

Power presses: maintenance and thorough examination



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Power presses are dangerous machines and have caused many accidents over the years. If you use or are involved in the installation of power presses, this book will show you how to meet your duties under the Provision and Use of Work Equipment Regulations (PUWER), and explains what is required for thorough examination and testing of power presses. This book is divided into two parts: Part 1 deals with good practice in the maintenance of power presses, and Part 2 is aimed at the competent person. Following this guidance will help you prevent accidents and avoid breakdowns.

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This guidance is issued by the Health and Safety Executive. Following the guidance is not compulsory 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 as illustrating good practice.

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Introduction

1 This guidance is intended to assist users of power presses* and people involved in the installation and maintenance of power presses to meet their duties under the Provision and Use of Work Equipment Regulations (PUWER). It also provides information on the requirements for thorough examination and testing of power presses.

*A power press is defined in PUWER as 'a press or press brake for the working of metal by means of tools, or for die proving, which is power driven and which embodies a flywheel and clutch'.

Part IV of PUWER 98, which applies only to power presses, requires that the press and its safety devices are subject to periodic thorough examination and an inspection and test every time the press is used or after tool setting or adjustment. There are some exceptions to these requirements - see Appendix 7.

2 Power presses are dangerous machines and they have caused many accidents over the years. The injuries are serious, often resulting in amputations of fingers or hands. The causes include poor maintenance of the press, its safeguards and the control system. Following this guidance will help you prevent accidents and avoid breakdowns. There are therefore commercial as well as safety benefits – if a press is out of use unexpectedly for any length of time it can be very costly.

3 This guidance is in two parts. **Part 1** covers good practice in the maintenance of power presses and tells you:

- what you need to do to maintain your power presses and safety-related systems as required by the Provision and Use of Work Equipment Regulations;
- how you can improve your maintenance by encouraging the person appointed to do the daily inspections and tests (the appointed person) and the press operator to report defects;
- what the 'thorough examination' is for and what it will tell you about your presses;
- about the relationship between maintenance and thorough examination (you will only get the full benefit from the thorough examination – and comply with the law – if you have proper maintenance systems).

4 The guidance includes examples of checklists in Appendices 1, 2 and 3 to help you plan and record maintenance activities.

5 **Part 2** is aimed at the competent person. It gives detailed guidance on the thorough examination and testing of power presses and mechanical press brakes. It updates and replaces the guidance in *Power presses: Thorough examination and testing* (PM79) which represented well-established good practice, and includes additional information on the electrical aspects of control systems.

Part 1. Power presses: Maintenance

Your duties as an employer under PUWER 98

6 You must ensure that:

- your power presses, all their guards, the control systems and ancillary equipment (for example automatic feed systems) are maintained so that they do not put people at risk;
- maintenance work on power presses is carried out safely, ie machinery is shut down and isolated, and is done by people who have the right skills and knowledge (see paragraph 32);
- training is provided for the 'appointed person' to help them fulfil their role (see paragraphs 9-12);
- adequate health and safety information and written instructions (where appropriate) are made available to everyone who uses, supervises or manages power presses;
- any existing maintenance log* is kept up to date; and
- your presses and safety devices are thoroughly examined by a competent person at the required intervals (see Part 2).

* It is strongly recommended that you keep a log of the maintenance activities performed at a power press. The maintenance log provides you, the enforcing authority, your insurance company, inspecting organisations and engineers with evidence that the power press has been properly maintained. By keeping it up to date, it will demonstrate that inspections and tests have been carried out and that any modifications to safety-related circuits have been properly implemented.

7 If you have maintenance work done by outside contractors it is important to make sure that they are competent to carry out this work (see the section 'Selecting and managing maintenance contractors', paragraphs 32-34).

Role of the press-shop manager/supervisor

8 Press shop managers and supervisors need to be properly trained and have arrangements in place to:

- know what maintenance work is required and make sure it is carried out, ie have a system for monitoring the condition of presses and receiving and acting on reports of defects;
- know what is expected of the appointed person and make sure they have the time and resources to carry out the daily inspections and tests;
- know what is expected of the competent person (see paragraph 15) and make sure the thorough examinations are carried out on time;
- be able to choose contractors who are competent to work on presses if maintenance work is put out to contract.

Role of the appointed person

9 The appointed person is someone designated by the employer (under regulation 7 of PUWER 98) to inspect and test the guards and safety devices on each press:

- every day they are in use (within the first four hours of each working period); and
- after setting, resetting or adjustment of the tools.

10 The appointed person has to be adequately trained to do the work on each type of power press, and be competent to do so.

11 The appointed person could also perform the following activities:

- monitor the condition of presses and gather information by asking press operators about the way the press is performing, and reporting anything unusual; and
- carry out routine minor maintenance tasks, after suitable training. They should know what they can deal with themselves and what needs reporting as a defect to be dealt with by someone else. The example maintenance checklist in Appendix 3 lists some of the daily and weekly maintenance tasks which could be done, for example checking lubrication.

12 If you are to involve your appointed person in maintenance tasks you will need to make sure they are competent to carry them out. They may have existing skills from previous employment, but you will need to assess them, for example by arranging for skilled maintenance staff to observe them carrying out set tasks under supervision.

Involving employees and acting on their comments

13 Employees need to have adequate health and safety information available to them and, where appropriate, written instructions about the use of the press. They also need to have adequate health and safety training so that they are able to understand:

- how the press operates, and the hazards;
- what safety devices are fitted to the press and where they are, how they work and what effect they have on the press; and
- any maintenance task falling to them (for example daily lubrication).

14 They need to know who to report any problems to, for example if the press seems to be operating in an unusual way, and to be told if they can continue to use the machine or not.

Role of the competent person

15 The competent person is someone the employer has selected to carry out the thorough examination and test of the power press, its guard(s) or protection device(s). They are usually employed by specialist inspection organisations and need sufficient practical or theoretical knowledge and experience to detect defects or weaknesses and decide how far these will affect the safe operation of the press. It is also important that they are sufficiently independent and impartial to be able to make an objective assessment of the press. When selecting a competent person, you need to check that they understand what is meant by a thorough examination and what the law requires. Accreditation by the United Kingdom Accreditation Service (UKAS) to the relevant standard (BS EN 45004:1995)¹ is an indication of the level of competence of an inspection body (see 'Useful information'). See also Part 2 of this guidance for details of what the thorough examination and test involves.

Acquiring new power presses: Starting off on the right foot

16 Your health and safety policy should take the purchasing of work equipment into account. Some time spent checking the safety standards on a press that you intend to purchase can save time and money when putting it into service. Suppliers of new or second-hand machinery have a duty to supply a machine that is safe, but users also have a duty to select suitable and safe equipment. See *Buying new machinery*² if you are thinking of buying a new press.

17 When you buy a new or reconditioned/second-hand press it is important to check that there is a manual, what maintenance is needed and what the maintenance intervals are. Ask for maintenance records before you buy. Make sure that the electrical, mechanical, hydraulic and pneumatic circuit diagrams are provided as part of the purchasing agreement. If you are buying a second-hand press, it is advisable to check that these diagrams are up to date. Your maintenance engineer, contractor or competent person may be able to do a visual check for you. You can also get the press stripped down with the competent person observing before you commit yourself. You will then be able to predict the cost of any remedial work needed in order to use the press safely.

18 If you buy a press fitted with electro-sensitive protective equipment (ESPE), such as a light curtain, make sure the device is made to the right standard and that it is correctly installed on the press so that it works properly. The standards which currently apply to these devices are BS EN 61496-1:1998 and BS IEC 61496-2:1997 *Safety of machinery - Electro-sensitive protective equipment*.³ The device should be installed according to the guidance in *Application of electro-sensitive protective equipment using light curtains and light beam devices to machinery* (HSG180).⁴



Power press fitted with a light curtain

19 If you buy an older press (made before about 1995) the photoelectric device may have been made to an earlier standard (BS 6491:1984) and installed according to earlier HSE guidance (PM41 instead of HSG180). There is no need to modify the press and photoelectric device to conform with HSG180 unless the risk assessment at the press indicates otherwise. You can get advice about presses with old photoelectric guards from your competent person.

