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HM Inspectors of Health & Safety
Specialist Group Inspectors

SAFEGUARDING METAL SPINNING MACHINES

This OC provides guidance to Inspectors on the safeguarding expected at metal spinning machines, including manual and computer controlled types. The Information Document (ID) may be copied to interested parties outside HSE.

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DRAFT INFORMATION DOCUMENT
SAFEGUARDING METAL SPINNING MACHINES

INTRODUCTION

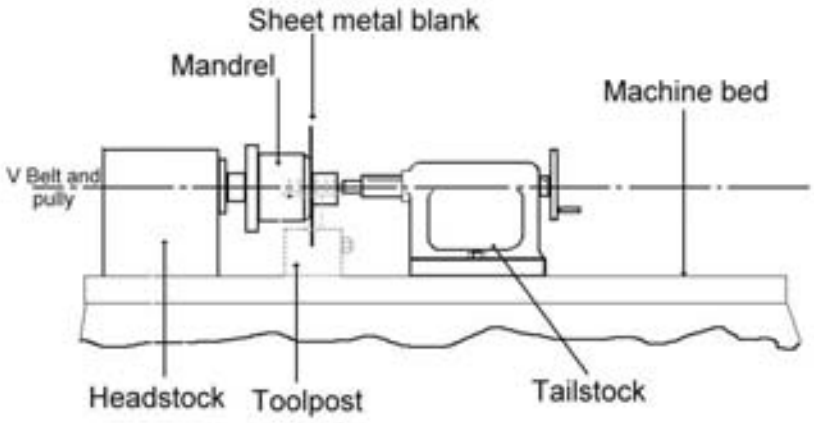
1 This Information Document contains internal guidance from the Health and Safety Executive (HSE) that has been made available to the public. It details the guarding requirements for manual and computer controlled spinning machines, and is considered good practice, which you may find useful in deciding what you need to do to comply with the law.

THE METAL SPINNING PROCESS

2 Metal spinning machines are used for the manufacture of rotationally symmetrical hollow components from circular blanks. The process is particularly common in the production of kitchenware, lighting equipment, and components for the fabrication of items such as boilers and cylinders e.g. dome ends. Spinning is often used as an alternative to 'deep drawing' presswork, as it is can be more cost effective where the required volume of components is relatively small.

3 The term 'metal spinning' is used to describe two main techniques. These are 'spinning' and 'flow forming'. 'Spinning' involves a combination of compressive and tensile forces, which bends the material around the mandrel. 'Flow forming' is the application of mainly compressive forces, e.g. when making cone shaped components.

4 The process is carried out on a metal spinning lathe (similar in principle to a conventional metalworking lathe).



Basic parts of a manual metal spinning lathe

5 A flat blank is clamped to a rotating chuck or former, which has the inner shape of the component being made. The required shape is produced using a forming stick or roller, which forces the blank against the former. The component is often progressively formed over several passes, or more rarely in a single pass (shear forming). The resulting product has the same thickness as the initial blank.

6 Traditionally, metal spinning has been a manual process, with hand held tools used to carry out the forming process, known as ‘hand spinning’. A cross-slide tool support is used as a brace for the forming stick / roller so that the operator can exert sufficient pressure on the blank. This is suitable for small to medium production runs, on light gauge components with a relatively small diameter.

7 The restrictions on the type of components that can be produced are usually determined by the mechanical properties of the material being worked. The addition of hydraulic power to move the machine axis, whilst still under the direct control of an operator, allows a greater size and thickness of component to be manufactured. This is suitable for small to medium size production runs on larger components.

8 Computer controlled machines are now in fairly common use in the industry. These machines have powered clamps and forming rollers, which automatically perform one or more passes to form the component. They are known as Computer Numerical Control (CNC) or Playback Numerical Control (PNC) machines. Many of the computer-controlled machines in use are made by the German manufacturer Leico (including Leifeld Machines).

9 PNC machines use a so-called 'Teach and learn' playback system for setting work, whereby manual controls are used to run through the spinning process. These are then stored as a programme for subsequent automatic operations. This setting activity is carried out with the chuck and component rotating at 600 - 700 rpm so that the initial 'teach' spinning can be done.

10 The addition of computer-controlled axes has enabled improved productivity and repeatability over longer production runs. An experienced operator can ‘teach’ (program) the machine how to make a component and then reproduce this many times for larger production runs (similar to any kind of machine tool). The ' tool path’ can be further edited ‘offline’ if necessary. Modern PNC spinning lathes can be provided with multiple tooling to enable multi-stage spinning of complex components without the need for numerous set-ups on several different machines.

11 During the spinning process lubricants have to be applied to the surface of the component. These take the form of a wax or grease, but may be applied as a spray.

ACCIDENT HISTORY

12 The hazards at manual and computer controlled metal spinning machines are similar to those found at conventional and CNC lathes. Accidents occur in almost equal proportions at manual and computer controlled machines, although it is estimated that there are more manual machines in use.

