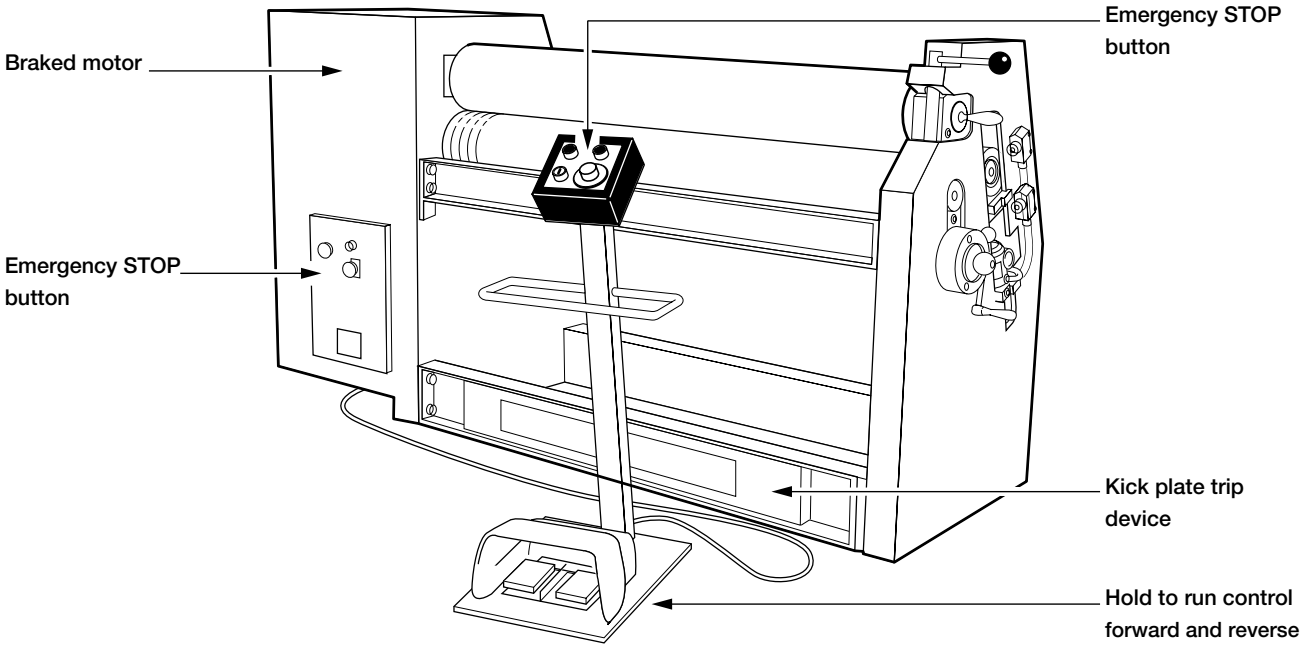
Safe use of 3 roll bending machines

HSE information sheet

Engineering Information Sheet No 7 (Revision 1)



Introduction

This guidance is for employers and operators of manually loaded 3 roll bending machines. It has been produced in order to assist with meeting legal duties specified in the Provision and Use of Work Equipment Regulations 1998. (PUWER 98)[1] It gives practical guidance on the safe use of the machine. This guidance may be applied to other types of bending machines where similar hazards and risks are present.

Hazards and risks

The main hazard at these machines is the operator's hands being caught and drawn into the in-running nip which is created by counter rotating rollers. Injury is most likely to occur during the initial feeding of the work piece into the rolls. There may be additional hazards, such as trapping of hands between the moving workpiece and other fixed parts of the machine.

A significant number of the accidents at these machines have resulted in serious injury, including amputation. A high proportion of the accidents are associated with the operator wearing gloves. The likelihood of entanglement in the in-running nip created between the counter rotating rollers is increased if gloves are worn.

Safety measures

General

The hierarchy of controls specified in Regulation 11 of PUWER 98[1] must be applied when guarding solutions are being determined. Fixed guarding should be provided, where practical, in order to prevent access to dangerous parts of machinery, namely the in-running nip created by the counter rotating rollers. Access to the rear of the machine should also be prevented or adequately controlled.

Safety distances

In some circumstances, feed and discharge table's can be used as a method of preventing access to the in-running nips. This can be achieved by ensuring that the tables provide a safe separation distance between the operator/s and the hazard zone (see BS EN ISO 13857).[2]

Protection devices

Protection for the operator and anyone near the machine may also be provided by a combination of protection devices. These include hold to run controls and trip devices, together with suitable safe systems of work.

These protection devices do not directly prevent entanglement or entrapment. They are intended to help prevent or minimise the extent of injury in the event of entanglement etc, by quickly stopping the machine. Operators should be trained to use the protection devices correctly. Managers should ensure that the protection devices are properly installed, maintained and used.

