



SLOVENSKI STANDARD

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Stroji za predelavo gume in plastike - Dvovaljni gnetilniki - Varnostne zahteve

Plastics and rubber machines - Two-roll mills - Safety requirements

Kunststoff- und Gummimaschinen - Walzwerke - Sicherheitsanforderungen

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

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Oprema za gumarsko
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Equipment for the rubber and
plastics industries

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EUROPEAN STANDARD
NORME EUROPÉENNE
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Plastics and rubber machines - Two-roll mills - Safety requirements

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

Kunststoff- und Gummimaschinen - Walzwerke -
Sicherheitsanforderungen

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 145.

If this draft becomes a European Standard, 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.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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COMITÉ EUROPÉEN DE NORMALISATION
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prEN 1417:2021 (E)**European foreword**

This document (prEN 1417:2021) has been prepared by Technical Committee CEN/TC 145 “Plastics and rubber machines”, the secretariat of which is held by UNI.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 1417:2014.

A transition period of 12 months (*dav + 6 months + 6 extra months*) is proposed.

In comparison with the previous edition EN 1417:2014, the following technical modifications have been made:

- a) the structure of the document is modified;
- b) covered ancillary equipment clarified in scope;
- c) the list of significant hazards is moved to an informative annex;
- d) technical developments in safeguards are taken into account;
- e) revised type-A and type-B standards are taken into account;
- f) removed the class of intermediate two-roll mills (requirements integrated in large and/or small two-roll mills);
- g) requirements for braking system adapted to the state of the art;
- h) requirements for trip bar modified;
- i) hazard and measures related to secondary roller added;
- j) requirements for small mill rolls modified.

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

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

Introduction

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

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 the 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.

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prEN 1417:2021 (E)**1 Scope**

This document deals with all significant hazards, hazardous situations or hazardous events relevant to two-roll mills for the processing of rubber and/or plastics (see Annex A), when it is used as intended and under conditions of misuse which are reasonably foreseeable by the manufacturer during all the phases of the life of the machine as described in EN ISO 12100:2010, 5.4.

This document covers two-roll mills as defined in 3.1.

This document deals with the following ancillary equipment as integral part of the machine:

- powered stock guides;
- strip cutting device;
- stock blender;
- recovery conveyor belt;
- retractable ploughs;
- secondary roller.

This document does not deal with the design of a local exhaust ventilation system that may be necessary in specific applications of the machine not known by the manufacturer.

This document is not applicable to two-roll mills manufactured before the date of its publication as a European Standard.

2 Normative references

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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.

EN 60204-1:2018, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:2016, modified)*

EN IEC 61000-6-2:2019, *Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity for industrial environments (IEC 61000-6-2:2016)*

EN IEC 61000-6-4:2019, *Electromagnetic compatibility (EMC) — Part 6-4: Generic standards — Emission standard for industrial environments (IEC 61000-6-4:2018)*

EN IEC 61496-1:2020, *Safety of machinery — Electro-sensitive protective equipment — Part 1: General requirements and tests (IEC 61496-1:2020)*

EN IEC 61496-2:2020, *Safety of machinery — Electro-sensitive protective equipment — Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs) (IEC 61496-2:2020)*

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)*
- 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 ISO 13851:2019, *Safety of machinery — Two-hand control devices — Principles for design and selection (ISO 13851:2019)*
- EN ISO 13854:2019, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body (ISO 13854:2017)*
- 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 13856-2:2013, *Safety of machinery — Pressure-sensitive protective devices — Part 2: General principles for design and testing of pressure-sensitive edges and pressure-sensitive bars (ISO 13856-2:2013)*
- EN ISO 13857:2019, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2019)*
- 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)*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1

