Safe use of horizontal boring machines

HSE information sheet

Engineering Information Sheet No 28 (Revision 1)

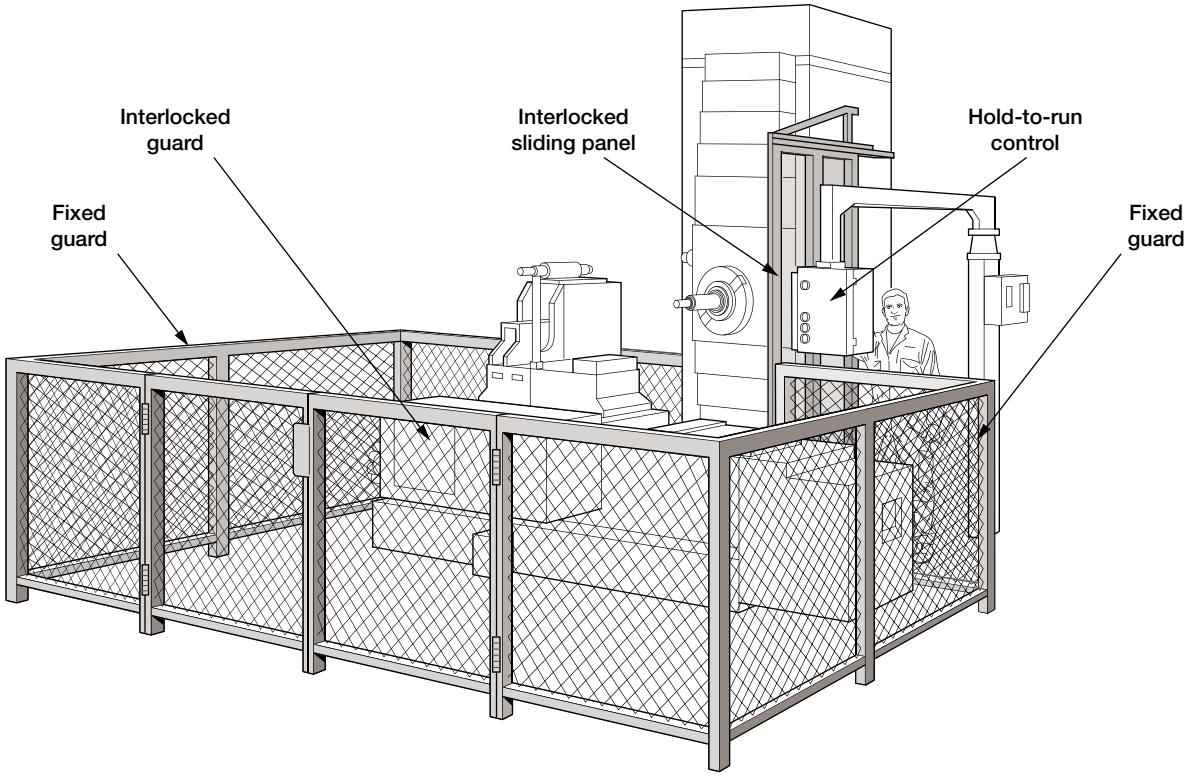

Figure 1 Fixed and interlocked guards prevent access to the work zone. The height of perimeter fencing will be determined by using the values given in BS EN ISO 13857[1].

Introduction

This guidance is for employers and operators of existing horizontal boring machines. It gives practical guidance on the safe use of horizontal boring machines. It has been produced in order to assist with meeting legal duties under the Provision and Use of Work Equipment Regulations 1998 (PUWER 98).[2] This guidance applies to both manual and computer numerically controlled (CNC) types of horizontal boring machines.

Hazards and risks

The hazards associated with horizontal boring machines include entanglement at the rotating chuck and cutting tools. Crushing or trapping may also arise from other moving parts, eg from the moving table. The automated nature of CNC machines means that additional risks to safety may be present as machine movement is not always reliable or predictable.

Injuries may occur during:

- machining observation;
- setting and adjustment; or
- swarf removal.