20 If you are thinking about fitting a new guard to an existing press, for example a new photoelectric guard, **remember** it must be thoroughly examined on the press to which it is fitted before the press is brought into use. Discuss plans for fitting new guards with your competent person – it can save mistakes being made which are expensive to put right.

Managing maintenance

21 The law requires that work equipment, which includes presses, is maintained in an efficient state, in efficient working order and in good repair, so far as health and safety is concerned. Your arrangements for maintenance should be adequate to meet this requirement.

Remember that the thorough examination is not a substitute for maintenance.

What to maintain

22 Target your maintenance at those parts of the power press that could cause danger or increase risks to health or safety if they failed or deteriorated (for example brakes, clutches, guards, safety-related parts of the control system – see Appendix 3). Where the condition of safety-related parts cannot be readily established by visual or functional checks, some additional testing may also be necessary periodically, for example to determine the effectiveness of protective bonding of electrical equipment or the integrity of electrical insulation.

23 **Preventive maintenance** is needed to identify potential failures **before** employees are put at risk – replace worn or defective parts and/or make any necessary adjustments at set intervals to ensure that the press will continue to work safely. If you also have to do breakdown maintenance, make sure you record what went wrong and why, then use this information in your planned maintenance system.

When to maintain

24 The machine manufacturer will have set down maintenance intervals for the press in the user manual or other documentation. These will vary according to the press design and the way the press is used. You can get further information about intervals for maintenance and what parts of the press need to be examined by:

- looking at your own experience of the way the press behaves, for example based on maintenance records, thorough examination reports and information obtained from employees;
- taking into account the usage and other service conditions, for example three shifts a day, single cycle, heavy-duty or infrequent use for short periods; and
- discussing the frequency of your maintenance programme with your competent person or your maintenance contractor.

25 Parts of the press and control system which are essential to safety at the tools need more frequent maintenance than other parts, especially where danger can result from a single component failure. Modifying the safety system can reduce the level of maintenance required. Appendix 5: 'Press design and maintenance intervals' explains how making changes to the safety system on the press can result in maintenance checks being done less often.



Flywheels need to be removed periodically

26 Maintenance activities can be broken down into daily, weekly, monthly and six-monthly checks, with some activities (for instance removing the flywheel) at intervals of two years or more. For example, electro-sensitive protective equipment (ESPE), such as light curtains, should be functionally checked on a daily basis as part of the inspection and test, but more rigorous checks to verify its safety performance should be carried out at six-monthly intervals. The checklist in Appendix 3 gives examples of parts which need checking and the likely frequency. It can be used to help you draw up your own checklists for periodic maintenance. To make sure the results of these checks are actioned, a responsible person should sign off the checklists when the repairs have been completed.

27 Simple daily checks – which may just be visual – are important and effective. There are also functional tests, to find out whether safety devices are working in the way they should. Other checks may involve removing covers and partial dismantling of parts of the press. The safety-related circuits associated with interlocks, guards and protective systems need to be included in the scheme of maintenance. This can include simple visual checks but also the use of instruments to check that parts of the system are working properly.

28 Some presses are designed so that it is easy to carry out the functional checks but this is not always the case. Maintenance and the thorough examination and test can be made simpler and quicker if features are provided which allow these tests to be done by pressing a control, rather than dismantling the parts (see, for example, paragraph 87).

29 The appointed person has to carry out a number of checks as part of the inspection and test of the press each working period it is used (see *Procedures for daily inspection and testing of mechanical power presses and press brakes*⁹). This could include some simple, but very important, visual checks on the electrical system – crushed cables to foot-pedals may lead to the press operating when the guard is open. You could record information gathered during these checks and use it as part of the maintenance system.



Ensure that maintenance work is carried out safely

Any activity carried out during maintenance checks on electrical equipment should, wherever practicable, be done with the electrical supply isolated. In exceptional circumstances, where it is necessary to remove covers, panels and open doors that may expose live parts operating at dangerous voltages, measures such as temporary shrouding, use of insulated tools and protective clothing should be used to minimise the risk of electric shock or burn. See *Electricity at work – safe working practices*⁹ for further advice on appropriate measures and safe systems of work that may be employed.

Carrying out repairs and maintenance

30 When safety-critical parts need replacing, make sure the replacement parts are made to the original specification or, better, by the press manufacturer or a reputable company dealing with press repairs and overhauls. For example, getting the right clutch key made to the right specification is crucial – clutch key failure will cause damage to the press and serious injury to the operator. It is very unlikely that weld repairs to hardened parts such as keys and drive rings will be effective and these should therefore be avoided. It is likely that any such repairs detected at the thorough examination will result in the part being rejected as unserviceable.



Safety critical parts such as clutch keys should not be welded

31 It is important to ensure that the press is reassembled correctly and in accordance with the manufacturer's specification, such as ensuring that bolts are tightened to the correct torque and retained in the correct manner, for example using locking washers, loctite or pins. Accidents have occurred where internal bolts have worked loose or failed due to incorrect installation causing an unintended stroke.

Selecting and managing maintenance contractors

32 You may have all the facilities to carry out your own maintenance. However, if you intend to contract this work out you need to ensure that the contractors you use are suitable. See *Use of contractors: A joint responsibility*⁷ which provides general information about what contractors should know and do.

33 To make sure any contractors you use are competent to work on presses you will need to ask some questions such as:

- their experience – have they worked on presses before, and what type?
- are they familiar with your type of press?
- do they have the necessary technical knowledge and skills that are required in order to properly maintain the electrical, electronic, mechanical, hydraulic and pneumatic parts of the safety-related control circuits at your type of press?
- are they familiar with the statutory requirements, standards and published guidance on the safe use of power presses, in particular with Part 2 of this publication and *Safe use of power presses. Provision and Use of Work Equipment Regulations 1998 as applied to power presses. Approved Code of Practice and guidance*?⁸
- who else have they worked for?
- can they send you a completed specimen of their report after carrying out maintenance or repair work? (See the example in Appendix 2 of the sort of detail they ought to be able to give you.);
- what steps do they take to ensure that measurement and test equipment is properly calibrated?
- what arrangements do they have for monitoring the standard of their own work?

34 You could ask your competent person or trade association for possible contacts of suitable contractors.

Making best use of the competent person's visit and report

Purpose of the thorough examination and test

35 The purpose of the thorough examination and test is to determine if, at the time of the thorough examination, the press and its safeguards are installed safely and are safe to operate and if there are any defects that could make the press unsafe in the future. It cannot tell you everything about the press, and there may be things that happen between examinations that you need to do something about. **The thorough examination is not a substitute for maintenance but the information from the thorough examination can help you check your maintenance systems are working properly.**

Liaising with the competent person

36 It is your duty as an employer to make sure the thorough examination is carried out at the right time, so you will need to make sure your competent person has made arrangements to visit.

37 Make best use of the competent person's visit and their time by agreeing beforehand:

- who is going to meet them;
- in what order they are going to look at the presses;
- what specialist support they will need from you (someone to isolate the press, open up parts of the press); and
- whether you need to get in experts from outside to do any of this work.

38 After the thorough examination has been completed, a report will be sent to you containing the legally required information. If there are defects that need to be repaired urgently, for example before the press is used again, you will be notified of these at the visit. It will be helpful if, at the time of the visit, the competent person can explain to someone with responsibility for press maintenance what defects have been identified and the action needed to correct them. In some cases it may be beneficial to have maintenance personnel present when the examination is being carried out, for example at the initial examination of a newly acquired press.

39 **Remember**, the better you plan the competent person's visit, the more information you will get out of it and the quicker it will be.

Information the competent person will need

40 To help the competent person carry out the thorough examination, provide wherever possible:

- the manufacturer's information including adjustment details and up-to-date drawings for electrical, electronic, mechanical, hydraulic and pneumatic circuits and systems (as appropriate). Details of the electrical control circuits are more important for presses with electrically interlocked guards;
- the maintenance record, which may also include checklists, indicating the maintenance activities;
- breakdown record;
- machine usage (single shift, continuous use, infrequent use);
- details of any modifications.

41 For older presses some of this information may not be available. It is sometimes possible to obtain manuals for old presses through the firm supplying parts for them, press maintenance firms or the competent person. Build up the above information gradually. If you have this information and if you carry out electrical tests and keep records of them, the competent person may not need to repeat them - see paragraphs 70 and 73.