13 The last detailed analysis of investigated accidents was carried out using information from the MARCODE database. A total of 27 investigated accidents were identified at metal spinning machines between 1985 and 1995. Most accidents occurred during production (13), or during application of lubricant or cleaning the component (8). Nine of these occurred at manually operated machines, nine at computer controlled machines and the remainder did not specify the mode of operation (probably manual).

The types of accident recorded were:

- Trapped between moving parts 10
- Cut on workpiece 7
- Caught on chuck / rotating parts 4
- Other 7

The injuries recorded were:

- Cuts 7
- Amputation (finger or part of) 3
- Severed tendon / ligament / nerve 3
- Fracture or crushing injury - 7
- Bruising / minor / not specified 7

NB: The above data should not be used for statistical purposes.

14 This analysis, and investigation of further, more recently reported, accidents (up to 2003) suggested that most occur as a result of contact with the rotating workpiece or chuck, entanglement of gloves or other loose clothing with rotating parts, or trapping between the fixed and moving parts (such as the powered forming rollers at computer-controlled machines). Accidents which occurred when lubricant was being applied, or when the workpiece was being cleaned, were often as a result of inappropriate tools being used to do the job.

15 An ejection risk was also identified, at the beginning of the hand spinning process, before the workpiece has been shaped around the former.

LEGAL REQUIREMENTS

16 Users of metal spinning machines should comply with the Provision and Use of Work Equipment Regulations 1998 (PUWER). Under regulation 11, employers are required to ensure that effective measures are taken to prevent access to any dangerous part of machinery. The regulation also sets out the ways in which this should be achieved. Under regulation 12, employers are required to ensure that people using the machine are not exposed to risks from things that maybe ejected from it.

17 Regulation 10 of PUWER requires that employers ensure that metal-spinning machines first provided for use at their premises meet the requirements of the Supply of Machinery (Safety) Regulations 1992 (as amended) by checking, firstly that the machine is CE marked and was supplied with a declaration of conformity saying it complies with the Machinery Directive, and secondly that it is free from patent defect, e.g. that suitable guarding is supplied and correctly fitted. However, the primary duty under these regulations is on the supplier of new machinery, who should ensure that it meets the relevant essential health and safety requirements laid down in the regulations and that it is, in fact, safe. A similar duty to ensure the safety of used machinery exists under section 6 of the Health and Safety at Work etc Act 1974.

RISK ASSESSMENT

18 Regulation 3 of the Management of Health and Safety at Work Regulations 1999 requires employers to carry out a suitable and sufficient assessment of the risks to people using metal spinning machines, in order to identify the precautions for safe use which need to be taken for these machines under other regulations. A template for completing a risk assessment for metal spinning operations is attached at Appendix 1 of this information sheet.

PRECAUTIONS REQUIRED - COMPUTER CONTROLLED MACHINES

19 New (CE marked) computer-controlled machines are similar in principle to CNC metalworking lathes, and should be safeguarded to a similar standard with an interlocked enclosure. The interlocking arrangements should not allow any powered movement of the spindle or forming rollers when the access doors are open. A fixed barrier fence guard with an interlocked gate may provide guarding at the rear of these machines. (see Further reading for details of relevant BS EN Standards) Setting operations, such as the 'Teach and Learn' programming, should be done from outside the enclosure, with the doors closed. The machine should, where practicable, apply lubricants automatically.

Modern NC Controlled spinning lathe

RETROFITTING OF SAFEGUARDS

20 On pre-CE marked CNC machines, which do not have any safeguarding fitted, it should be practicable to provide some kind of physical safeguarding similar to that provided at new machines. Work zone guards should be interlocked, and be fitted with guard locking, to prevent access to the danger zones whilst the machine is still rotating. Access should also be prevented to any traps resulting from powered axis.

21 The safeguarding fitted should allow all phases of the production process to be carried out in safety. When retrofitting guarding, users should also consider automatic systems to carry out lubrication and cleaning functions, such as those fitted at new machines. It is recommended that users contact the manufacturer of their machine to enquire about guarding, as availability of retrofits may vary from machine to machine.

PRECAUTIONS REQUIRED - MANUAL MACHINES

22 Due to the varied nature of components produced and manual operations required at these machines, total enclosure of the work area is not always practicable. However, suitable and sufficient risk assessment should identify all relevant improvements in safeguarding that can be achieved, applying the hierarchy of control measures specified under regulation 11 of PUWER 98, e.g. practicable side and rear guarding, and suitable precautions for operations requiring close and/or frequent approach to the work area from the front of the machine. Where safeguarding arrangements are not adequate, users should contact the manufacturer/supplier of their machine for advice and assistance with upgrading/retrofitting.

23 Several accidents have occurred whilst the operator was manually adding lubricants such as grease or tallow to the component. This is often applied, using a rag or piece of cloth, whilst the component is still rotating, and the risk of

entanglement is significantly increased. Where possible, lubricants should be applied to components before starting the machine cycle. Where automatic application is not practicable on manual machines, particular attention should be given to safe systems of work, to be followed for applying lubricant. Suitable tools, such as firm pads or spray guns, should be used to minimise the risk of entanglement.

