

# **SLOVENSKI STANDARD**

## **SIST EN 61784-3-17:2018**

**01-februar-2018**

---

**Industrijska komunikacijska omrežja - Profili - 3-17. del: Funkcijska varnost procesnih vodil - Dodatne specifikacije za CPF 17 (IEC 61784-3-17:2016)**

Industrial communication networks - Profiles - Part 3-17: Functional safety fieldbuses - Additional specifications for CPF 17 (IEC 61784-3-17:2016)

Industrielle Kommunikationsnetze - Profile - Teil 3-17: Funktional sichere Übertragung bei Feldbussen - Zusätzliche Festlegungen für die Kommunikationsprofilfamilie 17 (IEC 61784-3-17:2016)

Réseaux de communication industriels - Profils - Partie 3-17: Bus de terrain de sécurité fonctionnelle - Spécifications supplémentaires pour CPF 17 (IEC 61784-3-17:2016)

**Ta slovenski standard je istoveten z: EN 61784-3-17:2017**

---

**ICS:**

25.040.40	Merjenje in krmiljenje industrijskih postopkov	Industrial process measurement and control
35.100.01	Medsebojno povezovanje odprtih sistemov na splošno	Open systems interconnection in general

**SIST EN 61784-3-17:2018**

**en,fr,de**

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

SIST EN 61784-3-17:2018

<https://standards.iteh.ai/catalog/standards/sist/748e02af-57ad-4441-bc22-4028fccff05c/sist-en-61784-3-17-2018>

EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 61784-3-17**

December 2017

ICS 25.040.40; 35.100.01

English Version

**Industrial communication networks - Profiles - Part 3-17:  
Functional safety fieldbuses - Additional specifications for CPF  
17  
(IEC 61784-3-17:2016)**

Réseaux de communication industriels - Profils - Partie 3-17: Bus de terrain de sécurité fonctionnelle - Spécifications supplémentaires pour CPF 17  
(IEC 61784-3-17:2016)

Industrielle Kommunikationsnetze - Profile - Teil 3-17: Funktional sichere Übertragung bei Feldbussen - Zusätzliche Festlegungen für die Kommunikationsprofilfamilie 17  
(IEC 61784-3-17:2016)

This European Standard was approved by CENELEC on 2016-09-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

## European foreword

The text of document 65C/851/FDIS, future edition 1 of IEC 61784-3-17:2016, prepared by SC 65C "Industrial networks", of IEC/TC 65 "Industrial-process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61784-3-17:2017.

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2018-06-01
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2020-12-01

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

## Endorsement notice

The text of the International Standard IEC 61784-3-17:2016 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60204-1	NOTE Harmonized as EN 60204-1
IEC 61000-6-7:2014	NOTE Harmonized as EN 61000-6-7:2015
IEC 61131-6	NOTE Harmonized as EN 61131-6
IEC 61158-2	NOTE Harmonized as EN 61158-2
IEC 61496 (all parts)	NOTE Harmonized as EN 61496 (all parts)
IEC 61508-2	NOTE Harmonized as EN 61508-2
IEC 61508-4:2010	NOTE Harmonized as EN 61508-4:2010 (not modified).
IEC 61508-5:2010	NOTE Harmonized as EN 61508-5:2010 (not modified).
IEC 61511 (all parts)	NOTE Harmonized as EN 61511 (all parts)
IEC 61784-5 (all parts)	NOTE Harmonized as EN 61784-5 (all parts)
IEC 61800-5-2	NOTE Harmonized as EN 61800-5-2
IEC 62061	NOTE Harmonized as EN 62061
IEC 62443 (all parts)	NOTE Harmonized as prEN 62443 (all parts)
IEC/TR 62685	NOTE Harmonized as CLC/TR 62685
ISO 10218-1	NOTE Harmonized as EN ISO 10218-1
ISO 12100	NOTE Harmonized as EN ISO 12100
ISO 13849 (all parts)	NOTE Harmonized as EN ISO 13849 (all parts)
ISO 13849-1:2006	NOTE Harmonized as EN ISO 13849-1:2006
ISO 13849-2	NOTE Harmonized as EN ISO 13849-2

## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: [www.cenelec.eu](http://www.cenelec.eu).

