3 Threaded joints

5.2.3.1 A threaded joint shall consist of the number of fully engaged threads specified in Table 5.1 but not less than five. Threads shall not be finer than specified in Table 5.1.

Table 5.1
Thread engagement

Maximum diameter of threaded sections, inch	Maximum acceptable number of threads per inch	Minimum acceptable number of threads engaged
No limit	20	5
3/8	24	5
Over 3/8	24	6
Over 3/8	28	7
Over 3/8	32	8

5.2.3.2 The engagement between a threaded shaft and a tapped hole in an enclosure is to be considered a threaded joint.

5.2.4 Bolts in joint width

5.2.4.1 A bolt may be located in a 3/4 inch (19.1 mm) or wider joint if the distance from the inside of the enclosure to the nearest edge of the clearance hole for the bolt is not less than 1/2 inch (12.7 mm), and the diametrical clearance between the bolt and the clearance hole is not more than 0.045 inch (1.1 mm), measured over the shank or the major diameter of the threads, for a length of not less than one-half the required width of joint specified in Figure 5.1. The distance from inside the enclosure to the edge of the nearest clearance hole is to be measured with the cover in the most unfavorable position. The bolts may be provided with lock washers. If bolts or screws for fastening a cover each engage at least five full threads in a tapped hole in the enclosure, the hole need not be bottomed. See Figure 5.4.