IEC 61326-3-2

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electrical equipment for measurement, control and laboratory use – EMC requirements –
Part 3-2: Immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety) – Industrial applications with specified electromagnetic environment

Matériel électrique de mesure, de commande et de laboratoire – Exigences relatives à la CEM –
Partie 3-2: Exigences d'immunité pour les systèmes relatifs à la sécurité et pour les matériels destinés à réaliser des fonctions relatives à la sécurité (sécurité fonctionnelle) – Applications industrielles dont l'environnement électromagnétique est spécifié

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ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL AND LABORATORY USE – EMC REQUIREMENTS –

Part 3-2: Immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety) – Industrial applications with specified electromagnetic environment

INTERPRETATION SHEET 1

This interpretation sheet has been prepared by subcommittee 65A: System aspects, of IEC technical committee 65.

The text of this interpretation sheet is based on the following documents:

ISH	Report on voting
65A/632/ISH	65A/644/RVD

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

Introduction

IEC 61326-3-2:2008 gives immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety) in industrial applications with specified electromagnetic environment. The actual immunity levels, test parameters and applicable basic standards are listed in Table 1a to Table 1f of that standard.

In case of the phenomenon “Conducted r.f.” the basic standard IEC 61000-4-6:2004 shall be applied. The frequency range under consideration in IEC 61326-3-2:2008 is from 10 kHz to 80 MHz though the basic standard IEC 61000-4-6:2004 lists calibration parameters for the frequency range from 150 kHz to 80 MHz only. This lack in having some information concerning the calibration was the reason for having introduced footnote c in Table 1b (and for the identical footnotes regarding this phenomenon in the other tables).

However, footnote c in Table 1b leaves some space for interpretation as it is not entirely clear whether it applies to the entire calibration situation for all types of injection methods or to that one of CDNs only, as in the first case some information would be missing for the situation of testing via clamp injection.

Interpretation:

Footnote c in Table 1b shall be interpreted as follows:

The basic standard IEC 61000-4-6:2004 allows different injection methods, and their selection shall be done according to the rules for selecting injection methods and test points (see 7.1 of IEC 61000-4-6:2004).

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In case the CDN injection method is applied the impedance of the CDN in the frequency range 10 kHz up to 150 kHz has to comply with the asymmetric impedance requirements of IEC 61000-4-6:2004 at 150 kHz. Calibration shall be performed in accordance with IEC 61000-4-6:2004. Sufficient decoupling can be demonstrated if the impedance criterion is met both with the AE port short-circuited and then open-circuited.

In case the clamp injection is applied the procedures of 7.3 or 7.4 of the basic standard IEC 61000-4-6:2004 are applicable in the frequency range from 10 kHz to 150 kHz as well.

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International Standard IEC 61326-3-2 has been prepared by subcommittee 65A: System aspects, of IEC technical committee 65: Industrial-process measurement and control.

The IEC 61326 series cancels and replaces IEC 61326:2002 and constitutes a technical revision.

IEC 61326-3-2 is to be read in conjunction with IEC 61326-1.

The text of this standard is based on the following documents:

FDIS	Report on voting
65A/501/FDIS	65A/506/RVD

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.

A list of all the parts of the IEC 61326 series, under the general title *Electrical equipment for measurement, control and laboratory use – EMC requirements*, can be found on the IEC website.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

The contents of the interpretation sheet 1 of June 2013 have been included in this copy.

INTRODUCTION

Functional safety is that part of the overall safety relating to the equipment under control (EUC) and the EUC control system which depends on the correct functioning of the electrical safety-related systems. To achieve this all items of equipment of the safety-related system which are involved in the performance of the safety functions must behave in a specified manner under all relevant conditions.

The IEC basic safety publication for functional safety of electrical/electronic/programmable electronic safety-related systems is IEC 61508. It sets the overall requirements to achieve functional safety. Sufficient immunity to electromagnetic disturbances is one of those requirements.