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61000-6-2	-	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments	EN 61000-6-2	-
IEC 61131-2	-	Industrial-process measurement and control - Programmable controllers - Part 2: Equipment requirements and tests	EN 61131-2	-
IEC 61158-3-21	2010	Industrial communication networks - Fieldbus specifications - Part 3-21: Data-link layer service definition - Type 21 elements	EN 61158-3-21	2012
IEC 61158-4-21	2010	Industrial communication networks - Fieldbus specifications -- Part 4-21: Data-link layer protocol specification - Type 21 elements	EN 61158-4-21	2012
IEC 61158-5-21	2010	Industrial communication networks - Fieldbus specifications -- Part 5-21: Application layer service definition - Type 21 elements	EN 61158-5-21	2012
IEC 61158-6-21	2010	Industrial communication networks - Fieldbus specifications - Part 6-21: Application layer protocol specification - Type 21 elements	EN 61158-6-21	2012
IEC 61326-3-1	-	Electrical 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	EN 61326-3-1	-
IEC 61326-3-2	-	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	-	-
IEC 61508	series	Functional safety of electrical/electronic/programmable electronic safety-related systems -- Part 1: General requirements	EN 61508	series
IEC 61508-1	2010	Functional safety of electrical/electronic/programmable electronic safety-related systems -- Part 1: General requirements	EN 61508-1	2010

EN 61784-3-17:2017 (E)

IEC 61784-2	-	Industrial communication networks - Profiles - Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3	EN 61784-2	-
IEC 61784-3	-	Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions	EN 61784-3	-
IEC 61784-5-17	2013	Industrial communication networks - Profiles -- Part 5-17: Installation of fieldbuses - Installation profiles for CPF 17	EN 61784-5-17	2013
IEC 61918	-	Industrial communication networks - Installation of communication networks in industrial premises	EN 61918	-

## iTeh STANDARD PREVIEW (standards.iteh.ai)

SIST EN 61784-3-17:2018

<https://standards.iteh.ai/catalog/standards/sist/748e02af-57ad-4441-bc22-4028fccff05c/sist-en-61784-3-17-2018>



IEC 61784-3-17

Edition 1.0 2016-07

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE



**Industrial communication networks – Profiles –  
Part 3-17: Functional safety fieldbuses – Additional specifications for CPF 17**

**Réseaux de communication industriels – Profils –  
Partie 3-17: Bus de terrain de sécurité fonctionnelle – Spécifications  
supplémentaires pour CPF 17**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

ICS 25.040.40, 35.100.05

ISBN 978-2-8322-3493-8

**Warning! Make sure that you obtained this publication from an authorized distributor.  
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

## CONTENTS

FOREWORD.....	5
0 Introduction .....	7
0.1 General.....	7
0.2 Patent declaration .....	9
1 Scope.....	10
2 Normative references.....	10
3 Terms, definitions, symbols, abbreviated terms, and conventions.....	11
3.1 Terms and definitions .....	11
3.1.1 Common terms and definitions .....	11
3.1.2 CPF 17: Additional terms and definitions .....	17
3.2 Symbols and abbreviated terms.....	17
3.2.1 Common symbols and abbreviated terms.....	17
3.2.2 CPF 17: Additional symbols and abbreviated terms.....	18
3.3 Conventions.....	18
4 Overview of FSCP 17/1 (RAPIEnet Safety™).....	18
5 General .....	20
5.1 External documents providing specifications for the profile .....	20
5.2 Safety functional requirements .....	20
5.3 Safety measures .....	20
5.3.1 General .....	20
5.3.2 (Virtual) sequence number .....	21
5.3.3 Time expectation with watchdog .....	21
5.3.4 Connection authentication .....	21
5.3.5 Feedback message .....	21
5.3.6 Data integrity assurance.....	21
5.4 Safety communication layer structure .....	22
5.4.1 Principle of FSCP 17/1 safety communications .....	22
5.4.2 CPF 17 communication structures .....	22
5.5 Relationships with FAL (and DLL, PhL).....	22
5.5.1 General .....	22
5.5.2 Data types .....	23
6 Safety communication layer services.....	23
6.1 Overview.....	23
6.2 Functional Safety connection.....	23
6.2.1 General .....	23
6.2.2 Initiator class specification .....	23
6.2.3 Responder-class specification .....	24
6.2.4 Sender class specification.....	25
6.2.5 Receiver class specification .....	27
6.3 Functional Safety data transmission service.....	29
6.4 Functional Safety connection relation .....	29
7 Safety communication layer protocol .....	30
7.1 Safety PDU format .....	30
7.1.1 General .....	30
7.1.2 FSPDU command.....	31