two-roll mill

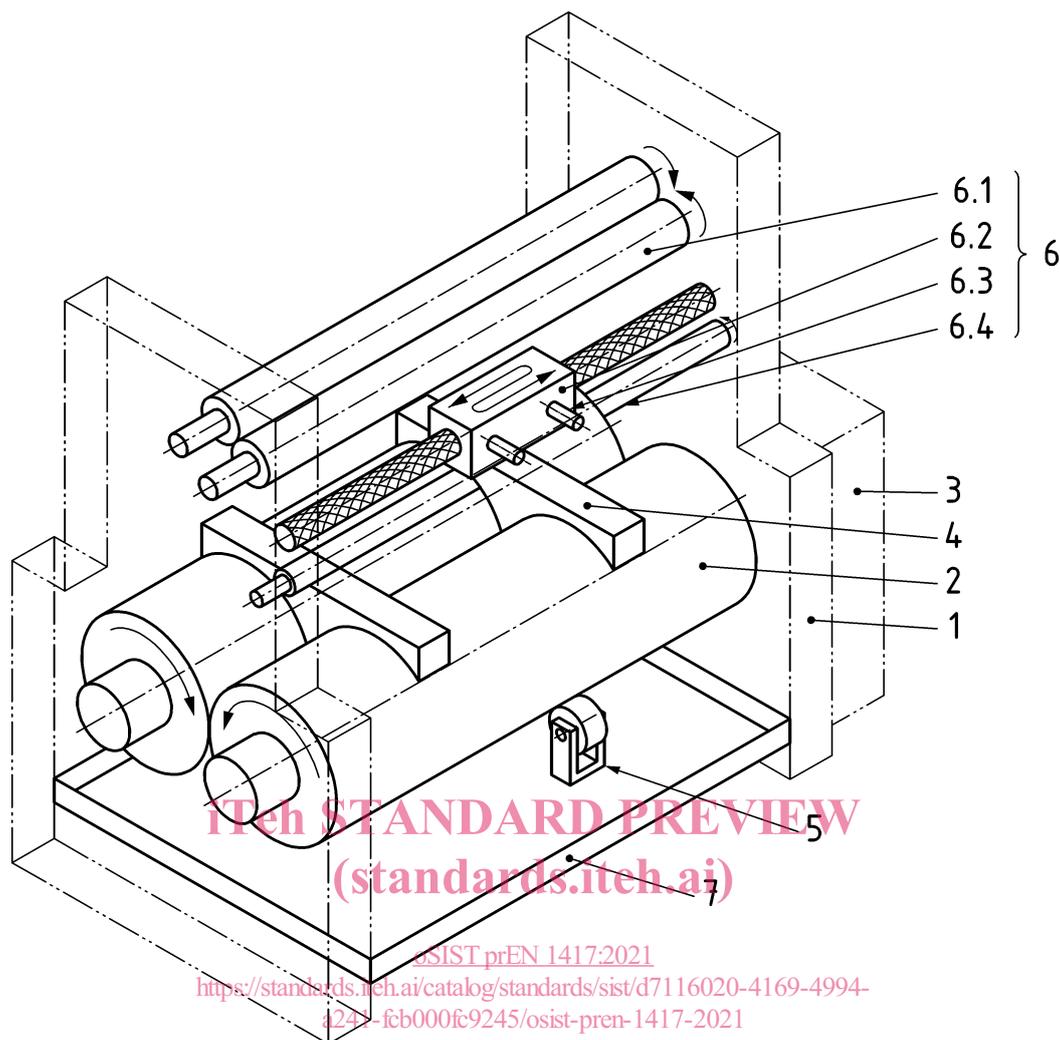
machine with two counter-rotating cylinders (known as mill rolls) which are not covered, which may be smooth or grooved, and whose axes are on substantially the same horizontal plane for the mixing of plastics or rubber

Note 1 to entry: See Figure 1:

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Key

| | | | |
|---|-----------------------------|-----|---|
| 1 | frame | 6 | stock blender |
| 2 | mill roll | 6.1 | stock blender rolls |
| 3 | drive and transmission unit | 6.2 | stock blender carriage |
| 4 | stock guide | 6.3 | guiding rolls of stock blender carriage |
| 5 | strip cutting device | 6.4 | guiding roll below stock blender carriage |
| | | 7 | mill tray |

Figure 1 — Example of a two-roll mill shown without safety devices

3.1.1

large two-roll mill

two-roll mill with a mill roll diameter $D > 200$ mm

3.1.2

small two-roll mill

two-roll mill with a mill roll diameter $D \leq 200$ mm

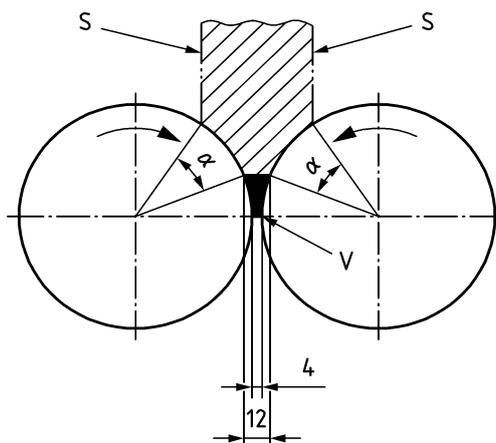
Note 1 to entry: Small two-roll mills are usually not equipped with stock blenders and strip cutting devices.

