

Guidelines for the safe use of vertical post mixers

Introduction

It is a well-established fact that moving machine parts have the potential to cause severe injuries such as crushed hands or amputations. This document points out the fundamental requirements that must be in place in order to ensure that the risk to workers' safety caused by running mixers and moving parts is minimised. No distinction is made between the different kinds of mixers used. All measures employed must comply with the Machinery Directive 2006/42/EC and the corresponding national legislation as well as relevant technical standards.

If local, national or regional laws are different from or more stringent than this guideline, please consult your HSE professional.

Risk assessment

Before using a mixer, a risk assessment has to be carried out, identifying and assessing the hazards and exposures associated with the operation. If necessary, additional protective measures must be included into the design and procedure and implemented. These would preferably be technical rather than organisational measures. This risk assessment must be formally documented.

The operator must be trained on all relevant topics which have been identified during the risk assessment, along with maintenance staff who may work with the equipment. Such training must be documented. As maintenance work often deviates from the normal operating procedure additional topics must be considered and included within the risk assessment, possibly in a separate paragraph. That could include the emergency cut-off of all (stored) energies, or the provision of special tools.

Protective devices

Machine guarding eliminates or controls hazards and provides essential and required protection for workers. One of the main risks is that hair, jewellery, body parts, clothes or powder bags become wrapped in the rotating shaft or mixing element. For this reason, long hair, jewellery (such as necklaces/ bracelets) or loose clothing parts (e.g. sleeves) must be tied-back and restrained, or removed, before using such devices.

Furthermore, crushes or fractures may occur if a scraper blade is installed inside the mixing system. With this design a totally enclosed system should be utilised. All removable lids should have interlocks, otherwise safe use is relying only on the operator's activities. Such interlocks must be periodically checked to ensure that they are functioning correctly.

An additional issue is that rotating shafts might get in contact with the lid (see picture 1), and this could then create a hot surface or sparks. In the presence of flammable liquids this hot surface/sparks might function as an ignition source, potentially leading to a fire.



Picture 1
(Rotating shaft in contact with removable lid)

The best way to prevent contact with the shaft is to fit the mixer with an appropriate fixed lid (Picture 2). A sleeve (indicated by the arrow) can also be installed around the upper part of the shaft. If necessary for production reasons, the mixer head can still be moved in the vertical direction although the lid stays on the vessel.

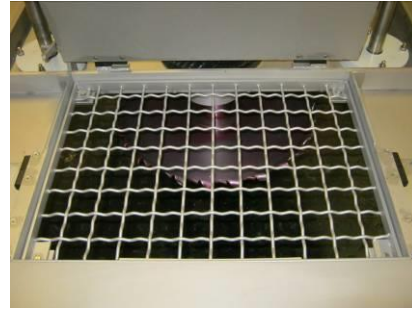


Picture 2
(Permanently installed lid with a sleeve)

Often lids with openings are used for adding powders or liquids. To reduce the risk of getting caught by the shaft or the scraper or - if applicable - the risk of falling into the vessel, bars (Picture 3) or grills (Picture 4) must be installed. Where necessary, according to the risk assessment, these features should be installed permanently and / or interlocked with the mixer/scraper drive. If this is the case, regular cleaning of these bars and grills is necessary.



Picture 3
(Slotted bar)



Picture 4
(Square grille)

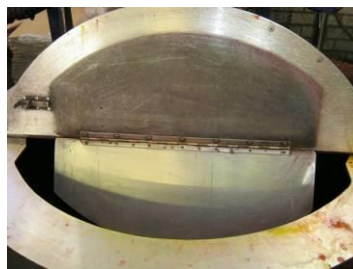
Extract from EN ISO 13857:2019:

Table 1: relationship between slotted bar aperture and safety distance (distance from aperture to danger zone)

Slotted bar aperture	Safety Distance
$\geq 20 \text{ mm} \dots \leq 120 \text{ mm}$	$\geq 850 \text{ mm}$
$\geq 12 \text{ mm} \dots \leq 20 \text{ mm}$	$\geq 120 \text{ mm}$
$\geq 10 \text{ mm} \dots \leq 12 \text{ mm}$	$\geq 100 \text{ mm}$

Table 2: relationship between square grille aperture size and safety distance

Square grille aperture size	Safety Distance
$\geq 40 \text{ mm} \dots \leq 120 \text{ mm}$	$\geq 850 \text{ mm}$
$\geq 30 \text{ mm} \dots \leq 40 \text{ mm}$	$\geq 200 \text{ mm}$
$\geq 12 \text{ mm} \dots \leq 30 \text{ mm}$	$\geq 120 \text{ mm}$



Picture 5
(Alternative to picture 3 and 4)

Smaller (lab) mixers (Picture 6) must also be taken into account as the risk is quite often comparable to bigger installations.



Picture 6
(Shaft protection and cover interlock)

The vessel should be secured in place at the mixer, e.g. with a clamp or strap (Picture 7.1 and 7.2). This clamp or strap should be interlocked with the motor to ensure that the motor of the mixer cannot be started when the vessel is not secured/fixed. The fixing of the vessel also safeguards that the vessel will not move while the mixer is running.



