



BSI Standards Publication

Plastics and rubber machines — Tyre curing machines — Safety requirements

National foreword

This British Standard is the UK implementation of EN 16474:2025. It supersedes BS EN 16474:2015, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee MCE/3/2, Rubber and plastics machine - Safety.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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- Machines à vulcaniser les pneumatiques - Exigences
de sécurité

Kunststoff- und Gummimaschinen -
Reifenvulkanisiermaschinen -
Sicherheitsanforderungen

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Content

Page

European foreword.....	4
Introduction	5
1 Scope.....	6
2 Normative references.....	7
3 Terms and definitions	8
4 Safety requirements and/or protective measures	15
4.1 Basic safety requirements and/or protective measures	15
4.1.1 General.....	15
4.1.2 Guards and protective devices	15
4.1.3 Safety related parts of the control system	15
4.1.4 Electrical equipment.....	15
4.1.5 Hydraulic and pneumatic systems.....	15
4.1.6 Ancillaries equipment	15
4.1.7 Ergonomic principles.....	16
4.1.8 Mechanical strength of machine parts	16
4.2 Specific safety requirements and/or protective measures	16
4.2.1 Specific requirements for operation in production mode	16
4.2.2 Specific requirements for tyre curing machines with two cavities and independent curing cycles and independent safeguarding	63
4.3 Emergency stop function	63
4.4 Requirements for noise reduction.....	63
4.4.1 Main noise sources	63
4.4.2 Noise reduction at source by design	63
4.4.3 Noise reduction by protective measures.....	63
4.4.4 Information connected with noise hazards.....	63
5 Verification of the safety requirements and/or protective measures.....	64
6 Information for use	70
6.1 General.....	70
6.2 Instruction handbook.....	70
6.2.1 General.....	70
6.2.2 Exhaust system.....	70
6.2.3 Leakage of nitrogen	70
6.2.4 Spraying jib using toxic substances.....	70
6.2.5 Hazards due to hot surfaces	70
6.2.6 Leakage of curing media from hoses and pipes	71
6.2.7 Non-permanent safe means of access.....	71
6.2.8 Falling of the green tyre.....	71
6.2.9 Set-up operations.....	71
6.2.10 Maintenance operations.....	71
6.2.11 Fixation of the upper part of the container or mould	71
6.2.12 Machine parameters	71
6.2.13 Emergency stop and discharge of curing media	72
6.2.14 Rescue movement	72
6.2.15 Noise emission	72
6.3 Marking.....	72
6.4 Warning signs.....	73
Annex A (informative) List of significant hazards.....	74

Annex B (normative) Noise test code 83

Annex ZA (informative) Relationship between this European Standard and the essential requirements of Directive 2006/42/EC aimed to be covered..... 89

Annex ZB (informative) Relationship between this European Standard and the essential requirements of Regulation (EU) 2023/1230 aimed to be covered..... 91

Bibliography 94

European foreword

This document (EN 16474:2025) has been prepared by Technical Committee CEN/TC 145 “Plastics and rubber machines”, the secretariat of which is held by DIN.

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 April 2026 and conflicting national standards shall be withdrawn at the latest by April 2026.

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

This document supersedes EN 16474:2015.

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

- modification of the scope including machines for bicycle and motorcycle tyres and Post Curing Inflator (PCI);
- consideration of revised type-A and type-B standards;
- added safety requirements for Post Curing Inflator;
- added requirements related to rescue movement for the movable upper part and the loading device;
- introduced fire hazard and related safety requirements;
- considered the possibility to leave pressurized the bladder above the semi-closed position for a limited time and also when safeguards are activated and to increase the pressure above the threshold for a very short time;
- considered the possibility to install a shield in order to leave pressurized the bladder below the semi-closed position for a limited time when safeguards are activated.

This document has been prepared under a standardization request addressed to CEN by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

For the relationship with EU Legislation, see informative Annexes ZA and ZB, which are an integral part of this document.

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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 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 and hazardous events are covered are indicated in the scope of this document.

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

1 Scope

This document applies to tyre curing machines having the following configuration:

- crossing flow tyre curing machines, with one cavity with manual or automatic feeding and discharge;
- crossing flow tyre curing machines, with two cavities, with manual or automatic feeding and discharge and with:
 - common curing cycle and common safeguarding; or
 - independent curing cycles and common safeguarding; or
 - independent curing cycles and independent safeguarding;
- tyre curing machines with automatic rear feeding and discharge.

The safety requirements and/or protective measures specified in this document apply to tyre curing machines used to cure bicycle, motorcycle, passenger vehicle and truck tyres or other tyres that can be cured according to the requirements of this document.

This document deals with the following ancillary equipment that are an integral part in a tyre curing machine:

- loading/unloading device;
- take-away conveyor;
- Post Cure Inflator (PCI) integrated in the rear side of a crossing flow machines for passenger vehicle tyres;
- spraying jib.

This document does not deal with:

- feeding system and discharge system;
- tyre curing machines with manual loading of the green tyre into the mould and manual unloading of the cured tyre from the mould;
- ancillary equipment which is not an integral part of the tyre curing machine, e.g. conveying equipment;
- exhaust systems.

