



# SLOVENSKI STANDARD

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### Stroji za predelavo gume in plastike - Notranji mešalniki - Varnostne zahteve

Plastics and rubber machines - Internal mixers - Safety requirements

Kunststoff- und Gummimaschinen - Innenmischer - Sicherheitsanforderungen

Machines pour les matières plastiques et le caoutchouc - Mélangeurs internes -  
Prescriptions de sécurité

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EUROPEAN STANDARD  
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January 2018

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English Version

**Plastics and rubber machines - Internal mixers - Safety  
requirements**

Machines pour les matières plastiques et le caoutchouc  
- Mélangeurs internes - Prescriptions de sécurité

Kunststoff- und Gummimaschinen - Innenmischer -  
Sicherheitsanforderungen

This European Standard was approved by CEN on 8 September 2017.

CEN 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 CEN 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 CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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EUROPÄISCHES KOMITEE FÜR NORMUNG

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

## Contents

Page

European foreword .....	4
Introduction .....	5
1 Scope.....	6
2 Normative references.....	6
3 Terms and definitions .....	8
4 Safety requirements and/or protective/risk reduction measures .....	11
4.1 General.....	11
4.2 Start, stop and restart functions.....	11
4.2.1 Start function.....	11
4.2.2 Stop function.....	11
4.2.3 Restart function.....	11
4.3 Safety related parts of the control system .....	11
4.4 Emergency stop .....	12
4.5 Emergency stop devices .....	12
4.6 Mechanical hazards.....	12
4.6.1 General.....	12
4.6.2 Safeguarding and risk reduction measures .....	12
4.6.3 Guidance for interpreting subclauses 4.6.4 to 4.6.7.....	13
4.6.4 Safety requirements and/or protective/risk reduction measures preventing mechanical hazards in the feeding area .....	14
4.6.5 Safety requirements and/or protective / risk reduction measures preventing mechanical hazards in the transition chute area of the tandem mixer .....	28
4.6.6 Safety requirements and/or protective / risk reduction measures preventing mechanical hazards in the discharge area.....	31
4.6.7 Safety requirements and/or protective / risk reduction measures preventing mechanical hazards for movement of the rotor drive elements .....	33
4.7 Hazards due to the hose assemblies of the hydraulic/pneumatic/heating and cooling systems .....	35
4.8 Additional hazards during major cleaning operation, maintenance and repair.....	35
4.8.1 Conditions for major cleaning operation, maintenance and repair at internal mixers and laboratory internal mixers .....	35
4.8.2 Additional conditions for major cleaning operations, maintenance and repair at laboratory internal mixers.....	36
4.9 Hazards due to electrical energy.....	36
4.9.1 General.....	36
4.9.2 Protection against direct contact.....	36
4.9.3 Protection against indirect contact.....	36
4.9.4 Protection against ingress of solids and liquids .....	36
4.9.5 Electric shock or fire due to electrostatic discharge.....	36
4.10 Thermal hazards .....	36
4.11 Hazards generated by noise.....	37
4.12 Hazards resulting from substances hazardous to health .....	37
4.13 Fire hazards .....	38
4.14 Slip, trip and fall hazards .....	38
4.14.1 Slippage due to leakage from dust seals.....	38