Things the competent person will ask you to do

42 Make the machine available – if necessary clear a safe working area around the machine and isolate it.

43 Where required, dismantle normally enclosed safety-critical components such as the key, clutch, or brake unit, and prepare them for thorough examination, and have covers removed from electrical and electromechanical components (switches, relays, fuse boxes) if these are part of the safety systems on the press. Care should be taken when dismantling and reassembling safety-critical components so that defects do not occur that may effect the subsequent safety performance of the power press. Also, where covers and/or panels are removed exposing electrical components energised at dangerous voltages, measures (for example temporary shrouding) should be taken to prevent electric-shock hazards occurring.

44 Where necessary, provide assistance so that guards/enclosures and covers can be removed safely to allow the thorough examination to be carried out – for activities such as flywheel removal, or examination and testing of electrical parts you may need to arrange for your maintenance contractor to do this. **If the competent person cannot gain access to parts that need to be seen and examined it may not be possible to complete the thorough examination and you will not get a statutory report. Without a current statutory report you cannot legally use the press.**

45 Re-energise and run the machine to perform a functional test.

46 Make any immediate or time-dependent repairs and adjustments, as required, and sign the associated immediate or time-dependent defect reports.

How to use the competent person's report in your maintenance system

47 The competent person has to provide a report of the examination containing the information specified in the Regulations (see Appendix 6).

48 Keep these reports and act on any advice and/or recommendations.

49 Record how the advice and/or recommendations were implemented at the power press.

50 Review your systems to incorporate the defects, recommendations or advice into your planned maintenance programme.

Remember: The competent person's thorough examination and report is not a substitute for instituting and implementing an in-house maintenance regime.

Keeping records

51 Encourage the operator and appointed person to tell you about problems with the press, for example odd behaviour or noises, and investigate these. Keep a record on the press of minor work done by the appointed person after routine inspection, for example tightening of bolts. This can be checked by the competent person or maintenance engineer who may use it to identify deeper problems, such as wear. Get expert help if you need it. Record what was wrong and what you did about it.

52 Keep records of every service, maintenance and repair, including repair after breakdown.

53 Make sure the maintenance staff including contractors tell you in enough detail what they have done (see examples in Appendix 2).

54 Keep records of any modifications that are carried out, especially those affecting safety-related control circuits.

55 Make sure diagrams, manuals etc are updated after modification work has been completed. This information is necessary for the competent person to use during the thorough examination of the press – **where it is not available or it is out of date, the competent person may not be able to proceed with the thorough examination.**

Recording your contractors' work

56 If contractors carry out tests for you they should give you a record of these, with enough information for other people, for example the competent person, to see that they have been done satisfactorily. Make sure they give you the information indicated in paragraphs 52-55. Copies of purchase orders and invoices may give the details you need. This information should also be included in your maintenance log.

Keeping a maintenance log

57 The maintenance log should contain the following information:

- details of machine make, type, serial number etc;
- copies of the statutory reports;
- record of all routine maintenance work carried out on the machine and its control circuits, including date and details of parts replaced;
- details of repairs following breakdowns;
- details of modifications, together with the date the work was carried out and, where necessary, amended drawings and letters (if appropriate) of approval from the machine manufacturer that the work is acceptable; and
- results of any tests carried out.

Part 2. Power presses: Thorough examination and test

Introduction

58 This part gives guidance on the thorough examination and testing of power presses and mechanical press brakes. It supplements guidance given in *Safe use of power presses: Provision and Use of Work equipment Regulations 1998 as applied to Power presses: Approved Code of Practice and guidance*⁸ in respect of regulation 32.

59 The guidance does not cover all parts on a press that need to be looked at during a thorough examination, nor is it intended to relieve those doing examinations of their statutory responsibilities. Where recommended intervals for examination of parts are quoted, these should not restrict the competent person in deciding if a press is safe to use until the next examination.

60 The design and construction of most power presses mean that some safety-critical components and safety devices are enclosed and are not normally accessible. However, these parts need to be dismantled and examined from time to time to determine their condition and ensure the continued safe use of the press. Recommendations are provided in this guidance for intervals between the examination of such components.

Legal commentary

61 The requirements in part IV of PUWER 98 apply to power presses that are wholly or partly used to work metal. They do not apply when a press is used to work non-metals, hot metals or metal powders. There is also a list in Appendix 7 of the types of press to which part IV does not apply. For other 'presses' that present similar risks but do not fall within the strict definition of a power press, for example hydraulic presses, regulation 6 of PUWER may apply where both an initial and periodic inspection of the machine may be required – see *Safe use of work equipment. Provision and Use of Work Equipment Regulations 1998. Approved Code of Practice and guidance*.⁹

62 Regulation 32 requires a thorough examination by a competent person in three cases:

- an initial examination of a new press and/or safety device(s). This includes second-hand or existing presses that have been moved and reassembled at a new site or new location in the same premises. Closed tools that act as a 'fixed guard' also require an initial examination;
- the periodic examination (see paragraph 71); and
- when exceptional circumstances have occurred which are likely to jeopardise the safety of the press, its guards or protection device(s) (see Appendix 8).

63 Regulation 34 requires the competent person to make a written report of every thorough examination and test to the user as soon as is practicable (see Appendix 6). The competent person must notify the employer straightaway if there are defects in the press, its guard or protection device which could become a danger to people, and send a copy of the report to the relevant enforcing authority.

64 Regulation 35 requires the reports to be kept available for inspection by the enforcing authority for two years. However, if information relevant to the thorough examination is over two years old (for example, confirmation of dismantling of a friction clutch/brake) it will need to be retained to enable the competent person to decide when the next dismantling will be necessary. Part 1 of this guidance suggests keeping the reports and using them to build up a history of press condition and remedial work as part of a maintenance system.

Organising the thorough examination

65 Careful organisation, which includes giving adequate notice to the power press user, is needed to ensure that the thorough examination can be carried out on time. Presses have to be released from production for examination. A report of thorough examination and test must cover all those parts of a press that, in the opinion of the competent person, need to be seen. In making a decision about this, the competent person will need to be given adequate information on the maintenance history, service conditions and usage of the press. Details of the kind of information needed are given in paragraphs 40-41. Where the competent person decides that non-invasive thorough examination techniques are insufficient, some dismantling of parts may be needed beforehand.

66 The thorough examination report should not be used to record parts of the power press which are not seen, and therefore to be regarded as outside the thorough examination, for example because the user has not had the opportunity to make the parts accessible. If the user has not made parts sufficiently accessible, the thorough examination cannot be completed and the statutory report should not be made.

67 It is recommended that where complete or partial removal of the flywheel, or dismantling of the clutch or brakes, is considered necessary at the next thorough examination, reference is made to this by the competent person in the statutory report. If a number of power presses are to be examined at one site, it is clearly helpful to develop an organised scheme of work to ensure that the dismantling requirements are staggered so that a proportion of presses are seen in the dismantled state at each visit. Examination of a line of transfer presses where dismantling is required should ideally be arranged during a shutdown period. It will be necessary to allow for the fact that further dismantling may be required, if the initial external examination suggests a possible defect.

Initial thorough examination of a power press

68 At this examination, the competent person needs to establish that the press has been installed correctly and would be safe to operate. To do this the competent person will need to see the manufacturer's instructions and evidence that they have been followed. The competent person will need to be satisfied that any guards fitted to the press are properly installed and effective. If the press is fitted with an ESPE, such as a light curtain, the competent person will need to see evidence that the ESPE is suitable and that it has been installed so that it works correctly. If this information is not available, the competent person will ask the employer to obtain it. This may involve having tests carried out and detailed checks made on the way the press and ESPE have been wired. The competent person may also carry out functional checks to ensure the safety devices are working, as well as electrical tests (see paragraphs 103-107).

69 At this initial examination an insulation resistance (IR) test should be performed by measuring the insulation resistance at a minimum of twice the rated voltage between the power circuit conductors and the protective bonding circuit. Precautions may be necessary to avoid damage to electronic devices while performing this IR test. The IR test should subsequently be performed at a frequency dependent upon the results of the thorough examination and when changes occur in the duty cycle or operating environment of the power press.