This document deals with all significant hazards, hazardous situations and events relevant to tyre curing machines, when they are used as intended and under conditions of misuse which are reasonably foreseeable by the manufacturer (see Annex A).

It does not deal with hazards associated with falling of parts of the container or mould because they are not part of the machinery.

This document is not applicable to tyre curing machines which are manufactured before the date of its publication as an EN.

2 Normative references

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 619:2022, *Continuous handling equipment and systems - Safety requirements for equipment for mechanical handling of unit loads*

EN 1005-3:2002+A1:2008, *Safety of machinery - Human physical performance - Part 3: Recommended force limits for machinery operation*

EN 1005-4:2005+A1:2008, *Safety of machinery - Human physical performance - Part 4: Evaluation of working postures and movements in relation to machinery*

EN 60204-1:2018, *Safety of machinery - Electrical equipment of machines - Part 1: General requirements*

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 IEC 61496-3:2019, *Safety of machinery - Electro-sensitive protective equipment - Part 3: Particular requirements for active opto-electronic protective devices responsive to diffuse reflection (AOPDDR) (IEC 61496-3:2018)*

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 7010:2020,¹ *Graphical symbols - Safety colours and safety signs - Registered safety signs (ISO 7010:2019, Corrected version 2020-06)*

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 11202:2010,² *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)*

¹ As impacted by EN ISO 7010:2020/A1:2020, EN ISO 7010:2020/A2:2022, EN ISO 7010:2020/A3:2022, EN ISO 7010:2020/A4:2023, EN ISO 7010:2020/A5:2023 and EN ISO 7010:2020/A6:2023.

² As impacted by EN ISO 11202:2010/A1:2021.

EN ISO 11688-1:2009, *Acoustics - Recommended practice for the design of low-noise machinery and equipment - Part 1: Planning (ISO/TR 11688-1:1995)*

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 13849-1:2023, *Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design (ISO 13849-1:2023)*

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

EN ISO 13855:2024, *Safety of machinery - Positioning of safeguards with respect to the approach of the human body (ISO 13855:2024)*

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 13856-3:2013, *Safety of machinery - Pressure-sensitive protective devices - Part 3: General principles for design and testing of pressure-sensitive bumpers, plates, wires and similar devices (ISO 13856-3:2013)*

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 14119:2025, *Safety of machinery - Interlocking devices associated with guards - Principles for design and selection (ISO 14119:2024)*

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 14122-2:2016, *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)*

ISO 1402:2021, *Rubber and plastics hoses and hose assemblies - Hydrostatic testing*

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 terminology databases for use in standardization at the following addresses:

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

3.1**tyre curing machine**

machine used for vulcanisation of tyres usually comprising fixed and movable parts that can be locked together, inside which the green tyre assumes its final shape and characteristics by the use of pressure and heating

Note 1 to entry: See Figure 1 and Figure 2.

3.2**crossing flow**

machine type in which green tyres are fed and loaded from the front and cured tyres are unloaded and discharged from the rear

3.3**cavity**

part of the machine in which the container and/or the mould and the bladder are installed

3.4**green tyre**

assembly of rubber parts partially reinforced with other, strength-enhancing materials intended to be cured

3.5**cured tyre**

tyre in its final form after vulcanisation

3.6**bladder**

inflatable rubber component used to push the green tyre into contact with the mould while being inflated by the curing media

Note 1 to entry: The bladder could be connected to the machine by means of the top ring and bottom ring or automatic clamped on the lower foot.

3.7**bottom ring**

assembly of the bottom bladder clamping plate

3.8**top ring**

assembly of the top bladder clamping plate

3.9**green tyre stand**

supporting element for the green tyre before loading

3.10**chuck**

device for holding or gripping the green or cured tyre

3.11**movable upper part**

part of the machine that is opened for loading the green tyre and unloading the cured tyre and is closed and locked during curing

3.12

heating platen

equipment used to heat sidewalls of the mould by contact

3.13

steam dome

equipment used to heat the complete mould by direct contact with the steam

3.14

container

exchangeable equipment used to heat the curing mould or part of it

Note 1 to entry: The container is fixed to the tyre curing machine by use of screws or automatic fixation device.

3.15

mould

exchangeable equipment used to give the external shape to the cured tyre

Note 1 to entry: The mould could be a two halves mould or a segmented mould.

3.16

dummy mould

subassembly representative of the mould

3.17

mould segment

movable part of the mould

3.18

loading pressure

pressure inflated into the bladder in order to make it able to hold the green tyre in place while the loading device deposits it into the cavity

3.19

pre-shaping pressure

pressure inflated into the bladder in order to make it able to pre-shape the green tyre while the curing machine is closing the mould

3.20

opening pressure

pressure inflated into the bladder in order to make it able to hold the cured tyre in place while the curing machine is opening the mould

3.21

semi-closed position

position of the movable upper part above which the loading pressure is applied and below which the pre-shaping pressure or the opening pressure is applied

Note 1 to entry: The position depends on the height of the mould and the height of the green tyre.

