Fachbereich AKTUELL

FBRCI-001

DGUV
Fachbereich Rohstoffe
und chemische Industrie
Berufsgenossenschaft Rohstoffe
und chemische Industrie

Sachgebiet Maschinen der chemischen Industrie

Checklist – Roll Mills in the Rubber and Plastics Industry (Roller Diameter D < 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. 1**).
- The roll mill was placed on the market in accordance with the standard DIN EN 1417:2015 "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. The results in the necessity 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 (Staturory 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

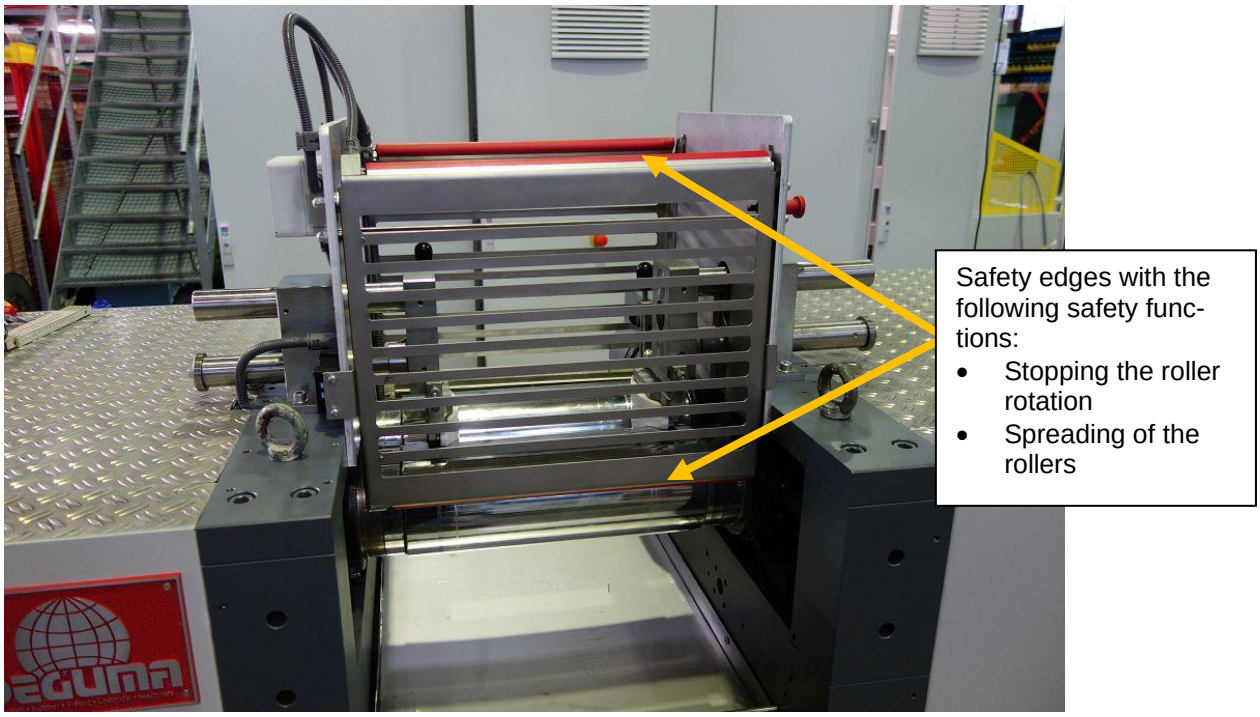

Fig. 1: Roll mill with roller diameter D = 150 mm. The roller intake gap is secured by separating protective equipment in combination with protective equipment reacting to contact (safety edges)