3.2

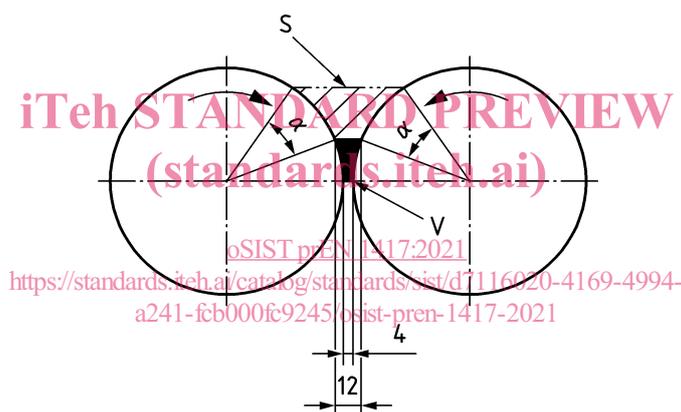
principal crushing zone

zone extending over the full length of the mill rolls indicated by V in Figure 2 and Figure 3

Dimensions in millimetres

Figure 2 — Principal crushing zone V, safety limits S and stopping angle α on a large two-roll mill

Dimensions in millimetres

Figure 3 — Principal crushing zone V, safety limit S and stopping angle α on a small two-roll mill

3.3

stopping angle α

angle through which the mill rolls rotate from the stop signal triggered by a protective device until the mill rolls have come to rest with the machine unloaded, and running at maximum rated speed

3.4

safety limit

vertical plane indicated by Line S in Figure 2 and Figure 3 demarcating the zone which is unsafe for operators who can reach into it without actuating the trip bar

3.5

stock guide (also known as “ear”)

part which prevents material being processed from going beyond the mill roll end

Note 1 to entry: See Figure 1, Location 4.

3.6**strip cutting device**

device equipped with rotating discs or stationary blades to cut off strips of processed material from a mill roll

Note 1 to entry: See Figure 1, Location 5.

3.7**stock blender**

equipment used to continuously recirculate the material being processed to obtain a uniform mixing, distributing it with a reciprocating motion along the length of the mill rolls

Note 1 to entry: See Figure 1, Location 6.

3.8**mill tray**

equipment for catching material which falls under the mill rolls

Note 1 to entry: See Figure 1, Location 7.

3.9**recovery conveyor belt**

equipment for recirculating material which falls under the mill rolls

Note 1 to entry: See Figure A.3.

3.10**retractable plough**

equipment which can be moved towards the mill roll in order to cut and turn over the material, and which can be retracted

Note 1 to entry: See Figure A.2.

3.11**secondary roller**

additional roller, which is used to support the mixing process

Note 1 to entry: See Figure 7.

Note 2 to entry: Examples are take-off rollers or pressure rollers applying pressure on the material processed by the two-roll mill. The pressure can be applied by the weight of the roller or by a power-driven actuator.

3.12**knee plate**

pressure sensitive protective device installed at a height so that it can be activated by the knee of the operator

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

Two-roll mills 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.

The hydraulic equipment and its components shall be designed in accordance with EN ISO 4413:2010.

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The pneumatic equipment and its components shall be designed in accordance with EN ISO 4414:2010.

4.2 Control systems**4.2.1 General**

The electrical part of the control system shall be designed in accordance with EN 60204-1:2018, Clause 9 and in addition with the specific requirements given in this standard.

The safety related parts of the control system (SRP/CS) shall be designed in accordance with EN ISO 13849-1:2015. The required performance level (PL_r) for each safety function is specified in the relevant subclauses.

4.2.2 Starting

The start of an operation shall be possible only when all safeguards are in place and functional (see EN 60204-1:2018, 9.2.3.2). The machine shall only be started by actuation of the start device provided for that purpose.