70 The first thorough examination after installation (or at a new installation or location for second-hand/existing machinery) should comprise all of the tests described in this document that are relevant to the electrical control circuits of the power press. The results of these tests should be recorded, as this will enable judgements to be made in future as to the integrity and functional safety of the electrical control circuits. If all of this information is not available, the competent person may ask the employer to obtain it. This may involve having tests carried out by a specialist sub-contractor, for example to perform detailed checks on the way the press and safety devices have been interconnected, measurement of insulation resistance etc. Whoever carries out these tests must be competent to do so (see paragraphs 32-33).

Periodic thorough examination of a power press

71 The periodic examination of a power press, along with its guards and protection devices, is required at least once in every period of six months or, where the tools are fenced exclusively by means of fixed fencing, every 12 months. The periodic examination is intended to ensure that safe conditions are maintained and that any defect or deterioration is remedied in good time. The competent person can use the information gained during the initial thorough examination and test to focus on the things that are most likely to cause problems.

72 However, the competent persons may be asked to carry out a thorough examination at an existing, used press that has not previously been seen by them or the organisation they work for. At the competent person's first thorough examination of such a press, the flywheel should be completely or partially removed or the clutch dismantled (as appropriate), unless clear verifiable records indicate that this has been done, for example at a recent thorough examination, and that any defects have been rectified. The competent person will need to see records of electrical maintenance and evidence that this has been done in accordance with the manufacturer's instructions (if still available) or another reasonable maintenance regime (see paragraphs 21-34). If this evidence is not available, the competent person may ask the employer to obtain it. This may involve having tests carried out where the competent person considers this necessary following a visual inspection and other relevant functional checks (see paragraph 70).

73 If the press is fitted with an ESPE, such as a light curtain, the competent person will need to see evidence that the ESPE is suitable and that it has been installed so that it works correctly. If this information is not available, the competent person will ask the employer to obtain it. This may involve having tests carried out, and detailed checks on the way the electrical control circuit of the press and ESPE have been interconnected. Further information on this issue is provided in *Application of electro-sensitive protective equipment using light curtains and light beam devices to machinery*.⁴

74 If a new guard is fitted to an existing press, the competent person will need to establish that the guard is suitable for the type of press, that it has been installed correctly and that it is functioning properly. The same sort of information referred to above may also be needed for other types of guard or protective device, for example for interlocked guards.

Power press actuation and control

Positive key clutches

75 On a positive key clutch press, the condition of the clutch key, key spring, extractor components, flywheel journal, flywheel bearing(s) and driving bush will need to be ascertained. From time to time, removal or partial removal of a flywheel will be essential, to verify that potentially dangerous defects such as hairline cracks and undue wear in keys and keyways are not present.



Use appropriate techniques for crack detection



Severely cracked bearing



Poor standards of repair during maintenance

76 The competent person should decide on the frequency at which these parts need to be exposed. However, it is recommended that this should be done at intervals not exceeding two years for power presses used regularly for single-stroke work on one shift per day. The interval may be varied, either to reduce or lengthen the period, depending on:

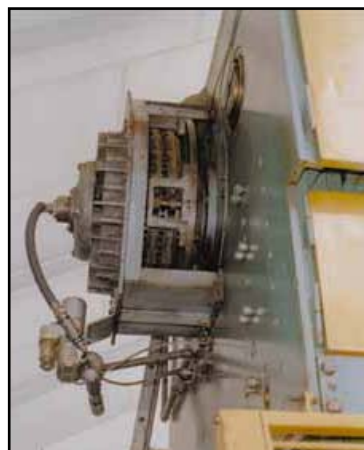
- the number of clutch applications. A machine used for occasional single-stroke or automatic stroke work will result in fewer clutch applications, which may extend the time interval before dismantling is required;
- the manufacturer's service information, and in particular the recommendation, where available, as to the intervals between dismantling of the clutch unit;
- the user's maintenance record (the examination may take into account dismantling carried out by another person on behalf of the user, provided this can be confirmed by documentation);
- the working environment of the press;
- general condition of the press;
- standard of maintenance applied to the press.

77 If a power press is fitted permanently with fixed guards or closed tools, the dismantling requirements will be at the competent person's discretion.

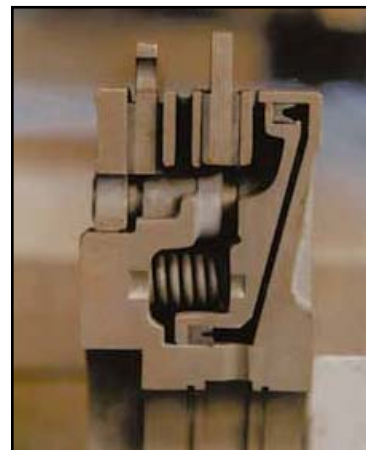
Friction clutch presses

78 Where a dual channel and monitored control system is required, it should be confirmed that it is in place, and allows safe clutch engagement.

79 A close examination should be carried out at every thorough examination after removal of the clutch guards or covers; the clutch should then be dismantled if there is excessive noise, debris, oil, undue wear, sluggishness of movement, dragging or other cause for concern. The design of some clutch and brake units is complex and may require special tools and procedures to dismantle them. In such cases the manufacturer's instructions should be consulted first. Assessment of the function and condition of clutch and brake plates, plate travel, springs and drive teeth should be made where necessary. Similar attention should also be given to the pneumatic and hydraulic hoses, pipework and connections, airline lubricators and filters and hydraulic oil levels at every examination.



Typical friction clutch



Clutch assembly cross section

80 The friction clutch should be dismantled if examination reveals that it is nearing the limit of adjustment, or an excessive number of adjustments has been made since the last dismantling. If the state of adjustment is not clear by visual examination, or by the user's records, the clutch should be dismantled.

81 For a machine used regularly for single-stroke work on one shift per day, the clutch (with the exception of toggle clutches, see paragraph 82) should be dismantled at appropriate intervals depending on:

- the number of clutch applications. A machine used for occasional single-stroke or automatic stroke work will result in fewer clutch applications, which may extend the time interval before dismantling is required;
- the manufacturer's service information, and in particular the recommendation, where available, as to the intervals between dismantling of the clutch unit;
- the user's maintenance record (the examination may take into account dismantling performed by another person on behalf of the user, provided this can be confirmed by documentation);
- the working environment of the press;
- general condition of the press;
- standard of maintenance applied to the press.

82 Clutches operated by toggle linkages present particular problems due to the nature of the design. Wear in these parts produces a gradual progression towards a condition in which the toggles lock into the drive condition. The competent person should ensure that the toggle linkages are visually examined for wear at each thorough examination.

Brakes

83 The thorough examination should include the brake at each examination, since this has important duties both for operation and safety. In particular, the following should be included:

- the condition of the brake, particularly the lining;
- the state of adjustment of the brake;
- interlinking arrangements for friction clutch and brake, including springs;
- overrun prevention/detection arrangements, where provided.



Cracked brake shoe

Dual operated valves

84 Where a dual monitored valve with dual control circuits is used to control the clutch, each circuit should be tested independently to ensure the monitoring of the valve is effective. This can be achieved by using the manual override on the valves or an inbuilt test facility or, where possible, by removing the power to each solenoid in turn, for example by removing the solenoid cap. These tests should be carried out by the competent person as part of the thorough examination.

Interlocking guards

85 The function of an interlocking guard is to prevent clutch engagement from taking place until the guard gate is closed and to maintain gate closure until the power press has come to rest at the normal stopping position. Where an early opening feature is provided on friction clutch presses, the guard can be opened when all dangerous movement has stopped.