3.22

feeding

manual or automatic operation to feed green tyres to the loading device

3.23**loading device**

device that is an integrated ancillary equipment of the machine and it is used to pick up the green tyre and insert it into the tyre curing machine

3.24**curing cycle**

period of time in which the curing process is completed, i.e. from full closing, squeezing and locking until the pressure is dropped down

3.25**unloading device**

device that is an integrated ancillary equipment of the machine and it is used to remove the cured tyre from the tyre curing machine

3.26**discharge**

manual or automatic operation to remove cured tyres from the unloading device

3.27**take-away conveyor**

conveyor that is an integral part of the machine and on which the unloading device deposits the cured tyres for discharge to the rear of the tyre curing machine

3.28**spraying device**

static or dynamic nozzle(s) used to treat the mould and/or the bladder with treatment fluid

3.29**distance guard**

guard which does not completely enclose a danger zone, but which prevents or reduces access by virtue of its dimensions and its distance from the danger zone, e.g. perimeter fence or tunnel guard

[SOURCE: EN ISO 14120:2015, 3.2.2]

3.30**enclosing guard**

guard which prevents access to the danger zone from all sides

[SOURCE: EN ISO 14120:2015, 3.2.1]

3.31**integrated ancillary equipment**

ancillary equipment which cannot in itself perform a specific application but need to be integrated with a curing machine in order to carry out the intended use

Note 1 to entry: A stand-alone PCI is not an integrated ancillary equipment.

3.32**Post Cure Inflator****PCI**

integrated ancillary equipment used for the inflation of the still hot cured tyre during its cooling

3.33

PCI half rim

exchangeable mechanical tool to keep the tyre in shape while inflating it

3.34

machine designed for automatic feeding only

machinery designed to operate only with automatic feeding equipment to feed green tyres to the loading device and when it is not possible to operate the machinery without those devices

3.35

machine designed for automatic discharging only

machinery designed to operate only with automatic discharging equipment to remove cured tyres from the unloading device and when it is not possible to operate the machinery without those devices

