UL 60079-47

STANDARD FOR SAFETY

Explosive Atmospheres – Part 47: Equipment Protection by 2-Wire Intrinsically Safe Ethernet Concept (2-WISE)

UL Standard for Safety for Explosive Atmospheres – Part 47: Equipment Protection by 2-Wire Intrinsically Safe Ethernet Concept (2-WISE), UL 60079-47

First Edition, Dated March 15, 2022

Summary of Topics

First Edition of the UL IEC-Based Standard for Explosive atmospheres – Part 47: Equipment protection by 2-wire intrinsically safe Ethernet concept (2-WISE), UL 60079-47.

UL 60079-47 is an adoption of IEC TS 60079-47, Explosive Atmospheres – Part 47: Equipment Protection by 2-Wire Intrinsically Safe Ethernet Concept (2-WISE), (first edition, issued by IEC February 2021). Please note that the National Difference document incorporates all of the U.S. national differences for UL 60079-47.

The requirements are substantially in accordance with Proposal(s) on this subject dated September 24, 2021 and January 28, 2022.

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MARCH 15, 2022

ANSI/UL 60079-47-2022

UL 60079-47

Standard for Explosive Atmospheres – Part 47: Equipment Protection by 2-Wire Intrinsically Safe Ethernet Concept (2-WISE)

First Edition

March 15, 2022

This ANSI/UL Standard for Safety consists of the First Edition.

The most recent designation of ANSI/UL 60079-47 as an American National Standard (ANSI) occurred on March 15, 2022. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface. The National Difference Page and IEC Foreword are also excluded from the ANSI approval of IEC-based standards.

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 https://csds.ul.com.

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Preface (UL)

This UL Standard is based on IEC Publication 60079-47: First edition Explosive atmospheres – Part 47: Equipment protection by 2-wire intrinsically safe Ethernet concept (2-WISE). IEC publication 60079-47 is copyrighted by the IEC.

This edition has been issued to satisfy UL Standards policy.

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Note – Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.

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There are five types of National Differences as noted below. The difference type is noted on the first line of the National Difference in the standard. The standard may not include all types of these National Differences.

DR – These are National Differences based on the **national regulatory requirements**.

D1 – These are National Differences which are based on **basic safety principles and requirements**, elimination of which would compromise safety for consumers and users of products.

D2 – These are National Differences from IEC requirements based on existing **safety practices**. These requirements reflect national safety practices, where empirical substantiation (for the IEC or national requirement) is not available or the text has not been included in the IEC standard.

DC – These are National Differences based on the **component standards** and will not be deleted until a particular component standard is harmonized with the IEC component standard.

DE – These are National Differences based on **editorial comments or corrections**.

Each national difference contains a description of what the national difference entails. Typically one of the following words is used to explain how the text of the national difference is to be applied to the base IEC text:

> ***Addition / Add*** - An addition entails adding a complete new numbered clause, subclause, table, figure, or annex. Addition is not meant to include adding select words to the base IEC text.
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> ***Modification / Modify*** - A modification is an altering of the existing base IEC text such as the addition, replacement or deletion of certain words or the replacement of an entire clause, subclause, table, figure, or annex of the base IEC text.
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FOREWORD

INTERNATIONAL ELECTROTECHNICAL COMMISSION

EXPLOSIVE ATMOSPHERES – Part 47: Equipment protection by 2-wire intrinsically safe Ethernet concept (2-WISE)

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

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• the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 60079-47, which is a technical specification, has been prepared by subcommittee 31G: Intrinsically safe apparatus, of IEC technical committee 31: Equipment for explosive atmospheres.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
31G/323/DTS	31G/334/RVC

Full information on the voting for the approval of this technical specification can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 60079 series, published under the general title *Explosive atmospheres*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

• reconfirmed,

• withdrawn,

• replaced by a revised edition, or

• amended.