Typical interlocked guard

86 It is essential that the clutch scotching arrangement and the guard control/locking device are closely examined and that tests are carried out to ensure, in the case of positive clutch presses, that:

- the fixings used in the interlocking guard assembly, including taper pins, split pins, bolts, set screws and washers, should be suitable for the application, correctly fitted and in a serviceable condition;
- the control disc/cup is securely mounted on the crankshaft;
the size of the notch or slot in the disc/cup allowing the guard to open when the roller enters does not exceed the diameter of the roller plus minimum clearance and that the 'lead out' provided on the disc/cup is in the correct direction; (the clearance between the guard control arm and guard control cup/disc slot should be the minimum compatible with efficient operation of the press. As a general rule the slot should not exceed 1.5 times the diameter of the roller);
- there is no undue wear or damage to the clutch scotch and extractor, the control disc/cup, control roller, control arm or associated linkage of the guard;
- undue movement of the clutch extractor is not possible when the guard gate is open and the taper pins/bolts securing the scotch in position are tight;

- the clutch extractor is prevented from releasing the clutch key into engagement with the flywheel until the guard gate is fully closed and has overlapped the guard apron by at least 10% of the total gate movement;
- the extractor remains scotched until sufficient crankshaft rotation has taken place to permit the guard control roller to engage on the periphery of the guard control disc or cup and the guard gate is positively held closed until the completion of the stroke;
- when the toolsetter's catch is disconnected, the interlocking assembly will fall easily into the 'extractor scotched' position, and will therefore fail to safety in the event of disconnection;
- where the interlocking guard is of the pneumatically operated type, sequential gate closure should be actuated by low pressure and operating with a force that presents no danger, ie less than 150N (BS EN 983¹⁰) – a force of approximately 35lbs or 15.3kg – or the risk should be controlled by other means.



Typical guard control arrangement

87 In the case of electrically controlled friction clutch presses, the cam-operated interlocking limit switches should not be actuated until full guard closure has been achieved. The gate locking/guard control device (whether mechanical or pneumatic), must also keep the guard closed throughout the stroke of the press and, in the event of an overrun, past the normal stopping position. Each switch should be individually tested during the examination.

Electro-sensitive protection systems (ESPS)

88 An ESPS comprises the ESPE (for example a light curtain and its control unit), cams and switches actuated by a crankshaft, solenoid actuated valves and all interconnecting wiring.

89 Where an ESPS has a box fitted with cams and switches actuated by the crankshaft, it will be necessary to open this box to check that:

- switches are physically secure, the cams have been pinned or otherwise secured and their condition is considered satisfactory by visual inspection and touch;
- cams and switches are set at correct positions, by asking for the press to be stroked. While this is done, overrun and the angular displacement of switches should be observed, together with confirmation that electrical switches are operating correctly; and
- the box itself is secured in position.

90 In normal operation, the cam box door is to be kept closed and locked and the key should be removed and retained by an authorised person. The user should be asked to open this box to make the parts available for examination and to lock it again after the examination has been completed.



Open-fronted power press with light curtain

91 Gaps allowing people to stand or reach between the photoelectric guard and danger point should not be permitted.

Measurement of stopping-time performance

92 A mechanical press and press brake fitted with a friction clutch and ESPS depends critically on the overall stopping performance during the dangerous phase of the closing stroke after the ESPE has been actuated. The maximum time within which dangerous motion should cease after insertion of a test piece into a light curtain of a photo-electric guard type of ESPS should be calculated according to *Application of electro-sensitive protective equipment using light curtains and light beam devices to machinery*.⁴



Minimum separation distance must be calculated to allow safe application of light curtain

93 Every thorough examination should include sufficient measurement of the stopping time of the power press to confirm the adequacy of braking performance. All competent persons should use a suitable device, fully calibrated across its measuring range, for accurately measuring the stopping time performance near the midway point of the down stroke. Integral calibrated stopping-time measuring devices are also acceptable.

94 At least ten measurements should be taken, and an average mean stopping-time calculated from the readings. If the stopping time is excessive when the safety distance is taken into account, it should be recorded in the report of thorough examination that a repair or alteration is required. In all cases, the report should confirm the average stopping time actually achieved.

95 Under no circumstances should a judgement on stopping-performance be made solely from a visual examination of the braking arrangements, or by an estimate from a visual examination of the time taken to achieve stopping during a test.

Safety-related circuits

96 On many presses, safety at the tools depends on the integrity of electrical control circuits. Where this is the case, the circuits should be included in the thorough examination and test. The likelihood of a fault occurring and leading to injury at the tools will determine the extent and depth of the examination.

97 Some presses have mechanical guards that rely on the correct operation of electrical limit switches while others have ESPE, such as light curtains. The insulation of electrical conductors can deteriorate over time, or because of exposure to chemicals (oil leaks) or physical damage. Similarly, ageing, physical damage and other service conditions in the workshop can cause components to wear out or fail to operate. Changes to the way the press operates may mean that the press has been rewired, and this may have affected the way the press safety system works. The thorough examination carried out in accordance with regulation 32 should be directed at ensuring safety at the tools of the press.



Cam-actuated electrical limit switch

98 The thorough examination of the electrical control system at a power press should follow the structure set out in Appendix 4. The flow diagrams in Appendix 4 show the interrelationship between the information provided from the power press user's maintenance activities, information for use supplied with the power press (where applicable) and the thorough examination.

99 Basic information, which ideally needs to be available at the start of the thorough examination of the safety-related aspects of the power press electrical control circuit, includes:

- control circuit diagrams, electrical schematic diagrams, drawings etc;
- information on use;
- information relevant to modifications to the control circuit (since the last thorough examination; since the power press was first installed at the premises);
- maintenance records which contain the results of the first and all subsequent tests performed at the power press and its installation.

100 In the case of a simple press it may be possible to carry out the thorough examination without all the above information, in particular the circuit diagram.

101 The thorough examination should include visual and functional checks of:

- start and stop controls – including foot pedal controls;
- emergency stop devices;
- electrical interlocking circuits and devices;
- ESPE – light curtains and light beam devices.

102 The competent person should carry out tests on safety-related circuits based on Appendix 4 or be satisfied that they are being carried out at appropriate intervals and that the results are properly documented. The competent person is required to evaluate these results in order to establish that the integrity of safety-related circuits is maintained and that any deterioration can be detected and remedied in good time. This may involve some re-examination of the power press to ensure that significant deterioration in performance has not occurred.



Modifications should only be done by competent electrical engineers – drawings should be amended where necessary

103 An examination of the external condition of the following parts should be performed and, where necessary, supplemented by appropriate tests (see paragraph 105), to ensure that the safety-related parts of the control circuits are free from contamination by dust, swarf, moisture etc or damage that may inhibit safe operation of the power press:

- machine control panels – an external visual examination to determine whether swarf, moisture etc can enter the panel, causing defects such as short-circuit of devices, preventing operation of control gear etc;
- wiring, conduits, junction boxes, glands etc – an external visual examination to determine the integrity of insulation, seals etc;
- motor and drive assemblies – an external visual examination to establish that the motor and drive assemblies are free from defects (for example damaged bearing, brushgear etc) that may inhibit their operation; to ensure that sufficient lubrication is present; and that cooling is present to prevent hazards arising from overheating of cases, shafts etc;
- protective devices – to ensure that appropriate devices are installed at the press and rated in accordance with the press manufacturer's data;
- lamps, indicators and displays – a visual inspection to ensure that lamps etc are working correctly and that they actually provide their designated information;
- functional test of each safety-related control circuit:
 - from sensor (for example the interlocking switch) through to final actuator (for example the motor drive), to determine that the entire circuit is working satisfactorily;
 - each channel of a dual channel circuit should be tested independently.

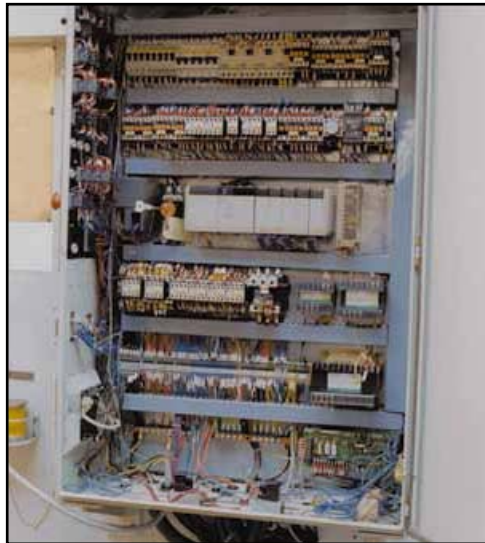
104 These functional tests may be supplemented by visual examination of the condition of solenoids, contactors etc.