4.14.2	Slipping, tripping and falling from permanent means of access .....	38
4.15	Ergonomics .....	38
5	Verification of the safety requirements and/or protective/risk reduction measures .....	38
6	Information for use .....	45
6.1	General .....	45
6.2	Instruction handbook .....	45
6.2.1	General .....	45
6.2.2	Installation .....	45
6.2.3	Operation .....	46
6.2.4	Cleaning and maintenance .....	46
6.2.5	Noise .....	47
6.2.6	Information on fire hazard emergency procedure .....	47
6.3	Marking .....	47
6.4	Warning signals and warning signs .....	47
Annex A	(informative) List of significant hazards .....	48
A.1	General .....	48
A.2	Design versions of internal mixers and their working levels .....	48
A.3	Hazards, hazardous situations and events .....	49
Annex B	(normative) Noise test code for laboratory internal mixers .....	62
B.1	Introduction .....	62
B.2	Determination of the A-weighted emission sound pressure level at the workstation .....	62
B.2.1	Basic standards and measurement procedure .....	62
B.2.2	Measurement uncertainty .....	63
B.3	Determination of the A-weighted sound power level .....	63
B.3.1	Basic standards and measurement procedure .....	63
B.3.2	Measurement uncertainty .....	64
B.4	Mounting and operating conditions .....	64
B.5	Information to be recorded and reported .....	65
B.5.1	General .....	65
B.5.2	General data .....	65
B.5.3	Mounting and operating conditions .....	65
B.5.4	Standards .....	65
B.5.5	Noise data .....	65
B.6	Declaration and verification of noise emission values .....	65
Annex C	(informative) Examples of possible technical measures to prevent fire hazards due to exothermically reacting compounds .....	68
Annex ZA	(informative) Relationship between this European Standard and the essential requirements of EU Directive 2006/42/EC aimed to be covered .....	69
Bibliography	.....	70

**EN 12013:2018 (E)****European foreword**

This document (EN 12013:2018) has been prepared by Technical Committee CEN/TC 145 “Plastics and rubber machines”, the secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2018 and conflicting national standards shall be withdrawn at the latest by July 2018.

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

This document supersedes EN 12013:2000+A1:2008.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

The main changes with respect to the previous edition are as follows:

- modification of the structure;
- list of significant hazards is moved into an informative annex;
- clarification that internal mixers for production and for laboratory applications are dealt with;
- tandem mixers (combination of two internal mixers) are added;
- technical developments in safeguards are taken into account;
- revised type-A and type-B standards are taken into account;
- the performance levels of safety related parts of control systems are specified in accordance with EN ISO 13849-1:2015;
- normative annex on noise measurement and declaration for laboratory internal mixers is added.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## Introduction

This document is a type-C standard as stated in EN ISO 12100:2010.

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

- machine manufacturers (small, medium and large enterprises);
- health and safety bodies (regulators, accident prevention organizations, market surveillance etc.)

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

- machine users/employers (small, medium and large enterprises);
- machine users/employees (e.g. trade unions, organizations for people with special needs);
- service providers, e.g. for maintenance (small, medium and large enterprises);
- consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

The machinery concerned and the extent to which hazards, hazardous situations or hazardous events are covered are indicated in the Scope of this document.

When requirements of this type-C standard are different from those which are stated in type-A or type-B standards, the requirements of this type-C standard take precedence over the requirements of the other standards for machines that have been designed and built according to the requirements of this type-C standard.

## EN 12013:2018 (E)

## 1 Scope

This European Standard deals with all significant hazards, hazardous situations or hazardous events relevant to the design and construction of internal mixers during all phases of the machine life cycle (see EN ISO 12100:2010, 5.4), irrespective of their size and of the control modes of the feeding door and discharge door, for production and laboratory applications, when the machines are used as intended and under the conditions of misuse which are reasonably foreseeable by the manufacturer (see Annex A).

An internal mixer for production and a tandem mixer with manual feeding begins at the feeding door and ends at the lower edge of the material discharge opening.

An internal mixer for production and a tandem mixer with automatic feeding begins at the conveyor, which is an integral part of the machine, and ends at the lower edge of the material discharge opening.

A laboratory internal mixer begins at the feeding door and ends at the material container, which is an integral part of the mixer.

With regard to noise emission measurement and declaration, only laboratory mixers are covered.

Explosion hazards are not dealt with in this document.

**NOTE** Internal mixers usually do not produce explosive atmospheres. Where materials are processed, which may cause an explosive atmosphere, the Directive 2014/34/EU on the Equipment and protective systems intended for use in potentially explosive atmospheres (ATEX) can be applied.