Accident history shows that serious injuries, including severe lacerations, crushing or amputation, occur on these machines. Other injuries include skull fracture and broken limbs. Fatal accidents have also occurred.

What the law says

Management of Health and Safety at Work Regulations 1999[3]

You must carry out a suitable and sufficient risk assessment to determine the appropriate safeguarding measures required to control the risks.

In your risk assessment, you will need to consider all operations where access to the work zone is required. This will include routine machining operations, observation and adjustment requirements and breakdowns and maintenance tasks. Risks associated with the machine being used for other machining operations, eg drilling or milling, will also need to be included in the risk assessment.

Provision and Use of Work Equipment Regulations 1998[2]
Effective measures must be taken to prevent access to any dangerous parts of machinery. The hierarchy of controls specified in the Regulations must be applied when safeguarding solutions are being determined. A safeguarding solution will need to be developed based on the specific functions of the individual horizontal boring machine. You will need to take into account the size and configuration of the machine and the specific applications for which the machine will be used.

Control measures

Primary safeguards
During routine machining operations, access to the work zone should be prevented by fixed and/or interlocking guards (see Figure 1). The height, position and construction of any new guards should meet appropriate standards (see References and Further reading). If physical guarding is not practicable, alternative types of safety devices may be used, eg light curtains or pressure sensitive mats.

Access into the enclosure inside the perimeter fencing should be via an interlocked gate, that either:

- includes guard locking, to prevent entry when the machine is in use; or
- stops movement of all the dangerous parts if the gate is opened during use.

Where an interlocking enclosure is not practicable and cannot be installed you should:

- Provide perimeter fencing around the machine in order to restrict general access by personnel not associated with the machine.
- Ensure any access gates are spring-closure and include a latch arrangement, such that a deliberate two stage opening of the gate is required (ie raising the latch and pushing against the spring pressure).
- Ensure any ancillary equipment, storage facility or other non-essential items are removed from the enclosure.

Your risk assessment will need to clearly demonstrate why a full interlocked enclosure is not practicable.

Safe systems of work for all operations are required, including activities such as safe swarf removal.

Trip probes (see Figures 2 and 3)
Trip probes with braking devices may form part of the safeguarding solution where the risk assessment permits. However, when considering the use of trip probes as a primary safeguard, all of the following conditions should apply:

- Movement of the machine table is slow and inadvertent contact by the operator may be considered to be low risk. In these circumstances, the primary risk remains from the rotating chuck and cutting tool.
- Various individual non-standard components are being machined and a high degree of close observation is required for setting the machines.

The limitations of these devices must be recognised, both in terms of their practicability of use and the level of protection they provide. A magnetic based trip probe is able to provide improved protection as it can be moved to the most appropriate position, depending on the particular workpiece being machined.

Trip probes do not directly prevent entanglement but mitigate the extent of injury, when actuated, by applying the brake to stop the machine quickly.

Trip devices alone do not protect against other hazards such as crushing and trapping between fixed and moving parts of the machine or workpiece. Your risk assessment should determine if trip devices will be effective for the range of hazards present. A detailed risk assessment will be required to justify that other safety measures are not practicable.

