Isolation Proposals, Revised 2025-03-12

Submitted by Jason Potterf - Cisco

Contents

Topic: Align General Safety Text with Clause 147

Revise Clause 188.10 as shown

188.10 Environmental specifications

188.10.1 General safety

All equipment subject to this clause shall ~~is expected to~~ conform to Annex J.2. ~~IEC 60950-1, IEC 62368-1, or~~ An example of an application-specific standard potentially applicable to this clause is IEC 61010-1. ~~All equipment subject to this clause is expected to conform to all applicable local, state, national, and application-specific standards.~~

Propose Maintenance Item for Clause 147.10

147.10 Environmental specifications

147.10.1 General safety

All ~~E~~equipment subject to this clause shall conform to ~~the general safety requirements in~~ Annex J.2. ~~or~~ An example of an application-specific standard potentially applicable to this clause is IEC 61010-1~~, as appropriate. All equipment subject to this clause is expected to conform to all applicable local, state, national, and application-specific standards.~~

Reference but do not alter Annex J.2

J.2 General safety

Equipment shall comply with all applicable local, state, national and application-specific standards, such as the applicable sections of IEC 62368-1:2018.

Topic: Remove Telephony Voltage Section

Remove Section 188.10.3 Telephony voltages in its entirety

~~188.10.3 Telephony voltages~~

~~The use of building wiring brings with it the possibility of wiring errors that might connect telephony voltages to a DTE. Other than voice signals, the primary voltages that can be encountered are the "battery" and ringing voltages. Although there is no universal standard, the following maximums generally apply: Battery voltage to a telephone line is generally 56 V DC, applied to the line through a balanced 400 Ω source impedance. Ringing voltage is a composite signal consisting of an AC component and a DC component. The AC component is up to 175 Vp at 20 Hz to 60 Hz with a 100 Ω source resistance. The DC component is 56 V DC with 300 Ω to 600 Ω source resistance. Large reactive transients can occur at the start and end of each ring interval. Care should be taken to avoid such connections as they can damage equipment. Application of any of the above voltages to the TCI of a DTE in non-automotive applications shall not preclude conformance with 188.10.1 and 188.10.2.~~

Topic: Annex J Expansion

Revise Annex J as shown

Annex J

(normative)

Electrical isolation and general safety

The requirements specified in this annex are to be used in conjunction with the requirements in the clause that specifies the interface(s) under consideration.

J.1 Electrical isolation

(Editorial Note: Question - at what point do we have to redfine acronyms? Once per doc, once per clause/annex?)

(Reviewer Note: I am fully aware that the text below is ambitious and could very likely exceed the scope of 802.3da. If so, I'm happy to reduce the text until it fits within our scope, but this text demonstrates one possible "north star" for the eventual state of isolation requirements we might be able to achieve in 802.3.)

PHY isolation is specified in numerous clauses of this standard to prevent propagation of faults across electrical interfaces. Clause 33 and Clause 145 Power over Ethernet (PoE) require isolation for all implementations of both PSEs and PDs and specifies a slightly modified version of the PHY Isolation test procedure. Clause 104 Power over Data Lines (PoDL) requires reduced isolation for PDs only and has no isolation requirements on PSEs.

Clause 189 MPoE differs in that it permits two system types with different MPI isolation requirements: Isolated MPoE and Grounded MPoE systems. This enables MPoE to adapt to common power distribution systems encountered in the environments where it is likely to be deployed.

Isolated MPoE systems, as shown in Figure J-1, are recommended for mixing segments that crosses any of the following:

— Ground references
— Boundaries between separate power distribution systems
— Boundaries of a single building

