

169.6 Additional electrical specifications

This clause defines additional electrical specifications for a fully connected MPoE system (that is, MPSE, cabling, one or more MPDs, and related PHYs) and therefore to each element of such a system.

169.6.1 Electrical isolation

MPDs and MPSEs shall provide isolation between all accessible external conductors, including frame ground (if any), and all **MDITCI** leads, including those not used by the MPD or MPSE. Any equipment that can be connected to an MPSE or MPD through a non-**MDITCI** connector that is not isolated from the **MDITCI** leads needs to provide isolation between all accessible external conductors, including frame ground (if any), and the non-**MDITCI** connector. External accessibility to conductors is specified in Section 5.4.10.1 b) of IEC 62368-1:2023+8.

169.6.1.1 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 LAN or LAN 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 LAN crosses the boundary between separate power distribution systems or the boundaries of a single building.

— **MPoE Environment C**: When a LAN or LAN 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.

169.6.1.1.1 MPoE Environment A requirements

Attachment of network segments via NIDs that have multiple instances of a **balanced** twisted-pair **MDITCI** requires electrical isolation between each segment and 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.” **class**

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

An Environment A multiport NID does not require electrical power isolation between **link-mixing** segments.

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

169.6.1.1.2 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.” **class**

For NIDs, the requirement for isolation is encompassed within the isolation requirements of the MAU or PHY (see 14.3.1.1, 25.4.6, and 40.6.1.1). Equipment with multiple instances of MPSE, MPD, or both shall meet or exceed the isolation requirement of the MAU/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.

169.6.1.1.3 MP~~o~~E Environment C requirements

Attachment of network segments via NIDs that have multiple instances of a balanced twisted-pair MDITCI requires electrical isolation between each segment and the protective ground of the NID.

This electrical isolation shall provide at least 1 MΩ dc isolation between all accessible external conductors, including frame ground (if any), and all MDITCI 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 MAU or PHY (see 14.3.1.1, 25.4.6, and 40.6.1.1). Equipment with multiple instances of MPSE, MPD, or both shall meet or exceed the isolation requirement of the MAU/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.