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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Functional safety – Safety instrumented systems for the process industry sector – Part 3: Guidance for the determination of the required safety integrity levels

Sécurité fonctionnelle – Systèmes instrumentés de sécurité pour le secteur des industries de transformation – Partie 3: Conseils pour la détermination des niveaux exigés d'intégrité de sécurité

IEC 61511-3:2003

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Functional safety – Safety instrumented systems for the process industry sector

Part 3: Guidance for the determination of the required safety integrity levels

CORRIGENDUM 1

Page 37

Table D.2 – Example calibration of the general purpose risk graph

“Comments” column, on page 38, comment 6:

Instead of: “D is a calibration factor…”

Read: “C is a calibration factor….”

Pages 48 and 49

Reverse the order of Table F.4 and Table F.3. In Clause F.6, second sentence, change the reference to Table F.4 to Table F.3 and in Clause F.7, last sentence, change the reference to Table F.3 to Table F.4.

Page 50

F.10 Intermediate event likelihood

Last paragraph, penultimate sentence:

Instead of: “…Figure 1…”

Read: “…Figure F.1…”

Page 52

F.14.9 Intermediate event likelihood, *first sentence:*

F.14.10 SIS, *last sentence:*

F.14.11 Next SIF, *second sentence:*

Instead of: “…Figure 1…”

Read: “…Figure F.1…”

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FUNCTIONAL SAFETY– SAFETY INSTRUMENTED SYSTEMS FOR THE PROCESS INDUSTRY SECTOR –

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FOREWORD

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International Standard IEC 61511-3 has been prepared by subcommittee 65A: System aspects, of IEC technical committee 65: Industrial-process measurement and control.

This bilingual version, published in 2004-10, corresponds to the English version.

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

FDIS	Report on voting
65A/367/FDIS	65A/370/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.

The French version of this standard has not been voted upon.

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

IEC 61511 consists of the following parts, under the general title *Functional safety – Safety Instrumented Systems for the process industry sector* (see Figure 1):

Part 1: Framework, definitions, system, hardware and software requirements

Part 2: Guidelines for the application of IEC 61511-1

Part 3: Guidance for the determination of the required safety integrity levels

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.

INTRODUCTION

Safety instrumented systems have been used for many years to perform safety instrumented functions in the process industries. If instrumentation is to be effectively used for safety instrumented functions, it is essential that this instrumentation achieves certain minimum standards and performance levels.

This International Standard addresses the application of safety instrumented systems for the process industries. It also requires a process hazard and risk assessment to be carried out to enable the specification for safety instrumented systems to be derived. Other safety systems are only considered so that their contribution can be taken into account when considering the performance requirements for the safety instrumented systems. The safety instrumented system includes all components and subsystems necessary to carry out the safety instrumented function from sensor(s) to final element(s).

This standard has two concepts which are fundamental to its application; safety lifecycle and safety integrity levels.

This standard addresses safety instrumented systems which are based on the use of Electrical (E)/Electronic (E)/Programmable Electronic (PE) technology. Where other technologies are used for logic solvers, the basic principles of this standard should be applied. This standard also addresses the safety instrumented system sensors and final elements regardless of the technology used. This standard is process industry specific within the framework of IEC 61508 (see Annex A of IEC 61511-1).

This standard sets out an approach for safety lifecycle activities to achieve these minimum standards. This approach has been adopted in order that a rational and consistent technical policy be used.

In most situations, safety is best achieved by an inherently safe process design. If necessary, this may be combined with a protective system or systems to address any residual identified risk. Protective systems can rely on different technologies (chemical, mechanical, hydraulic, pneumatic, electrical, electronic, programmable electronic). Any safety strategy should consider each individual safety instrumented system in the context of the other protective systems. To facilitate this approach, this standard

– requires that a hazard and risk assessment is carried out to identify the overall safety requirements;
– requires that an allocation of the safety requirements to the safety instrumented system(s) is carried out;
– works within a framework which is applicable to all instrumented methods of achieving functional safety;
– details the use of certain activities, such as safety management, which may be applicable to all methods of achieving functional safety.

This standard on safety instrumented systems for the process industry:

– addresses all safety life cycle phases from initial concept, design, implementation, operation and maintenance through to decommissioning;
– enables existing or new country specific process industry standards to be harmonized with this standard.

This standard is intended to lead to a high level of consistency (for example, of underlying principles, terminology, information) within the process industries. This should have both safety and economic benefits.

In jurisdictions where the governing authorities (for example national, federal, state, province, county, city) have established process safety design, process safety management, or other requirements, these take precedence over the requirements defined in this standard.

This standard deals with guidance in the area of determining the required SIL in hazards and risk analysis (H & RA). The information herein is intended to provide a broad overview of the wide range of global methods used to implement H & RA. The information provided is not of sufficient detail to implement any of these approaches.

Before proceeding, the concept and determination of safety integrity level(s) (SIL) provided in IEC 61511-1 should be reviewed. The annexes in this standard address the following:

Annex A provides an overview of the concepts of tolerable risk and ALARP.