All protection devices should be suitable for the purpose for which they are provided and be of good construction, sound material and adequate strength to withstand the stresses of the expected service conditions. Where necessary, components, eg interlock switches should be provided with additional mechanical protection.

Hold to run controls

Machines should be provided with hold to run controls which ensure that roll movement only occurs when the control is held in a set position. The control should automatically return to the stop position when released. This type of control may take the form of a button, joystick or foot operated control (see PD 5304)[3]. Where a foot operated control is used the pedal/lever should be protected to prevent accidental operation.

Trip devices

A trip device (bar or tensioned wire) should be positioned so that it may be easily actuated by any person caught or drawn towards the rolls and will stop the machine before serious injury can occur. The trip device will be required at both sides of a machine.

Mechanical trip bars including kick panels should be provided with two safety interlock switches, one at each of the bar or panel The switches should be arranged to actuate on minimal deflection of the bar or panel (see PD 5304)[3]. Where a trip wire is provided the safety switches should be of a suitable type which actuate if the wire is pulled in any direction or if the wire breaks. The trip device should be integrated into the machine control circuit.

Following operation of the trip device the machine should only be able to be restarted when the safety device reset is operated and the machine is switched on at the normal control start switch/button.

Braking systems – normal stop

Protection devices are only effective if the dangerous parts of the machine stop quickly. It may be necessary to provide a brake if there is any risk that overrunning, due to inertia, may give rise to injury.

The maximum operating speed of the rolls (RPM or m/min) and the roll diameters are an important consideration. A braking system may be mechanical, electrical or a combination of both. If brakes are to be fitted at a later date to older machines care should be taken to ensure that the machine is capable of withstanding the stresses caused by the effects of braking (see PD 5304)[3].

Emergency stop buttons

One or more emergency stop controls should be provided where appropriate. Emergency stop controls should be readily accessible. Where emergency stop controls are activated, the machine should only operate again when the emergency stop device has been reset manually and normal operating controls are used to restart the machine (see BS EN ISO 13850)[5].

Safe systems of work

Safe systems of work should be followed when operating a 3 roll bending machine. In particular:

- The use of gloves with fingertips during initial feeding of work pieces should be prohibited because the tips can be caught and drawn into the roll intake. Where there is a genuine need for hand protection, palm protection only may be sufficient. Loose fitting clothing should not be worn. Overalls with close fitting cuffs and sleeves are preferred.
- Work pieces should always be held sufficiently far back from the edge being fed into the rolls to allow for the infeed speed of the machine, and therefore prevent close hand approach to the rolls. Where the nature of the work permits, suitable handling aids such as feed tables or rollers should be used.
- The area around the machine should be adequately lit and kept free of materials which might cause slips or trips. When more than one operator is involved with the work, clear operating procedures should be established before work commences.

Inspection and maintenance

Regular inspection and maintenance of the safety devices and safety critical parts, including brakes, on the machine is essential. Detailed advice on this matter should be contained in the manufacturer's instruction manual. Cleaning, including cleaning of the rollers, should be carried out with the machine switched off and isolated.

References

1 *Safe use of work equipment Provision and Use of Work Equipment Regulations 1998. Approved Code of Practice and guidance* L22 (Fourth edition) HSE Books 2014 www.hse.gov.uk/pubns/books/l22.htm

2 BS EN ISO 13857:2008
Safety of machinery. Safety distances to prevent hazard zones being reached by upper and lower limbs British Standards Institution

3 PD 5304:2014
Guidance on safe use of machinery
British Standards Institution

4 *Health and safety in engineering workshops* HSG129 (Second edition) HSE Books 1999
www.hse.gov.uk/pubns/books/HSG129.htm

5 BS EN ISO 13850:2008
Safety of machinery. Emergency stop. Principles for design British Standards Institution

Further reading

Further information for suppliers, installers and users of new and second-hand machinery can be found on HSE's Work equipment and machinery webpages www.hse.gov.uk/work-equipment-machinery/index.htm

Further information

For information about health and safety, or to report inconsistencies or inaccuracies in this guidance, visit www.hse.gov.uk/. You can view HSE guidance online and order priced publications from the website. HSE priced publications are also available from bookshops.

This guidance is issued by the Health and Safety Executive. Following the guidance is not compulsory, unless specifically stated, and you are free to take other action. But if you do follow the guidance you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance.

British Standards can be obtained in PDF or hard copy formats from BSI: http://shop.bsigroup.com or by contacting BSI Customer Services for hard copies only Tel: 0845 086 9001 email: cservices@bsigroup.com.

This document is available at:
www.hse.gov.uk/pubns/eis7.pdf.