

Sachgebiet Maschinen der chemischen Industrie

Checklist – Roll Mills in the Rubber and Plastics Industry (Roller Diameter $D \geq 400$ mm)

As of: 18/10/2018

Field of Application

This checklist can be used subject to the following conditions:

- It is a roll mill with a roller diameter of ≥ 400 mm with 2 horizontally arranged rollers (see **Fig. 3**).
- The roll mill was placed on the market in accordance with the standard DIN EN 1417:2015-03 "Plastics and rubber machines – Two roll mills – Safety requirements"

Note: In individual cases, safety requirements are specified that deviate from the standard but which have proven themselves in practice and are recommended by the **Sachgebiet Maschinen der chemischen Industrie** (hereinafter referred to as SG).

Instructions for Using the Checklist

The checklist only deals with the safety requirements for the roll mill. The environment of the machine, interactions with other machines, etc. and additional company-specific measures (e.g. instruction of employees) are not dealt with.

The checklist can be used when the manufacturer hands a new machine over to the operator or as part of the risk assessment. By differentiating the requirements according to the year of manufacture of the machine, **the fact is taken into account** to what extent an adaptation to the state of the art is required.. In doing so, the "proportionality", as stated in the recommendation on operational

safety (EmpfBS [Recommendation on operational safety] 1114 of March 2018) of the Federal Ministry of Labour and Social Affairs (BMAS), is also taken into account.

Note: When carrying out risk assessments in accordance with Section 3(7) of the Ordinance on Industrial Safety and Health, it must be taken into account that the **state of the art** must be applied to the measures to be taken. The current version of the European harmonised standard for roll mills (DIN EN 1417) was published in Germany in March 2015. This makes it necessary to reassess the measures taken so far as part of the risk assessment.

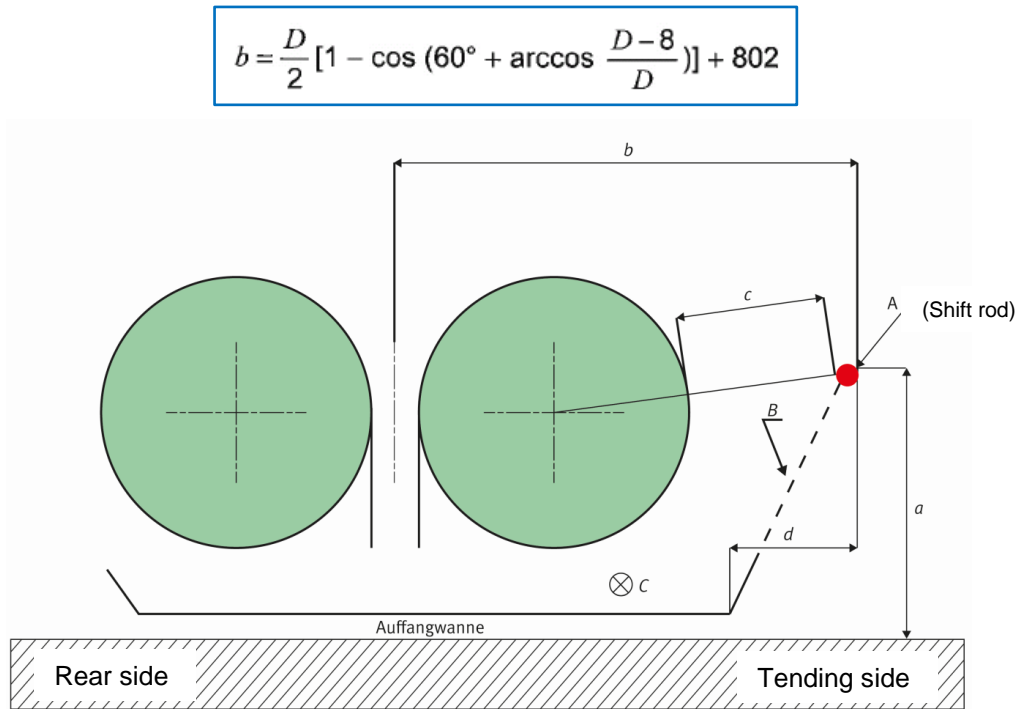
A generally accessible current overview of the standards can be viewed at:

