

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Safety of machinery – Electro-sensitive protective equipment –
Part 1: General requirements and tests**

**Sécurité des machines – Equipements de protection électro-sensibles –
Partie 1: Prescriptions générales et essais**



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2012 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.
If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.
Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

Useful links:

IEC publications search - www.iec.ch/searchpub

The advanced search enables you to find IEC publications by a variety of criteria (reference number, text, technical committee,...).

It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available on-line and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary (IEV) on-line.

Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente. un corrigendum ou amendement peut avoir été publié.

Liens utiles:

Recherche de publications CEI - www.iec.ch/searchpub

La recherche avancée vous permet de trouver des publications CEI en utilisant différents critères (numéro de référence, texte, comité d'études,...).

Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

Just Published CEI - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications de la CEI. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (VEI) en ligne.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Safety of machinery – Electro-sensitive protective equipment –
Part 1: General requirements and tests**

**Sécurité des machines – Equipements de protection électro-sensibles –
Partie 1: Prescriptions générales et essais**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE **XA**
CODE PRIX

ICS 13.110; 29.260.99

ISBN 978-2-8322-0061-2

**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.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	8
4 Functional, design and environmental requirements	13
4.1 Functional requirements	13
4.1.1 Normal operation	13
4.1.2 Sensing function.....	13
4.1.3 Types of ESPE	13
4.1.4 Types and required safety performance.....	14
4.1.5 Required PL _r or SIL and corresponding ESPE type	14
4.2 Design requirements	14
4.2.1 Electrical supply	14
4.2.2 Fault detection requirements	15
4.2.3 Electrical equipment of the ESPE.....	16
4.2.4 Output signal switching devices (OSSD).....	17
4.2.5 Indicator lights and displays.....	19
4.2.6 Adjustment means	20
4.2.7 Disconnection of electrical assemblies	20
4.2.8 Non-electrical components.....	20
4.2.9 Common cause failures	20
4.2.10 Programmable or complex integrated circuits	20
4.2.11 Software, programming, functional design of integrated circuits.....	20
4.3 Environmental requirements	21
4.3.1 Ambient air temperature range and humidity.....	21
4.3.2 Electrical disturbances.....	21
4.3.3 Mechanical environment.....	23
4.3.4 Enclosures	24
5 Testing.....	24
5.1 General.....	24
5.1.1 Type tests	24
5.1.2 Test conditions	25
5.1.3 Test results	26
5.2 Functional tests.....	26
5.2.1 Sensing function.....	26
5.2.2 Response time	26
5.2.3 Limited functional tests.....	27
5.2.4 Periodic test	28
5.2.5 Indicator lights and displays	28
5.2.6 Means of adjustment	28
5.2.7 Rating of components.....	28
5.2.8 Output signal switching devices (OSSD).....	28
5.3 Performance testing under fault conditions	29
5.3.1 General	29
5.3.2 Type 1 ESPE.....	29

5.3.3	Type 2 ESPE	29
5.3.4	Type 3 ESPE	29
5.3.5	Type 4 ESPE	30
5.4	Environmental tests	30
5.4.1	Rated supply voltage	30
5.4.2	Ambient temperature variation and humidity	30
5.4.3	Effects of electrical disturbances	31
5.4.4	Mechanical influences	33
5.4.5	Enclosures	33
5.5	Validation of programmable or complex integrated circuits	33
5.5.1	General	33
5.5.2	Complex or programmable integrated circuits	34
5.5.3	Software, programming, functional design of integrated circuits	34
5.5.4	Test results analysis statement	34
6	Marking for identification and for safe use	34
6.1	General	34
6.2	ESPE supplied from a dedicated power supply	35
6.3	ESPE supplied from an internal electrical power source	35
6.4	Adjustment	35
6.5	Enclosures	35
6.6	Control devices	35
6.7	Terminal markings	35
6.8	Marking durability	36
7	Accompanying documents	36
Annex A (normative)	Optional functions of the ESPE	39
Annex B (normative)	Catalogue of single faults affecting the electrical equipment of the ESPE, to be applied as specified in 5.3	46
Annex C (informative)	Conformity assessment	47
Bibliography	48
Index	49
Figure 1	– Examples of ESPEs using safety-related communication interfaces	19
Figure 2	– Test setup for the EMC test of ESPEs with safety-related communication interfaces	26
Table 1	– Types and required safety performance	14
Table 2	– Required PL _r or SIL and corresponding ESPE type	14
Table 4	– Supply voltage interruptions	21

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SAFETY OF MACHINERY –
ELECTRO-SENSITIVE PROTECTIVE EQUIPMENT –****Part 1: General requirements and tests**

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.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61496-1 has been prepared by IEC technical committee 44: Safety of machinery – Electrotechnical aspects.

This third edition cancels and replaces the second edition published in 2004 and its amendment 1 (2007). The document 44/615/CDV, circulated to the National Committees as amendment 2, led to the publication of this new edition.

The main changes with respect to the previous edition are as follows: The design, test and verification requirements have been updated to make them consistent with the latest standards for functional safety and EMC.

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

CDV	Report on voting
44/615/CDV	44/641/RVC

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 in the IEC 61496 series, published under the general title *Safety of machinery – Electro-sensitive protective equipment*, can be found on the IEC website.

A vertical line in the margin shows where the base publication has been modified by amendment 2.

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.

The contents of the corrigendum of April 2015 have been included in this copy.

Withdrawing

INTRODUCTION

An electro-sensitive protective equipment (ESPE) is applied to machinery presenting a risk of personal injury. It provides protection by causing the machine to revert to a safe condition before a person can be placed in a hazardous situation.

This part of IEC 61496 provides general design and performance requirements of ESPEs for use over a broad range of applications. Essential features of equipment meeting the requirements of this standard are the appropriate level of safety-related performance provided and the built-in periodic functional checks/self-checks that are specified to ensure that this level of performance is maintained.

Each type of machine presents its own particular hazards and it is not the purpose of this standard to recommend the manner of application of the ESPE to any particular machine. The application of the ESPE should be a matter for agreement between the equipment supplier, the machine user and the enforcing authority, and in this context attention is drawn to the relevant guidance established internationally, for example ISO 12100.

This part of IEC 61496 specifies technical requirements of electro-sensitive protective equipment. The application of this standard may require the use of substances and/or test procedures that could be injurious to health unless adequate precautions are taken. Conformance with this standard in no way absolves either the supplier or the user from statutory obligations relating to the safety and health of persons during the use of the equipment covered by this standard.

Due to the complexity of the technology used to implement ESPEs, there are many issues that are highly dependent on analysis and expertise in specific test and measurement techniques. In order to provide a high level of confidence, independent review by relevant experts is recommended.