4.2.3 Normal stopping

A normal stop device (e.g. a push button) shall be provided to stop the mechanical movements.

The normal stop command shall function as a stop category 0 or 1 in accordance with EN 60204-1:2018, 9.2.2, depending on the actuators and braking systems used.

4.2.4 Emergency stop

Emergency stop devices shall be positioned on the control panel and on each working side of the two-roll mill and shall conform to EN ISO 13850:2015 and to category 0 or 1 according to EN 60204-1:2018, 9.2.2, whichever provides the best stopping performance.

Actuation of emergency stop devices shall stop all hazardous movements of the mill rolls and associated equipment.

On machines equipped with a trip bar or trip devices, actuation of emergency stop devices shall cause the effects as in 4.3.2.1.5, 4.3.2.1.6, 4.3.3.2 and 4.3.3.3.

Emergency stop devices shall stop the hot fluid supply except when a manual shut-off actuator is installed.

See also 6.2.1.

4.2.5 Failure of energy supply

An interruption or a failure of the power supply shall not result in a loss of safety function 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 Mechanical hazards**4.3.1 Requirements applicable to all types of two-roll mills****4.3.1.1 Hazards of drawing-in and crushing between the mills rolls during normal (forward and reverse) operation****4.3.1.1.1 General**

Access to the principal crushing zone, as defined in 3.2, shall be prevented by guards. See also 4.3.2.1 and 4.3.3. On two-roll mills with roll diameter > 200 mm, a trip bar may be used as alternative, provided that the requirements in 4.3.2.1.2 are met.

Guards shall be designed in accordance with EN ISO 14120:2015 and positioned according to EN ISO 13857:2019, Table 2, Table 3 and/or Table 4 unless specified different in specific clauses of this standard.

Interlocking guards shall be designed and selected in accordance with EN ISO 14119:2013.

Interlocking guards shall be positioned in accordance with EN ISO 13855:2010, Clause 9, taking into account the braking performance achieved by the braking system described in 4.3.1.1.2. Opening of an interlocking guard shall stop the rotation of the rolls in accordance with $PL_T = d$.

If EN ISO 13855:2010, Clause 9 cannot be respected, interlocking guards with guard locking shall be adopted. The unlocking signal for the guard locking shall be in accordance with $PL_T = c$.

Where the smallest horizontal distance between the guard in its closed position and the mill rolls is more than 100 mm and it is possible to stand between the guard in its closed position and the mill rolls, a manual reset actuator shall be designed and located in accordance with EN ISO 13849-1:2015, 5.2.2 and with $PL_T = d$.

4.3.1.1.2 Braking system

The two-roll mill shall be equipped with a two-channel braking system in accordance with $PL_T = d$, category 3 using:

- either two mechanical brakes, spring operated; or
- one mechanical brake, spring operated and an electronic braking system, operating also without power supply.

The overall system stopping performance (see EN ISO 13855:2010, 3.1.2) shall be calculated taking power failure into account.

The braking system shall be so designed that in the case of a power failure a braking action will automatically bring the mill rolls to rest.

The thermal characteristics shall be sufficient to allow rapid dissipation of the heat produced by the braking action.

If it is possible to manually deactivate the braking system, the deactivation shall be interlocked with the control circuit in accordance with $PL_T = d$, so that the powered rotation of the mill rolls is prevented as long as the brake is manually deactivated.

4.3.1.2 Hazards of drawing-in and crushing in the drive mechanism of the mill rolls

Access to the dangerous area of the drive mechanism shall be prevented by one or more of the solutions in 4.3.1.1.1.

Opening of an interlocking guard shall stop the rotation of the rolls in accordance with $PL_T = c$.

4.3.1.3 Hazard of drawing-in and crushing between the stock guides and the mill rolls

Rotation of the rolls shall only be possible:

- with stock guides in working position with maximum gap between stock guides and rolls not exceeding 4 mm. The position shall be detected in accordance with $PL_T = c$; or
- with stock guides in rest position with gap between stock guides and rolls more than 120 mm. The position shall be detected in accordance with $PL_T = c$; or
- using a hold-to-run control device (see EN ISO 12100:2010, 3.28.3) in accordance with $PL_T = c$,