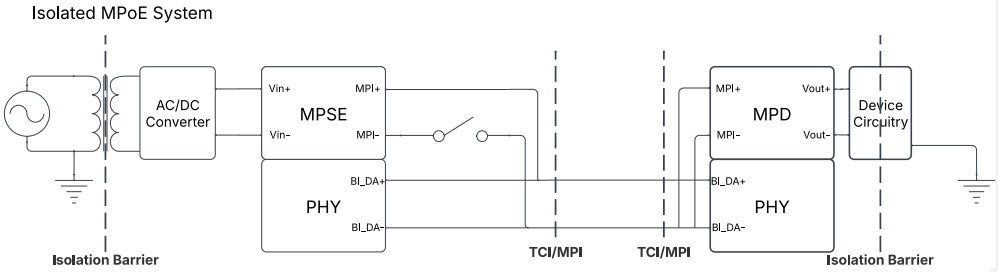

Figure J-1 Isolated MPoE System Diagram

Isolated MPoE systems have isolation requirements that are aligned with Clause 33 and Clause 145 isolation requirements. These isolation requirements target compatibility with low-voltage systems that prohibit intentional grounding of any

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conductor, such as a Safety Extra-Low Voltage (SELV) system. Because the MPSE outputs are isolated and floating, disconnecting the more negative conductor is sufficient to stop the flow of power and ground loops are not present.

Grounded MPoE systems, as shown in Figure J-2, are recommended for mixing segments which, with all associated interconnected equipment, share a common, continuous ground.

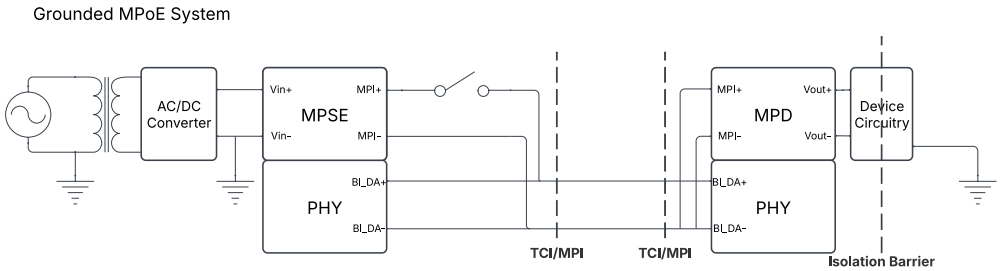

Figure J-2 Grounded MPoE System Diagram

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Grounded MPoE systems have isolation requirements that are aligned with Clause 104 isolation requirements. These isolation requirements target compatibility with low-voltage systems that intentionally ground one conductor, such as a Protective Extra-Low Voltage (PELV) system. Grounded MPSEs are permitted to ground the more negative conductor of their power supply, but must switch their more positive conductor to ensure that a ground path does not circumvent the MPSE's ability to stop the flow of power. MPDs are required to meet a lower isolation requirement to ensure the current supplied by the MPSE on the MPI returns to the MPSE via the MPI.

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J.1.1 Electrical isolation for PHY transceivers

Electrical isolation shall withstand at least one of the following electrical strength tests:

a) 1500 V rms at 50 Hz to 60 Hz. This test voltage amplitude is raised from zero to the prescribed voltage and held at that value for 60 s.
b) 2250 V dc. This test voltage is raised from zero to the prescribed voltage and held at that value for 60 s.
c) A sequence of ten 2400 V impulses of alternating polarity, applied at intervals of not less than 1 s. The shape of the impulses is 1.2/50 (1.2 µs virtual front time, 50 µs virtual time to half value), such as one produced by a 1.2/50-8/20 combination wave generator, as defined in ITU-T Recommendation K.44.

NOTE 1—If the MDI is also a Clause 33 or Clause 145 PI then see 33.4.1 or 145.4.1 for specific requirements associated with option c).

There shall be no insulation breakdown during the test. Insulation breakdown is considered to have occurred when the current that flows as a result of the application of the test voltage rapidly increases in an uncontrolled manner; that is, the insulation does not restrict the flow of the current. Corona discharge is not regarded as insulation breakdown. The resistance after the test shall be at least 2 MΩ, measured at 500 V dc.

NOTE 2—IEEE Std 802.3-2018 and previous revisions provided references to various editions of the IEC 60950-1 standard for guidance in performing the isolation test for options a) and b). IEC 60950-1 has been withdrawn. References to IEC standards are not essential to performing the isolation test specified in J.1. No technical change is implied by the removal of these references.

NOTE 3—Implementers should consider the effect of whether other ports are terminated or unterminated when testing the insulation of multi-port devices.