EXPLOSIVE ATMOSPHERES – Part 47: Equipment protection by 2-wire intrinsically safe Ethernet concept (2-WISE)

1 Scope

1DV *Modification of Clause 1 to replace with the following:*

1DV.1 DE This ~~part of IEC 60079, which is a technical specification,~~ document specifies requirements for the construction, marking and documenting of apparatus, systems and installations for use with the 2-Wire Intrinsically Safe Ethernet concept (2-WISE), such as the physical layer specification for 2-Wire Ethernet 10BASE-T1L as defined in IEEE 802.3cg.

2-WISE is a concept for an advanced physical layer (APL), designed to simplify the examination process for intrinsic safety parameters of components and cabling within APL segments. This is achieved by defining universal intrinsic safety parameter limits for APL ports, according to the specific hazardous area requirements and listing a concise set of rules for the segment setup.

1DV.2 DR The requirements for construction and installation of 2-WISE devices and systems are included in ~~IEC 60079-11~~ UL 60079-11, ~~IEC 60079-14~~ NFPA 70, National Electrical Code (NEC), and ~~IEC 60079-25~~ UL 60079-25, except as modified by this document. Parts of a 2-WISE device can be protected by any Type of Protection listed in ~~IEC 60079-0~~ UL 60079-0 appropriate to the EPL for the intended hazardous area. In these circumstances, the requirements of this ~~technical specification~~ document apply only to intrinsically safe circuits of the apparatus.

1DV.3 DR Where a requirement of this document conflicts with a requirement of ~~IEC 60079-0~~ UL 60079-0, ~~IEC 60079-11~~ UL 60079 11, ~~IEC 60079-14~~ NFPA 70 or ~~IEC 60079-25~~ UL 60079-25, the requirements of this document take precedence.

1DV.4 DE Where references are made to IEC and ISO standards, the referenced requirements found in these standards shall apply as modified by any applicable US National Differences for the standard (see Clause 2).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

2DV DR *Modification of Clause 2 references to replace with the following:*

~~IEC 60079-0, Explosive atmospheres – Part 0: Equipment - General requirements~~

~~IEC 60079-11, Explosive atmospheres – Part 11: Equipment protection by intrinsic safety "i"~~

~~IEC 60079-14, Explosive atmospheres – Part 14: Electrical installations design, selection and erection~~

~~**IEC 60079-25, *Explosive atmospheres – Part 25: Intrinsically safe electrical systems***~~

NFPA 70, *National Electrical Code* (NEC)

UL 60079-0, *Explosive atmospheres – Part 0: Equipment – General requirements*

UL 60079-11, *Explosive atmospheres – Part 11: Equipment protection by intrinsic safety "i"*

UL 60079-25, *Explosive atmospheres – Part 25: Intrinsically safe electrical systems*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60079-0, IEC 60079-11, IEC 60079-14, IEC 60079-25 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

• IEC Electropedia: available at http://www.electropedia.org/

• ISO Online browsing platform: available at http://www.iso.org/obp

3.1
10BASE-T1L
physical layer standard for 10 Mb/s Ethernet communication over a single balanced twisted-pair copper cabling with optional provision of power

Note 1 to entry: This is standardized in IEEE 802.3cg.

3.2
Advanced Physical Layer
APL
physical layer based on 10BASE-T1L

3.3
2-Wire Intrinsically Safe Ethernet
2-WISE
intrinsically safe electrical devices and system based on APL with standardized limits for intrinsic safety parameters at each port

3.4
2-WISE device
electrical equipment, either intrinsically safe apparatus or associated apparatus, that provides at least one 2-WISE compliant port

3.5
2-WISE system
assembly of interconnected items of 2-WISE devices, described in a descriptive system document, in which the circuits or parts of the circuits, intended to be used in an explosive atmosphere, are intrinsically safe circuits

3.6
Ports

3.6.1
power source port
port which in addition to communication feeds DC power into an APL segment

3.6.2
power load port
port which in addition to communication consumes DC power from an APL segment

3.6.3
communication only port
port which provides communication only and does not feed or consume significant power in normal operation

3.6.1
auxiliary device port
port of a 2-WISE device that provides functions other than communication

Note 1 to entry: 2-WISE devices with an auxiliary port can comprise a power load or introduce communication signal insertion losses. A surge protector is such a device.