7.1.3	Authentication key.....	31
7.1.4	FSPDU CRC .....	31
7.2	FSCP 17/1 communication procedure .....	34
7.2.1	FSCP 17/1 device states .....	34
7.3	Response to communication errors.....	42
7.3.1	General .....	42
7.4	State table for SCL of CPF 17 .....	42
7.4.1	General .....	42
7.4.2	Events .....	43
7.4.3	State table for Initiator.....	44
7.4.4	State table for Responder.....	53
8	Safety communication layer management.....	62
8.1	FSCP 17/1 parameter handling.....	62
8.2	Functional Safety communication parameters .....	62
9	System requirements .....	62
9.1	Indicators and switches .....	62
9.2	Installation guidelines.....	62
9.3	Safety function response time.....	62
9.4	Duration of demands .....	65
9.5	Constraints for calculation of system characteristics .....	65
9.5.1	General .....	65
9.5.2	Number of devices .....	65
9.5.3	Probabilistic consideration.....	65
9.6	Maintenance .....	66
9.7	Safety manual .....	66
10	Assessment.....	66
Annex A (informative) Additional information for functional safety communication profiles of CPF 17.....		67
A.1	Hash function calculation.....	67
A.2	.....	68
Annex B (informative) Information for assessment of the functional safety communication profiles of CPF 17 .....		69
Bibliography .....		70
Figure 1 – Relationships of IEC 61784-3 with other standards (machinery).....		7
Figure 2 – Relationships of IEC 61784-3 with other standards (process) .....		8
Figure 3 – Communication relationships among FSCP 17 devices.....		19
Figure 4 – Safety layer architecture.....		22
Figure 5 – Functional Safety Cycle .....		29
Figure 6 – Connection relationships among FSCP 17/1 devices .....		30
Figure 7 – Functional Safety PDU for CPF 17 over type 21 PDU .....		30
Figure 8 – FSPDU CRC code generation process .....		32
Figure 9 – Example of sequence number changing .....		33
Figure 10 – CRC comparison operation .....		34
Figure 11 – FSCP 17/1 device states .....		35
Figure 12 – State diagram for Functional Safety device .....		43
Figure 13 – State diagram for Initiator .....		44

Figure 14 – State diagram for Responder .....	53
Figure 15 – Safety function response time .....	63
Figure 16 – Residual error rate of FSCP 17/1 .....	66
Table 1 – Deployed measures to manage errors .....	21
Table 2 – General FSPDU .....	31
Table 3 – FSPDU command .....	31
Table 4 – FSPDU with 4 octets of safety data and RESET command after restart (reset connection) or error .....	36
Table 5 – FSPDU with 4 octets of safety data and RESET command to acknowledge a reset command from the Initiator .....	36
Table 6 – Connection request PDU for the Initiator in CONNECTION state .....	37
Table 7 – Connection response PDU for the Responder in CONNECTION state .....	37
Table 8 – Safety data transferred in the SET_PARA state .....	38
Table 9 – Sending FSPDU with 6 octets of safety data from the Initiator in SET_PARA state .....	38
Table 10 – Expected FSPDU with 6 octets of safety data from the Responder in SET_PARA state .....	39
Table 11 – Safety data from the Initiator in the WAIT_PARA state .....	39
Table 12 – Sending FSPDU with 6 octets of safety data from the Initiator in the WAIT_PARA state .....	40
Table 13 – Receiving FSPDU with 6 octets of safety data from the Responder in the WAIT_PARA state .....	40
Table 14 – FSPDU of Safety data in the DATA state .....	41
Table 15 – Example of 4 octets of safety data from a Sender .....	41
Table 16 – Example of ACK PDU from the Receiver with 4 octets of safety data .....	41
Table 17 – Functional Safety communication errors .....	42
Table 18 – Functional Safety communication error codes .....	42
Table 19 – States of the Functional Safety Initiator .....	43
Table 20 – States of the Functional Safety Responder .....	43
Table 21 – Events in the Functional Safety state .....	44
Table 22 – Functional Safety communication parameters .....	62
Table A.1 – the lookup table for FSCP 17/1 .....	68