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2012:087:0001:0055:DE:PDF>

Other Checklists

Safety requirements for electrical, hydraulic and pneumatic equipment are not covered by this checklist. It is therefore recommended to use the corresponding BG RCI (Statutory Accident Insurance for the Raw Materials and Chemical Industry) checklists for DGUV (German Statutory Accident Insurance Association) Information 213-054 for these areas:

- For the electrical system T 008-3
- For the hydraulic system T 008-4
- For the pneumatic system T 008-5
- For other protective devices T 008-1A



Legend

- A** Shift rod
- B** Complementary separating protective equipment
- C** Electro-sensitive protective equipment (ESPE)
- a** Shift rod height
- b** Horizontal distance between intake gap and shift rod in switching position
- c** Distance between shift rod and roller
- d** Horizontal distance between shift rod and drip pan

Fig. 1: Dimensions for shift rod arrangement according to DIN EN 1417:2015-03

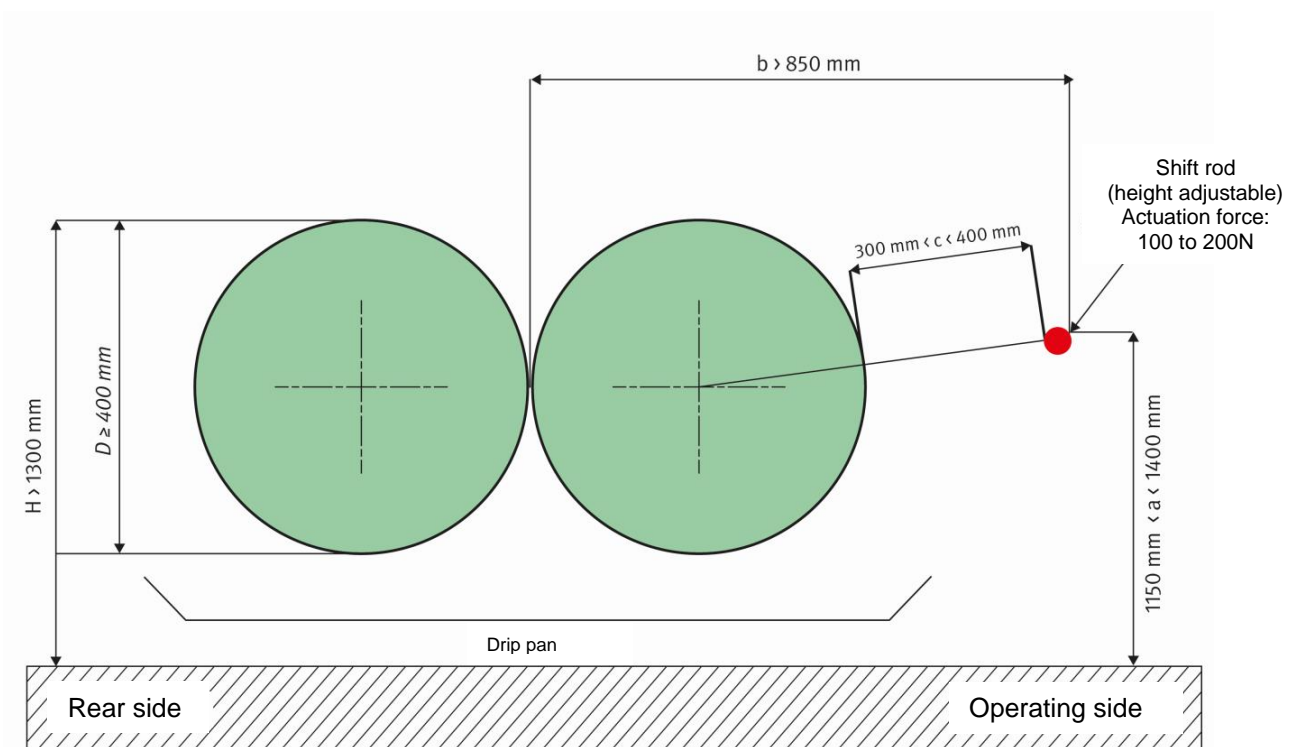


Fig. 2: Mounting of the shift rod deviating from the standard DIN EN 1417:2015-03