OTHER PRECAUTIONS – ALL MACHINES

24 Transmission machinery (V belt and pulley drives) should be safeguarded using fixed and/or interlocked guards, to prevent access to dangerous parts.

25 Gloves and loose fitting clothing present an entanglement risk during machine operation. Coveralls, particularly sleeves and cuffs, should be close fitting. The risk of cuts caused by handling components with sharp edges should be adequately controlled (see Engineering Information Sheet No. 16 - **'Preventing injuries from the manual handling of sharp edges in the engineering industry').**

TRAINING AND SUPERVISION

26 The training and supervision of operators is particularly important. Many of the accidents that have occurred at these machines have involved unskilled operatives who were not aware of the correct work procedures (such as those for workpiece clamping) or of the hazards, risks and precautions (including guarding) required.

EYE PROTECTION

27 The metal spinning process can result in considerable amounts of swarf being generated. There is a risk of injury to the eyes of operators and others working in the vicinity - suitable precautions should be taken. The risk is likely to be greatest at manual machines. Eye protection should be worn where a risk exists and is not being controlled by other means e.g. chip guards or other screening.

HSE PUBLICATIONS

L22 – Safe use of work equipment – Provision and Use of Work Equipment Regulations 1998 – Approved Code of Practice and Guidance on the regulations: ISBN 0-7176-1626-6; price £16.50

HSG 180 “Application of electro-sensitive protective equipment using light curtains and light beam devices to machinery”: ISBN 0-7176-1550-2; price £7.95

HSG 129 – Health & Safety in Engineering Workshops (Reprinted 2004):
ISBN 0-7176-1717-3; £9.50

INDG 174 – A Short Guide to the Personal Protective Equipment Regulations 1992

INDG 218(L) - A Guide to Risk Assessment Requirements

INDG 229 – Using Work Equipment Safely

INDG 270 – Supplying new Machinery

INDG 271 – Buying New Machinery

INDG 291 – Simple Guide to the Provision & Use of Work Equipment Regulations 1998

HSE priced and free publications are available by mail order from HSE Books, PO Box 1999, Sudbury, Suffolk, and CO10 2WA. Tel: 01787-881165 Fax: 01787-313995.

For information about health & safety ring HSE's Infoline Tel: 08701-545500, Fax:02920-859260, e-mail: hseinformationservices@natbrit.com or write to HSE Information Services, Caerphilly Business Park, Caerphilly CF83 3GG. You can also visit HSE's website

FURTHER READING

BS EN 12100:2003 – Parts 1 & 2: Safety of Machinery - Basic concepts, general principals for design

BS EN 294:1992 – Safety of Machinery – Safety distances to prevent danger zone being reached by the upper limbs

BS EN 954:1997 Part 1 – Safety of Machinery – Safety related parts of control systems – General principles for design

BS EN 953:1998 Safety of machinery – General requirements for the design and construction of guards (fixed and moveable).

BS EN 1088:1996 Safety of machinery – Interlocking devices associated with guards – Principles for design and selection

BS EN 60204:1998 Part 1 – Safety of Machinery – Electrical equipment for machines - Specifications for general requirements

BS EN 1050:1997 Safety of machinery – risk assessment

PD 5304:2000 – Code of Practice – Safeguarding of machinery

Details of British Standards Institute (BSI) publications are available from website

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

APPENDIX 1
RISK ASSESSMENT

The use of this template is not compulsory and you are free to use other means to complete the risk assessment. (Also see section 18)

MACHINE DETAILS

Machine type and plant/ref no.

Name of assessor/date of assessment

General description of machine, including ancillary equipment

Intended function of machine and suitability for function

PREVENTING ACCESS TO DANGEROUS PARTS

Is access possible to any part that could injure particularly the closing tools? What access is needed during normal operation of the machine?

Machine part	Location	Who is at risk?	Estimated injury

For the parts identified above, what method of guarding or protection will be necessary? Will they be suitable taking into account the operation of the machine?

Machine part	Fixed guard	Other guard	Other protective measures – eg: jigs, tongs

Where guards are provided are they effective? Will they prevent risks from inadvertent operation when more than operator is working at the machine?

Guard/device	Effective? E.g. – of sound construction, not easily by-passed/disabled, adequately distant from danger but allowing a good view of the process where necessary, maintenance access only, etc?

MAINTAINING GUARDS

What maintenance is necessary for the guards and protective devices? What preventative maintenance is required for safety related parts of the control system?

Guard/device	Maintenance	Frequency	Responsible person

INFORMATION, INSTRUCTION AND TRAINING

What information must be provided to operators and others working at that machine?	Who is responsible for providing that information?

What instruction and training must be provided to the following:

Operators	Maintenance staff	Supervisors

Who is responsible for providing instruction and training to the following:

Operators	Maintenance staff	Supervisors

Assessor details: **Name** **……**

Position **……**

Date **……**

Review date **……**

Note: A risk assessment should be reviewed following any changes in circumstances which may affect the outcome, or, in any event, a review is recommended at least every 12 months. (Also see section 18)