

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures –

Part 15: Functional safety requirements for insulation monitoring devices in IT systems and equipment for insulation fault location in IT systems

Sécurité électrique dans les réseaux de distribution basse tension de 1 000 V c.a. et 1 500 V c.c. – Dispositifs de contrôle, de mesure ou de surveillance de mesures de protection –

Partie 15: Exigences de sécurité fonctionnelle pour les contrôleurs d'isolement de réseaux IT et les dispositifs de localisation de défauts d'isolement pour réseaux IT



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ELECTRICAL SAFETY IN LOW VOLTAGE DISTRIBUTION SYSTEMS UP TO 1 000 V AC AND 1 500 V DC – EQUIPMENT FOR TESTING, MEASURING OR MONITORING OF PROTECTIVE MEASURES –

Part 15: Functional safety requirements for insulation monitoring devices in IT systems and equipment for insulation fault location in IT systems

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

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

This part of IEC 61557 is to be used in conjunction with Part 8 and Part 9.

A list of all parts of the IEC 61557 series, published under the general title *Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures*, can be found on the IEC website.

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INTRODUCTION

IEC 61508 deals with functional safety, this topic being of utmost importance for safety related systems. Functional safety may be applicable to IT systems where safety is based on insulation monitoring devices (IMD) and insulation fault location systems (IFLS), and also on additional safety related measures (e.g. circuit-breakers).

Insulation monitoring devices and insulation fault location systems comprise electrical and electronic components and can comprise embedded software.

Product requirements for these devices are defined in IEC 61557-8 and IEC 61557-9. These standards include elementary requirements which need to be taken into account for the functional safety approach according to IEC 61557-15, but do not cover the whole range of requirements which shall be fulfilled for the assignment of a defined level of functional safety and for the respective validation.

IEC 61508 series covers basic aspects to be considered when electrical and electronic systems are used to carry out safety functions. One of the major objectives of this series of standards is to facilitate the development of international application or equipment standards by the responsible technical committee. This will allow the technical committee to take the special requirements of their application fully into account.

It is recognized that there is a great variety of applications of insulation monitoring devices and of insulation fault location systems in IT systems. This part of IEC 61557 defines basic safety functions as well as their related levels of functional safety (SIL) and defines feasible measures and principles to develop and validate these devices and systems under functional safety aspects.

Figure 1 shows the link between IEC 61557-15 and the relevant product, safety and EMC standards as well as the link to the IEC 61508 series.

