Safeguarding at horizontal boring machines

Engineering Sheet No 28

Introduction

The guidance contained in this information sheet is intended for users of existing horizontal boring machines to assist them in meeting their legal duties under the Provision and Use of Work Equipment Regulations (PUWER).[1]

Hazards and risks

The principal hazards when working at or near these machines are mechanical in nature. A review of the accident history shows that the single largest cause of serious injury is entanglement at revolving tools. Entanglement also accounts for the majority of fatalities, particularly at larger machines. Crushing and trapping hazards have also been identified as very significant causes of injury.

Most injuries occur during activities such as setting/ adjustment, swarf removal or observation for the purpose of process control. Injuries are often very severe and include limb and skull fractures and amputations. The potential for fatal injury at these machines should not be underestimated.

Reports of investigated accidents show guarding standards to be generally unsatisfactory with an over-reliance on systems of work and the 'skill' of operators as the principal means of risk reduction.

Risk assessment

The precise combination of safety measures adopted will depend upon the outcome of the risk assessment and, in some cases, the practicability of carrying out modifications.[2]

Particular care needs to be taken when selecting the control measures. The final design of the safeguarding arrangements should take into account the need for observation, adjustment etc while still providing for adequate levels of protection. A distinction should be made between 'normal' machining operations and those occasions when access to the work zone may be *necessary* for the kinds of higher-risk activities previously described. (Note: These machines also perform milling and drilling operations; the associated risks need to be taken into account.)

Safeguarding

The variation in size and configuration of machines and the specific applications to which they may be put precludes the use of a standard safeguarding solution such as that which may, for example, be applied to most lathes.

Primary safeguards

The hierarchy of controls prescribed under regulation 11 of PUWER should be applied. During normal machining operations access to the work zone should be prevented by fixed and/or interlocked guards (Figure 1). The height,