Fig. 3: Operating side of a roll mill with shift bar at 1400 mm height



Fig. 4: Manipulation easily possible by clamping the shift rod

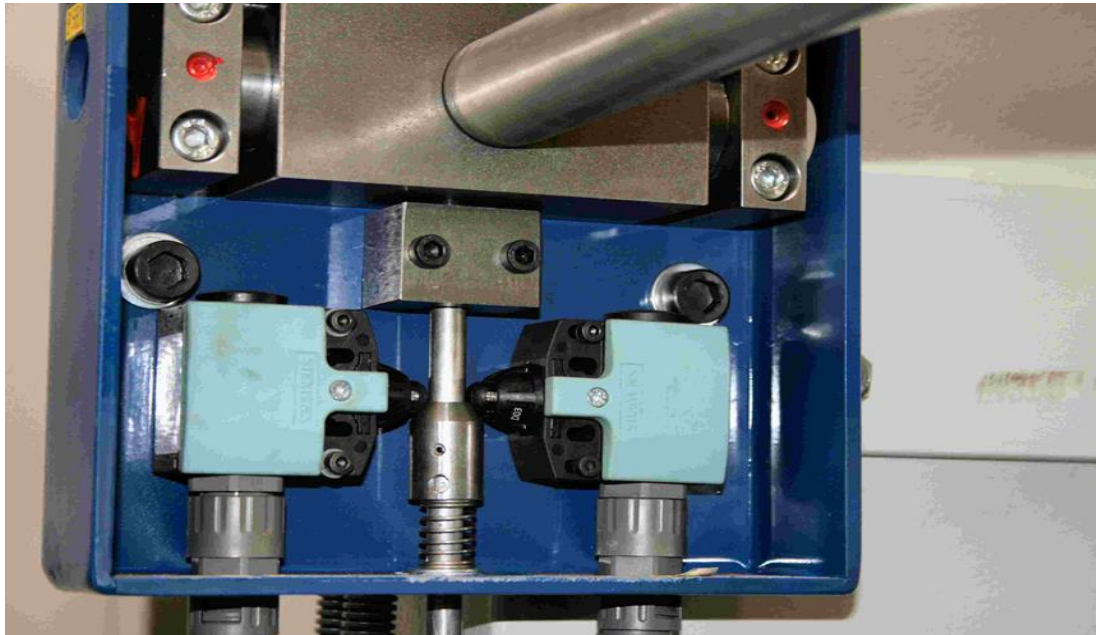


Fig. 5: Incorrectly mounted position switches for monitoring the shift rods

- Spring fracture makes both switches ineffective
- Similar actuation of the switches (both are actuated)
- No forced actuation of a switch