Exhaust systems are not covered.

This European Standard is not applicable to internal mixers manufactured before the date of its publication.

## 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.

EN 574:1996+A1:2008, *Safety of machinery - Two-hand control devices - Functional aspects - Principles for design*

EN 614-1:2006+A1:2009, *Safety of machinery - Ergonomic design principles - Part 1: Terminology and general principles*

EN 619:2002+A1:2010, *Continuous handling equipment and systems - Safety and EMC requirements for equipment for mechanical handling of unit loads*

EN 1037:1995+A1:2008, *Safety of machinery - Prevention of unexpected start-up*

EN 60204-1:2006, *Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 60204-1:2005, modified)*

EN 60529:1991, *Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989/A1:1999/A2:2013)*<sup>1)</sup>

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1) This document is impacted by the amendments EN 60529:1991/A1:2000 and EN 60529:1991/A2:2013.



EN 61310-1:2008, *Safety of machinery - Indication, marking and actuation - Part 1: Requirements for visual, acoustic and tactile signals (IEC 61310-1:2007)*

EN 61496-1:2013, *Safety of machinery - Electro-sensitive protective equipment - Part 1: General requirements and tests (IEC 61496-1:2012)*

EN 61496-2:2013, *Safety of machinery - Electro-sensitive protective equipment - Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs) (IEC 61496-2:2013)*

EN ISO 3744:2010, *Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering methods for an essentially free field over a reflecting plane (ISO 3744:2010)*

EN ISO 3746:2010, *Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Survey method using an enveloping measurement surface over a reflecting plane (ISO 3746:2010)*

EN ISO 4413:2010, *Hydraulic fluid power - General rules and safety requirements for systems and their components (ISO 4413:2010)*

EN ISO 4414:2010, *Pneumatic fluid power - General rules and safety requirements for systems and their components (ISO 4414:2010)*

EN ISO 4871:2009, *Acoustics - Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996)*

EN ISO 9614-2:1996, *Acoustics - Determination of sound power levels of noise sources using sound intensity - Part 2: Measurement by scanning (ISO 9614-2:1996)*

<https://standards.iteh.ai/catalog/standards/sist/15b159f-da7f-4fd6-ab45-11e111111111/iso-11201-2010>

EN ISO 11201:2010, *Acoustics - Noise emitted by machinery and equipment - Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections (ISO 11201:2010)*

EN ISO 11202:2010, *Acoustics - Noise emitted by machinery and equipment - Determination of emission sound pressure levels at a work station and at other specified positions applying approximate environmental corrections (ISO 11202:2010)*

EN ISO 11204:2010, *Acoustics - Noise emitted by machinery and equipment - Determination of emission sound pressure levels at a work station and at other specified positions applying accurate environmental corrections (ISO 11204:2010)*

EN ISO 12100:2010, *Safety of machinery - General principles for design - Risk assessment and risk reduction (ISO 12100:2010)*

EN ISO 13732-1:2008, *Ergonomics of the thermal environment - Methods for the assessment of human responses to contact with surfaces - Part 1: Hot surfaces (ISO 13732-1:2006)*

EN ISO 13849-1:2015, *Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design (ISO 13849-1:2015)*

EN ISO 13850:2015, *Safety of machinery - Emergency stop function - Principles for design (ISO 13850:2015)*

**EN 12013:2018 (E)**

EN ISO 13855:2010, *Safety of machinery - Positioning of safeguards with respect to the approach speeds of parts of the human body (ISO 13855:2010)*

EN ISO 13856-1:2013, *Safety of machinery - Pressure-sensitive protective devices - Part 1: General principles for design and testing of pressure-sensitive mats and pressure-sensitive floors (ISO 13856-1:2013)*

EN ISO 13857:2008, *Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2008)*

EN ISO 14119:2013, *Safety of machinery - Interlocking devices associated with guards - Principles for design and selection (ISO 14119:2013)*

EN ISO 14120:2015, *Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards (ISO 14120:2015)*

