
Safety of machinery — Pressure-sensitive protective devices —

**Part 1:
General principles for design and
testing of pressure-sensitive mats and
pressure-sensitive floors**

Sécurité des machines — Dispositifs de protection sensibles à la pression —

Partie 1: Principes généraux de conception et d'essai des tapis et planchers sensibles à la pression



Reference number
ISO 13856-1:2013(E)



COPYRIGHT PROTECTED DOCUMENT

© ISO 2013

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Requirements for design and testing	3
4.1 General	3
4.2 Actuating force	5
4.3 Response time	7
4.4 Static loading	7
4.5 Number of operations	7
4.6 Output state of sensor	7
4.7 Response of output signal switching device(s) to actuating force	8
4.8 Access for maintenance	8
4.9 Adjustments	8
4.10 Connections	9
4.11 Environmental conditions	9
4.12 Power supply	10
4.13 Electrical equipment	10
4.14 Enclosure	11
4.15 Performance levels and categories for SRP/CSs in accordance with ISO 13849-1	11
4.16 Sensor fittings	12
4.17 Tripping	12
4.18 Slip-resistance	12
4.19 Additional coverings of top surfaces of sensor(s)	13
4.20 Failure due to blocking or wedging	13
5 Marking	13
5.1 General	13
5.2 Marking of control unit	13
5.3 Marking of sensor	13
5.4 Marking of other components	13
6 Information for use	13
6.1 General	13
6.2 Instructions for use	14
7 Testing	16
7.1 General	16
7.2 Sensor test sample	17
7.3 Test pieces for load tests	17
7.4 Test No. 1 — Actuating force	18
7.5 Test No. 2 — Response time	20
7.6 Test No. 3 — Static loading	22
7.7 Test No. 4 — Number of operations	22
7.8 Test No. 5 — Output state of sensor	27
7.9 Test No. 6 — Response of output signal switching device to actuating force	28
7.10 Test No. 7 — Access for maintenance	28
7.11 Test No. 8 — Adjustments	28
7.12 Test No. 9 — Connections	28
7.13 Test No. 10 — Environmental conditions	28
7.14 Test No. 11 — Electrical power supply	30
7.15 Test No. 12 — Electrical equipment	30
7.16 Test No. 13 — Enclosure	30
7.17 Test No. 14 — PL according to ISO 13849-1	30

7.18	Test No. 15 — Slip-resistance.....	30
7.19	Test No. 16 — Additional coverings of top surfaces of sensor(s)	30
7.20	Test No. 17 — Failure due to blocking or wedging.....	31
Annex A (normative) Timing diagrams for pressure-sensitive mats/floors with/without reset		32
Annex B (informative) Application notes		35
Annex C (informative) Design notes		40
Annex D (informative) Installation, commissioning and testing		45
Bibliography		47

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 13856-1 was prepared by Technical Committee ISO/TC 199, *Safety of machinery* and by Technical Committee CEN/TC 114, *Safety of machinery* in collaboration.

This second edition cancels and replaces the first edition (ISO 13856-1:2001) which has been technically revised.

ISO 13856 consists of the following parts, under the general title *Safety of machinery — Pressure-sensitive protective devices*:

- *Part 1: General principles for design and testing of pressure-sensitive mats and pressure-sensitive floors*
- *Part 2: General principles for design and testing of pressure-sensitive edges and pressure-sensitive bars*
- *Part 3: General principles for design and testing of pressure-sensitive bumpers, plates, wires and similar devices*

Introduction

The structure of safety standards in the field of machinery is as follows:

- a) Type-A standards (basic safety standards) giving basic concepts, principles for design, and general aspects that can be applied to all machinery;
- b) Type-B standards (generic safety standards) dealing with one safety aspect or one type of safeguard that can be used across a wide range of machinery:
 - Type-B1 standards on particular safety aspects (e.g. safety distances, surface temperature, noise);
 - Type-B2 standards on safeguards (e.g. two-hand controls, interlocking devices, pressure-sensitive devices, guards);
- c) Type-C standards (machine safety standards) dealing with detailed safety requirements for a particular machine or group of machines.

This document is a type-B2 standard as stated in ISO 12100.

The requirements of this document can be supplemented or modified by a type-C standard.

For machines which are covered by the scope of a type-C standard and which have been designed and built according to the requirements of that standard, the requirements of that type-C standard take precedence.

The safeguarding of machinery (see ISO 12100:2010, 3.21) can be achieved by many different means. These means include guards which prevent access to the hazard zone by means of a physical barrier (for example, interlocking guards according to ISO 14119 or fixed guards according to ISO 14120) and protective devices (for example, electro-sensitive protective equipment according to IEC 61496-1 or pressure-sensitive protective devices according to this part of ISO 13856).

Type-C standards makers and designers of machinery/installations consider the best way to achieve the required level of safety taking into account the intended application and the results of the risk assessment (see ISO 12100).

The required solution can also be to combine several of these different means: the machinery/installation supplier and the user examine together carefully the existing hazards and constraints before making their decision on the choice of safeguarding.

Pressure-sensitive protective devices are used in a wide range of applications with different conditions of use relating, for example, to extremes of loading or electrical, physical and chemical environments. They are interfaced with machine controls to ensure that the machine reverts to a safe condition if the sensitive protective equipment is actuated.

ISO 13856 is restricted to the design of pressure-sensitive protective devices so that they can be used when the risk assessment carried out by the machine manufacturer and/or relevant type-C standard, when available, shows this to be appropriate.

Safety of machinery — Pressure-sensitive protective devices —

Part 1: General principles for design and testing of pressure-sensitive mats and pressure-sensitive floors

1 Scope

This part of ISO 13856 establishes general principles and specifies requirements for the design and testing of pressure-sensitive mats and pressure-sensitive floors normally actuated by the feet for use as devices for protecting persons from hazardous machinery. The minimum safety requirements for the performance, marking and documentation are given.

This part of ISO 13856 is applicable to pressure-sensitive mats and pressure-sensitive floors, regardless of the type of energy used (e.g. electrical, hydraulic, pneumatic or mechanical), designed to detect

- persons weighing more than 35 kg, and
- persons (e.g. children) weighing more than 20 kg.

It is not applicable to the detection of persons weighing less than 20 kg.

It does not specify the following because they are application-specific:

- a) dimensions or configuration of the effective sensing area of pressure-sensitive mat(s) or pressure-sensitive floor(s) in relation to any particular application;
- b) when pressure-sensitive mats or floors are appropriate in a particular situation;
- c) performance levels (PLs) for safety-related parts of control systems (SRP/CSs) other than providing a minimum level.

This part of ISO 13856 gives guidance to assist the user (i.e. machinery manufacturer and/or user of the machinery) in providing an adequate arrangement.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 13849-1:2006, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

ISO 13849-2, *Safety of machinery — Safety-related parts of control systems — Part 2: Validation*

ISO 13855, *Safety of machinery — Positioning of safeguards with respect to the approach speeds of parts of the human body*

ISO 15552, *Pneumatic fluid power — Cylinders with detachable mountings, 1 000 kPa (10 bar) series, bores from 32 mm to 320 mm — Basic, mounting and accessories dimensions*