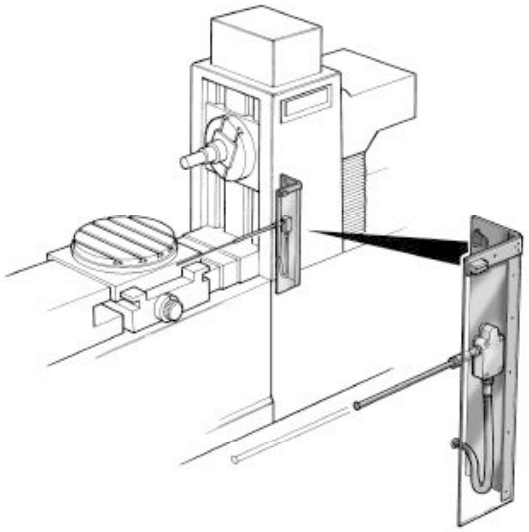

Figure 2 Application of telescopic trip device

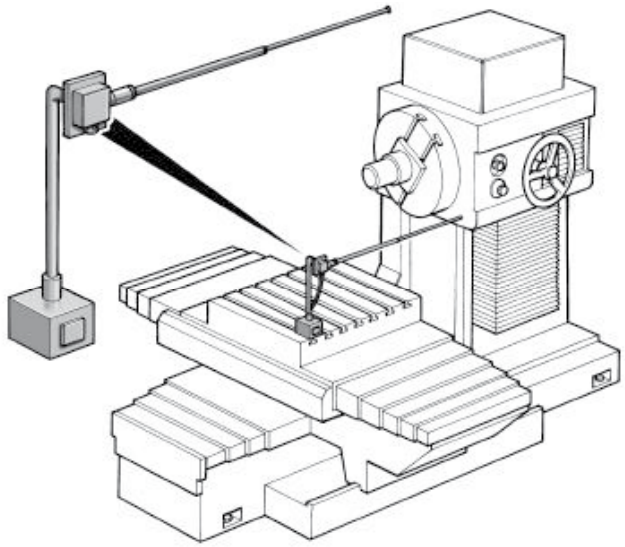

Figure 3 Application of magnetic telescopic trip device

CNC functionality must be disabled if use of trip probes is to be considered, due to the possibility of unexpected movement.

Braking systems
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.

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 PD 5304).[4] A braking system may be mechanical or electrical or a combination of both.

Supplementary safeguards during setting
A safe system of work must be prepared for setting operations and include management arrangements for the training of operators and monitoring that the system is implemented correctly.

Where powered movement of machine elements is necessary for setting operations, and access by the operator into the work zone must be justified by the risk assessment and the risks reduced by using supplementary safeguards.

In these cases the primary safeguard, i.e. guard interlocking, may be suspended by a nominated competent person using a key-operated selector switch. The key must be controlled by the competent person and not left in the machine.

Any further hazardous movement of the machine should only be possible 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 98.[2] (Note: New machines should be supplied with safety arrangements which provide for this kind of intervention.)

Machine controls
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.

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 be able to be restarted when the emergency stop device has been reset manually and normal operating controls are used to restart the machine.

Other hazards

Other hazardous parts such as transmission machinery including shafts, gears, pulleys, etc should be guarded using fixed guards. Where routine access is required to any of these parts, interlocked guards should be fitted. Guards should prevent access to the dangerous parts of swarf conveyors or elevators.

Information, instruction and training

All relevant health and safety information and, where appropriate, written instructions on the use of horizontal boring machines must be made available to operators.

Operators must be competent to use the machine safely and to follow all safe systems of work. Adequate training should be given to ensure they have the correct skill, knowledge and risk awareness, and to ensure that they are physically suited to the task.

Particular attention should be given to:

- dangers at the machine;
- location and operation of controls;
- precautions to reduce the risk of entanglement;
- correct use of guards and other safety devices;
- any tests, eg daily test of trip devices and the system for reporting defects; and

- safe systems of work for cleaning, maintenance, setting and adjustment, loading of workpieces etc.

Do not let unauthorised, unqualified or untrained people use machinery. Never allow young people under the minimum school leaving age, eg on work experience, to operate or help at machines. Some workers, eg new starters, young people or those with disabilities, may be particularly at risk and need additional instruction, training or supervision.

References

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

2 *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

3 *Management of health and safety at work. Management of Health and Safety at Work Regulations 1999. Approved Code of Practice and guidance* L21 (Second edition) HSE Books 2000 www.hse.gov.uk/pubns/books/l21.htm

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

Further reading

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

BS EN 953:1997+A1:2009 *Safety of machinery. Guards. General requirements for the design and construction of fixed and movable guards* British Standards Institution

BS EN ISO 12100:2010 *Safety of machinery. General principles for design. Risk assessment and risk reduction* British Standards Institution

BS EN 60204-1:2006+A1:2009 *Safety of machinery. Electrical equipment of machines: General requirements* British Standards Institution

BS EN ISO 14119:2013 *Safety of machinery. Interlocking devices associated with guards. Principles for design and selection* British Standards Institution

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.

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