EN ISO 14122-1:2016, *Safety of machinery - Permanent means of access to machinery - Part 1: Choice of fixed means and general requirements of access (ISO 14122-1:2016)*

EN ISO 14122-2:2016, *Safety of machinery - Permanent means of access to machinery - Part 2: Working platforms and walkways (ISO 14122-2:2016)*

EN ISO 14122-3:2016, *Safety of machinery - Permanent means of access to machinery - Part 3: Stairs, stepladders and guard-rails (ISO 14122-3:2016)*

EN ISO 14122-4:2016, *Safety of machinery - Permanent means of access to machinery - Part 4: Fixed ladders (ISO 14122-4:2016)*

CLC/TR 60079-32-1:2015, *Explosive atmospheres - Part 32-1: Electrostatic Hazards - Guidance*

### **3 Terms and definitions**

For the purposes of this document, the terms and definitions given in EN ISO 12100:2010 and the following apply.

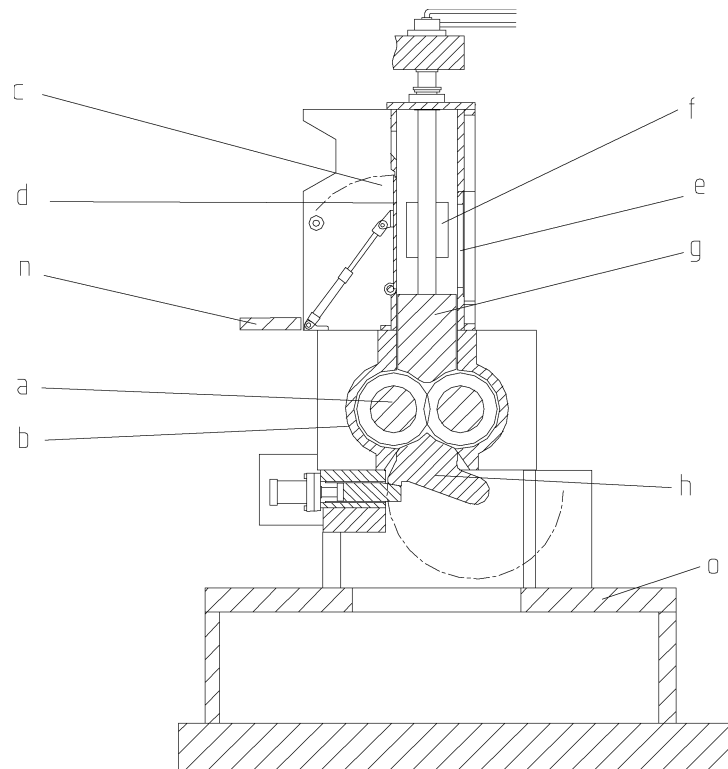
#### **3.1**

##### **internal mixer**

mixing machine for the discontinuous production of rubber or plastic compounds with two counter rotating horizontal rotors within a mixing chamber

Note 1 to entry: The main parts of an internal mixer are shown in Figure 1:

- a feed hopper with several openings:
  - at the feed side, a feed opening equipped with a door (feeding door) (d);
  - at the side opposite to the feed side, an inspection/access opening (hopper rear opening) equipped with a fixed enclosing guard or moveable guard (hopper rear door) (e);
  - possible additional feed openings for connection to the material handling system (f);
- a floating weight which applies pressure to the compound (g);
- a drop type discharge door (h).

