IFA
Institut für Arbeitsschutz der
Deutschen Gesetzlichen Unfallversicherung

0443

Focus on IFA's work

Issue: 12/2024

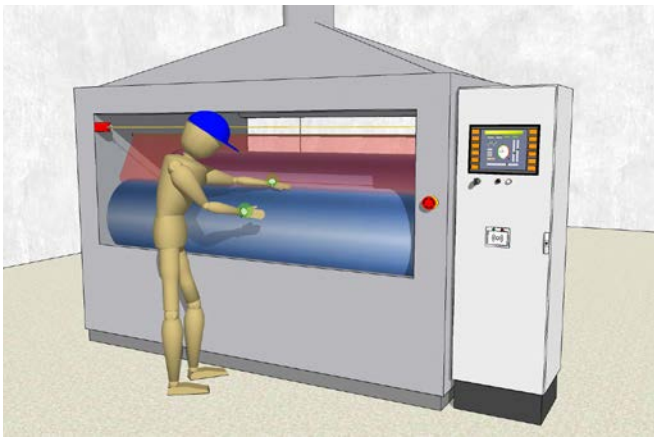
New transponder-based safeguards for rolling mills on plastic and rubber machines

Problem

Serious accidents occur repeatedly on rolling mills in the plastics and rubber industry at drawing-in points where the operating personnel feed the production material to the rolls. These tasks require workers to work with their hands very close to the danger zone. Conventional safeguards such as pressure sensitive bars or light curtains are unable to distinguish between the operating personnel and the production material. Such safeguards are therefore often unsuitable for this work situation, particularly since they can give rise to false tripping, which in turn increases the incentive for manipulation. An emergency stop device (e.g., in the form of a pull cord) is also insufficient of itself to ensure safety; by the time it is actuated, it is often too late to prevent injuries.

Activities

The Institute for Occupational Safety and Health (IFA) already investigated the suitability of wrist-worn transponder systems on various rolling mills on behalf of the German Social Accident Insurance Institution for the raw materials and chemical industry (BG RCI), some years ago. This technology requires the transponders to be worn willingly by the operator, which is why such systems are referred to as "volitional protective devices". The aim of these studies was to create a homogeneous sensing field around the entire danger zone by use of an antenna above or below the drawing-in nip. Through two wrist-worn transponders, a switch-off command is triggered at a defined distance from the danger zone as soon as a hand, i.e. the transponder, moves into the detection zone.



Operator protected by a transponder system at a rolling mill

The suitability in principle for this application was confirmed by the study conducted at that time and was presented in various lectures. In 2020, a manufacturer of transponder-based protective devices took up the issue and is now planning to develop a new system that meets current safety requirements through to readiness for series production, in consultation with the BG RCI and in dialogue with operators and manufacturers of rolling mills.

Since rolling mills are subject to strict safety requirements, the BG RCI tasked the IFA with assessing the safety concept. One difference between this concept and transponder systems that have already been tested lies is the required safety level. For the systems employing this technology that have been tested, this is a performance level c in accordance with the basic safety standard EN ISO 13849-1, implemented in category 2. Depending on the application, it is sufficient for the transponder worn on the person to be tested once a day or once per shift. This

is not sufficient for applications on rolling mills, where a safety level of performance level d, category 3 is required in accordance with the more specific EN 1417 standard (Plastics and rubber machines – Two-roll mills – Safety requirements). This requires the wrist-worn transponders to meet the criterion of single-fault tolerance, which typically results in a two-channel design for each hand. Failure of a transponder must trigger a stop command that immediately halts the rolling mill.

Results and use

Assessment of the concept was divided into several phases. Phase I examined the concept of the safeguard at block level and was completed successfully by the IFA; the concept is suitable for performance level d.

The concept is as follows: whilst the rolling mill is running, the workers move around the machine within a monitoring zone. When a person is wearing two transponders and they are detected, the conventional safeguard, e.g. a pressure sensitive bar, is deactivated. Persons not wearing transponders thus remain protected by the original safeguard. In addition to the initial check, motion sensing of the sensors ensures that the transponders cannot be taken off and left near the machine without detection.

In Phase II, the protective device undergoes a full concept assessment. This takes all requirements upon the system into account, for example with regard to the application and the applicable standards. A prototype for initial field experiments is also planned.

User group

Manufacturers, equipment fitters and operating companies of rolling mills in the plastics and rubber industry

Technical enquiries

- IFA, Department "Accident Prevention – Product Safety"

Literature enquiries

- IFA, Department "Interdisciplinary Services"

Further information

- DGUV Information 213-109: Sicheres Betreiben von Walzwerken der Gummi- und Kunststoffindustrie (09.19). http://www.dguv.de/publikationen, Webcode: p213109 (in German)
- EN 1417:2023-11: Plastics and rubber machines – Two-roll mills – Safety requirements

Published by:
Deutsche Gesetzliche Unfallversicherung e. V. (DGUV)
Glinkastrasse 40 · 10117 Berlin
ISSN (Internet): 2190-006X

Subscription:
www.dguv.de/publikationen Webcode: p22704

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