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Target Audience
 AFQ Inspectors
 Specialist Group Inspectors (Mech Eng)

**2002/03 FOD PLAN OF WORK:
 CNC TURNING MACHINES - CONTROLLING RISKS FROM EJECTED PARTS**

This SIM provides information on the Engineering Sector priority project in the 2002/03 FOD Plan of Work to reduce fatal and major injuries due to the ejection of parts from CNC turning machines.

INTRODUCTION

1 Following on from work done in the development of European Standards, the Engineering Sector published detailed guidance in OC 228/10 *CNC turning machines - Vision panels - Degrading of polycarbonate* and EIS 33 *CNC turning machines - Controlling risks from ejected parts* on the assessment and control of risks from ejection at CNC turning machines. The guidance has now been widely disseminated to machine manufacturers, suppliers and users via the relevant trade associations. This project takes this earlier work forward to ensure that machines over 2 years old are subject to an assessment for ejection risks and that appropriate standards of engineering controls are implemented. The project was accepted as one of the 'star chamber' programmes for 2002/03 and is referred to in the FOD Planning Guidelines, Appendix 6, Project 4.

BACKGROUND

2 CNC turning machines are normally fitted with one or more vision panels in the front guarding to enable the operator to observe the machining process. These panels are usually manufactured from polycarbonate - a clear ductile plastic which is capable of withstanding the high energy ejections that are known to occur at turning machines. In service the polycarbonate is subject to a significant deterioration in impact resistance due to the action of metalworking fluids and other lubricants. Incidents have also resulted from the inadequate design of the guard door and the means used to retain the vision panel in position.

3 There is a continuing history of incidents where parts have been ejected and operators have been seriously injured, fatally in some cases, because the panels have failed to contain the projectile. Although poor standards are more likely to be encountered at older machines failure of the control measures have been experienced at newer machines because of deficiencies in the initial design.

4 European Standards are relevant only to machines manufactured after the date of publication of the standard. BS EN 12415: 2001 *Machine tools - Safety - Small Numerically*

controlled turning machines and turning centres, contains requirements for the construction of guards and vision panels to contain ejected parts. For older machines that are CE marked, BS EN 953: 1997 *Safety of machinery - General requirements for the design and construction of guards (fixed and moveable)*, contains requirements for the strength of guards and the construction materials used.

OBJECTIVES


5 The overall aim is to reduce the risk of fatal and major injuries at those companies which are visited, the objectives of the project are that:

(1) users have undertaken a suitable and sufficient risk assessment to establish the risks from ejected parts and identify the necessary control measures to ensure that (2) and (3) below have been achieved;

(2) CNC turning machines have vision panels/guards that are suitably designed and constructed and have sufficient strength to contain parts which may foreseeably be ejected from the machine; and

(3) any necessary arrangements for the maintenance of vision panels/guards have been identified in order that they continue to perform their intended function.

TARGET MACHINES

6 The project applies to all types of CNC turning machine over 2 years old where a vision panel and associated guarding is intended to contain ejected parts. Inspectors will encounter wide variations in the standards of both construction and maintenance of vision panels. Older machines are most likely to present poorer standards of risk control. Examples of very poor maintenance or questionable standards of construction can be identified by visual examination (see OC 228/10 and [EIS 33](#) ). This will indicate that remedial action is necessary. However, a more detailed assessment will be necessary to determine exactly what the remedial measure should be to effectively control the risk based on the machine application(s).


7 On machines over 2 years old where there is no particular evidence of damage or deterioration an assessment will still be required to ensure that the polycarbonate/guard will continue to retain sufficient impact resistance for the machine application(s).

RISK ASSESSMENT

8 The subject of the assessment are those vision panels and sections of guards which are intended to contain parts which may be ejected from the machine, ie normally in the vicinity of the chuck. However, it is important that all vision panels are properly maintained to enable a clear view of the work zone, as it is known that interlocked guards are defeated and opened during machining because operators have difficulty seeing through the panel.