3.7
APL segment
interconnection of a power source port and a power load port or, alternatively, two communication only ports within a 2-WISE system

4 Requirements for 2-WISE devices

4.1 General

2-WISE devices shall conform to the relevant requirements of IEC 60079-11, except as modified by this document. 2-WISE devices shall be suitable for use in a 2-WISE system in accordance with this document.

Each port shall conform to the requirements of 4.2, 4.3 or 4.4.

If a termination network is present inside a 2-WISE power source port, power load port or communication only port, which is additional to the specified maximum output values allowed for 2-WISE, presenting a capacitance at the port connection facilities, the effective value of the capacitance shall not exceed 2,2 µF when the capacitance is protected by a series resistor of minimum value 90 Ω. Other equivalent combinations of capacitance and resistance may also be selected according to the permitted reduction of effective capacitance when protected by a series resistance requirements of IEC 60079-11.

NOTE The dielectric strength requirements for the insulation between the terminals of 2-WISE ports and the frame of the 2-WISE device or parts which are earthed are identical to those required in IEC 60079-11 between an intrinsically safe circuit and the frame of the electrical equipment or parts which are earthed.

4.2 2-WISE power source ports

Each 2-WISE power source port may have a linear or a non-linear output characteristic. The maximum output voltage U_o shall be in the range of 14 V to 17,5 V under the conditions specified in IEC 60079-11 for the respective Level of Protection.

The maximum voltage U_o is the sum of the DC supply voltage and the communication voltage. The maximum internal capacitance C_i and inductance L_i shall be not greater than 5 nF and 10 µH, respectively.

The maximum output current I_o for any 2-WISE power source port shall be determined in accordance with IEC 60079-11 and shall not exceed 380 mA.

The maximum output power P_o shall not exceed 5,32 W.

NOTE 1 Voltage and current limits for 2-WISE power source ports with a rectangular output characteristic can be found in IEC 60079-11 for the Fieldbus Intrinsically Safe Concept (FISCO) – apparatus requirements.

NOTE 2 Possible opening, shorting and earthing of field wiring connected to the port is also taken into account for the determination of the electrical parameters of a 2-WISE power source port.

4.3 2-WISE power load ports and 2-WISE auxiliary device ports

The following requirements apply to 2-WISE power load ports and 2-WISE auxiliary device ports connected to an intrinsically safe system whether installed inside or outside the hazardous area, in addition to the relevant clauses of IEC 60079-11.

The electrical parameters for 2-WISE power load ports and 2-WISE auxiliary device ports shall meet the values given in Table 1.

Table 1
Intrinsically safe parameters for 2-WISE Power load ports and auxiliary device ports

		2-WISE power load port	2-WISE auxiliary device port
Maximum input voltage	U_i	17,5 V	17,5 V
Maximum input current	I_i	380 mA	380 mA
Maximum input power	P_i	5,32 W	5,32 W
Maximum internal capacitance	C_i	5 nF	5 nF
Maximum internal inductance	L_i	10 µH	200 nH
Maximum leakage current		1 mA	50 µA
The values given above apply for all equipment groups.			

Under normal or fault conditions as specified in IEC 60079-11 for the respective Level of Protection, the connection facilities of 2-WISE load and auxiliary device ports shall not be a source of energy to the system except for a leakage current not exceeding the values given in Table 1.

4.4 2-WISE communication only ports

2-WISE communication only ports shall have a linear output characteristic.

The electrical parameters for 2-WISE communication only ports, connected to an intrinsically safe system, shall meet the values given in Table 2.

Table 2
Intrinsically safe parameters for 2-WISE communication only ports

Maximum output voltage	U_o	9 V
Maximum output current	I_o	112,5 mA
Maximum output power	P_o	254 mW
Maximum input voltage	U_i	17,5 V
Maximum input current	I_i	380 mA
Maximum input power	P_i	5,32 W
Maximum internal capacitance	C_i	5 nF
Maximum internal inductance	L_i	10 µH
NOTE The values of U_i, I_i and P_i are designed to prevent unintentional damage of an communication only port, if it is accidently connected to a powered port.		

