IEC/TS 61000-1-2

Edition 2.0 2008-11

TECHNICAL SPECIFICATION

BASIC SAFETY PUBLICATION

Electromagnetic compatibility (EMC) – Part 1-2: General – Methodology for the achievement of functional safety of electrical and electronic systems including equipment with regard to electromagnetic phenomena

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRICE CODE XC

ICS 33.100.99

ISBN 978-2-88910-368-3

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 1-2: General – Methodology for the achievement of functional safety of electrical and electronic systems including equipment with regard to electromagnetic phenomena

FOREWORD

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The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a technical specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- 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 61000-1-2, which is a technical specification, has been prepared by technical committee 77: Electromagnetic compatibility. It has the status of a basic safety publication in accordance with IEC Guide 104.

This second edition cancels and replaces the first edition published in 2001 and constitutes a technical revision.

The main changes are the following.

- For safety-related systems that use electrical, electronic or programmable electronic technologies, the technical information, definitions, terminology and text of this second edition have been aligned to IEC 61508.
- Risk assessment requirements and methodologies have been deleted from this document, so as not to duplicate or clash with IEC 61508.
- It now makes a clear distinction between complete safety-related systems and items of equipment that might be used in such systems, and clarifies its application by the different types of end-users.
- This technical specification focuses more on appropriate design methods, and their verification and validation.
- The methodology for assessing and specifying electromagnetic environments has been extended.
- The combination of electromagnetic and physical/climatic influences are taken into account.

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

Enquiry draft	Report on voting
77/356/DTS	77/359A/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 publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

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

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

IEC 61000 is published in separate parts according to the following structure:

Part 1: General

General considerations (introduction, fundamental principles)

Definitions, terminology

Part 2: Environment

Description of the environment

Classification of the environment

Compatibility levels

Part 3: Limits

Emission limits

Immunity limits (insofar as they do not fall under the responsibility of the product committees)

Part 4: Testing and measurement techniques

Measurement techniques

Testing techniques

Part 5: Installation and mitigation guidelines

Installation guidelines

Mitigation methods and devices

Part 6: Generic standards

Part 9: Miscellaneous

Each part is further subdivided into several parts, published either as international standards, technical specifications or technical reports, some of which have already been published as sections. Others will be published with the part number followed by a dash and completed by a second number identifying the subdivision (example: IEC 61000-3-11).

Particular considerations for IEC 61000-1-2

The function of electrical or electronic systems should not be affected by external influences in a way that could lead to an unacceptable risk of harm to the users, other persons, animals or property. A comprehensive safety analysis should consider various factors of climatic, mechanical, electrical nature and reasonably foreseeable misuse. Electromagnetic disturbances are present in most environments and should therefore be considered during such an analysis.

The purpose of this document is to provide guidance relating to the achievement of functional safety of electrical or electronic systems exposed to electromagnetic disturbances.

With respect to consistency within IEC, the document makes use, as far as appropriate, of existing relevant basic IEC standards. It considers the work of SC 65A relating to functional safety concepts of the IEC 61508 series and of TC 77, its subcommittees and CISPR relating to the electromagnetic environments. For details on these subjects reference should be made to the standards of these committees.

IEC 61508 has the status of a basic safety publication and it deals with the topic of functional safety of electric/electronic/programmable electronic (E/E/PE) safety-related systems. It sets the overall requirements to achieve functional safety. Sufficient immunity to electromagnetic interference is one of those requirements. However, it is limited in scope to systems that carry out safety functions that have integrity requirements assessed in the range of safety integrity level (SIL) 1 to SIL 4 range, and it does not give detailed requirements relating to electromagnetic immunity. This part of IEC 61000-1 gives guidance to achieve adequate immunity of the safety-related systems and equipment that are intended to be used in safety-related systems.

The concept of IEC 61508 is based on a lifecycle model (see Figure 1). The concept comprises application-specific activities and activities relating to the design of the equipment. The application-specific activities are contained in phases both before and after the phases for equipment design. The interface between the earlier application-specific phases and the equipment design phases is the safety requirements specification (SRS), see Table 1. It specifies all relevant requirements of the intended application(s):

a) definition of the safety-related function(s), based on a risk assessment of the intended application(s) (which function(s) may cause a hazard in case of failure).