Picture 7.1
(Clamp)



Picture 7.2
(Strap)

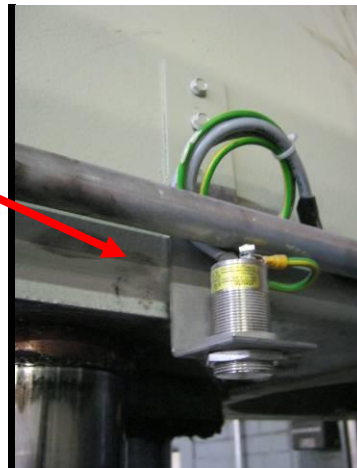
An additional contact interlock linked to the presence of a container may be necessary. This should be interlocked with the motor to ensure that the motor of the mixer cannot be started when no vessel is present.

Ensure also that containers of suitable diameter are employed. Containers that are too small introduce additional risks to the use of vertical post mixers. The stability of containers/vessels/drums etc. should also be taken into account, as they might get damaged during the fixation or the mixing process. Liners used e.g. inside a vessel might get caught by the shaft, which leads to additional risks. If liners are used, the problem of their conductivity has to be taken into account.

In addition to the above-mentioned protective device, the mixer drive and the hydraulics for raising and lowering the mixing element should be interlocked with the height position of the mixing element (see pictures 8&9 below). This is important for the lowest as well as for the highest position. The lowest position ensures that the mixing element will not be able to hit the bottom of the vessel; the highest position guarantees that the motor of the mixer cannot be started when the mixing element/shaft is not inside the vessel.



Picture 8
(Low position switch)



Picture 9
(Low position switch)

An emergency stop (Picture 10) must be easily identifiable and easily accessible (e.g. near the operator's work position). The emergency stop must respect European standards: a red button, with yellow crown and with the words "Emergency Stop" in the national language. The machine should not restart independently after releasing the emergency button.



Picture 10
(Example of Emergency Stop for the manual batch operation)

If the mixer is not being used and no vessel covers the mixing element (e.g. a dissolver disc) the risk of injuries is very high. Therefore, it is recommended that the mixing element should be covered by a blade guard (Picture 11) or a drum.



Picture 11
(blade guard)

Cleaning:

The cleaning procedure of the mixer must only be allowed to start when the machine is at rest and isolated or locked out.

The cleaning of the mixer blade should only be done with a long-handled tool. Other parts (e.g. the shaft) can be cleaned with a rag. Such activities are allowed only if the motor is switched off. The movement of the hand while cleaning with a scraper should always be away from the body. Brushes should be made of natural bristles as synthetic brushes may become electrostatically charged.

The use of proper PPE (e.g. cut-resistant gloves or face protection) is required as a matter of course.

General:

Before operating a mixer, operating instructions must be made available and the operator must be trained in running the machine. According to best practice, a tutor (an expert operator) must teach the newcomer. The mixer must be designed in such a way that it fits to the field of application and site location.

A stable guard must be used which must stay in position. It must be engineered in such a way that it cannot be bypassed easily. The design of the guard should comply with the standards EN ISO 13849-1:2016 and EN 62061:2016.

All guards should be regularly inspected and interlocks (including the emergency stop) should be regularly tested. This also holds true for adjacent equipment such as hoists or hydraulic systems.

All controls should be clearly visible and identifiable to the operator and thus in the local national language.

If the machine is running in the presence of an explosive atmosphere, either for gases or dusts, an ATEX Risk Assessment must be in place, as well as explosion protection measures employed, such as grounding and bonding interlocks.

Sampling should only be carried out when the mixer is stopped and at rest.

The information and recommendations in this guideline should not be regarded as exhaustive. Deviations from this guideline should only be made if at least an equivalent safety level is guaranteed.

References:

Machinery Directive 2006/42/EC

<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006L0042:20091215:EN:PDF>

Guide to application of the Machinery Directive 2006/42/EC (European Commission)
[Guide to application of the Machinery Directive 2006/42/EC | Safety and health at work EU-OSHA \(europa.eu\)](#)

EN ISO 13849-1:2016 - *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

EN 62061:2016 - *Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems.*

EN ISO 13857:2019 *Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs*

Directive 2014/34/EU on equipment and protective systems intended for use in potentially explosive atmospheres

[Directive 2014/34/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres \(recast\)Text with EEA relevance \(europa.eu\)](#)

Directive 1999/92/EC on minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres

<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31999L0092&qid=1643388365217&from=EN>

Guide to the safe operation of dispersion equipment (British Coatings Federation Ltd) HS033
[Health & Safety Publications \(coatings.org.uk\)](#)

Merkblatt T 020 „Rührwerke“ Ausrüstung und Betrieb (BG RCI, Germany)

[Downloadcenter \(bgrci.de\)](#)

ANSI B65/NAPIM 177.2 Safety standard - Printing ink vertical post mixers

EuPIA OSRA WG, 24th March 2022