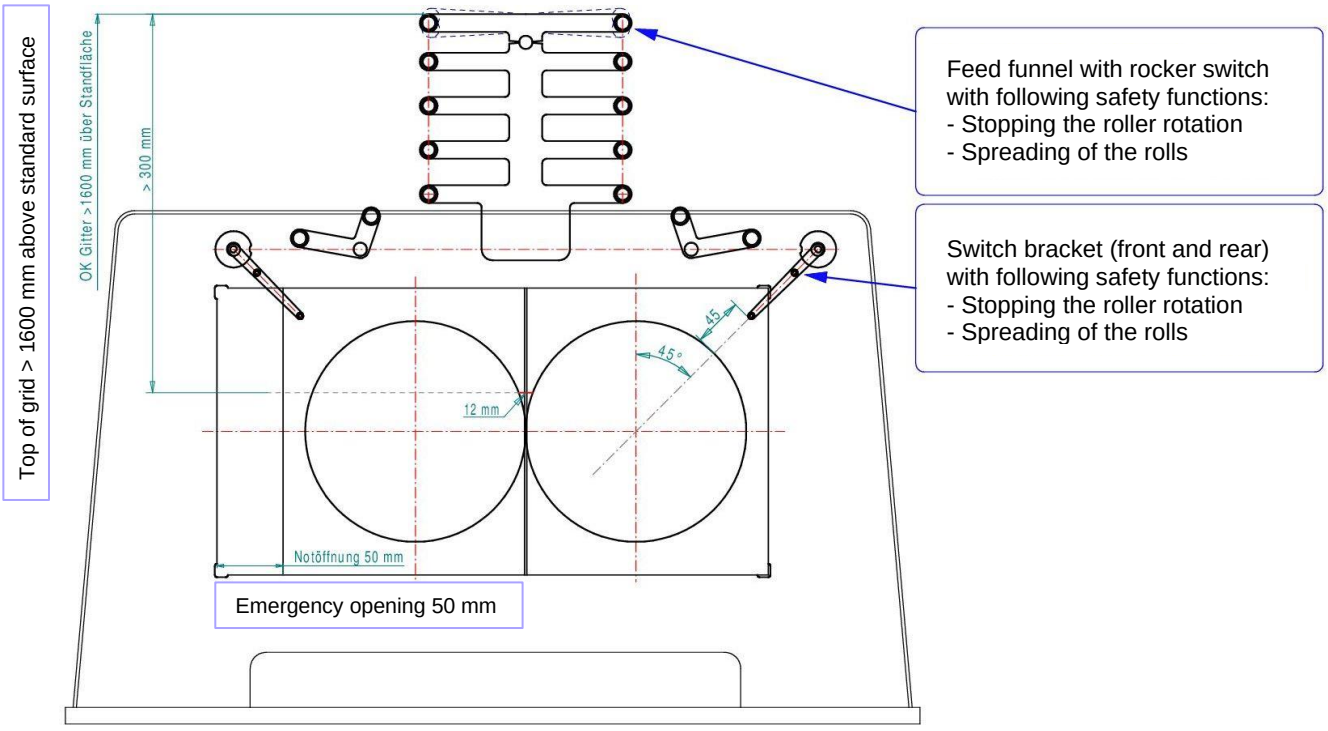

Fig. 2: Arrangement of the protective equipment for roll mills in rubber processing