**Key**

- |   |                        |   |   |
|---|------------------------|---|---|
| a | rotors                 | f | feed opening for connection to the material handling system |
| b | mixing chamber         | g | floating weight for applying pressure on the compound       |
| c | feed hopper            | h | discharge device  |
| d | feeding door           | n | working platform  |
| e | rear opening/rear door | o | internal mixer platform, material discharge level           |

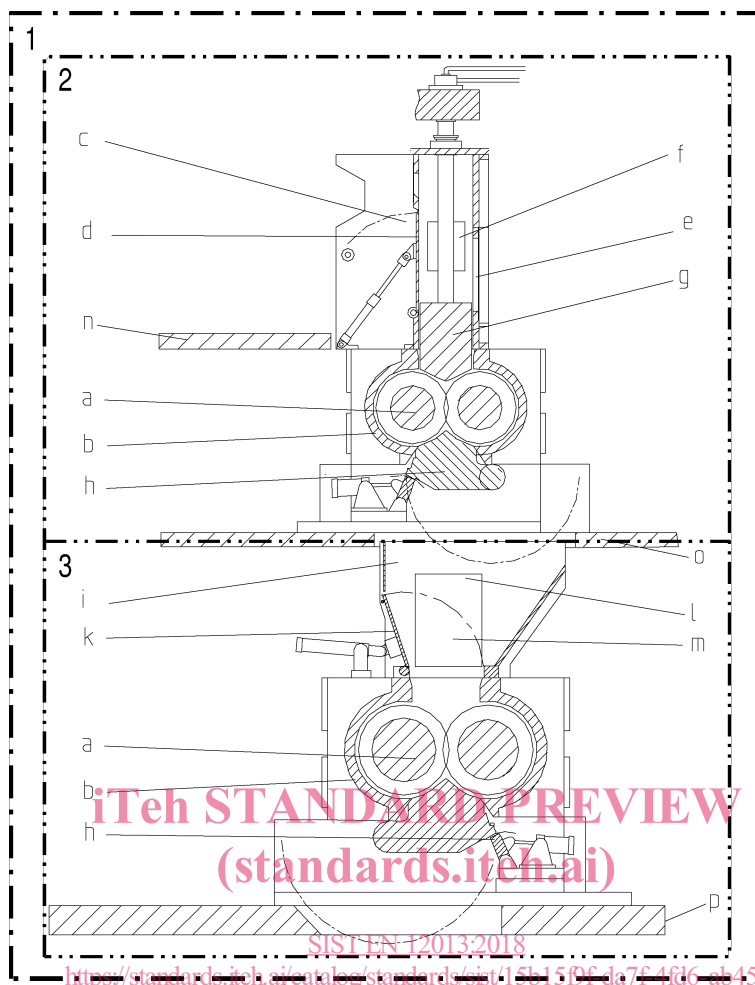
**Figure 1 — Main parts of an internal mixer****3.2****laboratory internal mixer**

internal mixer with a chamber volume up to 10 l

**3.3****tandem mixer**

combination of two internal mixers, whereby the lower internal mixer is equipped with a transition chute and a pusher flap instead of a floating weight

Note 1 to entry: The main parts of a tandem mixer are shown in Figure 2.

**Key**

1	tandem mixer	2	upper internal mixer
		3	lower internal mixer
a	rotors	i	transition chute
b	mixing chamber	k	pusher flap
c	feed hopper	l	opening
d	feeding door	m	inspection door
e	rear door opening	n	working platform
f	feed opening for material handling system connections	o	internal mixer platform, material discharge level of the upper mixer
g	floating weight for applying pressure on the compound	p	internal mixer platform, material discharge level of the tandem mixer
h	discharge device		

**Figure 2 — Main parts of a tandem mixer**

### 3.4 mixing chamber

part of the machine comprising two mixing chamber halves, rotors, side walls and discharge door, where the mixing process runs

**3.5****pusher flap**

pivoting door of the transition chute to open the mixing chamber of the lower internal mixer for feeding, or to cover this mixing chamber opening

**3.6****chamber volume**

volume within the halves of the mixing chamber and the floating weight in the lower position or the pusher flap closed

**3.7****major cleaning and/or maintenance operations**

cleaning and/or maintenance operation at the shutdown internal mixer, which requires suspension of production, the internal mixer to be emptied and access to the mixing chamber or to the floating weight

**3.8****manual mode**

selectable mode of operation that allows manual activation of individual movements

**3.9****automatic mode**

selectable mode of operation that runs one or more cycles continuously driven by the control system

**4 Safety requirements and/or protective/risk reduction measures****4.1 General**

Machinery shall comply with the safety requirements and/or protective/risk reduction measures of this clause. In addition, the machine shall be designed according to the principles of EN ISO 12100:2010 for relevant but not significant hazards, which are not dealt with by this document.