J.1.2 Electrical isolation requirements for fully isolated systems

Electrical isolation shall withstand at least one of the following electrical strength tests:

a) 1500 V rms at 50 Hz to 60 Hz. This test voltage amplitude is raised from zero to the prescribed voltage and held at that value for 60 s.
b) 2250 V dc. This test voltage is raised from zero to the prescribed voltage and held at that value for 60 s.
c) An impulse test consisting of a 1500 V, 10/700 waveform, applied 10 times, with a 60 s interval between pulses. The shape of the impulses is 10/700 (10 µs virtual front time, 700 µs virtual time to half value), as defined in ITU-T Recommendation K.44.

There shall be no insulation breakdown during the test. Insulation breakdown is considered to have occurred when the current that flows as a result of the application of the test voltage rapidly increases in an uncontrolled manner; that is, the insulation does not restrict the flow of the current. Corona discharge is not regarded as insulation breakdown. The resistance after the test shall be at least 2 MΩ, measured at 500 V dc.

NOTE 1—IEEE Std 802.3-2018 and previous revisions provided references to various editions of the IEC 60950-1 standard for guidance in performing the isolation test for options a) and b). IEC 60950-1 has been withdrawn. References to IEC standards are not essential to performing the isolation test specified in J.1. No technical change is implied by the removal of these references.

NOTE 2—Implementers should consider the effect of whether other ports are terminated or unterminated when testing the insulation of multi-port devices.

J.1.3 Electrical isolation for partially isolated systems

Electrical isolation shall provide at least 1 MΩ dc isolation when measured using a 5 V ± 20% source voltage.

J.2 General safety

Equipment shall comply with all applicable local, state, national and application-specific standards, such as the applicable sections of IEC 62368-1:2018.

J.3 Protocol implementation conformance statement (PICS) proforma for Annex J, Electrical isolation and general safety[270]

(Reviewer note: PICS will be written once requirements are stable.)

J.3.1 Introduction

The supplier of a protocol implementation that is claimed to conform to Annex J, Electrical isolation and general safety, shall complete the following protocol implementation conformance statement (PICS) proforma.

A detailed description of the symbols used in the PICS proforma, along with instructions for completing the PICS proforma, can be found in Clause 21.

J.3.2 Identification

J.3.2.1 Implementation identification

Supplier[1]	
Contact point for inquiries about the PICS[1]	
Implementation Name(s) and Version(s)[1,3]	
Other information necessary for full identification—e.g., name(s) and version(s) for machines and/or operating systems; System Name(s)[2]	
NOTE 1—Required for all implementations. NOTE 2—May be completed as appropriate in meeting the requirements for the identification. NOTE 3—The terms Name and Version should be interpreted appropriately to correspond with a supplier's terminology (e.g., Type, Series, Model).	

J.3.2.2 Protocol summary

Identification of protocol standard	IEEE Std 802.3-2022, Annex J, Electrical isolation and general safety
Identification of amendments and corrigenda to this PICS proforma that have been completed as part of this PICS	
Have any Exception items been required? No [ ] Yes [ ] (See Clause 21; the answer Yes means that the implementation does not conform to IEEE Std 802.3-2022.)	

Date of Statement	

J.3.3 Major capabilities/options

Item	Feature	Subclause	Value/Comment	Status	Support
*ISO	Electrical isolation	J.1		O	Yes [ ] No [ ]
*SAF	General safety	J.2		O	Yes [ ] No [ ]

J.3.4 PICS proforma tables for electrical isolation and general safety

J.3.4.1 Electrical isolation

Item	Feature	Subclause	Value/Comment	Status	Support
ISO1	Electrical isolation test a) performed	J.1	J.1 item a)	ISO:O.1	Yes [ ] No [ ] N/A [ ]

ISO2	Electrical isolation test b) performed	J.1	J.1 item b)	ISO:O.1	Yes [ ] No [ ] N/A [ ]
ISO3	Electrical isolation test c) performed	J.1	J.1 item c)	ISO:O.1	Yes [ ] No [ ] N/A [ ]
ISO4	Insulation breakdown after test	J.1	>2 MΩ, measured at 500 V dc	ISO:M	Yes [ ] N/A [ ]

