



UL 1022

STANDARD FOR SAFETY

Line Isolation Monitors

UL Standard for Safety for Line Isolation Monitors, UL 1022

Sixth Edition, Dated March 27, 2025

SUMMARY OF TOPICS

This new Sixth Edition of ANSI/UL 1022 dated March 27, 2025 incorporates editorial updates from the February 21, 2025 proposal(s) bulletin. Other editorial updates include renumbering and reformatting to align with current style.

The revised requirements are substantially in accordance with Proposal(s) on this subject dated February 21, 2025.

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The most recent designation of ANSI/UL 1022 as an American National Standard (ANSI) occurred on March 27, 2025. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

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INTRODUCTION

1 Scope

1.1 These requirements cover dynamic line isolation monitors and related supplementary indicating units for supervising isolated power-supply circuits in patient care areas of health care facilities, including inhalation-anesthetizing locations in accordance with the National Electrical Code, NFPA 70.

1.2 The detectors and supplementary indicating units are intended to be:

- a) Included as part of an isolated power-supply center for patient care locations of health care facilities; and
- b) Installed in an Other-Than-Hazardous (Classified) Location of a health care facility as defined by the National Electrical Code, NFPA 70.

1.3 These requirements do not cover ground fault circuit interrupters for use on grounded alternating current systems in accordance with the National Electrical Code, NFPA 70.

2 Components

2.1 A component of a product covered by this Standard shall:

- a) Comply with the requirements for that component as specified in this Standard;
- b) Be used in accordance with its ratings(s) established for the intended conditions of use; and
- c) Be used within its established use limitations or conditions of acceptability.

2.2 A component of a product covered by this Standard is not required to comply with a specific component requirement that:

- a) Involves a feature or characteristic not required in the application of the component in the product covered by this Standard; or
- b) Is superseded by a requirement in this Standard; or
- c) Is separately evaluated when forming part of another component, provided the component is used in accordance with its established ratings and limitations.

2.3 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.

2.4 A component that is also intended to perform other functions such as overcurrent protection, ground-fault circuit-interruption, surge suppression, any other similar functions, or any combination thereof, shall comply additionally with the requirements of the applicable standard(s) that cover devices that provide those functions.

3 Units of Measurement

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

4 Referenced Publications

4.1 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.

4.2 The following publications are referenced in this Standard:

ASTM E230/E230M, *Standard Specification for Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples*

NFPA 70, *National Electrical Code*

5 Glossary

5.1 For the purpose of this Standard the following definitions apply.

5.2 **FAULT IMPEDANCE** – An impedance that may consist of balanced or unbalanced resistive, capacitive-reactive, or combined resistive-capacitive-reactive loads connected to either or both isolated conductors. See [Figure 20.1](#) for load configurations.

5.3 **HAZARD CURRENT** – The test current that would flow through a low impedance connected between either isolated conductor and ground. Hazard current includes:

- a) **TOTAL HAZARD CURRENT (THC)** – Hazard current with all devices connected, including line isolation monitors;
- b) **MONITOR HAZARD CURRENT (MHC)** – That portion of the total hazard current contributed only by the monitor and remote indicators; and
- c) **FAULT HAZARD CURRENT (FHC)** – That portion of the total hazard current resulting when all devices, except the line isolation monitors, are connected.

5.4 **LINE ISOLATION MONITOR (LIM)** – A test instrument designed to continually check the balanced and unbalanced impedances from each side of an isolated circuit to ground and equipped with a built-in test circuit to exercise an alarm without adding to the hazard current. It initiates a visual and an audible indication when the hazard current exceeds a preset threshold level.

5.5 **REMOTE INDICATOR** – Device connected remotely to the line isolation monitor which provides any one of the following functions; visual signal, audible signal, or both visual and audible signals which supplement the signal provided by the line isolation monitor.

5.6 **VOLTAGE CLASSIFICATION** –

- a) **HIGH-VOLTAGE** – A circuit classified as high-voltage is one having circuit characteristics in excess of those of a low-voltage circuit.
- b) **LOW-VOLTAGE** – A circuit classified as low-voltage is one involving a potential of not more than 30 volts alternating current (42.4 peak) or direct current, and supplied by a primary battery or by a Class 2 transformer or by a combination of transformer and fixed impedance which, as a unit, complies with all the performance requirements for a Class 2 transformer.

6 Instructions and Drawings

6.1 A copy of the operating and installation instructions and related schematic, wiring diagrams, and installation drawings is to be furnished with the sample submitted for investigation to be used as a guide in the examination and test of the unit, and for this purpose is not required to be in final printed form.

6.2 The instructions and drawings shall include such directions and information as deemed by the manufacturer to be adequate for attaining proper installation and maintenance. A description of the circuit functions shall be provided to facilitate understanding of the system operation.

CONSTRUCTION

7 Enclosure

7.1 General

7.1.1 A line isolation monitor enclosure shall be formed and assembled so that it has the strength and rigidity required to resist the abuses to which it is subjected without total or partial collapse resulting in reduction of spacings, loosening or displacement of parts, or other serious defects.