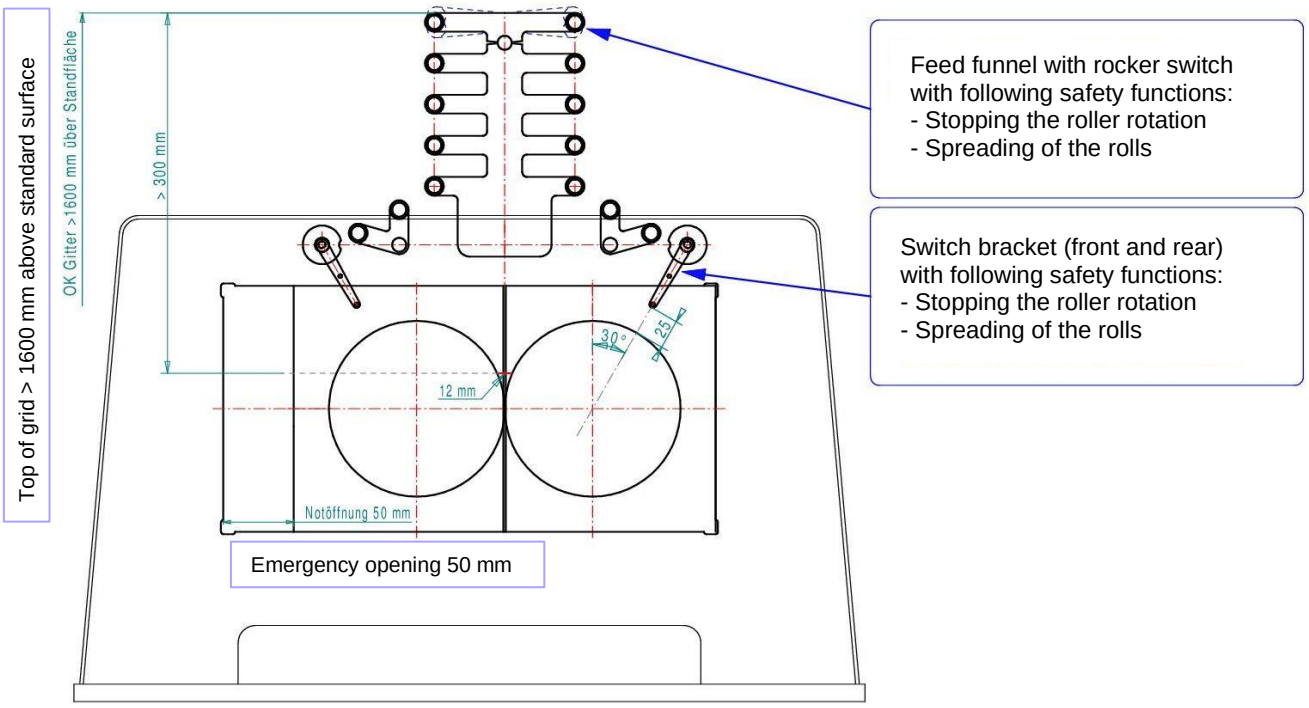

Fig. 3: Arrangement of the protective equipment for roll mills in plastics processing

The distance between two struts must not exceed 25 mm.

Fig. 4: Roll mill with rocker switch on the feed funnel and switch bracket on the roller

D (mm)	110	150	200	250	300
α_s (°)	27,01	23,07	19,95	17,82	16,26
α_{max} (°)	30,00	30,00	30,00	40,00	40,00
α_{tot} (°)	57,01	53,07	49,95	57,82	56,26
S (mm)	50,11	59,88	71,30	116,87	133,37
α_x (°)	92,99	98,83	100,05	92,18	93,74
X (mm)	89,26	126,88	174,63	201,10	245,41
g (mm)	25,16	29,86	35,83	39,14	44,68