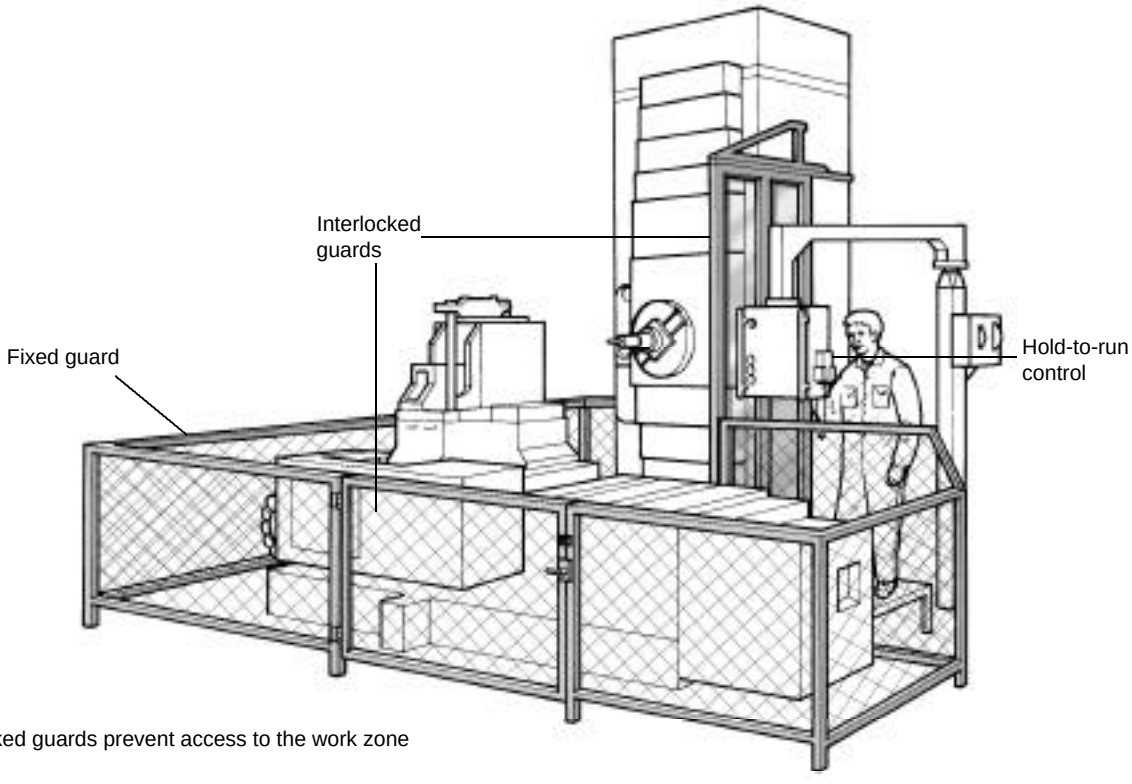

Figure 1 Fixed and interlocked guards prevent access to the work zone

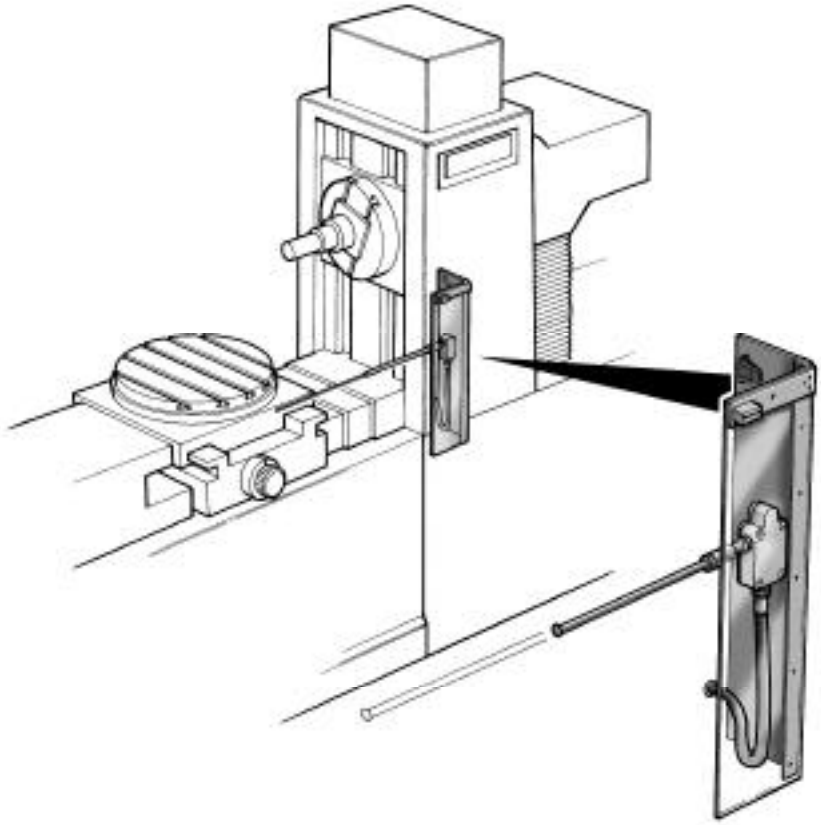

Figure 2 Application of telescopic trip device

position and construction of any new guards should meet appropriate standards (see ‘Further reading’ on back page). If physical guarding is not practicable alternative types of safety device may be used, eg light curtains or pressure mats. Where routine observation of the machining process is required, the means to achieve it safely should be considered and accommodated within the guard design. Related matters such as local lighting should also be checked to ensure that they are adequate.

In addition, the guarding arrangements should take into account access by second persons, particularly at large machines, where hazardous parts may also be accessible from the sides and rear. Perimeter fencing should be provided where there is a risk to second persons.

Trip probes with braking devices may be used as the sole means of safeguarding at the spindle/tools in some circumstances (Figures 2 and 3). However, the limitations of these devices need to be recognised, both in terms of their practicability of use and the level of protection they provide. Trip probes do not directly prevent entanglement but mitigate the extent of injury, when actuated, by applying the brake to stop the machine quickly.

These devices alone do not protect against other hazards such as crushing and trapping between fixed and moving parts of the machine or workpiece. The risk assessment should determine if trip devices alone will be effective for the range of hazards present. Physical guarding which prevents access to the danger zone, or safety devices which cause the machine to stop before hazardous parts can be reached are the recommended options.

Brakes

It is not possible to specify a minimum stopping performance for braking systems. This is because of the wide range of machine sizes and other design characteristics. Nevertheless, the objective should be to stop the machine as quickly as possible taking into account the particular circumstances. Where brakes are fitted to older machines, care should be taken to ensure that the machine is capable of withstanding the stresses induced by the effects of braking (see BS 5304, section 5.6). A braking system may be mechanical or electrical or a combination of both. Preference should be given to disc or calliper brakes in mechanical braking systems. Advice should normally be sought from the machine manufacturer before modifications are carried out.

Supplementary safeguards

Where powered movement of machine elements is necessary for setting purposes etc, and access is required by the operator to the work zone, the risks can be reduced by using supplementary safeguards. In these cases the primary safeguard, ie guard interlocking, can be suspended via a key-operated selector switch. Any further hazardous movement of the machine