7.1.2 All electrical parts of a line isolation monitor shall be enclosed to provide protection against contact with uninsulated live parts.

7.1.3 A compartment enclosing electrical parts shall not be open to the floor or other support on which the unit rests.

7.1.4 An enclosure for a line isolation monitor shall have provision for connection of metal-clad cable or conduit, or a nonmetallic-enclosed wiring system (for example, nonmetallic sheathed cable) acceptable for the application under the provisions of NFPA 70.

Exception No. 1: An enclosure without provision for the connection of metal-clad cable, conduit, or a nonmetallic-enclosed wiring system is not prohibited from being used when there are furnished with it, definite instructions indicating the section(s) of the unit intended to be drilled in the field for the connection(s).

Exception No. 2: A line isolation monitor which is intended to be installed in an overall enclosure with other equipment is not required to have provision for connection of metal-clad cable or conduit.

7.1.5 A line isolation monitor which is to be installed in an overall enclosure shall not be exposed to an ambient temperature exceeding 50 °C (122 °F).

7.1.6 An enclosure shall have means for mounting which shall be accessible without disassembling any operating part of the unit. Removal of a completely assembled panel or printed wiring board to mount the enclosure is not considered to be disassembly of an operating part.

7.1.7 An enclosure for a line isolation monitor which is intended for recessed (flush) mounting shall not have any openings other than conduit hubs, knockouts, or openings for mounting screws.

7.2 Cast metal enclosures

7.2.1 The thickness of cast metal for an enclosure shall be as indicated in [Table 7.1](#), except that cast metal having a thickness 1/32 inch (0.8 mm) less than that indicated in the [Table 7.1](#) is not prohibited from

being used when the surface under consideration is curved, ribbed, or otherwise reinforced, or when the shape and/or size of the surface is such that equivalent mechanical strength is provided.

7.2.2 When threads for the connection of conduit are tapped all the way through a hole in an enclosure wall, or when an equivalent construction is employed, there shall not be less than 3-1/2 nor more than 5 threads in the metal, and the construction shall be such that a standard conduit bushing is capable of being properly attached.

7.2.3 When threads for the connection of conduit are tapped part way through a hole in an enclosure wall, there shall be at least 3-1/2 full threads in the metal, and a smooth, rounded inlet hole for the conductors, which shall afford protection to the conductors equivalent to that provided by a standard conduit bushing.

Table 7.1
Cast-Metal Enclosures

Use, or dimensions of area involved	Minimum thickness			
	Die-cast metal		Cast metal of other than the die-cast type	
	inches	(mm)	inches	(mm)
Area of 24 square inches (154 cm ²) or less and having no dimension greater than 6 inches (152 mm)	1/16	(1.6)	1/8	(3.2)
Area greater than 24 square inches or having any dimension greater than 6 inches	3/32	(2.4)	1/8	(3.2)
At a threaded conduit hole	1/4	(6.4)	1/4	(6.4)
At an unthreaded conduit hole	1/8	(3.2)	1/8	(3.2)

7.3 Sheet metal enclosures

7.3.1 The thickness of sheet metal employed for the enclosure of a line isolation monitor shall not be less than indicated in [Table 7.2](#), except that sheet metal of two gage sizes lesser thickness is not prohibited from being used when the surface under consideration is curved, ribbed, or otherwise reinforced, or when the shape and/or size of the surface is such that adequate mechanical strength is provided.

7.3.2 At any point where conduit or metal-clad cable is to be attached, sheet metal shall be of such thickness or shall be formed or reinforced so that it has the stiffness at least equivalent to that of uncoated flat sheet steel having a minimum thickness of 0.053 inch (1.35 mm) (No.16 MSG).

7.3.3 A plate or plug for an unused conduit opening or other hole in the enclosure shall have a thickness not less than:

- a) 0.014 inch (0.36 mm) for steel or 0.019 inch (0.48 mm) for nonferrous metal for a hole having 1/4 inch (6.4 mm) maximum dimension or
- b) 0.027 inch (0.66 mm) steel or 0.032 inch (0.81 mm) nonferrous metal for a hole having a 1-3/8 inch (34.9 mm) maximum dimension.

7.3.4 A closure for a larger hole shall have a thickness equal to that required for the enclosure of the device or a standard knockout seal shall be used. Such plates or plugs shall be securely mounted.

7.3.5 A knockout in a sheet metal enclosure shall be reliably secured but shall be capable of being removed without undue deformation of the enclosure.

7.3.6 A knockout shall be provided with a flat surrounding surface adequate for proper seating of a conduit bushing, and shall be located so that installation of a bushing at any knockout likely to be used during installation will not result in spacings between uninsulated live parts and the bushing of less than those indicated in Spacings, Section [14](#).