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

# INDUSTRIAL COMMUNICATION NETWORKS – PROFILES –

## Part 3-17: Functional safety fieldbuses – Additional specifications for CPF 17

## FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

International Standard IEC 61784-3-17 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

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

FDIS	Report on voting
65C/851/FDIS	65C/854/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 parts of the IEC 61784-3 series, published under the general title *Industrial communication networks – Profiles – Functional safety fieldbuses*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability 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.

**IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.**

## iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN 61784-3-17:2018](https://standards.iteh.ai/catalog/standards/sist/748e02af-57ad-4441-bc22-4028fccff05c/sist-en-61784-3-17-2018)

<https://standards.iteh.ai/catalog/standards/sist/748e02af-57ad-4441-bc22-4028fccff05c/sist-en-61784-3-17-2018>

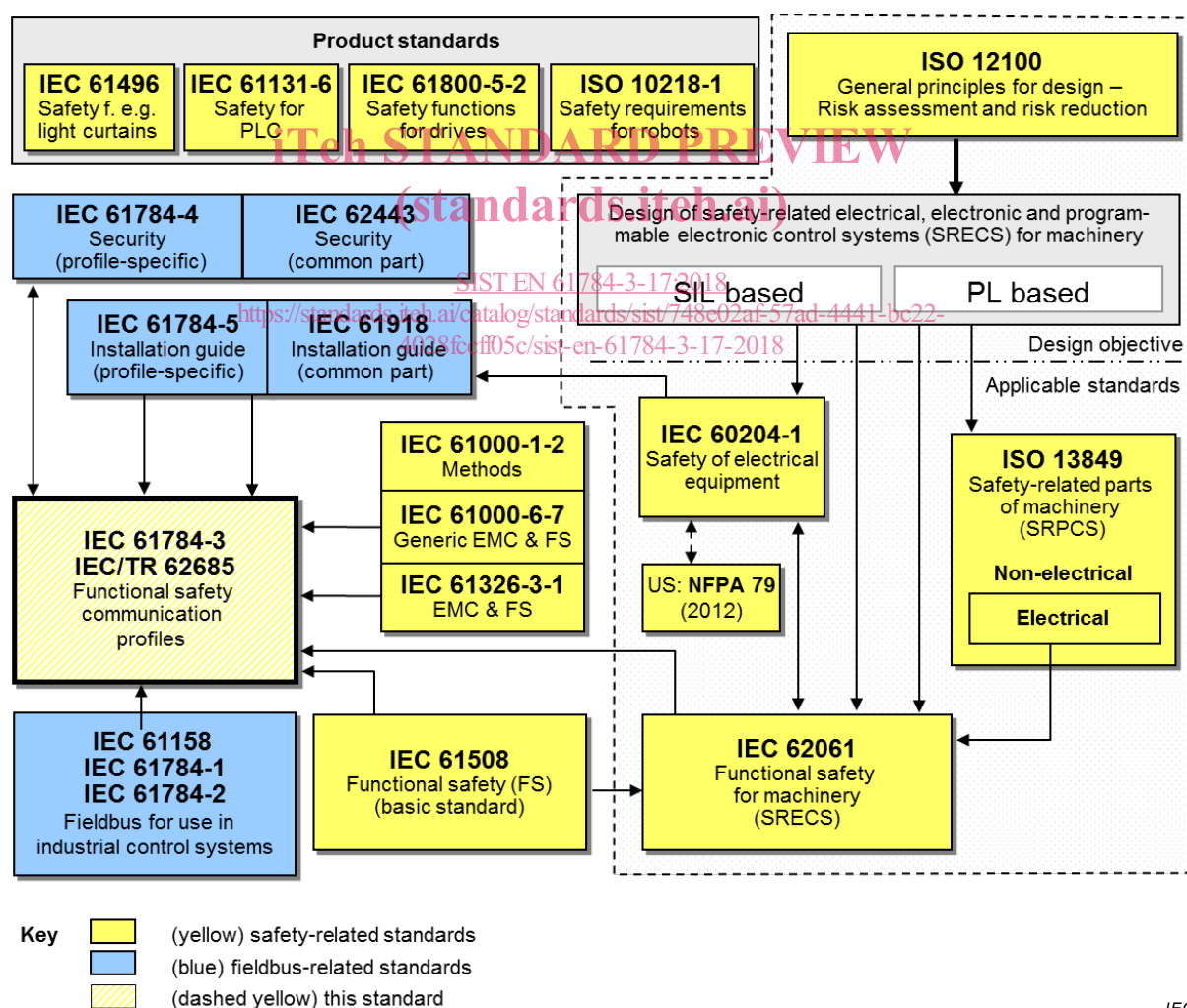
## 0 Introduction

### 0.1 General

The IEC 61158 fieldbus standard together with its companion standards IEC 61784-1 and IEC 61784-2 defines a set of communication protocols that enable distributed control of automation applications. Fieldbus technology is now considered well accepted and well proven. Thus fieldbus enhancements continue to emerge, addressing applications for areas such as real time, safety-related and security-related applications.

This standard explains the relevant principles for functional safety communications with reference to IEC 61508 series and specifies several safety communication layers (profiles and corresponding protocols) based on the communication profiles and protocol layers of IEC 61784-2 and the IEC 61158 series. It does not cover electrical safety and intrinsic safety aspects.

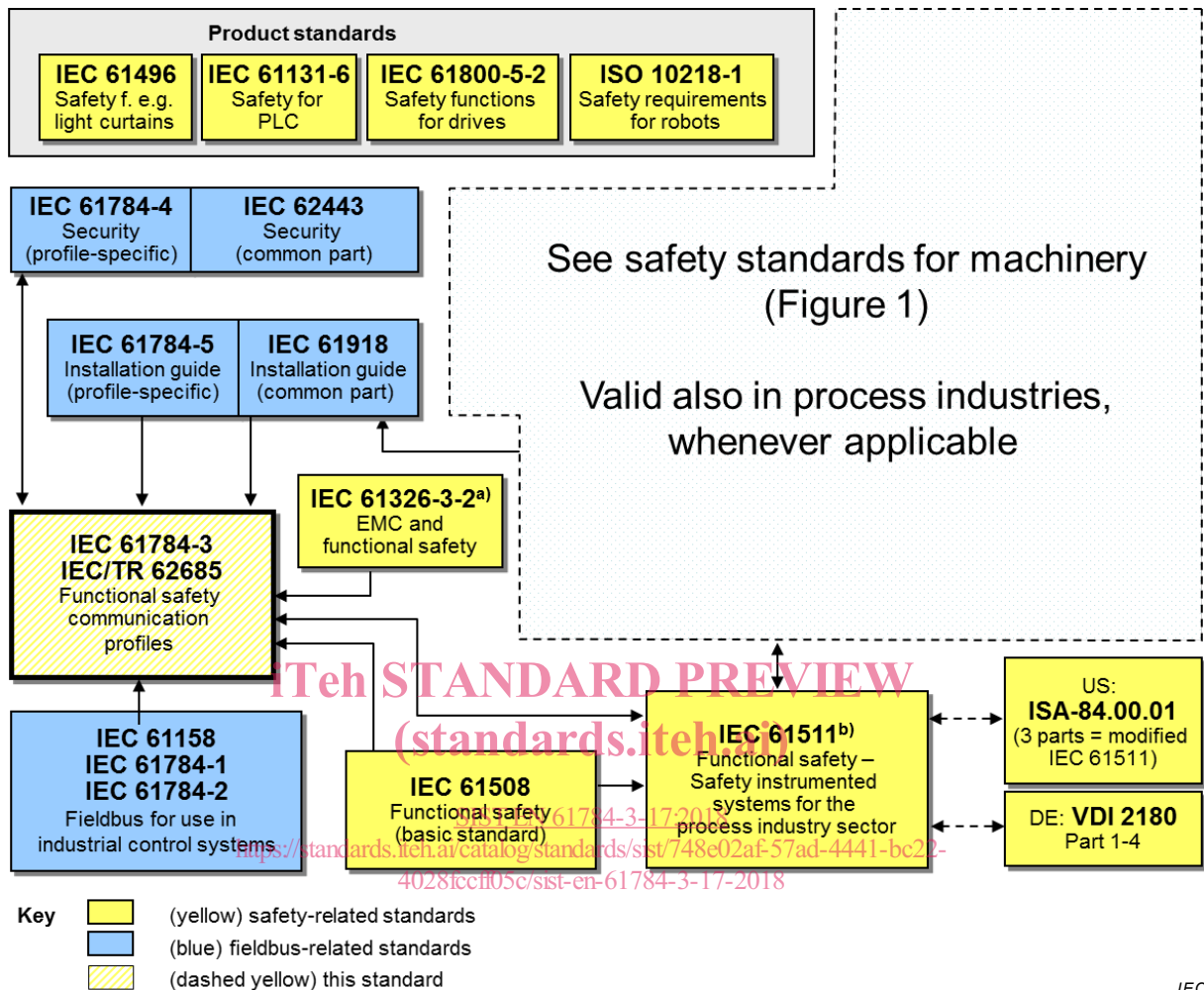
Figure 1 shows the relationships between this standard and relevant safety and fieldbus standards in a machinery environment.