The concept of IEC 61508 distinguishes between the consideration of the application and the design of safety-related electrical and electronic systems. The interface between both is the safety requirements specification (SRS). It specifies all relevant requirements of the intended application, as follows.

a) Definition of the safety function, based on a risk assessment of the intended application (which function is intended to reduce risk).
b) Appropriate safety integrated level (SIL) for each safety-function based on a risk assessment of the intended application.
c) Definition of the environment in which the system is intended to work including the electromagnetic environment as required by IEC 61508-2.

Hence, with regard to immunity against electromagnetic phenomena, the essential starting point is that the electromagnetic environment and its phenomena are considered in the SRS, as required by IEC 61508. The safety-related system intended to implement the specified safety-function has to fulfil the SRS, and from it corresponding immunity requirements have to be derived for the items of equipment; this results in an equipment requirement specification. With respect to the electromagnetic environment, the SRS and the equipment requirement specification should be based on a competent assessment of the foreseeable electromagnetic threats in the real environment over the whole operational life of the equipment. Hence immunity requirements for the equipment depend on the characteristics of the electromagnetic environment in which the equipment is intended to be used.

The equipment manufacturer, therefore, has to prove that the equipment fulfils the equipment requirement specification and the system integrator must prove that the system fulfils the SRS. Evidence has to be produced by application of appropriate methods. They do not need to consider any other aspects of the application, for example, risk of the application associated to any failure of the safety-related system. The objective is for all equipment in the system to comply with particular performance criteria taking into account functional safety aspects (for example the performance criterion FS) up to levels specified in the SRS independent of the required safety integrity level (SIL).

There are basically two approaches on how to deal with the electromagnetic environments and to conclude on immunity requirements.

(A) To consider a general electromagnetic environment with no specific restrictions, for example an industrial environment, and to take into account all the electromagnetic phenomena that can occur as well as their maximum amplitudes when deriving appropriate immunity levels for the system and the equipment. This approach has been used to determine the levels specified within IEC 61326-3-1 leading to increased immunity levels for some electromagnetic phenomena compared to immunity levels which are derived without functional safety considerations.

(B) To control the electromagnetic environment for example by the application of particular installation and mitigation practices, in such a way that electromagnetic phenomena and their amplitudes could occur only to a certain extent. These phenomena and restricted amplitudes are then taken into account by appropriate

immunity levels. These levels are not necessarily higher than those derived without functional safety considerations because it is ensured by corresponding means that no higher amplitudes as normally are to be expected. This approach is considered in this part of IEC 61326..

Applying approach (B) results in the fact that there is a specified electromagnetic environment due to the strict observation of particular installation and mitigation practices. In addition, however, appropriate knowledge is required concerning the electromagnetic phenomena and the amplitudes to be expected in this specified electromagnetic environment. This has been achieved by taking into account statistical data on faults in safety applications of the process industry. For this evaluation more than 20 000 units in safety applications are annually analysed on the occurrence of failures; from this data it has been shown that the failure rates meet the requirements connected to the safety integrity level (SIL). These units are in compliance with particular EMC requirements of the process industry.

Following approach (B), IEC 61326-3-2 gives specific electromagnetic immunity requirements that apply to safety-related systems and equipment intended to be used in safety-related systems. These requirements supplement some requirements of IEC 61326-1 (or of comparable EMC requirements of the process industry) and the selected electromagnetic phenomena and defined immunity test levels are expected to match with the environmental conditions of the specified industrial applications as defined in the scope of this standard.

The correlation between the standards IEC 61326-1, IEC 61326-2-X, IEC 61326-3-1 and IEC 61326-3-2 is described in the diagram of Figure 1.

The specified test levels in this standard are derived from the highest levels to be expected in the specified environment of industrial applications. These test levels are related to the electromagnetic environment (what can occur). They cannot be related in an analytical way to the SIL required for the safety-related system because there is no practically provable relationship between test level and probability of failure during use. The influences of electromagnetic phenomena are considered as systematic effects and by their nature often result in common cause events.