Table 7.2
Sheet Metal Enclosures

Maximum enclosure dimensions				Minimum thickness of sheet metal					
Any linear dimension		Area of any surface		Steel				Copper, brass, or aluminum	
				Zinc-coated		Uncoated			
inches	(mm)	in ²	(cm ²)	inches	(mm)	inches	(mm)	inches	(mm)
12	(305)	90	(581)	0.034	(0.86)	0.032	(0.81)	0.045	(1.14)
				[20] ^a		[20] ^a		[16] ^a	
24	(610)	360	(2322)	0.045	(1.14)	0.042	(1.07)	0.058	(1.47)
				[18]		[18]		[14]	
48	(1219)	1200	(7742)	0.056	(1.42)	0.053	(1.35)	0.075	(1.91)
				[16]		[16]		[12]	
60	(1524)	1500	(9678)	0.070	(1.78)	0.067	(1.70)	0.095	(2.41)
				[14]		[14]		[10]	
Over 60	(1524)	Over 1500	(9678)	0.097	(2.46)	0.093	(2.36)	0.122	(3.10)
				[12]		[12]		[8]	

^a The figures in brackets are the Galvanized Sheet Gage numbers (for zinc-coated steel), the Manufacturers' Standard Gage numbers (for uncoated steel), and the American Wire Gage (B & S) numbers (for a nonferrous metal) which provide the required minimum thickness of metal.

7.4 Nonmetallic enclosures

7.4.1 Nonmetallic material shall not be employed for an enclosure of a line isolation monitor intended to be connected directly to rigid conduit or metal-clad cable. It is not prohibited from being used as an enclosure of a unit intended to be installed in an overall metal enclosure with other equipment, such as in an isolating power panel assembly.

7.4.2 When a nonmetallic enclosure is employed, the continuity of the grounding system shall not rely on the dimensional integrity of the nonmetallic material.

7.4.3 Among the factors taken into consideration when determining the acceptability of a nonmetallic enclosure are:

- a) The mechanical strength;
- b) Resistance to impact;
- c) Moisture-absorptive properties;
- d) Combustibility and resistance to ignition from electrical sources;
- e) Dielectric strength, insulation resistance, and resistance to arc tracking; and
- f) Resistance to distortion and creeping at temperatures to which the material is subjected under conditions of normal or abnormal usage.

All these factors are to be considered with regard to aging.

7.5 Ventilating openings

7.5.1 Ventilating openings in an enclosure, including perforated holes, louvers, and openings protected by means of wire screening, expanded metal, or perforated covers, shall be of such size or shape that no opening permits passage of a rod having a diameter of 9/64 inch (3.6 mm).

7.5.2 An enclosure housing fuses or any other overload-protective device, and provided with ventilating openings, shall afford adequate protection against the emission of flame or molten metal.

7.5.3 The average thickness of perforated sheet metal and sheet metal employed for expanded-metal mesh shall not be less than:

- a) 0.042 inch (1.07 mm), 0.046 inch (1.14 mm) if zinc coated, when the mesh openings or perforations are 1/2 in² (323 mm²) or less in area and
- b) 0.080 inch (2.04 mm), 0.084 inch (2.14 mm) if zinc coated, for larger openings.

Exception: When the indentation of a guard or enclosure wall does not alter the clearance between uninsulated live parts and grounded metal and affect performance adversely or reduce spacings below the minimum value given under Spacings, Section 14, 0.021 inch (0.53 mm) expanded metal mesh [0.024 inch (0.59 mm) if zinc coated] is not prohibited from being used, when the exposed mesh on any one side or surface of the device so protected has an area of not more than 72 in² (464 mm²) and no dimension greater than 12 inches (305 mm), or when the width of an opening so protected is not greater than 3-1/2 inches (90 mm).

7.5.4 The wires of a screen shall not be smaller than 16 AWG (1.3 mm diameter) and the screen openings shall not be greater than 1/8 inch (3.2 mm) square in area.

7.6 Covers

7.6.1 An enclosure cover shall be hinged, sliding, pivoted or similarly attached when it provides ready access to fuses or any other overcurrent protective device, the intended protective functioning of which require renewal, or when it is required to open the cover in connection with the normal operation of the unit.

7.6.2 With reference to 7.6.1, normal operation is considered to be operation of a switch for testing or for silencing an audible signal appliance or operation of any other component of a unit which requires such action in connection with its intended performance.

7.6.3 A hinged cover is not required when it is not necessary to open the cover in connection with normal operation of the unit, and the only fuse(s) enclosed is for protection of portions of internal circuits against damage resulting from a fault. The following or equivalent marking shall be indicated on the outer surface of the cover provided: "CAUTION – CIRCUIT FUSE(S) INSIDE – DISCONNECT POWER-SUPPLY PRIOR TO SERVICING. "

7.6.4 When a hinged cover is required, it shall be provided with a latch, screw, or catch to hold it closed. The hinged cover of a unit intended to be installed where it is accessible to other than authorized personnel shall be provided with a key lock or with a screw requiring a tool for removal.

7.6.5 An unhinged cover shall be securely held in place by screws or the equivalent.