9 Inspectors should note that vision panels are not designed to contain ejections in all circumstances. The strength of the panel on new machines is determined on the basis of retaining a chuck jaw being ejected at the maximum RPM of the machine (based on a range of chuck diameters). The panel is not necessarily designed to contain all workpieces or to compensate for very poor working practices.

10 The control measures provided should be in proportion to the risk. The cost of replacing

vision panels or upgrading can be significant, when a fully laminated vision panel is to be fitted. Upgrading vision panels to the fully laminated type is not necessarily required and alternative methods can be adopted, eg additional mechanical protection in the form of steel bars, grids or sheet material. The costs of upgrading should not be incurred unnecessarily and there are circumstances when the user could establish that no further action is required to control the risk (see [EIS 33](#)  for further details). Existing design constraints may reduce the choice of remedial action that can be taken.

11 The actual risk associated with ejection hazards will depend entirely on the particular application the machine (see OC 228/10 and EIS 33 for further details). Users will need to identify situations where an ejection is 'reasonably foreseeable' and EIS 33 should enable users to make the necessary judgements when estimating risk and deciding on the effectiveness of the existing control measures.

12 The assessment should also consider the steps that can be taken to minimise the likelihood of ejection in the first place. These occur for a variety of reasons. The competence of machine setters/operators and persons producing component programmes are critical factors in preventing ejections. Any non-standard work holding arrangements need to be carefully considered. Close attention to the proper use and maintenance of work holding devices is also important.

13 The machine manufacturer or supplier should be able to provide further information on technical specifications for the machine and give advice on appropriate modifications. The manufacturers advice should always be sought where equipment is still within any warranty period.

ACTION BY INSPECTORS

14 At all routine visits to engineering premises where CNC turning machine are in service and during investigations of failures of vision panels, inspectors should make enquiries about the integrity of the vision panels/guards fitted to these machines. Users should be able to confirm the suitability and effectiveness of the guards to contain ejected parts following a suitable and sufficient risk assessment. Inspectors should follow the enforcement guidance summarised below where an assessment has not been carried out or conditions are otherwise unsatisfactory. Model improvement notices and suggested wording for letters are given at [Appendices 1](#) and [2](#).

15 Inspectors are asked to bear in mind that this project is part of a national project. Failure to consistently require improvements for example through appropriate enforcement action, may have a negative impact upon users attitudes. Machine suppliers will also be aware that this initiative will be taking place. This should be considered as a strategic factor for the purposes of the Enforcement Management Model (EMM).

16 Inspectors are reminded that a SAPID form should be completed where there is reason to suspect that the machine was not provided with a suitable guard in the first place (OM 2001/111 and the HSE *Guide to the inspection and manufacture of supply* [Chapter 6](#), refer).

RISK CONTROL INDICATORS AND REPORTING


17 Risk control indicators for this project are:

- (1) employees working at CNC turning machines are protected against risks from

ejection by the provision of suitable engineering control measures;


(2) the dutyholder has undertaken a suitable and sufficient assessment of the risk from ejection and has identified appropriate risk control measures; and

(3) the dutyholder has identified the arrangements needed to maintain the control measures and meet the requirements of the Provision and Use of Work Equipment Regulations 1998 (PUWER) reg.5, and has implemented them.

18 [Appendix 3](#)  (8Kb) is a visit report form for completion and return to the Engineering Sector in Birmingham.

ENFORCEMENT GUIDANCE

19 The following is a guide to when enforcement action may be appropriate. It is based on EMM version 2 and applies to situations where there is a risk of injury from ejected parts not being contained by vision panels at CNC turning machines. Any action should reflect any subsequent changes to the EMM. The final decision on enforcement action should also take account of local factors and of any strategic factors such as outlined at [para 15](#).

20 Depending upon the nature of the work being undertaken, there is a 'remote' risk of 'serious personal injury' from ejected parts not being contained by vision panels which have been degraded by metalworking fluids, or are cracked or otherwise damaged, or are of unsuitable construction (see OC 228/10 paras 12 and 13 and [EIS 33](#)  for further information).