J.3.4.2 General safety

Item	Feature	Subclause	Value/Comment	Status	Support
SAF1	Conformance to safety specifications	J.2	IEC 62368-1:2018, where applicable	SAF:M	Yes [ ] N/A [ ]

Topic: Clause 189 Isolation Section Rewrite

Revise Section 189.6.2 Electrical isolation as follows:

189.6.2 Electrical ~~isolation~~ distribution system compatibility

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~~MPDs and MPSEs shall provide isolation between all accessible external conductors, including frame ground (if any), and all MPI leads, including those not used by the MPD or MPSE. Any equipment that can be connected to an MPSE or MPD through a non-MPI connector that is not isolated from the MPI leads needs to provide isolation between all accessible external conductors, including frame ground (if any), and the non-MPI connector. External accessibility to conductors is specified in Section 5.4.10.1 b) of IEC 62368-1:2023.~~

MPoE permits two approaches to electrical distribution system compatibility.

— Isolated MPoE systems: See Annex J.1 for criteria defining when an MPoE system requires isolation.

— Grounded MPoE systems: See Annex J.1 for criteria defining when a power distribution system is permitted to be grounded.

~~189.6.2.1 Electrical isolation environments~~

~~There are three electrical power distribution environments to be considered that require different electrical isolation properties. They are as follows:~~

~~— MPoE Environment A: When a mixing segment, with all its associated interconnected equipment, is entirely contained within a single low-voltage power distribution system and within a single building.~~

~~— MPoE Environment B: When a mixing segment crosses the boundary between separate power distribution systems or the boundaries of a single building.~~

~~— MPoE Environment C: When a mixing segment, with all its associated interconnected equipment, is entirely contained within a single low-voltage power distribution system contained within a single cabinet, vehicle, machine, or other power domain where ground loops are unlikely to occur.~~

189.6.2.~~1~~.1 MPoE ~~Environment A~~ requirements for Isolated MPoE systems

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Isolated ~~Attachment of a network segment via a Network Interface Device (NID) that has multiple instances of an MPI requires electrical isolation between each segment and the protective ground of the NID.~~

MPDs and Isolated MPSEs shall provide electrical power isolation between all ~~accessible~~ external conductors to which a connection can be made, including frame ground (if any), and all MPI leads, including those not used by the MPD or MPSE. An MPSE that has more than one MPSE MPI does not require electrical power isolation between MPSE MPIs. An MPD that has more than one MPI, either to implement Mulitple MPDs via multiple MPIs, or to implement a combination of MPD and MPSE MPIs, shall provide electrical power isolation between all MPD MPIs as well as between any MPD MPIs and any MPSE MPIs.

~~Any equipment that can be connected to an MPSE or MPD through a non-MPI connector that is not isolated from the MPI leads needs to provide isolation between all accessible external conductors, including frame ground (if any), and the non-MPI connector. External accessibility to conductors is specified in Section 5.4.10.1 b) of IEC 62368-1:2023.~~

This electrical isolation shall meet the isolation requirements as specified in Annex J.1.2. ~~with electrical strength test c) details being replaced by: "An impulse test consisting of a 1500 V, 10/700 waveform, applied 10 times, with a 60 s interval between pulses. The shape of the impulses is 10/700 (10 µs virtual front time, 700 µs virtual time to half value)", as defined in ITU-T Recommendation K.44.~~

Any equipment that can be connected to an MPSE or MPD through a non-MPI connector that is not isolated from the MPI conductors needs to provide isolation between all accessible external conductors, including frame ground (if any), and the non-MPI connector.

~~For NIDs, the requirement for isolation is encompassed within the isolation requirements of the PHY (e.g., see 14.3.1.1, 25.4.6, or 40.6.1.1). Equipment with multiple instances of MPSE, MPD, or both shall meet or exceed the isolation requirement of the PHY with which they are associated.~~

~~An Environment A multiport NID does not require electrical power isolation between mixing segments.~~

A~~n Environment A~~ Isolated MPSE shall switch the more negative conductor. It is allowed to switch both conductors.