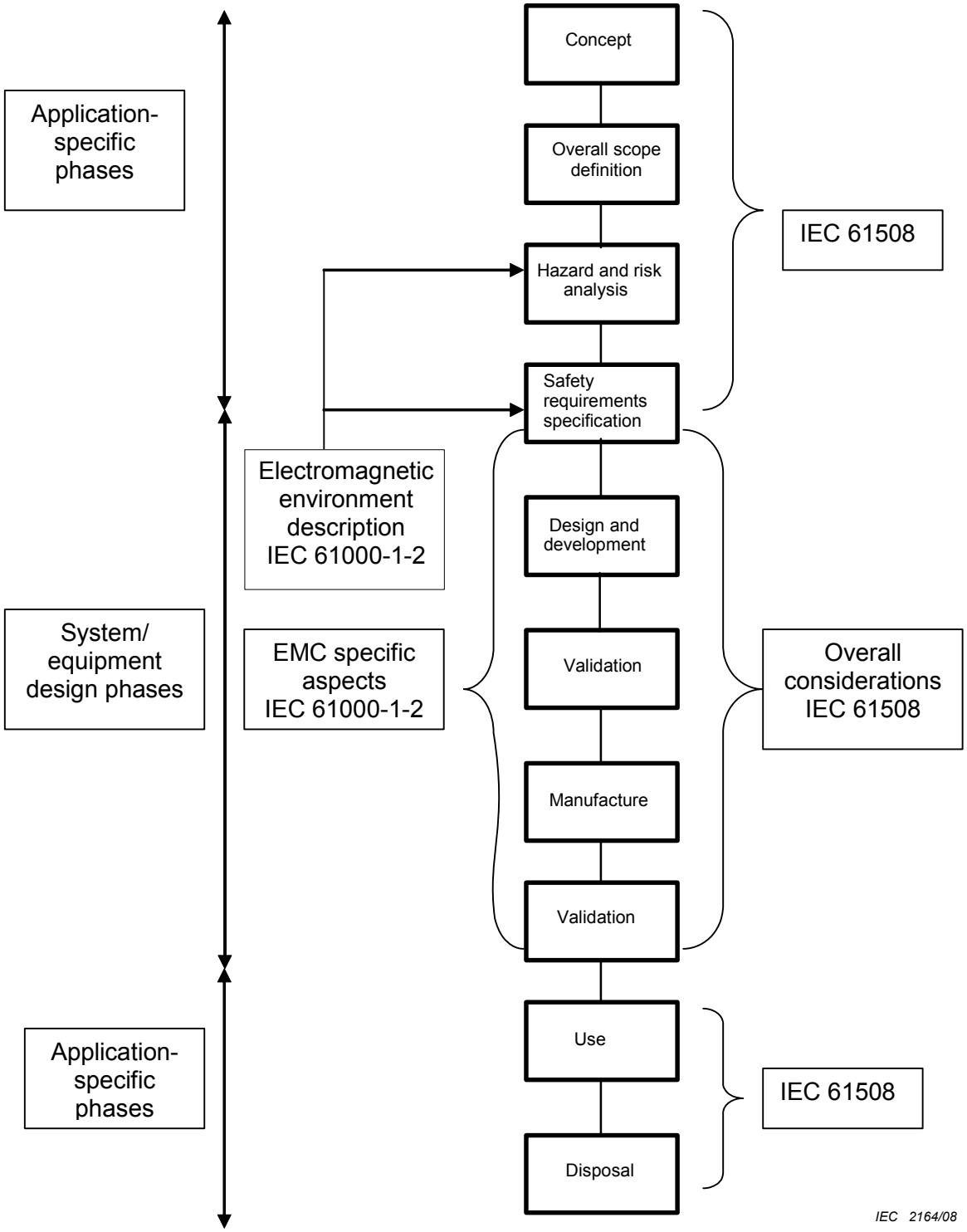
b) selection of appropriate safety integrity level (required) based on a risk assessment of the intended application(s).

c) definition of the environment in which the system will work.

The safety-related system intended to implement the specified function(s) has to fulfil the safety requirements specification (SRS). Equipment intended for use in that system has to fulfil the relevant requirements derived from the safety requirements specification (SRS).