3.36

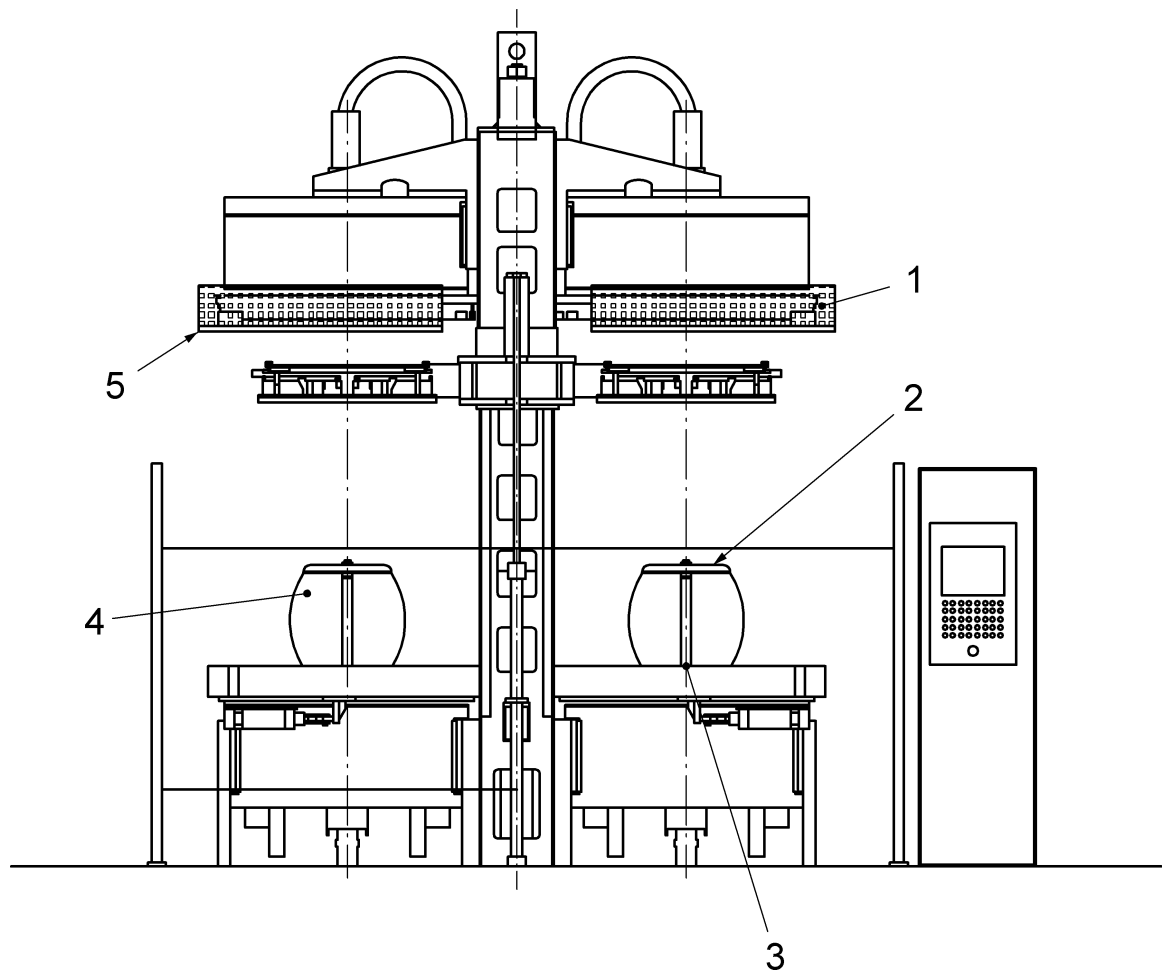
rescue pushbutton

control device to rescue trapped person reversing the movements of some elements

3.37

mould or container change mode

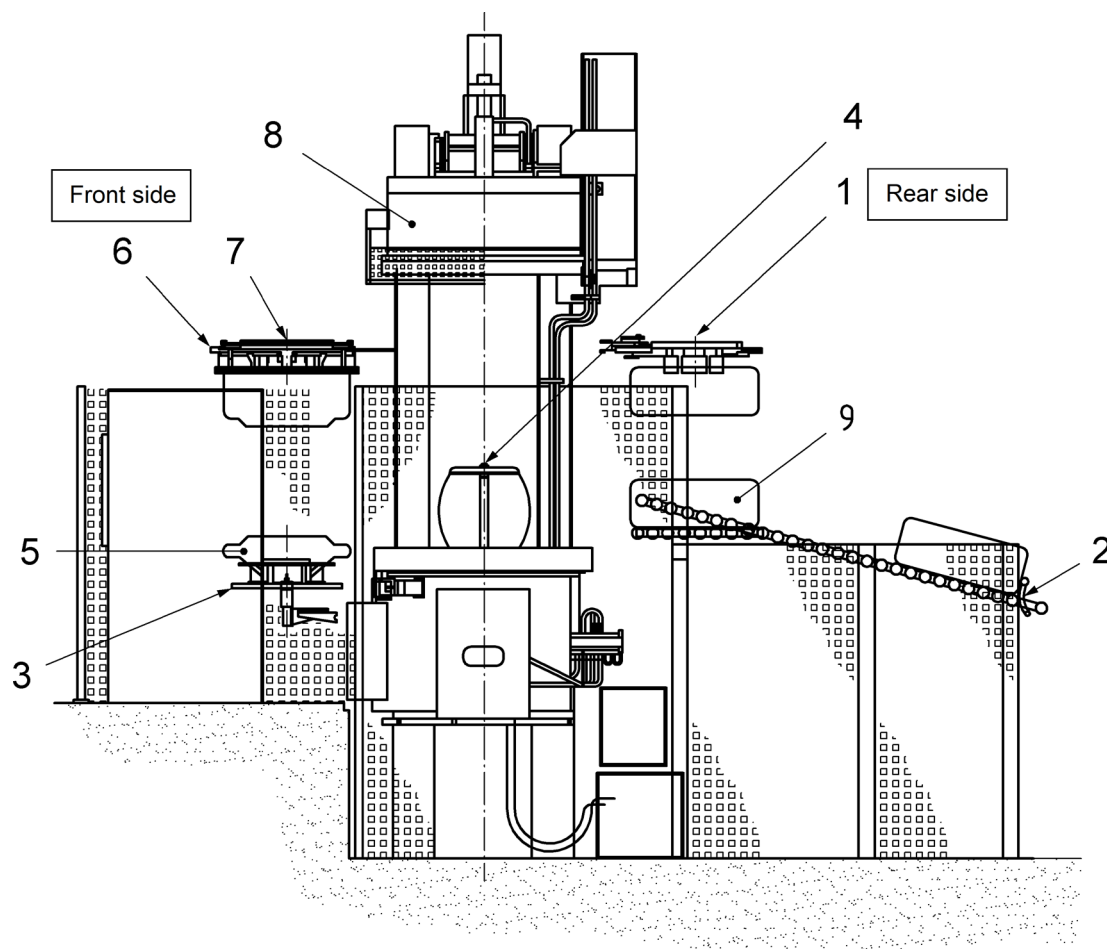
selectable mode of operation of the machine that allows individual motions at a low speed, low pressure and low force, used for changing the mould or container



Key

- 1 container
- 2 top ring
- 3 bottom ring or bottom clamping
- 4 bladder
- 5 heating platen

Figure 1 — Main parts of tyre curing machines (front view)



Key

- 1 unloading device
- 2 take-away conveyor
- 3 green tyre stand
- 4 top ring
- 5 green tyre
- 6 loading device
- 7 chuck
- 8 movable upper part
- 9 cured tyre

Figure 2 — Main parts of tyre curing machines (side view)

4 Safety requirements and/or protective measures

4.1 Basic safety requirements and/or protective measures

4.1.1 General

Machinery shall comply with the safety requirements and/or protective measures of this clause. In addition, the machines 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.

Pressure requirements are given in Table 1.

NOTE All pressure values in this document are given as gauge pressure.