105 Additional tests may need to be performed on the electrical installation of the power press to determine the functional integrity of those parts of the control circuit that cannot readily be examined visually, namely:

- continuity test of the protective bonding circuit;
- insulation resistance (IR) test to assess the integrity of electrical insulation (after initial installation or subsequent reinstallation or after modification to internal wiring and/or if the duty cycle and operating environment has changed). See also paragraph 69 for details of this IR test;
- earth loop impedance test of the installation to determine the suitability of any associated protective devices.

106 Throughout the duration of these tests care should be taken to remove or effectively minimise the risk of electric shock or burn by employing protective measures and a safe system of work in accordance with *Electricity at work: safe working practices*.⁶

107 Upon completion of the examination and tests of the electrical control system at a power press the person conducting the examination should ensure that all covers and panels are properly fitted and that any instruments or other devices used during tests have been removed.



Typical electrical control panel on a modern power press

Other requirements: Inspection and test of guards and/or protection devices

108 In addition to the thorough examination, the employer is responsible for implementing an inspection and test procedure by a person appointed to do so as required by regulation 33 of PUWER 98.

109 Competent persons should consider telling their clients if they find that the appointed person's certificate of inspection and test has not been signed:

- within four hours of the start of the working period and the press has been in operation; or
- before use after setting, resetting or adjustment of the tools; or
- the appointed person has signed a certificate where there are clear defects affecting the safe operation of the press; or
- if the certificate is missing.

Appendices

- 1 Maintenance log sheet – Example
- 2 Record of contractor's work – Example
- 3 Checklist for daily inspections and periodic maintenance – Example
- 4 Thorough examination – Electrical control system aspects
- 5 Press design and maintenance intervals
- 6 PUWER 98 Part IV: Power presses – Schedule 3 (regulation 34(1)(b)).
Information to be contained in a report of thorough examination of a power press,
guard or protection device
- 7 PUWER 98 Part IV: Power presses – Schedule 2 (regulation 31). Power
presses to which regulations 32 to 35 do not apply
- 8 PUWER 98 Part IV: Power presses – Regulation 32(4)(a)(iii) – Exceptional
circumstances. Requirement for a thorough examination

Appendix 1: Maintenance log sheet – Example

[illegible]

- 1** *If preventative maintenance is required to prevent future failure, tick box and take the sheet to the technical manager with any recommendations.*
- 2** *If the work to be carried out requires a detailed examination by an external body, ie suspected cracked crankshaft, then place 'out of order' warning notice on the machine and inform the technical manager immediately.*

Appendix 2: Record of contractor's work – Example

X Y Z ENGINEERING LTD

POWER PRESSES AT KLM PRESSINGS LTD, HIGH STREET, INDUSTRIA,
W. MIDS

MAINTENANCE LOG

PRESS MAKE: Rhodes **MODEL:** RH 75 **SERIAL NO:** 12345

CAPACITY: 75 TONS **STROKE OF PRESS:** S.P.M **PLANT NO:** PP7

OPERATOR GUARD MAKE: UDAL **SERIAL NO:** 6789

RECOMMENDED FULL SERVICE EVERY THREE MONTHS (SINGLE SHIFT)

DATE	Details of maintenance service, repairs etc	Work done by (Name and title)	Next check/ service
07.07.99	<i>Press overrunning – found excessive movement of clutch and brake unit. Clutch adjusted and press now stopped correctly at T.D.C. Clutch and brake friction linings satisfactory – check linings in three months' time.</i>		07.12.99
10.09.99	<i>Press sometimes will not cycle – Found lubrication tank empty and low level switch prevented press from running – Re-filled tank with oil – press OK.</i>		
11.12.99	<i>Carried out a full service check – Slide guide strips adjusted from 0.5 clearance to 0.05 clearance. Ball Joint lift excessive – cap adjusted to give 0.1 clearance. Con-rod oil pipe worn away and leaking. New pipe fitted and pipe re-routed to stop it rubbing.</i>		Next service due: 11.04.00

Appendix 3: Checklist for daily inspections and periodic maintenance – Example

The information contained in this sample checklist is not exhaustive and other items may be required depending upon the particular machine, its control system and guarding arrangements. The numbers in brackets refer to the footnotes on pages 37-38.

POWER PRESS MAINTENANCE – MAINTENANCE ITEMS

		Frequency					
ITEM	CHECK	D ⁽¹⁾	W	M	3M	6M	Y
General							
<i>Pneumatic circuits</i>	air pressure		X				
	drain air filters		X				
	drain tanks – balance cylinder surge tank, accumulators		X				
	air lubricator levels	X					
	air leaks				X		
	condition of flexible pipes (rubber)			X			
	drain water from system	X					
<i>Hydraulic circuits</i>	hydraulic oil-level indicators		X				
	other hydraulic oil levels					X	
	hydraulic leaks				X		
	filters and strainers					X	
	condition of flexible hoses			X			
	renew hydraulic fluid at intervals recommended by the manufacturer						
<i>Lubrication</i>	general manual lubrication – bearings, drive shafts, spur wheels, stroke adjustment, slide				X		
	automatic lubrication		X				
	oil levels	X					
<i>Other</i>	drive-belt tension and condition			X			
	controls, switches, warning lamps, and pressure gauges			X			

Frequency							
ITEM	CHECK	D ⁽¹⁾	W	M	3M	6M	Y
	slide clearances and adjustment						X
	bolts – motor, bearings, slide			X			
Guards							
<i>Fixed guards</i>	structure integrity and security	X ⁽²⁾					
<i>Interlocked guards</i>	structure integrity and security	X ⁽²⁾					
	functional check	X ⁽²⁾					
	detailed check – switch operation, linkages, guard and clutch controls					X	
<i>Automatic guards</i>	screen setting – press at TDC and within 50 mm of nearest trap	X ⁽²⁾					
	functional check	X ⁽²⁾					
	structure integrity and security – wear in linkages	X					
	detailed check – wear in linkages					X	
	secondary traps between fixed and moving parts of guard	X ⁽²⁾					
Full revolution clutch presses	functional check of brake and clutch	X ⁽²⁾					
	enclosed parts – clutch key, drive ring, extractor mechanism						*(3)
	bearings – flywheel, crankshaft, con rod, pitman screw, back shaft						*(3)
	brake linings					X	
	brake adjustment and performance	X ⁽²⁾					
	balance cylinder setting			X ⁽⁴⁾			
	slide clearances and alignments						X
	functional check – guard and clutch controls	X ⁽²⁾					

Frequency							
ITEM	CHECK	D ⁽¹⁾	W	M	3M	6M	Y
Part revolution clutch presses	functional check of brake and clutch	X ⁽²⁾					
	functional check of flywheel brake		X				
	operation of clutch valves and monitor if fitted					X	
	clutch/brake adjustment					X	
	clutch/brake linings					X ⁽⁵⁾	
	clean/replace double valve silencer				X		
	check oil level (wet and hydraulically operated clutches)	X					
	functional check – guard and clutch controls	X ⁽²⁾					
Safety-related control circuits							
<i>Start and stop controls</i>	Functional check	X					
	External condition of installation	X					
	Detailed examination of installation					X	
<i>Emergency stop devices and controls</i>	Functional check	X					
	External condition of installation	X					
	Detailed examination of installation					X	
<i>Electrical interlocking circuits and devices⁽⁶⁾</i>	Functional check ⁽⁷⁾	X					
	External condition of installation	X					
	Detailed examination of installation					X	
<i>Electro-sensitive protective equipment (ESPE) – light curtains and light beam devices</i>	Functional check ⁽⁸⁾	X					

Frequency							
ITEM	CHECK	D ⁽¹⁾	W	M	3M	6M	Y
	Separation distance – ensure that the position of the ESPE(s) is the correct distance from the dangerous parts and record the distance measured					X	
	Muting mode – ensure that machinery is no longer hazardous while operating in muting mode, measure and record muting position (ie gap between top and bottom tools when muting occurs); check for deviation in muting position; check that mute indicator is illuminated when the ESPE(s) has been muted	X					
	Stopping performance – test overall stopping performance against manufacturer's recommendation and record result					X	
	Overrun detection – ensure switch is correctly positioned and filtered; test that the switch is working correctly				X		
	Examine and test the machine primary control elements to ensure correct operation					X	
	Examine and inspect the controls and connections to the ESPE(s) to ensure no modifications have been made to wiring etc.					X	
	Check the condition of control gear, programmable electronic system enclosures, fixings, and associated devices (for example cam switches)					X	
<i>Electrical equipment and its installation</i>	Examination of external condition of machine control panel(s)					X	
	Examination of external condition of wiring, conduits, junction boxes, glands, extraneous wiring and cabling etc					X	
	Examination of external condition of motor and drive assemblies					X	