Table 1 – Safety requirements specification, interfaces and responsibilities according to IEC 61508

Functional safety	
Safety-related system (IEC 61508)	
Application (system level)	Safety requirements specification (SRS) a) Definition of safety-related function, based on a risk assessment of the intended application (IEC 61508) (which function may cause a dangerous failure) b) Selection of appropriate safety integrity level (required) based on a risk assessment of the intended application (IEC 61508) c) Definition of the environment in which the system will work (IEC 61508, IEC 61000-1-2, IEC 61000-2-5)
E/E/PE equipment intended for use in a safety-related system	Equipment manufacturer has to fulfil the relevant requirements of the safety requirements specification (SRS). This includes: ensuring that there is adequate confidence that electromagnetic disturbances will not result in dangerous systematic failures (systematic capability with respect to electromagnetic disturbances); and producing evidence that appropriate methods and techniques have been employed.



NOTE 1 The diagram shows a simplified overview of the relationship between IEC 61508 and IEC 61000-1-2. It should be noted that EMC issues may need careful consideration during lifecycle stages other than those covered by IEC 61000-1-2, e.g. maintenance activities for EMC characteristics may be required during the "use-of-equipment" phase to ensure continued safety-related system performance.

NOTE 2 Verification is not shown in the diagram but it is relevant to all lifecycle phases.

Figure 1 – Relationship between IEC 61000-1-2 and the simplified lifecycle as per IEC 61508

ELECTROMAGNETIC COMPATIBILITY (EMC) –

Part 1-2: General – Methodology for the achievement of functional safety of electrical and electronic systems including equipment with regard to electromagnetic phenomena

1 Scope and object

This part of IEC 61000 establishes a methodology for the achievement of functional safety only with regard to electromagnetic phenomena of electrical and electronic systems and installations, as installed and used under operational conditions. This methodology includes the implication it has on equipment used in such systems and installations.

This technical specification:

a) applies to safety-related systems incorporating electrical/electronic/programmable electronic equipment;

b) considers the influence of the electromagnetic environment on safety-related systems; it is intended for designers, manufacturers and installers of safety-related systems and can be used as a guide by IEC committees;

c) is not concerned with direct hazards from electromagnetic fields on living beings nor is it concerned with safety related to breakdown of insulation or other mechanisms by which persons can be exposed to electrical hazards.

It mainly covers EMC related aspects of the design phase of safety-related systems and equipment used therein, and deals in particular with

– some basic concepts in the area of functional safety,
– the various EMC specific steps for the achievement and management of functional safety,
– the description and assessment of the electromagnetic environment,
– the EMC aspects of the design and integration process taking into account the process of EMC safety planning on system as well as on equipment level,
– the validation and verification processes regarding the immunity against electromagnetic disturbances,
– the performance criterion and some test philosophy considerations for safety-related systems and the equipment used therein,
– aspects related to testing of the immunity of safety-related systems and equipment used therein against electromagnetic disturbances.

This Technical Specification is applicable to safety-related systems intended to comply with the requirements of IEC 61508 and/or associated sector-specific functional safety standards.

For safety-related systems covered by other functional safety standards, a consideration shall be made of the requirements of this Technical Specification in order to identify the appropriate measures that shall be taken with relation to EMC and functional safety.

This Technical Specification may also be used as a guide for considering EMC requirements for other systems having a direct contribution to safety.

2 Normative references

The following referenced documents are indispensable for the application 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.

IEC 60050(161), *International Electrotechnical Vocabulary (IEV) – Chapter 161: Electromagnetic compatibility*

IEC 61000-2-5, *Electromagnetic compatibility (EMC) – Part 2: Environment – Section 5: Classification of electromagnetic environments*

IEC 61000-2-13, *Electromagnetic compatibility (EMC) – Part 2-13: Environment – High-power electromagnetic (HPEM) environments – Radiated and conducted*

IEC 61000-4 (all parts), *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques*

IEC 61000-4-1, *Electromagnetic compatibility (EMC) – Part 4-1: Testing and measurement techniques – Overview of IEC 61000-4 series*

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*

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

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

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

IEC Guide 104:1997, *The preparation of safety publications and the use of basic safety publications and group safety publications*