4.5 Simple apparatus

The internal inductance L_i and internal capacitance C_i of each simple apparatus connected to a 2-WISE system shall be less than 1 µH and 1 nF respectively.

With the exception of the marking requirements found in Clause 7, simple apparatus shall comply with all relevant requirements of this document and of IEC 60079-11.

5 Requirements for 2-WISE systems

5.1 General

A typical 2-WISE system comprises two 2-WISE ports connected to the opposite ends of a cable, with a maximum of two 2-WISE devices with 2-WISE auxiliary device ports in between.

There are two different types of 2-WISE systems:

– the communication only system; and

– the powered system.

The common function is communication. The powered system provides additional supply power in the following manner:

– the power source port supplies DC power to the system, and the power load port consumes DC power from the system. Auxiliary device ports may also consume DC power from the system.

– in an communication only system no DC power is provided to the system via the 2-WISE connection and in this case 2-WISE devices are always separately powered. A communication only port shall not be connected to a power source port.

Simple apparatus according to 4.5 may be added to a 2-WISE system without modifying the safety assessment of the system.

The total inductance and capacitance of all simple apparatus connected to a 2-WISE system shall not exceed 10 µH and 5 nF respectively.

NOTE 1 2-WISE connection facilities or electromechanical switches are considered as simple apparatus according to 4.5 but do not contribute to the total inductance and capacitance.

NOTE 2 For functional reasons, the cable (stubs) for connecting 2-WISE devices with auxiliary device ports in parallel to the 2-WISE system, will be less than 1 m, and are not considered to be part of the total cable length of the 2-WISE system.

5.2 Wiring systems

The cable used in a 2-WISE system shall comply with the following parameters:

– cable resistance R_c: 15 Ω/km to 150 Ω/km;

– cable inductance L_c: 0,4 mH/km to 1 mH/km;

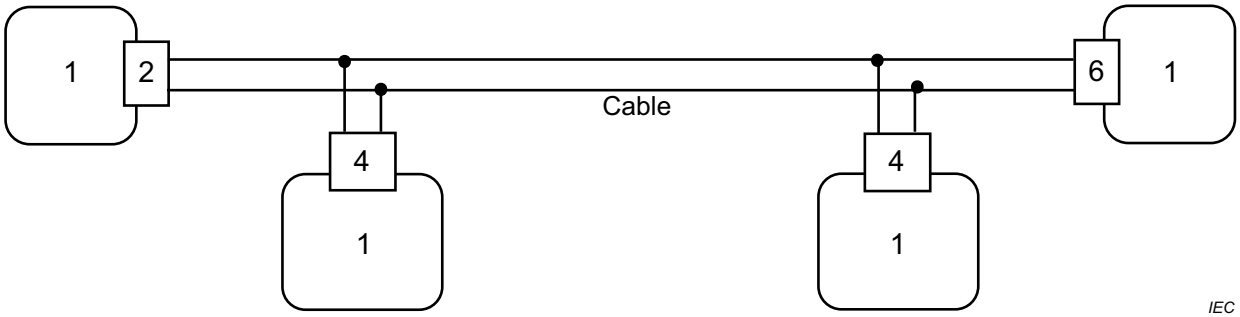
– cable capacitance C_c: 45 nF/km to 200 nF/km;

NOTE 1 The installation and constructional requirements of individual cables and multi-circuit cables carrying more than one intrinsically safe circuit are contained in IEC 60079-25.

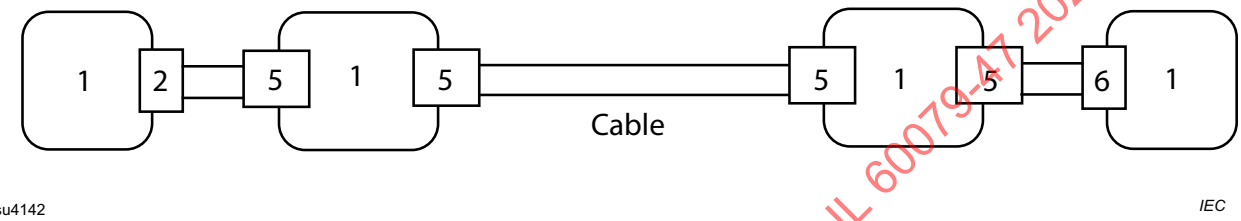
NOTE 2 For the determination of cable parameters see IEC 60079-25.