Annex B provides an overview of a semi-quantitative method used to determine the required SIL.

Annex C provides an overview of a safety matrix method to determine the required SIL.

Annex D provides an overview of a method using a semi-qualitative risk graph approach to determine the required SIL.

Annex E provides an overview of a method using a qualitative risk graph approach to determine the required SIL.

Annex F provides an overview of a method using a layer of protection analysis (LOPA) approach to select the required SIL.

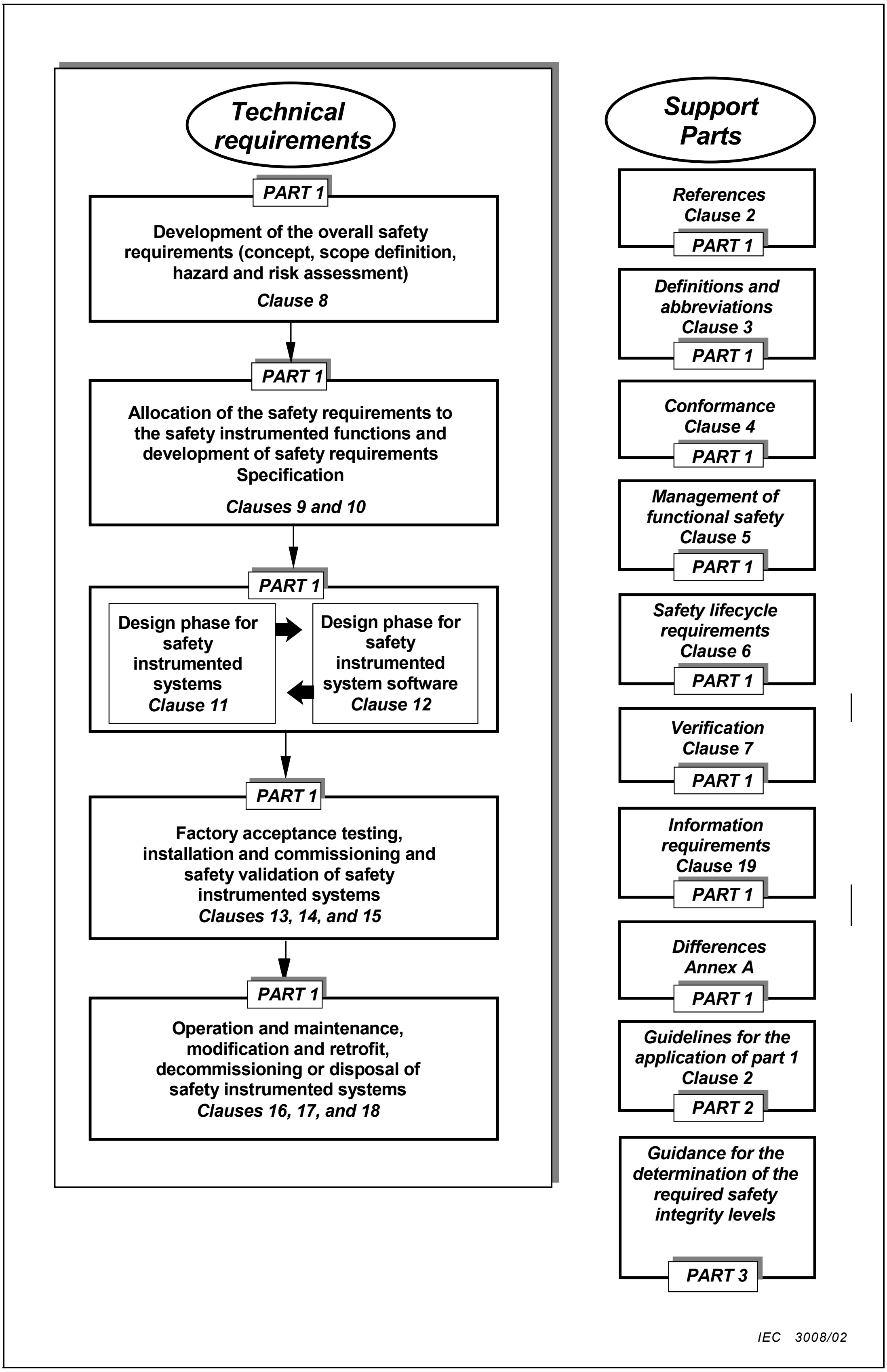

Figure 1 – Overall framework of this standard

FUNCTIONAL SAFETY–

SAFETY INSTRUMENTED SYSTEMS FOR THE PROCESS INDUSTRY SECTOR –

Part 3: Guidance for the determination of the required safety integrity levels

1 Scope

This part of IEC 61511 provides information on

– the underlying concepts of risk, the relationship of risk to safety integrity, see Clause 3;
– the determination of tolerable risk, see Annex A;
– a number of different methods that enable the safety integrity levels for the safety instrumented functions to be determined, see Annexes B, C, D, E, and F.