		Frequency					
ITEM	CHECK	D ⁽¹⁾	W	M	3M	6M	Y
<i>Protective bonding circuit</i>	Examination of external condition of protective bonding circuit conductors					X	
	Continuity test – verification of continuity of the protective bonding circuit	See note ⁽⁹⁾					
<i>Protective devices⁽¹⁰⁾</i>	Condition and rating of protective devices					X	
<i>Electrical insulation</i>	Insulation resistance test	See note ⁽¹¹⁾					
<i>Lamps, indicators and displays</i>	Functional check					X	
Documentation and information for safe use of the power press							
<i>Control circuit diagrams</i>	Maintain up to date – examine to ensure that diagrams are properly representative of the current condition of the power press, particularly if modification/repair work has been carried out						X
<i>Electrical installation schematic diagrams, drawings</i>	Maintain up to date – examine to ensure that diagrams are properly representative of the current condition of the power press, particularly if modification/repair work has been carried out						X
<i>Labelling and marking of power press⁽¹²⁾</i>	Examination of condition					X	

Notes

It is anticipated that most of the daily checks and checks after tool changing or setting would be carried out by the appointed person. Those items as well as the items carried out at longer intervals and requiring more detailed inspection and dismantling would be carried out by the maintenance department.

- (1) Daily checks normally carried out by the appointed person.
- (2) Checks to be carried out by the appointed person at the stated interval and also when tools are changed or adjusted.
- (3) Frequency should be determined by usage and duty.
- (4) Also check after tool changes.
- (5) See manufacturer's instructions for inspection and replacement.
- (6) Examination of the operation and performance of safety-related interlocking circuits should comprise:
 - inspection and functional performance checks of each safety-related interlocking circuit from sensing device(s) through to the actuating element(s) that prevent dangerous motion and/or remove motive power from the press;
 - redundant circuit configurations should be subject to independent checks, ie a dual-redundant circuit should be examined by disabling each channel in turn so as to determine the presence of any unrevealed faults.
- (7) All interlocking devices should also be inspected to ensure that they are correctly adjusted and installed in accordance with the manufacturer's instructions.
- (8) A functional check of ESPE(s) should comprise:
 - checks to ensure that access to dangerous parts of the power press is not possible from any direction not protected by the ESPE, and that side and rear guards are properly installed;
 - a check to ensure that the separation distance from the dangerous parts to the ESPE is not less than the distance stated on the power press and/or ESPE information plate;
 - a check to ensure that it is not possible for a person to stand between the ESPE (for example, light curtain) and dangerous parts;
 - tests to ensure the operational effectiveness of the ESPE(s) using appropriate test pieces;
 - checks to ensure that the muting mode is set up and working correctly;
 - checks to ensure that the stopping performance monitor is set up and functioning in the manner recommended by the ESPE supplier;
 - visual examination to ensure that the cabinets housing the electrical/electronic equipment of the ESPE(s) are closed and locked and that the key is removed for retention by a suitable person; and
 - visual checks for external signs of damage to the ESPE or to its electrical wiring – damage found should be reported to line management.
- (9) Verification of the continuity of the protective bonding circuit of the power press may be necessary to determine the functional integrity of parts of safety-related control circuits that cannot readily be examined visually during maintenance activities.

The frequency of this test should be based upon consideration of the results of the other maintenance activities (for example functional testing) and thorough examinations, and the extent to which it is possible to test and inspect safety-related electrical control circuits.

(10) Protective devices include fuses, circuit-breakers, disconnecting devices with a switch-fuse etc. This item should also include an examination of apparatus installed to protect against residual voltages.

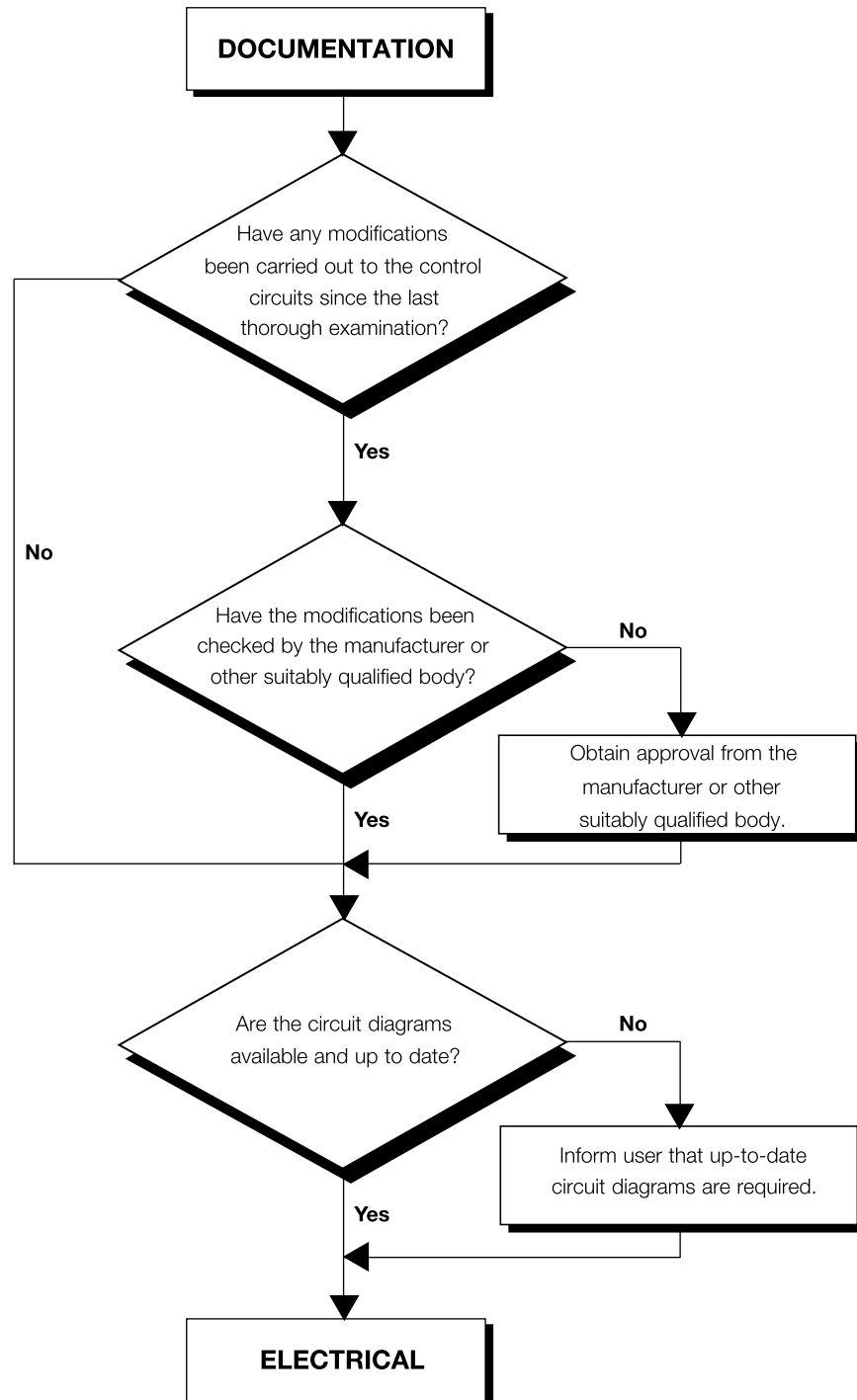
(11) The insulation resistance (IR) between the power circuit conductors and the protective bonding circuit should be measured at a minimum of twice the rated voltage while the power press installation is isolated from the mains supply. The value of resistance measured should be greater than or equal to 1 Mohm.