Design features of equipment must take into account the required SIL and must be designed to avoid dangerous systematic failures. Sufficient immunity against electromagnetic disturbances can only be ensured by design, mitigation and construction techniques which take into account electromagnetic aspects, which, however, are not within the scope of this standard.

It is therefore recommended that the approach to achieve the capability for the required SIL should be through the adoption of design features on the one hand and through appropriate test performance parameters in order to increase the level of confidence in the test results on the other hand.

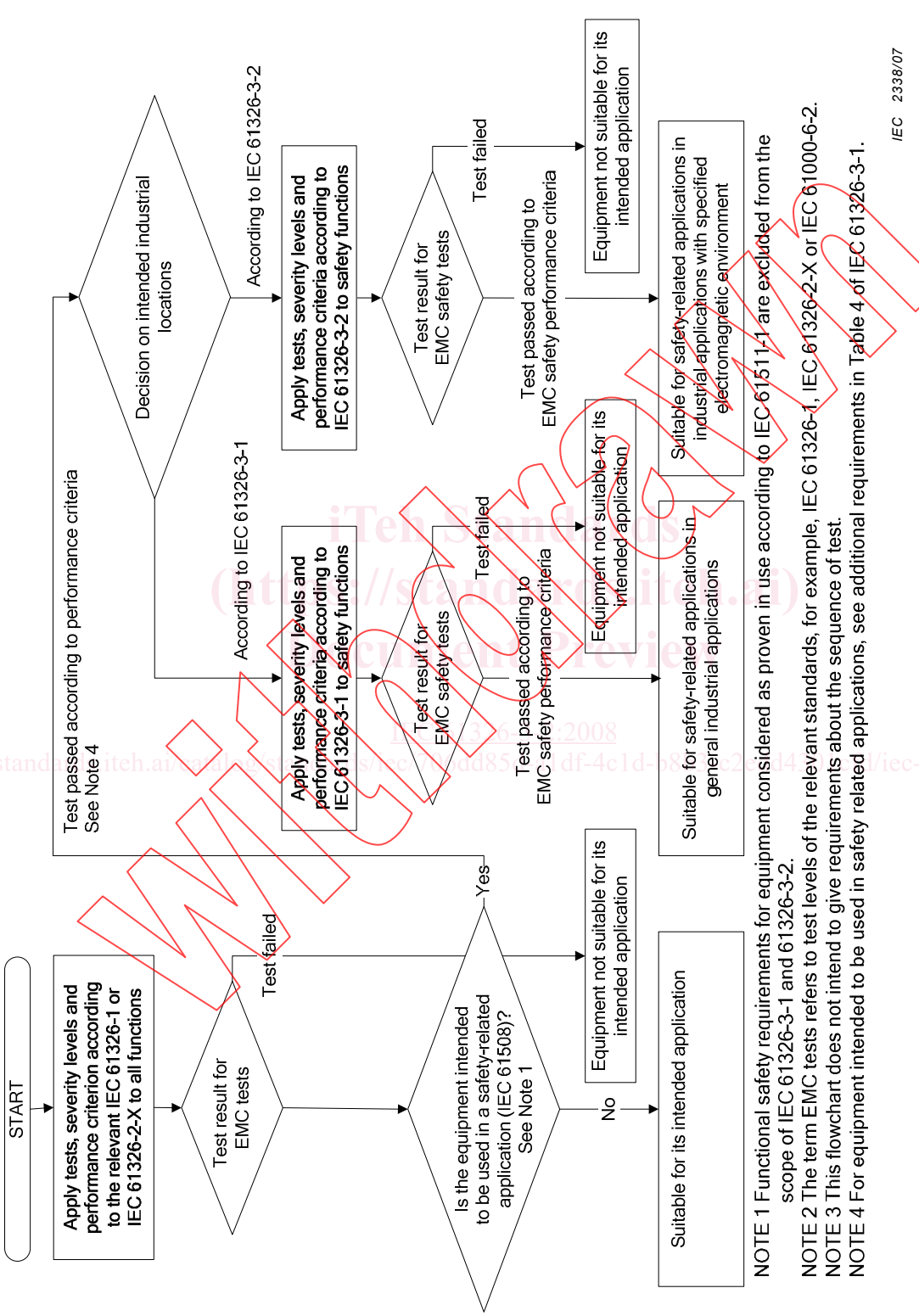

Figure 1 – Correlation between the standards IEC 61326-1, IEC 61326-2-X, IEC 61326-3-1 and IEC 61326-3-2