In particular, this part

a) applies when functional safety is achieved using one or more safety instrumented functions for the protection of either personnel, the general public, or the environment;
b) may be applied in non-safety applications such as asset protection;
c) illustrates typical hazard and risk assessment methods that may be carried out to define the safety functional requirements and safety integrity levels of each safety instrumented function;
d) illustrates techniques/measures available for determining the required safety integrity levels;
e) provides a framework for establishing safety integrity levels but does not specify the safety integrity levels required for specific applications;
f) does not give examples of determining the requirements for other methods of risk reduction.

Annexes B, C, D, E, and F illustrate quantitative and qualitative approaches and have been simplified in order to illustrate the underlying principles. These annexes have been included to illustrate the general principles of a number of methods but do not provide a definitive account.

NOTE Those intending to apply the methods indicated in these annexes should consult the source material referenced in each annex.

Figure 1 shows the overall framework for IEC 61511-1, IEC 61511-2 and IEC 61511-3 and indicates the role that this standard plays in the achievement of functional safety for safety instrumented systems.

Figure 2 gives an overview of risk reduction methods.

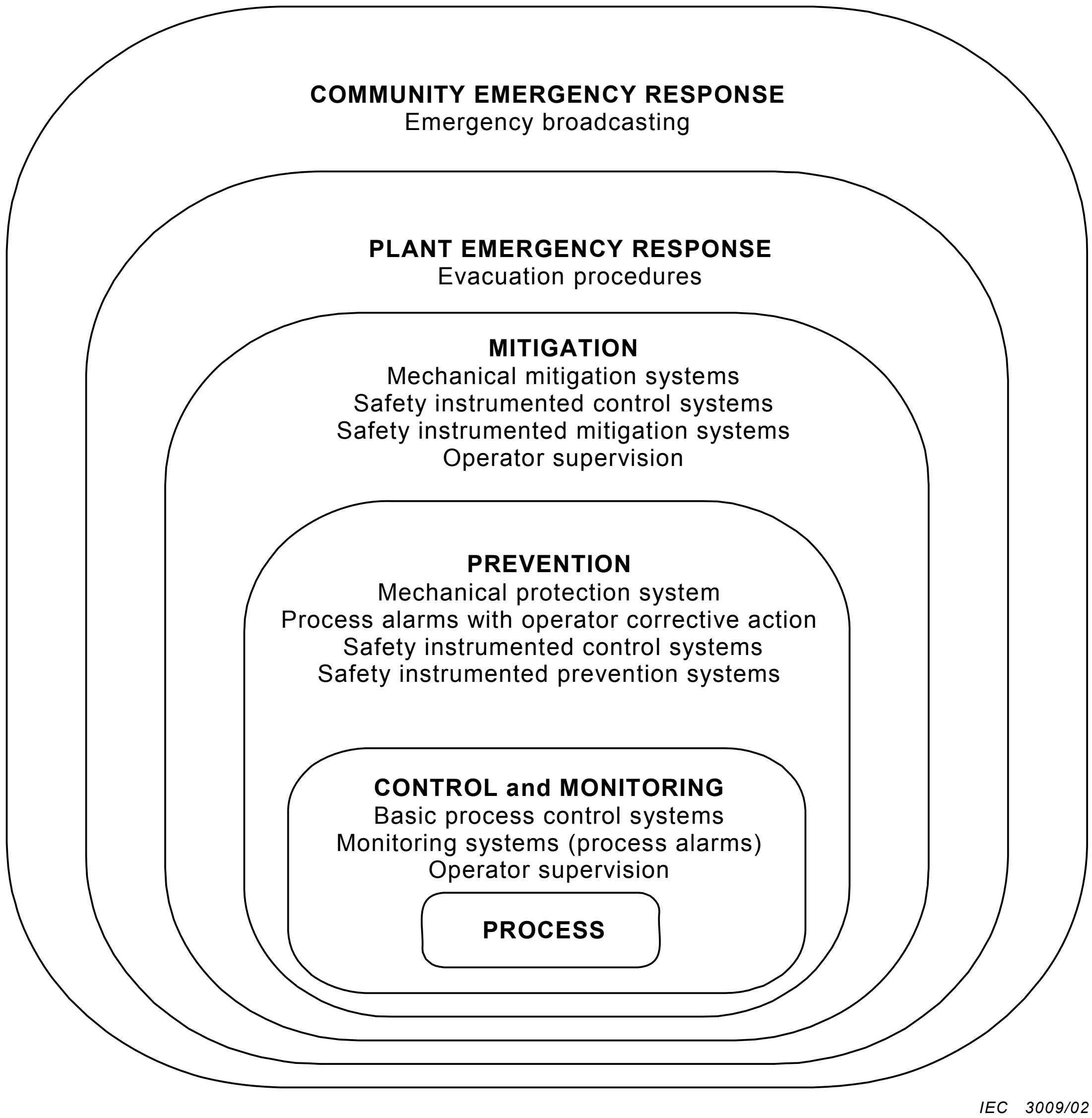

Figure 2 – Typical risk reduction methods found in process plants (for example, protection layer model)