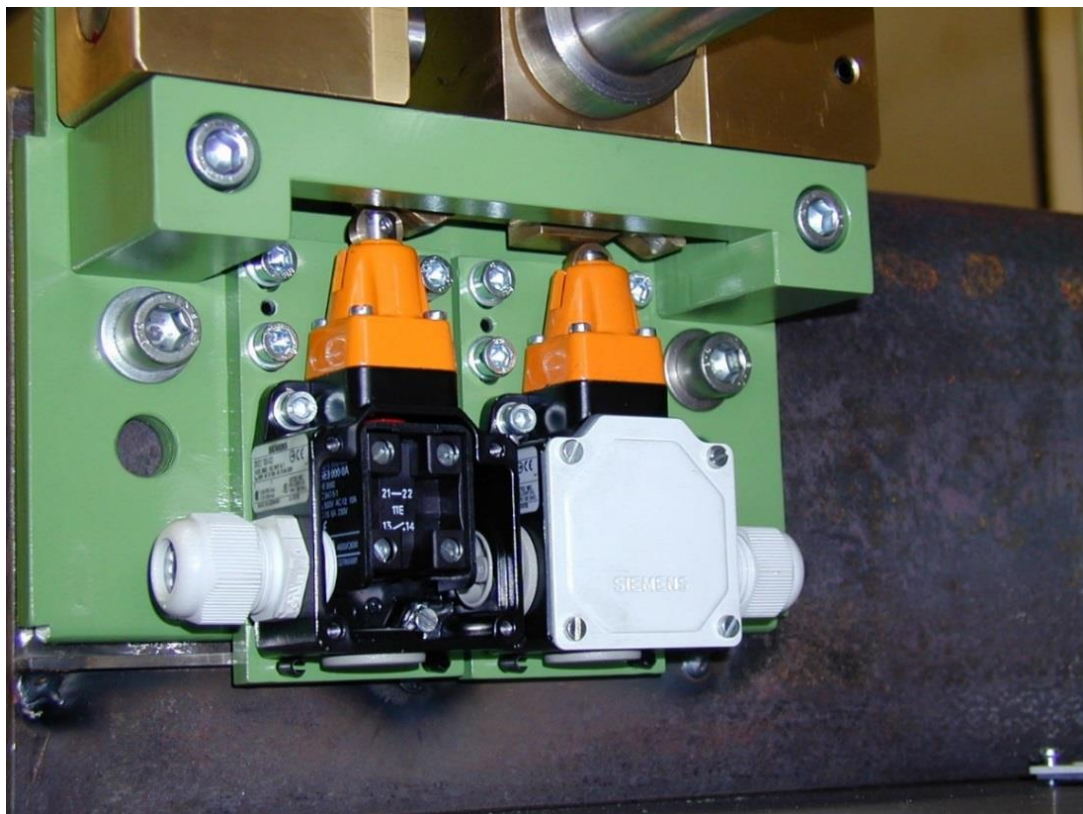


Fig. 6: Correct actuation of the position switches, different in principle

- The right switch is positively actuated
- The left switch actuates its contact through the inner spring

Picture credits:

The images used in this DGUV Information of the FB RCI (Department of Raw Materials and Chemical Industry) are for illustration purposes only. A product recommendation on the part of the DGUV is expressly not intended.

The pictures shown here were kindly provided by:

Fig. 1: Principle picture created by Sachgebiet Maschinen der chemischen Industrie

Fig. 2: Schematic created by Sachgebiet Maschinen der chemischen Industrie

Fig. 3: Westland Gummiwerke GmbH & Co. KG, Melle

Fig. 4: Westland Gummiwerke GmbH & Co. KG, Melle

Fig. 5: Westland Gummiwerke GmbH & Co. KG, Melle

Fig. 6: Maschinenbau und Konstruktion GmbH Schwerin

Annexes

Checklist

Report on the checklist

Publisher

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Protective devices for the roller nip and the stockblender

No.	Source	Requirement	Year of Manufacture		Notes / Explanations / Alternatives	Assessment/result
			before 03/2015	from 03/2015		
1	DIN EN 1417-2015 5.2.2.1	Attachment of shift rods on the operating side to trigger safety functions			<p>(X) means that deviations from the requirement are considered permissible, which are described here.</p> <p><i>Note:</i> DIN EN 1417 also mentions separating protective equipment for the intake gap. As these are almost always unsuitable for working on the machine, they are not dealt with in this checklist.</p> <p>EMERGENCY STOP ripcords are not sufficient as sole protective measures.</p> <p>Protective equipment is also required at the rear of the roll mill. In addition to the shift rod, interlocked separating protective equipment may also be considered here in exceptional cases.</p> <p>If, in individual cases, a stooped working position is adopted and the protection objectives are no longer achieved, alternative protective devices are required (e.g. horizontal electro-sensitive protective equipment = ESPE).</p>	
		a) Is there a shift rod on the operating side over the entire width of the roll mill?	X	X	a) The elevated installation of used roll mills to reach the minimum height need only be carried out if no further elaborate modifications to the roll mill or adjacent machinery (e.g. relocation of internal mixers) are necessary. Below 1150 mm, however, the height of the top edge of the rollers must be adjusted to the footprint.	
		Is the height of the top edge of the roller at least 1300 mm?	(X)	X		
		b) Is the shift rod fixed at a height of 1250 mm?	(X)	(X)	b) According to DIN EN 1417, the shift rod must be fixed at 1250 ± 50 mm. To enable ergonomic body postures or to take process-related constraints into account, the rod may be fixed at a height ranging from 1150 mm to 1400 mm or it may be height adjustable in this range. In justified exceptional cases (e.g. for strip discharge) the shift rod may be arranged at the height range between 900 mm and 1150 mm.	