**4.2 Start, stop and restart functions****4.2.1 Start function**

The start of an operation shall be possible only when all safeguards are in place and functional (see EN 60204-1:2006, 9.2.5.2). The machine shall only be started by actuation of the start device provided for that purpose.

**4.2.2 Stop function**

The normal stop command shall function as a category 0 in accordance with EN 60204-1:2006, 9.2.2.

**4.2.3 Restart function**

An interruption or a failure of the power supply shall not result in a loss of safety function until a complete stop is reached and restoration of the energy supply shall not result in the automatic restarting of the machine (see EN ISO 12100:2010, 6.2.11.4 and 6.2.11.5).

**4.3 Safety related parts of the control system**

The safety related parts of the control system shall be in accordance with EN ISO 13849-1:2015. The required performance levels (PL<sub>r</sub>) for the relevant safety functions are given in the corresponding subclauses.

## EN 12013:2018 (E)

**4.4 Emergency stop**

Emergency stop equipment shall comply with EN ISO 13850:2015. The emergency stop shall interrupt all energy supply for the internal mixer. The stop category shall be in accordance with category 0 of EN 60204-1:2006, 9.2.2.

The emergency stop safety function shall be in accordance with  $PL_r = c$ .

When a fire emergency procedure has started, it shall be possible to activate manually the completion of the fire emergency procedure even if an emergency stop has been activated.

**4.5 Emergency stop devices**

One or more emergency stop devices shall be provided. The number of the devices depends on the dimensions of the machine and its configuration. The emergency stop devices shall be so positioned, that from all of the operating positions at least one is easily accessible. Emergency stop devices shall be positioned at least at the operating position (control panel), at the feed hopper, at the hydraulic unit and at the control cabinet.

For laboratory internal mixers, a single emergency stop device mounted at the control panel is sufficient, if the control panel is positioned in the vicinity of the feed openings and a clear view to these openings is ensured.

**4.6 Mechanical hazards****4.6.1 General**

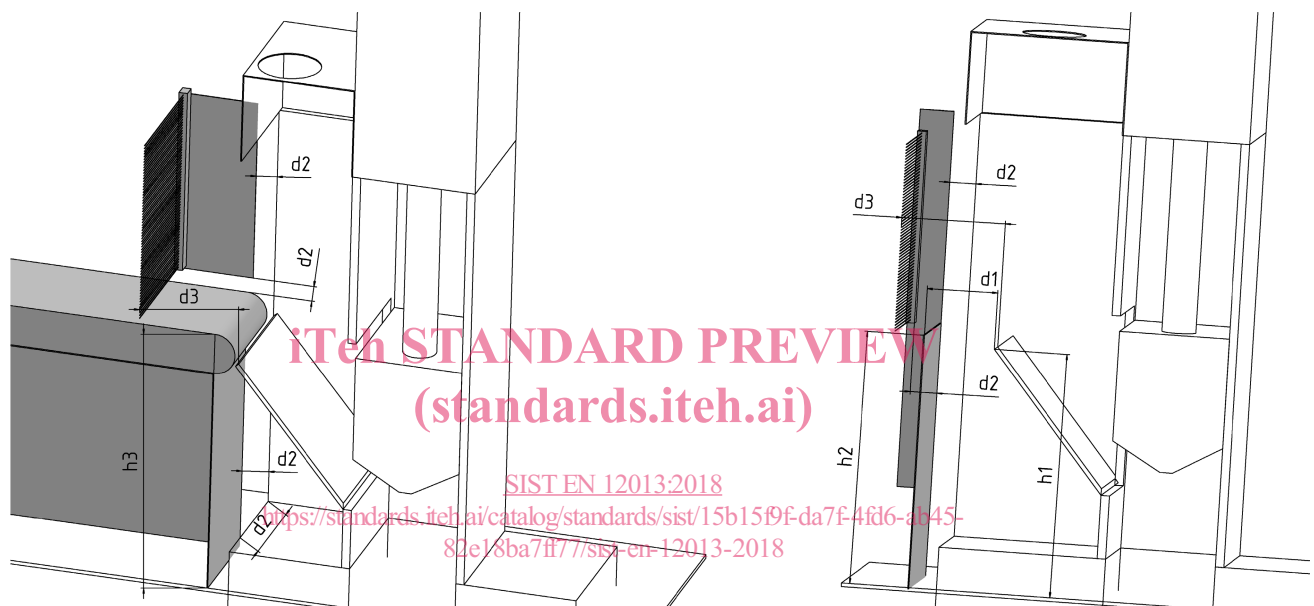
Depending on the design of the machine, single safety solutions or a combination of safety solutions are possible for the individual local danger point or individual local danger area.