21 The EMM benchmark is 'nil/negligible' and the risk gap 'substantial' in relation to the failure of a vision panel where appropriate workshop practices are being adopted for turning operations. The engineering control measures prescribed are not intended to compensate for very poor practices. Where such practices have been identified, eg during inspection or following an accident investigation, Inspectors should seek improvements in both training and supervision.

22 Appropriate standards of engineering control can be achieved by employers carrying out a risk assessment of those machines already in service and ensuring that vision panels/guards which are intended to contain ejections are of adequate strength and properly secured and maintained. For non-CE-marked machines the standards are 'defined' within PUWER reg.12 which require engineering means to control the risk and similarly CE-marked machine should satisfy the essential health and safety requirement (EHSR) 1.3.3 of annex 3 to the Supply of Machinery (Safety) Regulations 1992 (as amended).

23 The following are relevant to deriving the authority of standards for use in table 5.1 of EMM and hence for deciding the initial enforcement expectation.

Initial enforcement expectation (IEE)

Title:	Authority:
Provision and Use of Work Equipment Regulations 1998, reg.12 and/or reg.5 (see para 22 above) and ACoP (L22)	Defined
Management of Health and Safety at Work Regulations 1999 and ACoP (L21)	Defined
HSE Information Sheet EIS 33 <i>CNC turning machines: Controlling risks from</i>	Established

*ejected parts*HSG 129 *Health and Safety in Engineering Workshops* EstablishedOC 228/10 *CNC Turning Machines - Vision Panels - Degrading of Polycarbonate* EstablishedSIM 3/2002/19 *CNC turning machines - controlling risks from ejected parts* Established

24 The EMM considers risk assessment as an administrative measure. The standard for risk assessment is a defined standard in the Management of Health and Safety at Work Regulations 1999. Any absence, or inadequacies with an assessment should be considered using table 5.2 of the EMM.

25 Specialist support for the notice is unlikely to be required unless an appeal is made. Inspectors requiring assistance or wishing to enforce, eg in cases of particularly poor maintenance, should request specialist group support in the usual way.

Date first issued: 28 March 2002

APPENDIX 1
(para 14)

MODEL IMPROVEMENT NOTICES

IMPROVEMENT NOTICE 1

For use in relation to no risk assessment having been carried out

you as an employer, are contravening/have contravened in circumstances that make it likely that the contravention will continue or be repeated, the following statutory provisions:

The Management of Health and Safety at Work Regulations 1999 - Regulation 3

The reasons for my said opinion are:

You have not carried out a suitable and sufficient assessment of the risks to employees whilst using the (specify machine) turning machine to identify the measures that you need to take to comply with the Provision and Use of Work Equipment Regulations 1998.

SCHEDULE

In order to comply with this Improvement Notice you shall ensure that the following measures are taken:

1 Carry out a suitable and sufficient assessment of the risks and establish the control measures required to prevent foreseeable injury to employees from parts being ejected from the CNC turning machine(s).

NOTES (attached to but not forming part of this notice)

Further information relevant to this Notice is contained in the HSE publication - HSE

Information sheet *EIS 33 CNC turning machines: Controlling risks from ejected parts* (copy enclosed).

IMPROVEMENT NOTICE 2

For use in relation to machines where there is evidence that the guard and/or vision panel has not been properly maintained eg the vision panel is severely scratched and/or discoloured (yellowing) or cracked following previous impacts from ejected parts.

Note: in cases of doubt about the condition of the vision panel a notice requiring an assessment could be issued. It is recommended that the date of manufacture of the machine is obtained together with a photograph of the vision panel/guard as evidence in the event of an appeal.

you as an employer, are contravening/have contravened in circumstances that make it likely that the contravention will continue or be repeated, the following statutory provisions:

The Provision and Use of Work Equipment Regulations 1998 Regulation 5

The reasons for my said opinion are:

The safeguarding arrangements provided to control the risks to employees from the ejection of parts at the (specify machine) turning machine are not properly maintained and there is a foreseeable risk of injury due to failure of the guard to contain parts ejected from the machine.