4.1.2 Guards and protective devices

Safety distances for fixed distance guards and machine parts acting as fixed guards shall comply with EN ISO 13857:2019. For “reaching over protective structures”, if not otherwise specified in the relevant subclauses, Table 2 shall be applied for crushing and shearing hazards, otherwise Table 1 shall be used. For reaching through openings, Table 3 and Table 4 shall be used.

Guards shall be designed and manufactured in accordance with EN ISO 14120:2015. Interlocking devices shall comply with EN ISO 14119:2025. The choice between interlocking guards and interlocking guards with guard locking shall comply with EN ISO 14119:2025, Clause 7 and EN ISO 13855:2024, Clause 12. Interlocking guards may be power operated on tyre curing machines with automatic rear feeding and discharge. In case of interlocking guards with guard locking giving access to areas where whole body access is possible, an escape release device shall be provided according to EN ISO 14119:2025, 6.9.1.

Light curtains shall be in accordance with EN IEC 61496-1:2020 and EN IEC 61496-2:2020.

Scanners shall comply with EN IEC 61496-3:2019.

Light curtains and interlocking guards without guard locking shall be positioned in accordance with EN ISO 13855:2024.

4.1.3 Safety related parts of the control system

The safety related parts of the control system (SRP/CS) shall be designed in accordance with EN ISO 13849-1:2023. The required performance level (PL_r) for each safety function is specified in the relevant subclauses taking into account the risk assessment. When safety measures other than SRP/CS are listed in the Table 1, they don't require any PL_r.

In Table 1 some safety functions related to pressure in the bladder depend by appropriate position of the movable upper part and/or by suitable conditions of the tyre curing machine. They are parts of the safety functions, therefore they concur to reach the PL_r stated in Table 1. Hazards involved are the following: n° 21, 22, 23, 24, 25, 26.

4.1.4 Electrical equipment

The electrical equipment shall be in accordance with EN 60204-1:2018.

4.1.5 Hydraulic and pneumatic systems

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

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

4.1.6 Ancillary equipment

Power operated take-away conveyors shall be in accordance with EN 619:2022.

4.1.7 Ergonomic principles

Ergonomic principles shall be in accordance with EN 1005-3:2002+A1:2008 and EN 1005-4:2005+A1:2008 for the design of green tyre stands in case of manual feeding as well as recurring activities such as PCI rims change, mould change, bladder change, etc.

4.1.8 Mechanical strength of machine parts

For tyre curing machines which include pressure equipment, the manufacturer shall consider the forces resulting from the pressurization for the calculation of the mechanical strength of machine parts subjected to these forces. See also Table 1, hazards 21 to 25.

The machine shall be designed taking into consideration the max values with reference to 6.2.12.

4.2 Specific safety requirements and/or protective measures

4.2.1 Specific requirements for operation in production mode

4.2.1.1 Protection against hazards associated with specific machine parts or areas

Safety requirements and/or protective measures for operation in production mode are given in Table 1 for crossing flow tyre curing machines and for tyre curing machines with automatic rear feeding and discharge. Safeguards and/or protective measures are expressed in tabular form in precise and clearly understandable terms.

The lines of Table 1 are related to the respective significant hazards listed in A.3.

In Table 1, the safety requirements and/or protective measures are specified for the front, rear and side positions on the tyre curing machine. Figure 3 and Figure 4 show these positions.