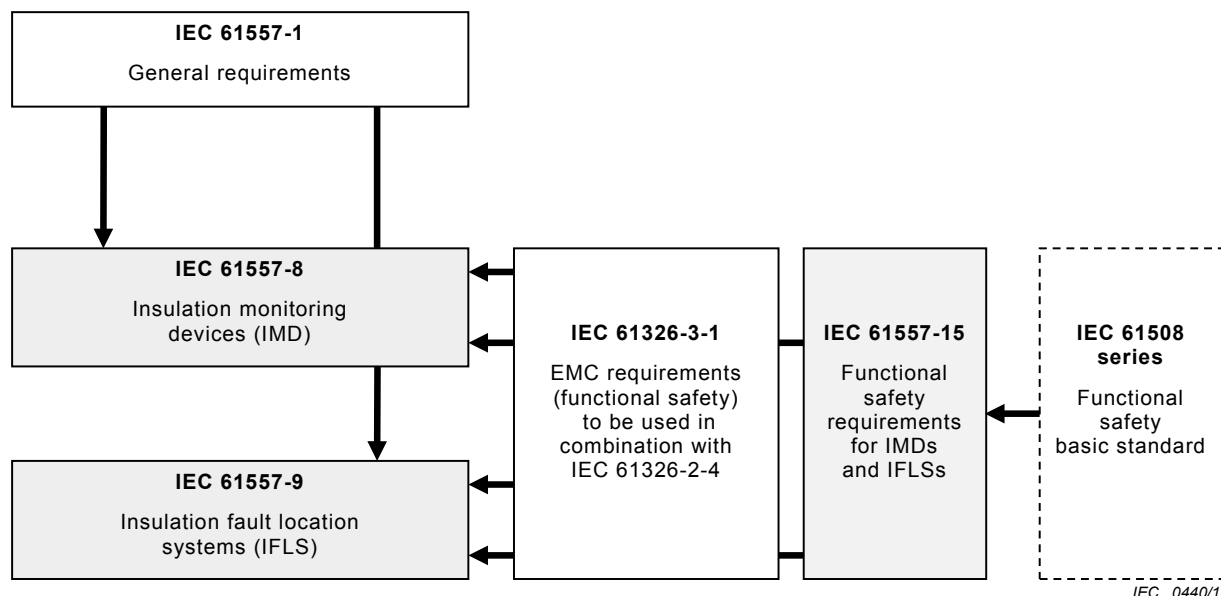


Figure 1 – Relationship between IEC 61557-15 and related standards

This part of IEC 61557 does not cover phases 1 to 9 and 11 to 16 of IEC 61508-1 for the complete IT systems. In particular, this standard does not cover the use of IMDs and IFLSs in customer application.

NOTE 1 An insulation fault location system (IFLS) can consist of several devices according to IEC 61557-9: insulation fault locator (IFL), locating current injector (LCI), locating current sensor (LCS), insulation monitoring device (IMD) according to IEC 61557-8.

IMDs and IFLSs are not protective devices in general, but they are part of the protective measures in IT systems. IMDs and IFLSs function as permanent monitoring of the insulation resistance of the unearthed IT system and the localization of insulation faults in any part of the system can be seen as safety functions which are part of the protective measures in an IT system.

This part of IEC 61557 only applies to IMDs and IFLSs implementing SIL 1 and SIL 2 related safety functions. Higher SIL levels are not specified in this standard because those levels are generally not required for IMDs and IFLSs in IT systems.

Conformance to this standard may be required for IMDs or IFLSs when functional safety is requested in the respective application within IT systems. However, it does not generally dictate that for these devices, a defined level of functional safety according to this standard is required.

NOTE 2 Examples of applications where functional safety can be requested depending on the risk analysis are:

- chemistry,
- mines,
- marine,
- hospital,
- photovoltaic farms,
- railway signalling systems,
- control systems (e.g. in nuclear power plants),
- etc.

Examples of typical applications are provided in Annex F.

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Part 15: Functional safety requirements for insulation monitoring devices in IT systems and equipment for insulation fault location in IT systems

1 Scope

This part of IEC 61557 specifies requirements related to functional safety and is based on the IEC 61508 standard series for the realization of insulation monitoring devices (IMD) as specified in IEC 61557-8 and for insulation fault location systems (IFLS) according to IEC 61557-9, according to phase 10 of the IEC 61508-1 lifecycle. These devices provide safety related functions for IT systems.

This part of IEC 61557 is:

- concerned only with functional safety requirements intended to reduce the functional risk during the use of IMDs and IFLSs;
- restricted to risks arising directly from the device itself or from several IMDs or IFLSs working together in a system;
- intended to define the basic safety functions provided by the devices.

This part of IEC 61557 does not:

- deal with electrical safety according to IEC 61010-1 and the requirements of IEC 61557-8 and IEC 61557-9;
- cover the hazard and risk analysis of a particular use of the IMD or IFLS;
- identify all the safety functions for the application in which the IMD or IFLS is used;
- cover the IMD or IFLS manufacturing process.

Functional safety requirements depend on the application and should be considered as part of the overall risk assessment of the specific application. The supplier of IMDs and IFLSs is not responsible for the application. The application designer is responsible for the risk assessment and for specifying the overall functional safety requirements of the complete IT system and he should select the functional safety level (SIL) of the IMD and/or IFLS when their safety function is part of the functional safety assessment in the IT system.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61508-1:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 1: General requirements*

IEC 61508-2:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems*

IEC 61508-3:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 3: Software requirements*

IEC 61508-4:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 4: Definitions and abbreviations*

IEC 61508-5:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 5: Examples of methods for the determination of safety integrity levels*

IEC 61508-6:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 6: Guidelines on the application of IEC 61508-2 and IEC 61508-3*

IEC 61557-1, *Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 1: General requirements*

IEC 61557-8, *Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 8: Insulation monitoring devices for IT systems*

IEC 61557-9:2009, *Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 9: Equipment for insulation fault location in IT systems*

IEC 61326-2-4:2012, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 2-4: Particular requirements. Test configurations, operational conditions and performance criteria for insulation monitoring devices according to IEC 61557-8 and for equipment for insulation fault location according to IEC 61557-9*

IEC 61326-3-1:2008, *Equipment for measurement, control and laboratory use – EMC requirements – Part 3-1: Immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety) – General industrial applications*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the definitions given in IEC 61557-1, IEC 61557-8 and IEC 61557-9 and the following apply.

