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Safety Requirements of Mill for Rubber and Plastics

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Foreword

All technical content of this Standard is mandatory.

This Standard corresponds to the British standard BS EN 1417:1997, *Rubber and Plastics Machines – Two Roll Mills – Safety Requirements* (English version). This Standard is nonequivalent to BS EN 1417. The major differences are as follows:

-- it cancels retractable plough in the terms and definitions, cancels the term interpretations consistent with Chinese standards and directly adopts the relevant terminology standard of China;

-- it changes the radian(s) to degree(s) of angle for the stopping angle;

-- it adds, in the mechanical hazards related to the mill rolls, the hazards of drawing-in and crushing between the couplers between the mill rolls and the reducer, between the couplers between the motor and the reducers;

-- it adds the hazards of burns and/or scalds caused by the leakage or ejection of the rotation joints in the thermal hazards;

-- it changes the gap between the mill rolls and the stock guides from not exceeding 4 mm to not exceeding 2 mm;

-- it adds the requirements for the value of noise.

From July 1, 2007, this national standard shall be implemented for the products manufactured; from October 1, 2007, the distribution of products which do not conform to this national standard shall be stopped.

This Standard was proposed by China Petroleum and Chemical Industry Association.

This Standard shall be under the jurisdiction of the National Standardization Technical Committee on Rubber and Plastics Machinery (SAC/TC 31).

The responsible drafting organization of this Standard: Dalian Bingshan Rubber & Plastics Machinery Co., Ltd.

The contributory drafting organizations of this Standard: Shanghai Rubber Machinery Co., Ltd., Wuxi No.1 Rubber & Plastic Machinery Co., Ltd., Beijing Research & Design Institute of Rubber Industry.

The main drafters of this Standard: Lu Jing, Li Xianglan, Liu Menghua, Luo Shaoning, Wang Chengxu, Xia Xiangxiu.

This Standard was issued for the first time.

Safety Requirements of Mill for Rubber and Plastics

1 Application Scope

This Standard specifies the safety requirements for two roll mills for the processing of rubber and plastics.

This Standard covers the terms and definitions, list of hazards, safety requirements and measures, and verification and information for use of safety requirements and measures of two rolls mills for the processing of rubber and plastics.

This Standard applies to all two roll mills for the processing of rubber and plastics.

This Standard does not cover the safety requirements for the design of an exhaust system.

2 Normative References

The provisions in following documents become the provisions of this Standard through reference in this Standard. For dated references, the subsequent amendments (excluding corrigendum) or revisions do not apply to this Standard, however, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest edition of the referenced document applies.

GB 5226.1-2002, *Safety of Machinery – Electrical Equipment of Machines – Part 1: General Requirements* (IEC 60204-1:2000, IDT)

GB 12265.1-1997, *Safety of Machinery – Safety Distances to Prevent Danger Zones Being Reached by the Upper Limbs* (eqv EN 294:1992)

GB 12265.3-1997, *Safety of Machinery – Minimum Gaps to Avoid Crushing of Parts of the Human Body* (eqv EN 349:1993)

GB/T 13577-2006, *Mill for Rubber and Plastics*

GB/T 15706.1-1995, *Safety of Machinery – Basic Concept, General Principles for Design – Part 1: Basic Terminology, Methodology* (eqv ISO/TR 12100-1:1992)

GB/T 15706.2-1995, *Safety of Machinery – Basic Concepts, General Principles for Design – Part 2: Technical Principles and Specifications* (eqv ISO/TR 12100-2:1992)

HG/T 2149-2004, *Measuring Method of Mill for Rubber and Plastics*

HG/T 3223, *Rubber Machinery – Terminology*

JB/T 5438, *Plastics Machinery – Terminology*

3 Terms and Definitions

For the purposes of this document, the following terms and definitions and those defined in HG/T 3223 and JB/T 5438 apply.

3.1 Principal parts of mill

Principal parts of mill in this Standard refer to parts involving safety of mill, as shown in Figure 1.

3.2 Principal crushing zone

Principal crushing zone refers to zone extending over the full length of the mill rolls indicated by *V* in figure 2.

3.3 Stopping angle

Mill is equipped with a trip bar including safety bar and control button. The stopping angle is the angle through which the mill rolls rotate from the actuation of the trip bar until the rolls have come to rest. The specified stopping angle is specified by mechanical design, related to the conditions of machine unloaded and machine running at maximum speed, indicated by α_0 in Figure 2. The maximum stopping angle is the upper limit of stopping angle, indicated by α_{max}. The measured stopping angle is the stopping angle measured, indicated by α_m.

3.4 Safety limit

For two roll mills equipped with a trip bar, the safety limit is the vertical plane indicated by line *S* in figure 2 demarcating the zone which is unsafe for operators who can reach into it without actuating the trip bar.

3.5 Stock guide

Stock guide can be divided into fixed type and movable type which is installed on both sides of mill rolls and used to prevent material in process from going beyond the mill roll end (see Figure 1, location 7).