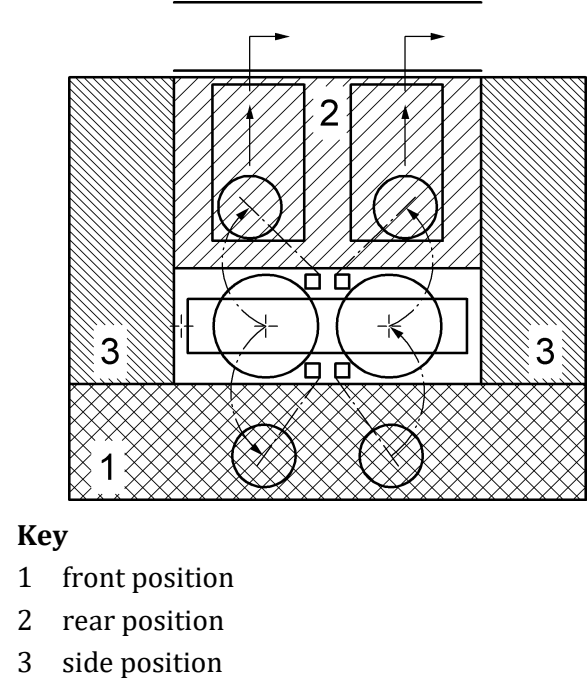


Figure 3 — Positions on crossing flow tyre curing machines

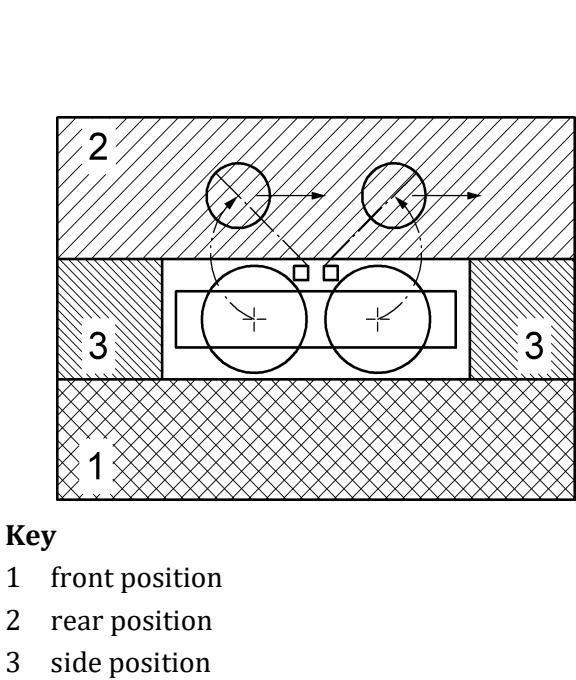


Figure 4 — Position on tyre curing machine with automatic rear feeding and discharge

Table 1 — Safety requirements and/or protective measures for tyre curing machines in production mode (1 of 45)

Hazard N°	Dangerous situation	Significant hazard(s)	Position/ location	Crossing flow tyre curing machines		Tyre curing machines with automatic rear feeding and discharge	
				Safeguards and/or protective measures	PL _r	Safeguards and/or protective measures	PL _r
1	Closing of the movable upper part	Crushing Shearing Trapping	Position 1: front	Scanner or Light curtain or Combination of fixed distance guards and machine parts acting as fixed guards preventing access. Where these safeguards cannot be practically implemented, e.g. due to lack of space, pressure sensitive protective devices in accordance with EN ISO 13856-3:2013 shall be installed under the following conditions: — the pressure sensitive protective devices shall be dimensioned and positioned so that the dangerous moving part has stopped before any injury can occur and that nobody can stand between the pressure sensitive protective device and crushing/shearing points; — if the pressure sensitive protective device is adjustable, its safe position with respect to the size of the container and mould shall be detected by the safety related parts of the control system of the machine before the movement can be started. A rescue pushbutton according to 4.2.1.7 shall be installed.	d	Interlocking guard with or without guard locking.	d for the safe- guarding function c only for the stopping function of the downward movement in case of use of the interlocking guard with guard locking

Hazard N°	Dangerous situation	Significant hazard(s)	Position/location	Crossing flow tyre curing machines		Tyre curing machines with automatic rear feeding and discharge	
				Safeguards and/or protective measures	PL _r	Safeguards and/or protective measures	PL _r
2	Opening of the movable upper part	Crushing Shearing Entanglement Impact	Position 2: rear	Fixed distance guard and/or Take-away conveyor, acting as a fixed distance guard according to EN 619:2022		Interlocking guard with guard locking for the feeding/discharge system and/or Interlocking guard without guard locking associated with light curtains.	
			Position 3: side	Fixed distance guard and interlocking guard with or without guard locking or Combination of fixed distance guards and machine parts acting as fixed guards preventing access.		Fixed distance guard.	
			Position 1: front	Scanner or Light curtain or Combination of fixed distance guards and machine parts acting as fixed guards preventing access.	b if no access to the crushing/shearing hazard d if access to crushing/shearing hazard	Interlocking guard with or without guard locking.	b if no access to the crushing/shearing hazard d if access to crushing/shearing hazard
			Position 2: rear	Fixed distance guard and/or Take-away conveyor, acting as a fixed distance guard according to EN 619:2022.		Interlocking guard with guard locking for the feeding/discharge system and/or Interlocking guard without guard locking associated with light curtains.	
			Position 3: side	Fixed distance guard and interlocking guard with or without guard locking or Combination of fixed distance guards and machine parts acting as fixed guards preventing access.		Fixed distance guard.	

Hazard N°	Dangerous situation	Significant hazard(s)	Position/location	Crossing flow tyre curing machines		Tyre curing machines with automatic rear feeding and discharge	
				Safeguards and/or protective measures	PL _r	Safeguards and/or protective measures	PL _r
3	Unexpected falling of the movable upper part when it is in the fully open position.	Crushing	Position 1: front	Combination of fixed distance guards and machine parts acting as fixed guards preventing access or Mechanical restraint device that is automatically engaged; the engagement of this device shall be visually indicated.	d	Upper part mechanical restraint device that is automatically engaged. The engagement of this device shall be visually indicated.	d
			Position 2: rear	Fixed distance guard and/or Take-away conveyor acting as fixed distance guard, according to EN 619:2022 or Mechanical restraint device that is automatically engaged; the engagement of this device shall be visually indicated.		Upper part mechanical restraint device that is automatically engaged. The engagement of this device shall be visually indicated.	
			Position 3: side	Combination of fixed distance guards and machine parts acting as fixed guards preventing access or Mechanical restraint device that is automatically engaged; the engagement of this device shall be visually indicated.		Fixed distance guard and Upper part mechanical restraint device that is automatically engaged. The engagement of this device shall be visually indicated.	