SCHEDULE

In order to comply with this Improvement Notice you shall ensure that the following measures are taken:

2 Replace, repair or otherwise modify those parts of the guard and/or vision panel such that they will contain parts which may be foreseeably ejected from the machine and:

3 Identify the steps that you need to take to maintain the safeguards such that they will continue to perform their safety function effectively.

OR ALTERNATIVELY

4 You shall take any other measures which are equally effective in achieving compliance with this legislation.

NOTES (attached to but not forming part of this notice)

Further information relevant to this Notice is contained in the HSE publication HSE information sheet *EIS 33 CNC turning machines: Controlling risks from ejected parts* (copy enclosed).

APPENDIX 2
(para 14)

SUGGESTED STANDARD PARAGRAPH FOR LETTERS

CNC turning machines - controlling risk from ejected parts

There is a risk of serious or fatal injury if operators are struck by parts ejected from turning machines. It is essential that the guards, intended to contain ejections, are properly designed constructed and maintained. Some materials used in the construction of the vision panel, eg polycarbonate, which forms part of the guard, are subject to significant reductions in impact resistance because of the degrading effects of metalworking fluids and lubricants. Further detailed information on this matter is contained in the HSE information sheet EIS 33 CNC turning machines - Controlling risks from ejected parts.

Because of the age of the turning machine(s) in use you should carry out an assessment to ensure that the existing guards/vision panel(s) are capable of containing parts that may foreseeably be ejected from the machine(s). A guide to performing the assessment is given in EIS 33. Further information on the materials used in the construction of the guard and other technical specifications should be available from the machine manufacturer or supplier. It is strongly recommended that replacement materials (particularly polycarbonate) are obtained from suppliers who specialise in provided materials for guarding applications.

It is also important that the guards/vision panel(s) are maintained so that they will continue to perform their safety functions effectively. The risk assessment should establish what periodic maintenance needs to be carried out.

(insert as appropriate)

An Improvement Notice is enclosed which requires you to carry out a suitable and sufficient assessment from risks due to ejected parts at your CNC turning machines.....

APPENDIX 3

[proforma for printing](#)  (8Kb)

RISK CONTROL INDICATORS AND REPORTING

Employer/Client No

Address/Location

(1) Risk Control Indicators for this project are:

1) employees working at CNC turning machines are protected against risks from ejection by the provision of suitable engineering control measures	1	2	3	4
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2) the dutyholder has undertaken a suitable and sufficient assessment of the risk from ejection and has identified appropriate risk control measures.	1	2	3	4
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3) the dutyholder has identified the arrangements needed to maintain

the control measures and meet the requirements of PUWER reg.5, and has implemented them. 1 2 3 4

Assessment scale:

- 1) Full compliance
- 2) Broad compliance
- 3) Some compliance
- 4) Limited or no compliance

YES NO

(2) Was the user aware of HSE guidance EIS 33 before the visit?

(3) Number of CNC turning machines in use

Any other comments: (eg users experience of previous ejection incidents, machine types/makes with particularly poor design of guard/vision panel).

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Name:
 Office/Group:
 Date of visit:

Please return completed proformas to the Engineering Sector in Birmingham



APPENDIX 3
(para 18)

RISK CONTROL INDICATORS AND REPORTING

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1	2	3	4
---	---	---	---

3) the dutyholder has identified the arrangements needed to maintain the control measures and meet the requirements of PUWER reg.5, and has implemented them.

1	2	3	4
---	---	---	---

Assessment scale:

- 1) Full compliance
- 2) Broad compliance
- 3) Some compliance
- 4) Limited or no compliance

(2) Was the user aware of HSE guidance EIS 33 before the visit?

YES	NO
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(3) Number of CNC turning machines in use

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Any other comments: (eg users experience of previous ejection incidents, machine types/makes with particularly poor design of guard/vision panel).

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Name:
Office/Group:
Date of visit:

Please return completed proformas to the Engineering Sector in Birmingham