

Application Bulletin AB-1 IsoLoop Standards Guide

This application note is intended as a guide to the safety standards to which the IsoLoop[®] Isolators have been qualified or approved. Only the areas of those standards that are applicable to IsoLoop Isolators are addressed. Also included in this bulletin is an overview of partial discharge testing and VDE0884.

Standards

IsoLoop Isolators are approved to the following standards:

- **UL1577** Standard for Safety for Optical Isolators.
Component Recognition Program File Number: E207481
- **IEC61010-2001** Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use.
TUV Certificate Numbers: N1502812, N1502812-101

UL1577

The requirements of the UL1577 safety standard cover only the insulation properties of the isolation barrier, not the electrical properties of the separate circuits on either side of the isolation barrier. Neither does this standard place any restrictions on creepage and clearance. UL1577 states, "The external spacings between input and output circuits shall be based on the end product spacing requirements." Since the isolation barrier is encapsulated, the device need only be subjected to the dielectric voltage-withstand tests.

The process of UL1577 qualification is outlined below.

Dielectric Voltage-Withstand Tests:

Parts are preconditioned as listed below. Separate sets of samples are used for each conditioning step:

1. Six samples are tested in "as-received" condition.
2. Six samples are exposed to the maximum rated junction temperature for seven hours before testing.
3. Six samples are exposed to 85% relative humidity at $32.0 \pm 2.0^\circ\text{C}$ for 24 hours before testing.
4. Six samples are exposed to $0.0 \pm 2.0^\circ\text{C}$ for seven hours before testing.

Immediately following the conditionings 1 through 4 listed below, each sample shall be capable of withstanding, for a period of 60 seconds, a potential equal to the rated dielectric insulation voltage applied between input and output (for IsoLoop Isolators this is $2500 V_{\text{RMS}}$).

Manufacturing and Production-Line Test:

UL1577 mandates a production test of 120% of the rated withstand voltage for a period of 1 second. This $3000 V_{\text{RMS}}$ test is performed for 1 second on all devices.

IEC61010-2001

This standard specifies general safety requirements for electrical equipment intended for professional, industrial process, and educational use, including equipment and computing devices for measurement and test, control, laboratory use, and accessories intended for use with the equipment. It does not cover medical equipment.

The objective of this standard is to ensure the design and methods of construction of the equipment provide adequate protection for the OPERATOR and surrounding area against electric shock or burn.

IEC61010 applies to equipment intended for operation under the following conditions:

- Indoor use
- Altitude up to 2,000 meters unless otherwise specified.
- Temperature 5°C to 40°C .
- Maximum relative humidity 80% up to 31°C , then decreasing linearly to 50% at 40°C .
- Maximum main supply voltage fluctuation of $\pm 10\%$ of nominal.

Environmental Condition for Tests:

Unless otherwise specified, the following environmental conditions shall exist for the tests. They should not conflict with those specified for intended equipment operation.

- Temperature of 15°C to 35°C
- Relative humidity of not more than 75%
- Air pressure 75 kPa to 106 kPa (100 kPa = 14.50 psi)
- No dew, frost, rain, etc.

Equipment approved under this standard is categorized by three main areas: insulation class, exposure to pollution, and installation category (overvoltage category). These areas are explained in Glossary of Terms.

The requirements under which IsoLoop Isolators are tested are shown in Table 1:

		Pollution Degree II							
		Installation Category (Overvoltage Category) II							
		Creepage Distance (mm)					Test Voltage (V)		
Working Voltage (RMS or DC) up to V	Clearance (mm)	In Equipment			On Printed Wiring Board		Peak Impulse 1.2/50 μ s	RMS 50/60Hz 1 min.	DC or 50/60Hz peak 1 min.
		Material Group			Not Coated CTI>175	Coated CTI>100			
		I CTI>600	II CTI>400	III CTI>100					
50	0.2	1.2	1.7	2.4	0.4	0.12	850	510	720
100	0.4	1.4	2	2.8	0.4	0.4	1,360	740	1,050
150	1.6	1.6	2.2	3.2	1.6	1.6	2,550	1,400	1,950
300	3.3	3.3	4.2	6	3.3	3.3	4,250	2,300	3,250
600	6.5	6.5	8.5	12	6.5	6.5	6,800	3,700	5,250
1000	11.5	11.5	14	20	11.5	11.5	10,200	5,550	7,850
1500	16	16	21	30			13,600	7,400	10,450
2000	21	22	28	40			17,000	9,300	13,150
2500	26	28	36	50			20,400	11,100	15,700

Table 1. Double Insulation or Reinforced Insulation

The test voltage used may be either the peak impulse, RMS, or DC value according to Table 1. There is no requirement to test using all three voltages. These test voltages, which are derived from IEC664, take into account the possible transient over-voltages that may occur in systems with the working voltages shown in Table 1. The and working and production test voltages for the various IsoLoop Isolators packages are shown in Table 2:

Package Type	Pollution Degree	Material Group	Working Voltage	Production Test Voltage (AC RMS)
MSOP-8 (qualification pending)	II	III	120 V _{RMS}	1200V/ 1 sec.
SOIC-8	II	III	150 V _{RMS}	3000V/ 1 sec.
PDIP-8	II	III	300 V _{RMS}	3000V/ 1 sec.
0.15" SOIC-16	II	III	150 V _{RMS}	3000V/ 1 sec.
0.3" SOIC-16	II	III	300 V _{RMS}	3000V/ 1 sec.

Table 2. Maximum Working Voltages for IsoLoop Isolators

Glossary of Terms

The terms used in this section are from IEC61010. Some categories, such as pollution degree or installation category, may depend on the standard being used.

Primary Circuit	An internal circuit which is directly connected to the external supply mains or other equivalent source which supplies the electric power.
Secondary Circuit	A circuit which has no direct connection to primary power and derives its power from a transformer, converter or equivalent isolation device, or from a battery.
Creepage Distance	The shortest path between two conductive parts, or between a conductive part and the BOUNDING SURFACE of the equipment, measured along the surface of the insulation.
Clearance	The shortest distance between two conductive parts, or between a conductive part and the BOUNDING SURFACE of the equipment, measured through air.
Insulation:	
<i>Operational insulation</i>	Insulation needed for the correct operation of the equipment.
<i>Basic insulation</i>	Insulation to provide basic protection against electric shock.
<i>Supplementary insulation</i>	Independent insulation applied in addition to Basic insulation in order to ensure protection against electric shock in the event of a failure of the Basic insulation.
<i>Double insulation</i>	Insulation comprising both Basic and Supplementary insulation.
<i>Reinforced insulation</i>	A single insulation system which provides a degree of protection against electric shock equivalent to Double insulation under the conditions specified in this standard.
Pollution Degree:	
<i>Pollution Degree 1</i>	No pollution, or only dry, non-conductive pollution occurs. The pollution has no influence.
<i>Pollution Degree 2</i>	Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.
Installation Category (overvoltage category):	This section is directed at insulation coordination by identifying the transient overvoltages which may occur and assigning four different levels as indicated in IEC664. Each category should be subject to smaller transients than the category above it.
	<i>I:</i> Signal Level. Special equipment or parts of equipment.
	<i>II:</i> Local Level. Portable equipment etc.
	<i>III:</i> Distribution Level. Fixed installation
	<i>IV:</i> Primary Supply Level. Overhead lines, cable systems.