Hazard N°	Dangerous situation	Significant hazard(s)	Position/ location	Crossing flow tyre curing machines		Tyre curing machines with automatic rear feeding and discharge	
				Safeguards and/or protective measures	PL _r	Safeguards and/or protective measures	PL _r
4	Unexpected gravity fall of the movable upper part when it is in any raised position	Crushing	Position 1: front	Combination of fixed distance guards and machine parts acting as fixed guards preventing access or Restraint system activated by opening an interlocking guard or actuating a protective device that achieves a stopping distance of the moveable upper part of less than 20 mm, e.g. restraint valves fitted directly on the cylinder, a brake system, etc.	d	Combination of fixed distance guards and machine parts acting as fixed guards preventing access or Restraint system activated by opening an interlocking guard or actuating a protective device that achieves a stopping distance of the moveable upper part of less than 20 mm, e.g. restraint valves fitted directly on the cylinder, a brake system, etc.	d Not applicable if interlocking guard with guard locking
			Position 2: rear	Fixed distance guard and/or Take-away conveyor, acting as a fixed distance guard according to EN 619:2022 or Restraint system activated by opening an interlocking guard or actuating a protective device that achieves a stopping distance of the moveable upper part of less than 20 mm, e.g. restraint valves fitted directly on the cylinder, a brake system, etc.		Fixed distance guard and/or Take-away conveyor, acting as a fixed distance guard or Restraint system activated by opening an interlocking guard or actuating a protective device that achieves a stopping distance of the moveable upper part of less than 20 mm, e.g. restraint valves fitted directly on the cylinder, a brake system, etc.	
			Position 3: side	Combination of fixed distance guards and machine parts acting as fixed guard preventing access or Restraint system activated by opening an interlocking guard or actuating a protective device that achieves a stopping distance of the moveable upper part of less than 20 mm, e.g. restraint valves fitted directly on the cylinder, a brake system, etc.		Combination of fixed distance guards and machine parts acting as fixed guards preventing access or Restraint system activated by opening an interlocking guard or actuating a protective device that achieves a stopping distance of the moveable upper part of less than 20 mm, e.g. restraint valves fitted directly on the cylinder, a brake system, etc.	

Hazard N°	Dangerous situation	Significant hazard(s)	Position/location	Crossing flow tyre curing machines		Tyre curing machines with automatic rear feeding and discharge	
				Safeguards and/or protective measures	PL _r	Safeguards and/or protective measures	PL _r
5	Locking of the movable upper part	Crushing Shearing	Position 1: front	Scanner or Light curtain or Combination of fixed distance guards and machine parts acting as fixed guards preventing access and/or Fixed enclosing guard shall be compliant with EN ISO 13857:2019, Table 4.	d	Interlocking guard with or without guard locking or Fixed distance guard.	d
			Position 2: rear	Fixed distance guard and/or Take-away conveyor, acting as a fixed distance guard according to EN 619:2022 or Fixed enclosing guard shall be compliant with EN ISO 13857:2019, Table 4.		Interlocking guard with guard locking for the feeding/discharge system and/or Interlocking guard without guard locking associated with light curtains or Fixed distance guard.	
			Position 3: side	Fixed distance guard and interlocking guard with or without guard locking or Combination of fixed distance guards and machine parts acting as fixed guards preventing access or Fixed enclosing guard shall be compliant with EN ISO 13857:2019, Table 4.		Fixed distance guard.	

Hazard N°	Dangerous situation	Significant hazard(s)	Position/ location	Crossing flow tyre curing machines		Tyre curing machines with automatic rear feeding and discharge	
				Safeguards and/or protective measures	PL _r	Safeguards and/or protective measures	PL _r
6	Unlocking of the movable upper part	Crushing Shearing	Position 1: front	Scanner or Light curtain or Combination of fixed distance guards and machine parts acting as fixed guards preventing access and/or Fixed enclosing guard shall be compliant with EN ISO 13857:2019, Table 4.	d	Interlocking guard with or without guard locking or Fixed distance guard.	d
			Position 2: rear	Fixed distance guard and/or Take-away conveyor, acting as a fixed distance guard according to EN 619:2022 or Fixed enclosing guard shall be compliant with EN ISO 13857:2019, Table 4.		Interlocking guard with guard locking for the feeding/dischARGE system and/or Interlocking guard without guard locking associated with light curtains or Fixed distance guard.	
			Position 3: side	Fixed distance guard and interlocking guard with or without guard locking or Combination of fixed distance guards and machine parts acting as fixed distance guards preventing access or Fixed enclosing guard shall be compliant with EN ISO 13857:2019, Table 4.		Fixed distance guard	