~~189.6.2.1.2 MPoE Environment B requirements~~

~~The attachment of network segments that cross Environment A boundaries requires electrical isolation between each segment and all other attached segments as well as to the protective ground of the NID.~~

~~This electrical isolation shall meet the isolation requirements as specified in Annex J.1 with electrical strength test c) details being replaced by: "An impulse test consisting of a 1500 V, 10/700 waveform, applied 10 times, with a 60 s interval between pulses. The shape of the impulses is 10/700 (10 µs virtual front time, 700 µs virtual time to half value)", as defined in ITU-T Recommendation K.44.~~

~~For NIDs, the requirement for isolation is encompassed within the isolation requirements of the PHY (e.g., see 14.3.1.1, 25.4.6, or 40.6.1.1). Equipment with multiple instances of MPSE, MPD, or both shall meet or exceed the isolation requirement of the PHY with which each is associated.~~

~~An environment B MPSE shall switch the more negative conductor. It is allowed to switch both conductors. The requirements for interconnected electrically conducting link segments that are partially or fully external to a single building environment may require additional protection against lightning strikes or other hazards. Protection requirements for such hazards are beyond the scope of this standard. Guidance on these requirements may be found in Section 6 of IEC 60950-1:2001 and throughout IEC 62368-1:2023, as well as many local and national codes related to safety.~~

189.6.2.~~1.3~~ 2 MPoE ~~Environment C~~ requirements for Grounded MPoE systems

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A Grounded MPSE does not require electrical isolation between mixing segments, nor is electrical power isolation required between Clause 104 link segments and the MPoE mixing segements.

A Grounded MPSE shall switch the more positive conductor. It is allowed to switch both conductors.

~~Attachment of network segments via NIDs that have multiple instances of an MPI requires electrical isolation between each segment and the protective ground of the NID.~~MPDs compatible with Grounded MPSEs shall provide electrical power isolation between all external conductors to which a connection can be made, including

frame ground (if any), and all MPI leads, including those not used by the MPD. An MPD that has more than one MPI shall provide electrical power isolation between all MPD MPIs as well as between any MPD MPIs and any MPSE MPI.

This electrical power isolation shall meet the isolation requirements as specified in Annex J.1.3. Any equipment that can be connected to an MPD through a non-MPI connector that is not isolated from the MPI leads needs to provide isolation between all accessible external conductors, including frame ground (if any), and the non-MPI connector.

~~This electrical isolation shall provide at least 1 MΩ DC isolation between all accessible external conductors, including frame ground (if any), and all MPI leads, when measured using a 5 V ± 20% source voltage. Environment C MPSEs shall not be required to comply with the isolation requirements as specified in Annex J.1.~~

~~For NIDs, the requirement for isolation is encompassed within the isolation requirements of the PHY (e.g., see 14.3.1.1, 25.4.6, or 40.6.1.1). Equipment with multiple instances of MPSE, MPD, or both shall meet or exceed the isolation requirement of the PHY with which they are associated.~~

~~An Environment C multiport NID does not require electrical power isolation between link segments.~~

~~An Environment C MPSE shall switch the more negative conductor. It is allowed to switch both conductors.~~

Topic: Update Labeling Requirements

Revise Section 189.7.8 Labeling as follows:

189.7.8 Labeling

It is recommended that the MPSE or MPD (and supporting documentation) be labeled in a manner visible to the user with at least the following parameters:

a) System type (i.e., “Type 0”, “Type 1”, or “Type 0/1”).

b) Port type (e.g., 10BASE-T1M, TIA Category, or ISO Class).

c) “MPSE” or “MPD” as appropriate.

d) MPoE ~~Environment~~ system type (e.g., ~~Environment A, B,~~ Isolated or ~~C~~ Grounded).

e) Maximum continuous power supplied or consumed in units of Watts.

f) Maximum current supply capacity or consumption in units of Amperes.

g) For MPDs only, unit loads for each compatible operating voltage range.

h) For isolated MPoE MPSEs or MPDs, ~~Indicate~~ indicate any non-MPI connectors which are not isolated from the MPI leads.

i) Any applicable safety warnings.

Grounded MPSEs and MPDs that are only compatible with Grounded MPSes as permitted in 189.6.2.1.2 shall clearly indicate that it is only compatible with Grounded MPoE systems. Grounded MPSEs shall also indicate the MPI(s) are internally grounded or intended to be grounded at an external connection point.