No.	Source	Requirement	Year of Manufacture		Notes / Explanations / Alternatives	Assessment/result
			before 03/2015	from 03/2015		
		<p>c) Is the release force a maximum of 200 N?</p> <p><i>Note:</i> The maximum release value of 200 N as defined in DIN EN 1417 should only be used in justified exceptional cases (e. g. frequent false tripping). A maximum release force of 150 N has proven to be ideal.</p>	X	X	<p>(X) means that deviations from the requirement are considered permissible, which are described here.</p> <p>c) In the case of height-adjustable shift rods or fixed mounting heights deviating from DIN EN 1417, the release force shall not exceed the following limits:</p> <ul style="list-style-type: none"> - maximum 150 N in the bottom end position (1150 mm) - maximum 100 N in the top end position (1400 mm) - maximum 100 N between 900 mm and 1150 mm - intermediate values can be interpolated linearly <p>The lowest value must be fixed in height-adjustable shift rods.</p> <p>It shall only be possible to adjust the release force using tools.</p>	
		<p>d) Does the horizontal distance between the shift rod and the intake point correspond at least to the result of the calculation equation for the dimension "b" in Fig. 1?</p>	(X)	X	<p>d) A distance of at least 850 mm must be maintained in roll mills manufactured before 03/2015 (dimension "b" in Fig. 1).</p>	
2	DIN EN 1417-2015 5.2.1.1	<p>Rear of the roll mill</p> <p>Are protective devices provided at the rear of the roll mill?</p>	X	X	<p>Protective devices are always required at the rear. Preferably, shift rods should be used here as well. (see notes under No. 1)</p>	

No.	Source	Requirement	Year of Manufacture		Notes / Explanations / Alternatives	Assessment/result
			before 03/2015	from 03/2015		
			(X) means that deviations from the requirement are considered permissible, which are described here.			
3	DIN EN 1417-2015 5.2.2.1.4	Other requirements for the shift rod:				
		a) Does it respond in both directions, away from the roll mill (towards the operator) and towards the roll mill?	X	X	a) The movement of the shift rod away from the roll mill serves to protect persons who have come in between the rod and the roller. If frequent false tripping occurs, the additional measure described in No. 13 should be implemented.	
		b) Is it difficult to manipulate?	X	X	b) It must not be possible to block it, for example, by wooden wedges (see Fig. 4).	
4	DIN EN 1417-2015 5.2.2.1.5 and 5.2.2.1.6	Safety functions of the shift rod				
		a) Braking of the rollers: Is the braking angle less than 45 ° and is this value maintained even when a power failure occurs?	(X)	X	(a) The braking angle is determined at maximum speed without material. The standard only requires a braking angle < 60 ° for new roll mills. This value does not correspond to the state of the art. 45 ° can easily be achieved. In roll mills manufactured before 03/2015, the braking angle may not exceed 60 °. In roll mills manufactured before 1995, a braking angle of 90 ° is considered sufficient if the following conditions are met: - Release force for the shift rod < 100 N - Shift rod height between 1250 mm and 1400 mm - Top edge of the rollers > 1500 mm - Roller diameter > 600 mm	
		b) Spreading of the rollers: Does the spreading take place to a minimum gap width of 50 mm within 5 seconds?	(X)	X	b) Spreading is always required in addition to braking the rollers and can usually only be achieved within 5 seconds with hydraulic drives. If automatic reversing takes place, a light barrier must be provided in the lower area (see Fig. 1), which stops the reversing process if interrupted. Roll mills manufactured before 03/2015: Retrofitting the spreader is necessary in cases where a hydraulic roller gap adjustment is already available. Retrofitting in the absence of a hydraulic roller gap adjustment is considered disproportionate. In this case, retrofitting according to No. 7 and No. 8 must be carried out.	