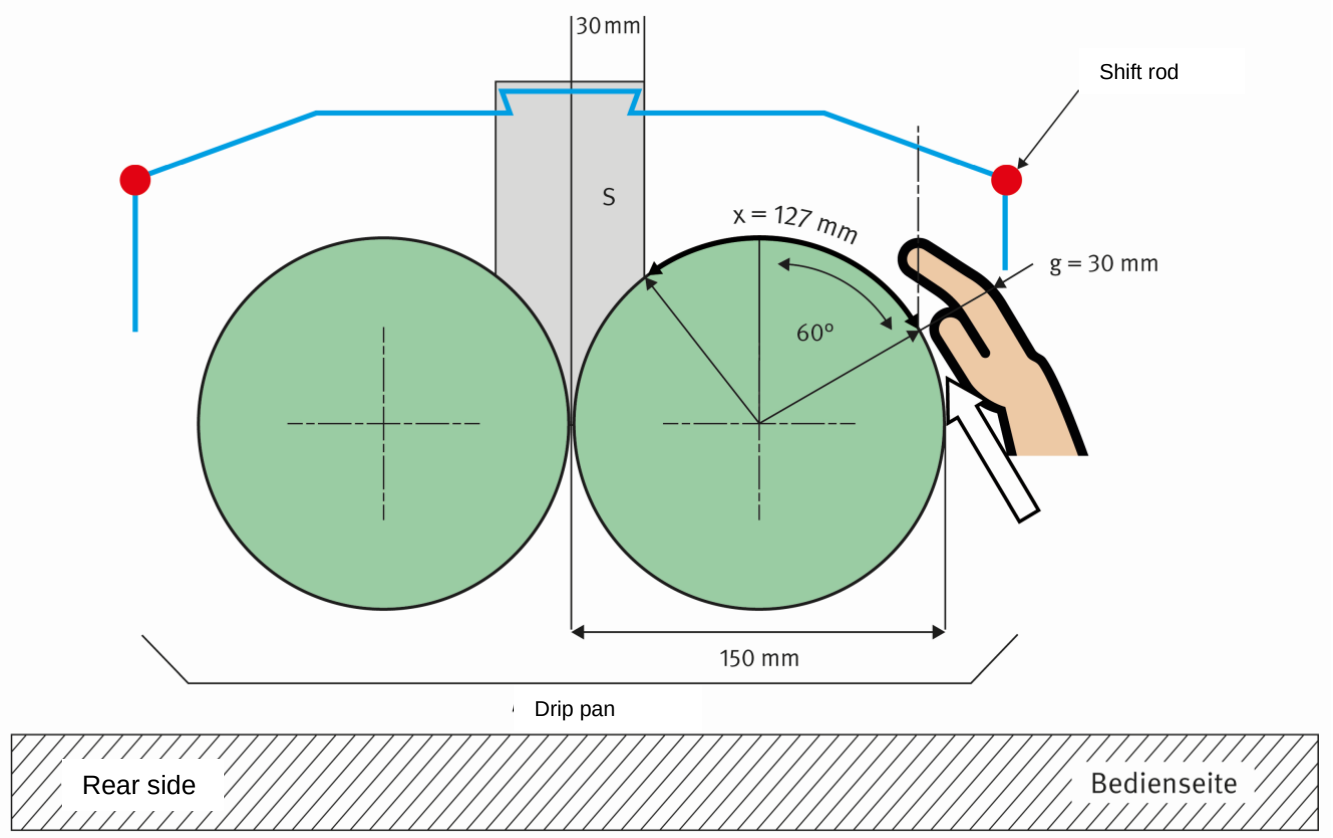

Fig. 5: Distance dimensions according to DIN EN 1417:2015-03. The dimension "g" = 29.86 mm (reach-through width for the hand) leads to frequent false tripping of the protective equipment. The remaining working area on the roller (white arrow), e.g. for winding the material, is small.