**4.6.2 Safeguarding and risk reduction measures**

For safeguarding and risk reduction measures in the left and middle columns of subclauses 4.6.4 to 4.6.7.2.2, the following apply:

- guards shall be in accordance with EN ISO 14120:2015 taking into consideration the safety distances of EN ISO 13857:2008 as follows:
  - for reaching over protective structures the selection between Table 1 or Table 2 is given in the relevant subclauses;
  - for reaching through openings Table 3 and Table 4 apply;
- interlocking guards shall be in accordance with EN ISO 14119:2013;
- interlocking guards with guard locking shall be in accordance with EN ISO 14119:2013;
- the positioning of safeguards with respect to the approach speeds of parts of the human body shall be in accordance with EN ISO 13855:2010;
- two-hand control devices shall be in accordance with EN 574:1996+A1:2008; for the positioning of the devices see EN ISO 13855:2010. The required types are specified in the relevant subclauses; the danger area shall be clearly visible;
- hold-to-run control devices as defined in EN ISO 12100:2010, 3.28.3; the danger area shall be clearly visible; the minimum distance to the closest crushing and shearing points shall be at least 2 m;

- if several operational modes are used, two-hand control devices and hold-to-run control devices shall be enabled in manual mode by a mode selector in accordance EN ISO 12100:2010, 6.2.11.10 and EN 60204-1:2006, 9.2.4;
- electro-sensitive protective equipment (ESPE, e.g. light curtains) shall be in accordance with EN 61496-1:2013;
- active opto-electronic protective devices (AOPDs) shall be in accordance with EN 61496-2:2013;
- pressure sensitive mats and pressure sensitive floors shall be in accordance with EN ISO 13856-1:2013;
- to prevent whole body access between guards or light curtains and danger areas the maximum distance shall be 120 mm; see dimension d2 in Figure 3.



#### Key

- h1 height of the opened feeding door
- h2 height of fixed enclosing guard or interlocking guard or openings in fixed enclosing guard
- h3 height of conveyor acting as a guard
- d1 distance between guard and movable part of the machine
- d2 distance between guard and fixed part of the machine to prevent whole body access
- d3 safety distance between light curtain and movable part of the machine / danger zone

**Figure 3 — Example of maximum distances to prevent whole body access**

#### 4.6.3 Guidance for interpreting subclauses 4.6.4 to 4.6.7

The different protective measures for each hazard are separated in table rows. Each measure in a row shall be deemed to be a self-contained alternative.

The first column "Admissible protective measures" contains one or more alternative safety solutions.

The second column "Mandatory requirements for the protective measures" contains requirements which need to be applied for the corresponding protective measure in the first column of the same row.

The third column contains, if any, the required performance level.

See also list of significant hazards in Annex A.