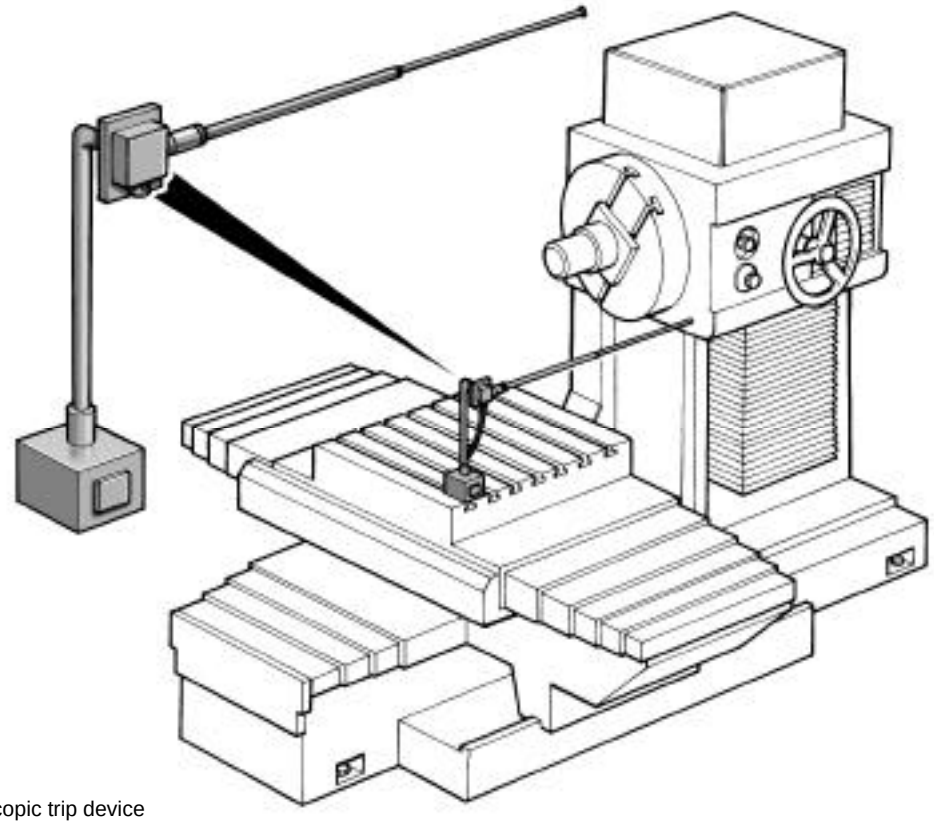

Figure 3 Application of magnetic telescopic trip device

element should be achieved by using a hold-to-run control arrangement or enabling device. The selector switch should also enable the braking arrangements, eg dc injection braking. On release of the hold-to-run control (or enabling device) the braking system should be applied. This principle may be incorporated into an existing pendant control. These aspects of the control system are safety-critical and should be designed to meet the requirements of regulation 18 of PUWER. (Note: New machines should be supplied with safety arrangements which provide for this kind of intervention into the work zone.)

Emergency stop and other controls

In addition to the measures detailed above, an emergency stop device should be provided at the main operating position and at any remote workstation/control position. Emergency stop buttons should be of the lock-in type. Release of the button should not cause the machine to operate. Start-up should only be possible by operating the normal start control. The emergency stop should actuate the brake (if fitted) before cutting off the power supply.

Other machine controls, eg the start button or feed and speed selectors, should be clearly visible and identifiable with appropriate marking where necessary. The main controls should be positioned so that people are not at risk when operating them.

Other parts

Other hazardous parts such as transmission elements including shafts, gears, pulleys etc should be guarded using fixed guards. Where routine access is required to any of these parts more frequently than once per shift, interlocked guards are recommended. Guards should prevent access to the dangerous parts of swarf conveyors or elevators.

Training

The provision of information, instruction and training is a legal requirement. Those matters which require particular attention include:

(a) dangers at the machine;

(b) location and operation of controls;

(c) precautions to reduce the risk of entanglement;

(d) correct use of guards and other safety devices;

(e) any tests, eg daily test of trip devices, and the system for reporting defects;

(f) safe systems of work for cleaning, maintenance, setting and adjustment, loading of workpieces etc.

Activities such as swarf removal should normally be carried out with the spindle stopped.

The selection and use of suitable workwear and other personal protective equipment, eg for eyes, is important to help minimise other residual risks.

References

1 Provision and Use of Work Equipment Regulations

2 *The Provision and Use of Work Equipment Regulations 1992* MISC101 HSE Books (free) (available until the new PUWER Regulations are in force)

These Regulations are currently under review. New Regulations, an Approved Code of Practice and guidance are expected at the end of 1998. No significant changes to this information sheet are anticipated as a result of amendments to PUWER.

Further reading

Health and safety in engineering workshops HSG129 HSE Books 1995 ISBN 0 7176 0880 8

BS EN 1050: 1997 *Safety of machinery - principles for risk assessment*

BS EN 292: 1991 Parts 1 and 2: *Safety of machinery - basic concepts, general principles for design*

BS EN 60204: 1993 *Safety of machinery - electrical equipment of machines* Part 1: *Specification for general requirements*

BS EN 294: 1992 *Safety of machinery - safety distances to prevent danger zones being reached by the upper limbs*

BS EN 1088 *Safety of machinery - interlocking devices associated with guards - principles for design and selection*

BS EN 953: 1998 *Safety of machinery - guards - general requirements for the design and construction of fixed and movable guards*

BS 5304: 1988 *Code of practice for safety of machinery*

Further information

The future availability and accuracy of the publications listed in this information sheet cannot be guaranteed.

HSE priced and free publications are available by mail order from HSE Books, PO Box 1999, Sudbury, Suffolk CO10 6FS. Tel: 01787 881165. Fax: 01787 313995.

HSE priced publications are also available from good booksellers.

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HSE home page on the World Wide Web: http://www.open.gov.uk/hsehome.htm

This leaflet contains notes on good practice which are not compulsory but which you may find helpful in considering what you need to do.

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