NOTE Subclauses 6.7.6.4 (high complexity) and 6.7.8.1.6 (low complexity) of IEC 62061 specify the relationship between PL (Category) and SIL.

**Figure 1 – Relationships of IEC 61784-3 with other standards (machinery)**

Figure 2 shows the relationships between this standard and relevant safety and fieldbus standards in a process environment.



<sup>a</sup> For specified electromagnetic environments; otherwise IEC 61326-3-1 or IEC 61000-6-7.

<sup>b</sup> EN ratified.

**Figure 2 – Relationships of IEC 61784-3 with other standards (process)**

Safety communication layers which are implemented as parts of safety-related systems according to IEC 61508 series provide the necessary confidence in the transportation of messages (information) between two or more participants on a fieldbus in a safety-related system, or sufficient confidence of safe behaviour in the event of fieldbus errors or failures.

Safety communication layers specified in this standard do this in such a way that a fieldbus can be used for applications requiring functional safety up to the Safety Integrity Level (SIL) specified by its corresponding functional safety communication profile.

The resulting SIL claim of a system depends on the implementation of the selected functional safety communication profile (FSCP) within this system – implementation of a functional safety communication profile in a standard device is not sufficient to qualify it as a safety device.

This standard describes:

- basic principles for implementing the requirements of IEC 61508 series for safety-related data communications, including possible transmission faults, remedial measures and considerations affecting data integrity;
- functional safety communication profiles for several communication profile families in IEC 61784-1 and IEC 61784-2, including safety layer extensions to the communication service and protocols sections of the IEC 61158 series.

## 0.2 Patent declaration

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of patents concerning the functional safety communication profiles for family 17 as follows, where the [xx] notation indicates the holder of the patent right:

PCT/KR2012/008651 [LSIS] Communication apparatus and Communication method

PCT/KR2012/008653 [LSIS] Communication apparatus and Communication method

PCT/KR2012/008654 [LSIS] Communication apparatus and Communication method

PCT/KR2012/008655 [LSIS] Communication apparatus and Communication method

KR 10-1389604 [LSIS] Communication Device and communication method

KR 10-1442963 [LSIS] Communication Device and communication method

KR 10-1389646 [LSIS] Communication Device and communication method

IEC takes no position concerning the evidence, validity and scope of these patent rights.

The holders of these patents rights have assured the IEC that they are willing to negotiate licences either free of charge or under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statements of the holders of these patent rights are registered with IEC.

Information may be obtained from:

[LSIS] LSIS Co Ltd  
 LS Tower  
 1026-6, Hogue-Dong  
 Dongan-Gu  
 Anyang, Gyeonggi-Do, 431-848  
 South Korea

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those identified above. IEC shall not be held responsible for identifying any or all such patent rights.