5.3 Powered 2-WISE systems

A DC-powered 2-WISE system shall be considered intrinsically safe if one 2-WISE source port, one 2-WISE power load port and up to two 2-WISE auxiliary device ports are connected with a cable of maximum length 200 m, according to the above specification and as shown in Figure 1.



a) 2-WISE auxiliary device ports connected with short wires (stubs) to the cable



b) 2-WISE auxiliary device ports connected via a series connection in the cable

Key

1 2-WISE device

2 2-WISE power source port

4 2-WISE auxiliary device port

5 2-WISE auxiliary device port that is physically split into two termination facilities, but electrically connected through and therefore counted as one 2-WISE auxiliary device port per 2-WISE device

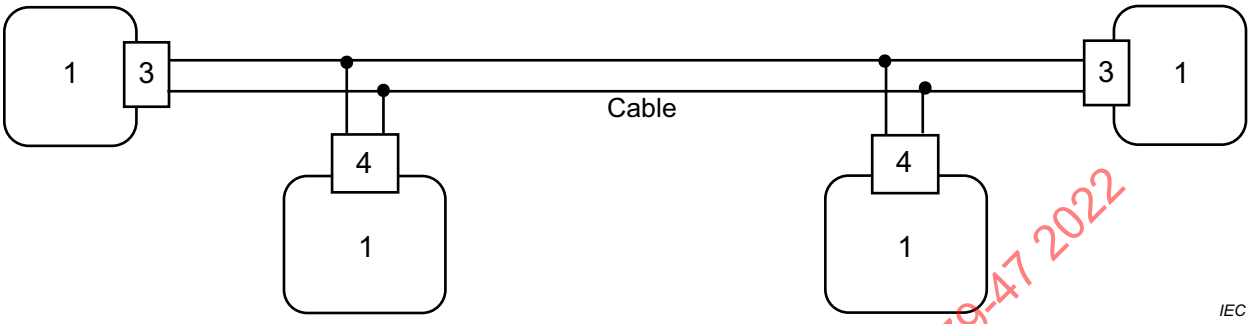
6 2-WISE power load port

Figure 1

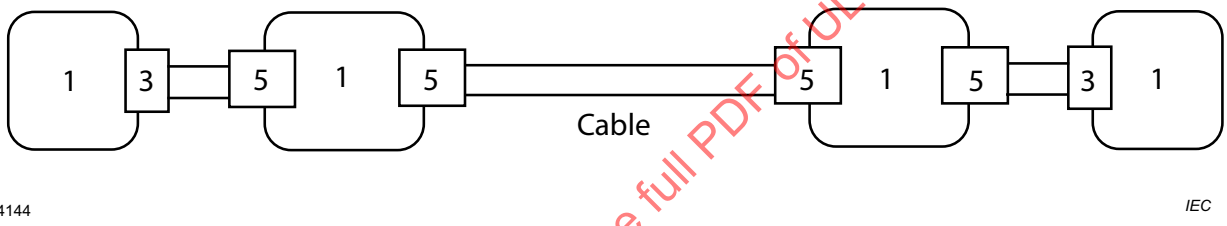
DC-powered 2-WISE system

5.4 Communication only 2-WISE systems

A communication only 2-WISE system shall be considered intrinsically safe if two 2-WISE communication only ports and up to two 2-WISE auxiliary device ports are connected with a cable of maximum length 1 000 m, according to 5.2 and as shown in Figure 2.



a) 2-WISE auxiliary device ports connected in parallel with short wires (stubs) to the cable



b) 2-WISE auxiliary device ports connected via a series connection to the cable

Key

1 2-WISE device

3 2-WISE communication only port

4 2-WISE auxiliary device port

5 2-WISE auxiliary device port that is physically split in two termination facilities but electrically connected through and therefore counted as one 2-WISE auxiliary device port per 2-WISE device

Figure 2

Communication only 2-WISE system