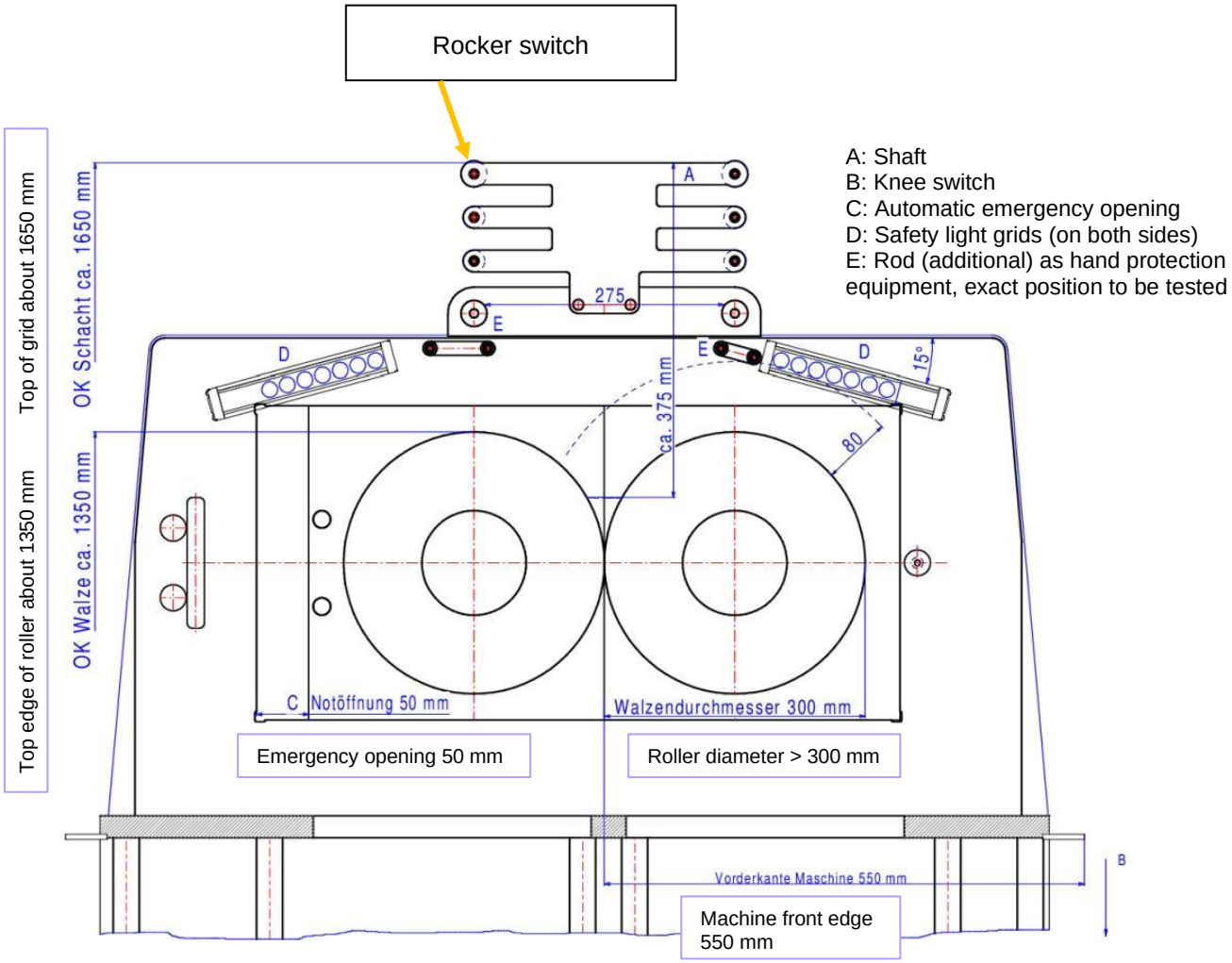

Fig. 6: Field-proven arrangement of electro-sensitive protective equipment (ESPE)

Picture credits:

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The pictures shown here were kindly provided by

Fig. 1: DEGUMA-Schütz GmbH, Geisa

Fig. 2: Servitec Maschinenservice GmbH, Wustermark

Fig. 3: Servitec Maschinenservice GmbH, Wustermark

Fig. 4: Servitec Maschinenservice GmbH, Wustermark

Fig. 5: Principle picture by Sachgebiet Maschinen der chemische Industrie

Fig. 6: Servitec Maschinenservice GmbH, Wustermark

Annexes

Checklist
Report on the checklist

Publisher

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We have contributed to the development of this short information sheet of the DGUV:

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- Berufsgenossenschaft Holz und Metall
- Verwaltungs-Berufsgenossenschaft
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- Wirtschaftsverband der deutschen Kautschukindustrie e. V.
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- Reifenhäuser Group
- Servitec Maschinenservice GmbH
- Vibracoustic GmbH

Protection Device for the Roller Intake Gap

No.	Source	Requirement	Year of Manufacture		Notes / Explanations / Alternatives (X) means that deviations from the requirement are considered permissible, which are described here.	Assessment/result
			before 03/2015	from 03/2015		
1	DIN EN 1417-2015 5.2.3.1 and 5.2.3.2	**Basic Requirements**			*Note:* Swivelling brackets located in the area of the intake gap are generally not sufficient as the sole protective devices.	
		a) Is the height of the top edge of the roller at least 1100 mm?	**X**	**X**	a) Heights ranging from 1100 mm to 1350 mm have proven themselves	
		b) Is the roller intake gap secured by a combination of fixed separating equipment, electro-sensitive protective equipment (ESPE) and protective equipment that is tripped by contact (e.g. switch brackets or safety edges)?	**X**	**X**	b) According to DIN EN 1417 the protective equipment must be arranged and designed in such a way that - the fixed separating equipment complies with DIN EN ISO 13857 (no accessibility to the intake gap due to large safety distances). - interlocked separating protective equipment complies with DIN EN 13855 (quick stop under consideration of the approach speed). If this is not possible, solenoid interlocks must be used. In practice, however, compliance with the limit values from the above-mentioned standards leads to frequent false tripping of the protective equipment. In addition, only a small working area on the rollers is left free for manual intervention (e.g. winding of the material), which results in a high incentive for manipulation, which often leads to the operator dismantling the protective device. Smaller safety clearances (than required by the standard) therefore increase safety, as manipulation incentives are eliminated. Slot-shaped openings may have a maximum distance of 25 mm. This dimension is required in order to be able to add mixture components easily and without loss. **Figure 5** shows an example of the problematic distance dimensions (sizes) as specified in the standard. In particular, the dimension "g" from the standard in practice leads to frequent false tripping of the protective equipment (e.g. with "stiff" rubber compounds).	