No.	Source	Requirement	Year of Manufacture		Notes / Explanations / Alternatives	Assessment/result
			before 03/2015	from 03/2015		
		c) Are the movements of stockblenders interrupted?		X	(X) means that deviations from the requirement are considered permissible, which are described here. c) These include: Guide carriages and the rollers of the stockblender <i>Note:</i> The pressure roller of the stockblender should be opened.	
		d) Are the stockblender rollers positioned so high that they cannot be reached without the shift rod being tripped?		X	d) When determining the distance, the dimensions set out in DIN EN 13857:2008 must be used as basis.	
5	DIN EN 1417-2015 5.2.2.1.2	Measuring system for the braking angle Is there an automatic measuring device to check the braking angle?		X	The measuring system must have the following properties: - Automatic measurement at least once a week - Measurement of the castor angle - Blocking the roll mill drive by the controller if the angle is too large The measuring device must be checked every 4 years.	
6	DIN EN 1417-2015 5.2.1.2 and 5.2.2.1.5	What to do in case of a power failure				
		a) Is the castor angle maintained even in the event of a power failure?	X	X	<i>Note:</i> For roll mills manufactured before 03/2015, the tool for manually opening the roller gap must be kept in the immediate vicinity to the roll mill.	
		b) Do the rollers continue to spread apart?		X		

No.	Source	Requirement	Year of Manufacture		Notes / Explanations / Alternatives	Assessment/result
			before 03/2015	from 03/2015		
7		Rescuing people in an emergency	X		<p>(X) means that deviations from the requirement are considered permissible, which are described here.</p> <p>Organisational: Carry out appropriate rescue exercises. Keep ratchet, wedges and insulating blanket ready near the roll mill. This applies to all roll mills.</p> <p><i>Note:</i> The requirement (manual spreading) does not need to be implemented for roll mills manufactured after 03/2015, as spreading must also be automatic when there is a power failure (DIN EN 1417:2015, 5.2.1.5).</p>	
		Is a device available with which the rollers can be moved apart manually?				
8		Reversing in distance-limited jog mode Is it possible to reverse the rollers in distance-limited jog mode?	X		<p><i>Note:</i> This functionserves to quickly free people. After triggering the shift rod and/or actuating the emergency stop, only reversing in distance-limited jog mode must be possible. The roller movement must be switched off automatically as soon as 45 ° is reached. A further rotation of 45 ° is permissible, but must again be manually initiated by the operator.</p> <p>The reversing function is not required for roll mills manufactured after 03/2015, as two safety functions (braking and spreading) are automatically triggered.</p> <p>Exception: This requirement may only be deviated from if the retrofitting is considered disproportionate. This may be the case, for example, in medium and high voltage drives. It is assumed here that the requirements from No. 1 - 7 are met.</p>	

Technical control-related requirements

No.	Source	Requirement	Year of Manufacture		Notes / Explanations / Alternatives	Assessment/result
			before 03/2015	from 03/2015		
9	DIN EN 1417-2015 5.2.2.1.4	Signals of the shift rod			(X) means that deviations from the requirement are considered permissible, which are described here.	
		Is there at least one position switch at each end of the shift rod?	X	X	It is necessary to ensure that two independent signals are emitted regardless of where the shift rod is actuated. The switches must be actuated on different principles (see Fig. 6). As a rule, two position switches at each end of the shift rods are required, as it cannot be ensured that both sides are deflected at all actuation points of the rod. (Exception: The shift rod is mounted in a way that it can be rotated and controls the switches via a lever arm).	