3.1.1

hazard

potential source of harm

Note 1 to entry: The term includes danger to persons arising within a short time scale (for example, fire and explosion) and those that have a long-term effect on a person's health (for example, release of a toxic substance).

[SOURCE: ISO/IEC Guide 51:1999, 3.5, modified – The note has been adapted.]

3.1.2

electrical hazard

potential source of harm when electric energy is present in an electrical installation or equipment

[SOURCE: IEC 60050-651:1999, 651-01-30, modified – The note has been deleted.]

3.1.3

hazardous situation

circumstance in which people, property or the environment are exposed to one or more hazards

[SOURCE: IEC 61508-4:2010, 3.1.3]

3.1.4

hazardous event

event that may result in harm

Note 1 to entry: Whether or not a hazardous event results in harm depends on whether people, property or the environment are exposed to the consequence of the hazardous event and, in the case of harm to people, whether any such exposed people can escape the consequences of the event after it has occurred.

[SOURCE: IEC 61508-4:2010, 3.1.4]

3.1.5

harmful event

occurrence in which a hazardous situation or hazardous event results in harm

Note 1 to entry: Adapted from ISO/IEC Guide 51:1999, 3.4, to allow for a hazardous event.

[SOURCE: IEC 61508-4:2010, 3.1.5]

3.1.6

risk

combination of the probability of occurrence of harm and the severity of that harm

[SOURCE: ISO/IEC Guide 51:1999, 3.2]
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3.1.7

tolerable risk

risk which is accepted in a given context based on the current values of society

Note 1 to entry: Tolerable risk is achieved by the iterative process of risk assessment (risk analysis and risk evaluation) and risk reduction.

[SOURCE: ISO/IEC Guide 51:1999, 3.7, modified – Note 1 to entry has been added.]

3.1.8

residual risk

risk remaining after protective measures have been taken

[SOURCE: ISO/IEC Guide 51:1999, 3.9]

3.1.9

safety

freedom from unacceptable risk

[SOURCE: ISO/IEC Guide 51:1999, 3.1, modified – The note has been deleted.]

3.1.10

functional safety

part of the overall safety relating to the EUC and the EUC control system that depends on the correct functioning of the E/E/PE safety related system and other risk reduction measures

[SOURCE: IEC 61508-4:2010, 3.1.12]

3.1.11**safe state**

state of the EUC when safety is achieved

Note 1 to entry: In going from a potentially hazardous condition to the final safe state, the EUC may have to go through a number of intermediate safe states. For some situations a safe state exists only so long as the EUC is continuously controlled. Such continuous control may be for a short or an indefinite period of time.

[SOURCE: IEC 61508-4:2010, 3.1.13]

3.1.12**reasonable foreseeable misuse**

use of a product, process or service in a way not intended by the supplier, but which may result from readily predictable human behaviour

[SOURCE: ISO/IEC Guide 51:1999, 3.14]

3.1.13**environment**

all relevant parameters that can affect the achievement of functional safety in the specific application under consideration and in any safety lifecycle phase

Note 1 to entry: This would include, for example, physical environment, operating environment, legal environment and maintenance environment.

[SOURCE: IEC 61508-4:2010, 3.2.2]

3.1.14**fault**

abnormal condition that may cause a reduction in, or a loss of, the capability of a functional unit to perform a required function

[SOURCE: IEC 61508-4:2010, 3.6.1; based on ISO/IEC 2382-14:1997, 14-01-10]

3.1.15**fault avoidance**

use of techniques and procedures that aim to avoid the introduction of faults during any phase of the safety lifecycle of the safety related system

[SOURCE: IEC 61508-4:2010, 3.6.2]

3.1.16**fault tolerance**

ability of a functional unit to continue to perform a required function in the presence of faults or errors

Note 1 to entry: The definition in IEC 60050-191-15-05 refers only to sub-item faults (the attribute of an item that makes it able to perform a required function in the presence of certain given sub-item faults).

[SOURCE: IEC 61508-4:2010, 3.6.3, modified – The note has been adapted; based ISO/IEC 2382-14:1997, 14-01-10]

3.1.17**failure**

termination of the ability of a functional unit to provide a required function or operation of a functional unit in any way other than as required

Note 1 to entry: This is based on IEC 60050-191-04-01 with changes to include systematic failures due to, for example, deficiencies in specification or software.