3.6 Strip cutting device

A device, equipped with rotating or stationary blades, to cut off strips of the material from a mill roll and send to stock blender or next procedure (see Figure 1, location 3).

5 Safety Requirements and/or Measures

5.1 Mechanical hazards related to mill rolls

5.1.1 Hazard of drawing-in and crushing between the mill rolls during normal (forward) operation.

5.1.1.1 The trip bar emergency stop protection shall satisfy the following requirements:

5.1.1.1.1 For the installation of the machine, the top of the mill rolls shall be at a height of not less than 1300 mm above the normal standing level of the operator.

5.1.1.1.2 The maximum stopping angle α_{max} of the mill rolls shall be 60°.

5.1.1.1.3 The specified stopping angle α_o shall not exceed the maximum stopping angle α_{max}.

5.1.1.1.4 The mill rolls shall come to rest at an angle not greater than α_o after actuation of the trip bar.

5.1.1.1.5 The mill rolls shall automatically come to rest at an angle not greater than α_{max} in the event of a power failure.

5.1.1.1.6 The trip bar shall be positioned in accordance with the following requirements:

a) the trip bar shall extend over the full length of the rolls.

b) the trip bar (see Figure 4) shall be positioned at a distance *a* more than 1115 mm above the operator's normal standing level;

c) the horizontal distance *b* (see Figure 4) between the trip bar and the centre of working zone shall not be less than $b_{\alpha o}$, which is calculated in accordance with the formula:

$$b_{\alpha_o} = \frac{D}{2}\left[1 - \cos\left(\alpha_o + \arccos\frac{D-8}{D}\right)\right] + 802$$

where

$b_{\alpha o}$—the horizontal distance between the trip bar and the centre of working zone, in mm; when the value of $b_{\alpha o}$ is less than 850 mm, the distance is 850 mm; $b_{\alpha o}$ shall not be less than the calculated value when α_o = 30°;

α_o—the specified stopping angle, in °;

D—the diameter of mill rolls, in mm.

3—interlocking guard with guard locking

Figure 5 -- Examples of Guards of Small Two Roll Mill

5.1.2 Hazard of drawing-in and crushing between the mill rolls during reverse operation

5.1.2.1 Automatic reverse movement

When the trip bar is actuated, automatic reverse movement of the mill rolls is actuated within 2 s to prevent human body from getting into the area under the mill rolls; the two roll mill shall be as specified in 5.1.1.1.8 and 5.1.1.2.

5.1.2.2 Intentional reverse movement

Intentional reverse movement of the mill rolls shall only be possible by means of a hold-to-run control device.

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

The gap between the mill rolls and the stock guides shall not exceed 2 mm.

5.1.4 Hazards resulting from loss of braking efficiency

a) 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.

b) If the braking system consists of a mechanical friction brake only, the thermal characteristics shall be sufficient to allow rapid dissipation of the heat produced by the braking action.

5.2 Mechanical hazards related to complementary devices

5.2.1 Strip cutting device

5.2.1.1 Unless the knives are inherently safe due to their location, the cutting edges of knives shall be protected to prevent involuntary contact.

5.2.1.2 Movement of knives from the rest position to the working position and backwards shall only be effected by a hold-to-run control device situated away from the knives if automatic control is adopted.

5.2.2 Stock blender

5.2.2.1 Where the gap between the stock blender carriage and the machine frame can be reached, crushing hazards shall be prevented by limiting the travel of the carriage to maintain the minimum gaps, according to GB 12265.3-1997, Table 1, with respect to the endangered part of the body.

5.2.2.2 The stock blender rolls shall be positioned so that they cannot be reached

continuity of the protective earthing circuit shall be as specified in 19.2 of GB 5226.1-2002.

5.4.3 The insulation resistance shall be tested in accordance with the requirements in 19.3 of GB 5226.1-2002; the insulation resistance shall be as specified.

5.4.4 Withstand voltage test shall be carried out for all circuit lines and protective earthing circuits of the electric equipment in accordance with 19.4 of GB 5226.1-2002; they shall be as specified.

5.5 Thermal hazards

5.5.1 Where unintentional contact with hot machine parts other than the mill rolls is not precluded, these parts shall be insulated (if they are not provided by the manufacturer, it shall be stated clearly in the accompanying documents).

5.5.2 For the two roll mill heated by hot oil and steam, the rotation joints shall not have leakage during operation.

5.6 Hazards generated by neglecting ergonomic principles

5.6.1 The two roll mill shall be designed in accordance with the ergonomic principles to reduce the intensity of work and prevent the fatigue of operators.

5.6.2 The specified detailed installation dimensions for the emergency stop trip bar (5.1.1.1) shall be implemented for the two roll mill; the required positioning of the trip bar only applies to the operators of normal height.

5.7 Hazards generated by noise

The noise of the two roll mill during idling shall be less than 85 dB. For the drive and transmission unit(s), the requirement shall be met by selecting low noise components and/or by partial or complete insulation using the state of the art.

6 Verification of the Safety Requirements and/or Measures

The verification items and verification methods shall be as shown in table 1.

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