Hazard N°	Dangerous situation	Significant hazard(s)	Position/location	Crossing flow tyre curing machines		Tyre curing machines with automatic rear feeding and discharge	
				Safeguards and/or protective measures	PL _r	Safeguards and/or protective measures	PL _r
7	Downward movement of the loading device and /or green tyre stand	Crushing Shearing Impact	Position 1: front	Scanner or Light curtain or Combination of fixed distance guards and machine parts acting as fixed guards preventing access. Where these safeguards cannot be practically implemented, e.g. due to lack of space, pressure sensitive protective devices in accordance with EN ISO 13856-3:2013 shall be installed under the following conditions: — the pressure sensitive protective device shall be dimensioned and positioned so that the dangerous moving part has stopped before any injury can occur and that nobody can stand between the pressure sensitive protective device and crushing/shearing points; — if the pressure sensitive protective device is adjustable, its safe position with respect to the size of the loading device and/or green tyre stand shall be detected by the safety related parts of the control system of the machine before the movement can be started. A rescue pushbutton according to 4.2.1.7 shall be installed.	d in case of manual feeding c in case of automatic feeding	Interlocking guard with or without guard locking.	c

Hazard N°	Dangerous situation	Significant hazard(s)	Position/location	Crossing flow tyre curing machines		Tyre curing machines with automatic rear feeding and discharge	
				Safeguards and/or protective measures	PL _r	Safeguards and/or protective measures	PL _r
8	Upward movement of the loading device and /or green tyre stand	Crushing Shearing Impact	Position 2: rear	Fixed distance guard and/or Take-away conveyor, acting as a fixed distance guard according to EN 619:2022.		Interlocking guard with guard locking for the feeding/ discharge system.	
			Position 3: side	Fixed distance guard and interlocking guard with or without guard locking or Combination of fixed distance guards and machine parts acting as fixed guards preventing access.		Fixed distance guard.	
			Position 1: front	Scanner or Light curtain or Combination of fixed distance guards and machine parts acting as fixed guards preventing access.	a if access to impact hazard only c if access to crushing/shearing hazard	Interlocking guard with or without guard locking.	a if access to impact hazard only c if access to crushing/shearing hazard
			Position 2: rear	Fixed distance guard and/or Take-away conveyor, acting as a fixed distance guard according to EN 619:2022.		Interlocking guard with guard locking for the feeding/ discharge system and/or Interlocking guard without guard locking associated with light curtains.	
			Position 3: side	Fixed distance guard and interlocking guard with or without guard locking or Combination of fixed distance guards and machine parts acting as fixed guards preventing access.		Fixed distance guard.	

Hazard N°	Dangerous situation	Significant hazard(s)	Position/location	Crossing flow tyre curing machines		Tyre curing machines with automatic rear feeding and discharge	
				Safeguards and/or protective measures	PL _r	Safeguards and/or protective measures	PL _r
9	Rotation of the loading device (chuck type)	Crushing Shearing Impact	Position 1: front	Scanner or Light curtain or Combination of fixed distance guards and machine parts acting as fixed guards preventing access. Where these safeguards cannot be practically implemented, e.g. due to lack of space, pressure sensitive protective device in accordance with EN ISO 13856-3:2013 shall be installed under the following conditions: — the pressure sensitive protective device shall be dimensioned and positioned so that all the dangerous moving parts are protected and have stopped before any injury can occur and that nobody can stand between the pressure sensitive protective device and crushing/shearing points; — if the pressure sensitive protective device is adjustable, its safe position with respect to the size of the loading device and/or green tyre stand shall be detected by the safety related parts of the control system of the machine before the movement can be started.	c	Interlocking guard with or without guard locking.	c
			Position 2: rear	Fixed distance guard and/or Take-away conveyor, acting as a fixed distance guard according to EN 619:2022.		Interlocking guard with guard locking for the feeding/discharge system.	
			Position 3: side	Fixed distance guard and interlocking guard with or without guard locking or Combination of fixed distance guards and machine parts acting as fixed guards preventing access.		Fixed distance guard.	

Hazard N°	Dangerous situation	Significant hazard(s)	Position/ location	Crossing flow tyre curing machines		Tyre curing machines with automatic rear feeding and discharge	
				Safeguards and/or protective measures	PL _r	Safeguards and/or protective measures	PL _r
10	Unexpected gravity fall of the loading device when it is in raised position	Crushing Shearing Impact	Position 1: front	Combination of fixed distance guards and machine parts acting as fixed guards preventing access or Restraint system, e.g. restraint valves fitted directly on the cylinder, a brake system, etc.	d	Combination of fixed distance guards and machine parts acting as fixed guards preventing access or Restraint system, e.g. restraint valves fitted directly on the cylinder, a brake system, etc.	d Not applicable if interlocking guard with guard locking used
			Position 2: rear	Fixed distance guard and/or Take-away conveyor, acting as fixed distance guard according to EN 619:2022 or Restraint system, e.g. restraint valves fitted directly on the cylinder, a brake system, etc.		Fixed distance guard and/or Take-away conveyor, acting as fixed distance guard according to EN 619:2022 or Restraint system, e.g. restraint valves fitted directly on the cylinder, a brake system, etc.	
			Position 3: side	Combination of fixed distance guards and machine parts acting as fixed guards preventing access or Restraint system, e.g. restraint valves fitted directly on the cylinder, a brake system, etc.		Combination of fixed distance guards and machine parts acting as fixed guards preventing access or Restraint system, e.g. restraint valves fitted directly on the cylinder, a brake system, etc.	