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.	
2	DIN EN 1417-2015 5.2.3.3 and 5.2.1.1	**Is the separating protective equipment that prevents access from above to the intake gap designed in accordance with DIN EN 13857:2008?**	**(X)**	**(X)**	The implementation of this requirement means that the protective eqipment must also maintain the safety distances against "reaching over" and "reaching through" slot-shaped openings. For the usual dimensions of rolling mills, the application of the standard results in a height of the separating protective equipment of up to 2 m. Ergonomic working is not possible with this dimension. It is therefore permissible to deviate from the dimensions given in the standard if a comparable level of safety is achieved through additional measures (e.g. safety edge or rocker switch on the top edge) (see **Fig. 2, 3, 5**).	
3	DIN EN 1417-2015 5.2.3.3.3	**Are the following requirements met when using electro-sensitive protective equipment (ESPE)?**				
		a) Is the electro-sensitive protective equipment (ESPE) only used for access from	**X**	**X**	a) According to the standard, access from above must only be secured by separating equipment.	
		b) Does the ESPE comply with DIN EN 61496, type 4?	**X**	**X**	b) The required ESPE type meets the highest requirements.	
		c) Is the ESPE arranged according to DIN EN 13855:2010?	**(X)**	**(X)**	c) The application of the standard results in very small distances between the ESPE and the roller surface. In practice, these dimensions can only be implemented in exceptional cases, as they lead to frequent false tripping. **Fig. 6** shows an arrangement that has proven itself in practice.	
4	DIN EN 1417-2015 5.2.1.1	**Rear of the roll mill**				
		Are protective devices also provided at the rear of the roll mill?	**X**	**X**	The same protective equipment must be provided as on the operator side.	

Safety functions triggered by locked protective devices

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.	
5	DIN EN 1417-2015 5.2.3.3.2	**Safety functions of the interlocked protective equipment**				
		a) **Braking of the rollers:** Is the braking angle less than 60°?	**X**	**(X)**	(a) The braking angle is determined at maximum speed without material. The value from the standard does not correspond to the state of the art. The following braking angles are required for new roll mills: < 30 ° for roll mills 400 mm > D ≥ 200 mm < 20 ° for roll mills D < 200 mm These values can be achieved with an electronically controlled drive, for example. If the electronic system fails, the second braking system must at least reach a value of < 60 °. This value is required in DIN EN 1417.	
		b) **Spreading of the rollers:** Does the spreading take place to a minimum gap width of 50 mm within 5 seconds?		**X**	(b) In the case of new roll mills, spreading of the rollers is always required in addition for braking the rollers. Implentation is only needed in new roll mills. Automatic reversing is not recommended, as it is possible to simultaneously reach into both the infeed and outfeed side. The following function must be retrofitted in roll mills manufactured before 03/2015 that are not equipped with power-operated spreading of the rollers: After trriggering the safety function “braking", it must be possible to carry out distance-controlled reversing in jog mode in order to quickly free parts of the body (e.g. a hand caught in the rollers). The roller movement must be switched off automatically as soon as a maximum rotation of 45 ° is reached. A further rotation of 45 ° is permissible, but must again be manually initiated by the operator.	
6	DIN EN 1417-2015 5.2.1.2	**What to do in case of a power failure** Is the castor angle maintained even in the event of a power failure?	**X**	**X**	At least one braking system that meets proven principles is considered necessary for roll mills built before 03/2015. This includes in particular the "closed-circuit current principle”, according to which the braking function remains effective even in the event of a power failure.	

Technical control-related requirements

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.	
7	DIN EN 1417-2015 5.2.3.3.2	**Dual-channel capability for roller stop** Doesn't a fault in the controller cause the failure of the protective functions with regard to braking the rollers? *Note:* The term “controller" covers both signal processing and the components that trigger the braking.	**(X)**	**X**	DIN EN 1417 requires that the safety function "braking of the rollers" must be implemented with PLr = d. In addition, the implementation of category 3 according to DIN EN 13849-1 is required. This makes it clear that dual-channel capability is necessary. For roll mills manufactured from 03/2015, this means: 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. Two electronic systems are also permissible when PLr = d is achieved. If the first braking system fails, the second system must achieve a braking angle of < 60 °. *Note:* DIN EN 1417 excludes electronic braking systems. The maximum castor angle must be maintained even if an electronic braking system fails and if a power failure occurs. For roll mills manufactured before 03/2015, dual-channel capability is limited to signal processing. A braking system (e.g. spring-loaded electromagnetic brake), which has been designed applying proven principles (e.g. function is maintained even in case of power failure), must be in place.	
8	DIN EN 1417-2015 5.2.3.3.2	**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 per 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. The following applies to roll mills manufactured before 03/2015: The brake must be checked once a day or before each use.	

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 hydraulic system T008-4

☐ for electrical system T008-3 ☐ 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