No.	Source	Requirement	Year of Manufacture		Notes / Explanations / Alternatives	Assessment/result
			before 03/2015	from 03/2015		
			(X) means that deviations from the requirement are considered permissible, which are described here.			
10	DIN EN 1417-2015 5.2.2.1.4	<p>Dual-channel capability</p> <p>Doesn't a fault in the controller cause the failure of the protective functions of the shift rod with regard to braking the rollers?</p>	(X)	X	<p>As per DIN EN 13849-1, the safety function "braking of the rollers" must correspond to PLr = d with Cat. 3 in roll mills manufactured from 2015. Two independent braking systems are mandatory. Deviating from DIN EN 1417, they can also consist of an electronic braking system and a spring-loaded mechanical brake.</p> <p>For roll mills manufactured before 2015, dual-channel capability is limited to signal processing. It is sufficient to have a brake designed according to proven principles. A single electronic brake is not sufficient.</p> <p>The proven principles include in particular:</p> <ul style="list-style-type: none"> - Closed-circuit current principle - Sufficient braking effect even after spring fracture - High level of stability (after three braking operations in quick succession, the braking angle must still be maintained) <p>Further criteria can be found in the comments of the Institute for Occupational Safety.</p> <p>Exception: If old drives are replaced when retrofitting the drive technology (e.g. energy saving), it is required to retrofit a dual-channel braking system as described above for roll mills manufactured from 2015.</p> <p><i>Note:</i> DIN EN 1417 is not clearly formulated with regard to electronic braking systems. The maximum castor angle must be maintained even if the electronic braking system fails.</p>	

Strip-cutting equipment

No.	Source	Requirement	Year of Manufacture		Notes / Explanations / Alternatives	Assessment/result
			before 03/2015	from 03/2015		
11	DIN EN 1417-2015 5.2.1	Power-operated knife movements			(X) means that deviations from the requirement are considered permissible, which are described here.	
		Are protective devices provided for the knives swivelling in and out?				
		a) Are both hands required for manual swivelling in and out?			Note: The requirement in No. 11 a) is not very practical. It is unclear how this requirement can be implemented.	
		b) For power-operated swivelling in and out with two-hand control or in jog mode with a distance of 2 m to the danger point	X	X	b) - The two-hand control must correspond to type I according to DIN EN 574. - The jog button control must be made of reliable tried and tested components. The controller must not take over the swivelling movement until at least 4 mm in front of the roller surface (self-restraint principle).	

Additional measures to increase safety

- Note: These devices are not dealt with in DIN EN 1417-2015! -

No.	Source	Requirement	Year of Manufacture		Notes / Explanations / Alternatives <small>(X) means that deviations from the requirement are considered permissible, which are described here.</small>	Assessment/result
			before 03/2015	from 03/2015		
12		If an internal mixer is positioned above the roll mill				
		Is there a swivel-mounted camera/monitor system to check whether the internal mixer contains caked materials?	(X)	(X)	It is recommended to install such systems if experience shows that caking occurs frequently. This usually makes it unnecessary to climb onto the roll mill to check the internal mixer. <i>Note:</i> Additional lighting must be provided to light up the internal mixer.	
13		Is it possible to operate the roll mill at reduced speed for a limited period of time to avoid false tripping of the shift rod?	(X)	(X)	It is recommended that this device be provided if experience shows that false tripping of the shift rod frequently occurs when stiff mixtures are processed. With reduced speed, it is often possible to significantly reduce false tripping by manually guiding the mixture, thus avoiding incentives for manipulation. The system should be easy to operate. For example, pressing a pushbutton once triggers a reduction in speed for a limited time. The usual processing speed is automatically reset by the controller after a time interval has elapsed.	

Report on the checklist

- Updating the risk assessment (adapting to the state of the art)
- Part of the acceptance report between manufacturer and operator (first inspection)

Machine type:

Year of manufacture:

Manufacturer:

Date/place of the inspection:

Name of the examiner(s):

The assessment was based on the following checklists

- for roll mills
- for electrical system T008-3
- for hydraulic system T008-4
- for pneumatic system T008-5

Summary assessment of the results of the inspection:

- the machine has minor defects, start-up/continued operation can take place
- the machine has major defects, start-up/continued operation can only take place after the defects have been rectified

Manufacturer's signature

Operator's signature