NOTE 1 Functional safety requirements for equipment considered as proven in use according to IEC 61511-1 are excluded from the scope of IEC 61326-3-1 and 61326-3-2.
NOTE 2 The term EMC tests refers to test levels of the relevant standards, for example, IEC 61326-1, IEC 61326-2-X or IEC 61000-6-2.
NOTE 3 This flowchart does not intend to give requirements about the sequence of test.
NOTE 4 For equipment intended to be used in safety related applications, see additional requirements in Table 4 of IEC 61326-3-1.

ELECTRICAL EQUIPMENT FOR MEASUREMENT, CONTROL AND LABORATORY USE – EMC REQUIREMENTS –

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1 Scope

The scope of IEC 61326-1 applies to this part of IEC 61326 but is limited to systems and equipment for industrial applications within a specified electromagnetic environment and intended to perform safety functions as defined in IEC 61508 with SIL 1-3.

The electromagnetic environments encompassed by this product family standard are industrial, both indoor and outdoor, as they can be found in industrial applications with an electromagnetic environment having specified characteristics (for example, process industry). The difference between the electromagnetic environment covered by this standard compared to the general industrial environment (see IEC 61326-3-1) is due to the mitigation measures employed against electromagnetic phenomena leading to a specified electromagnetic environment.

The environment of industrial application with a specified electromagnetic environment typically includes the following characteristics:

- industrial area with limited access;
- limited use of mobile transmitter;
- dedicated cables for power supply and control, signal or communication lines;
- separation between power supply and control, signal or communication cables;
- factory building mostly consisting of metal construction;
- overvoltage/lightning protection by appropriate measures (for example, metal construction of the building or use of protection devices);
- pipe heating systems driven by a.c. main power may be present;
- no high-voltage substation close to sensitive areas;
- presence of CISPR 11 Group 2 ISM equipment using ISM frequencies only with low power;
- competent staff;
- periodical maintenance of equipment and systems;
- mounting and installation guidelines for equipment and systems.

A more detailed description of the above-mentioned typical characteristics is given in Annex B.

Equipment and systems considered as “proven-in-use” according to IEC 61508 or IEC 61511 are excluded from the scope of IEC 61326-3-2.

Fire alarm systems and security alarm systems intended for protection of buildings are excluded from the scope of IEC 61326-3-2.

2 Normative references

The following referenced documents are indispensable for the application of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-161, *International Electrotechnical Vocabulary – Chapter 161: Electromagnetic compatibility*

IEC 61000-4-2:2001, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3:2006, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4:2004, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast/transient burst immunity test*

IEC 61000-4-5:2005, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6:2004, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8:1993, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*[1]

Amendment 1 (2000)

IEC 61000-4-11:2004, Electromagnetic compatibility (EMC) – Part 4-11: *Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

IEC 61000-4-29:2000, *Electromagnetic compatibility (EMC) – Part 4-29: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests*

IEC 61000-6-2:2005, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments*

IEC 61326-1:2005, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements*

IEC 61326-2-1:2005, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 2-1: Particular requirements – Test configurations, operational conditions and performance criteria for sensitive test and measurement equipment for EMC unprotected applications*

IEC 61326-2-2:2005, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 2-2: Particular requirements – Test configurations, operational conditions and performance criteria for portable test, measuring and monitoring equipment used in low-voltage distribution systems*

IEC 61326-2-3:2006, *Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 2-3: Particular requirements – Test configurations, operational*

[1] There exists a consolidated edition 1.1 (2001) that includes edition 1.0 and its amendment.