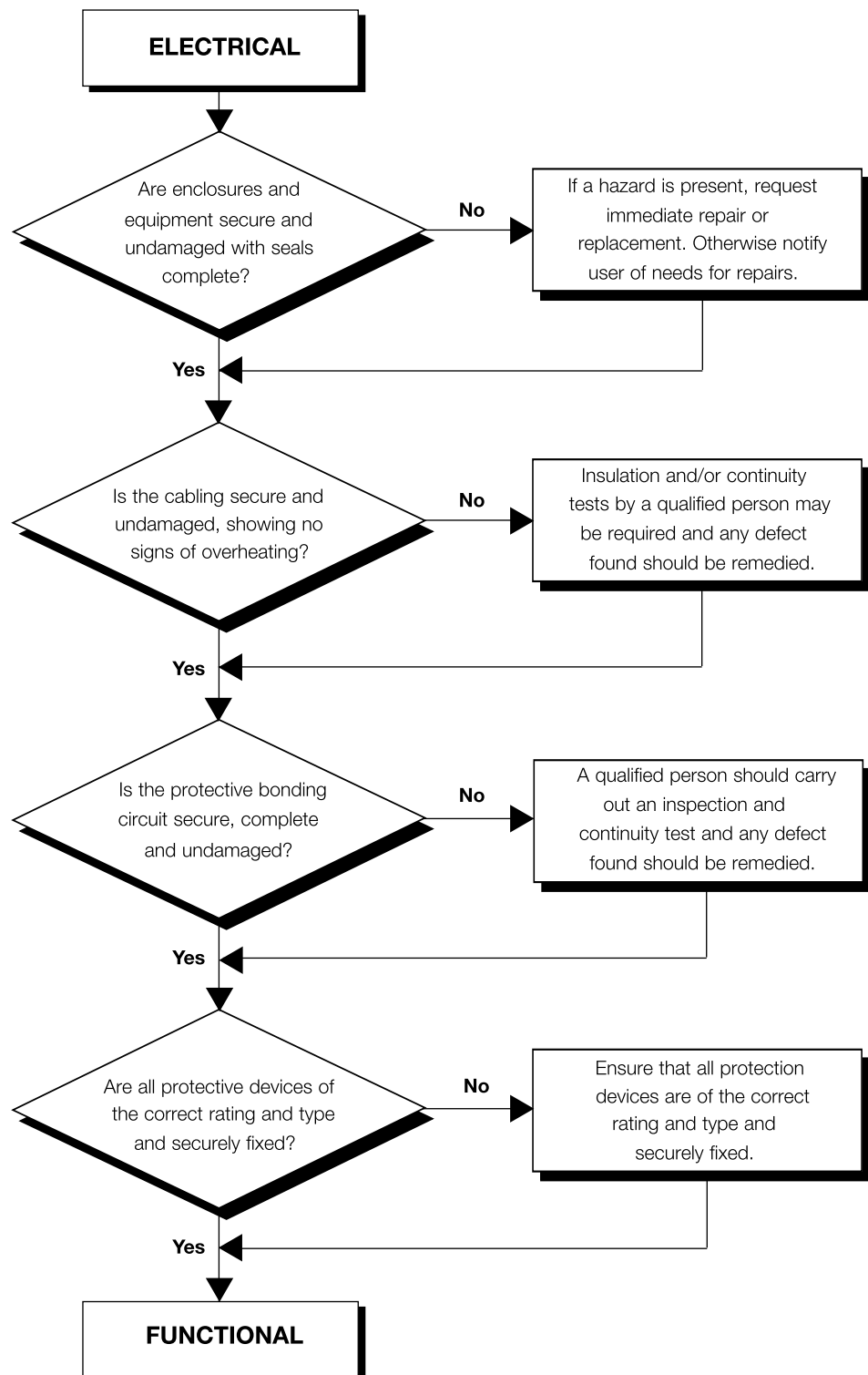
This IR test should be performed at the time of the installation of the power press and the next subsequent test should be performed at a frequency dependent upon the results of the thorough examination, and the age and condition of the power press, taking into account both the duty cycle and operating environment. In the absence of any changes to the electrical installation or modes of use of the power press it is recommended that an IR test is performed every three years.

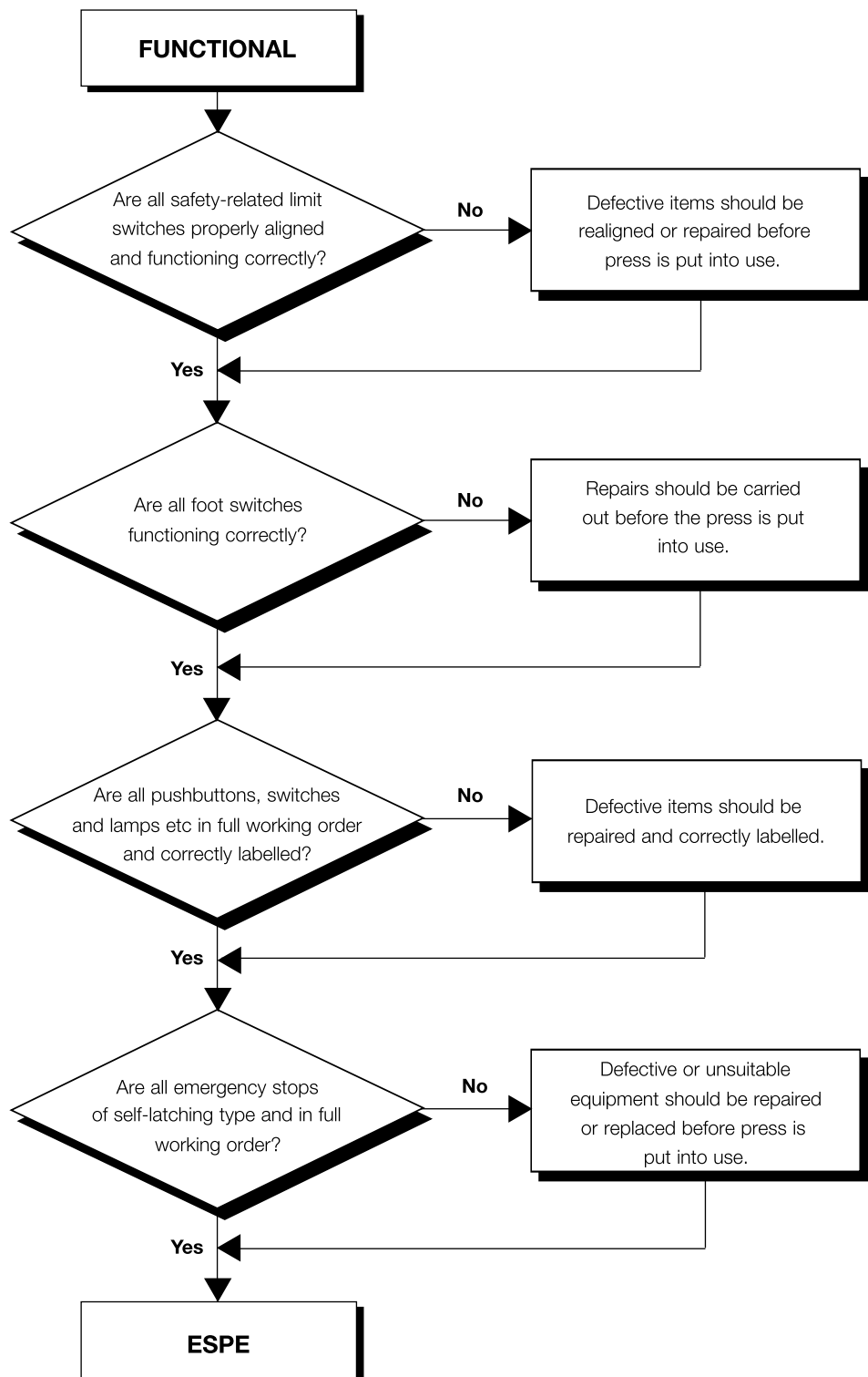
Also, it should be noted that where a circuit includes electronic devices, only a measurement of the IR should be made between the power circuit conductors and the protective bonding circuit. Precautions may be necessary to avoid damage to electronic devices.

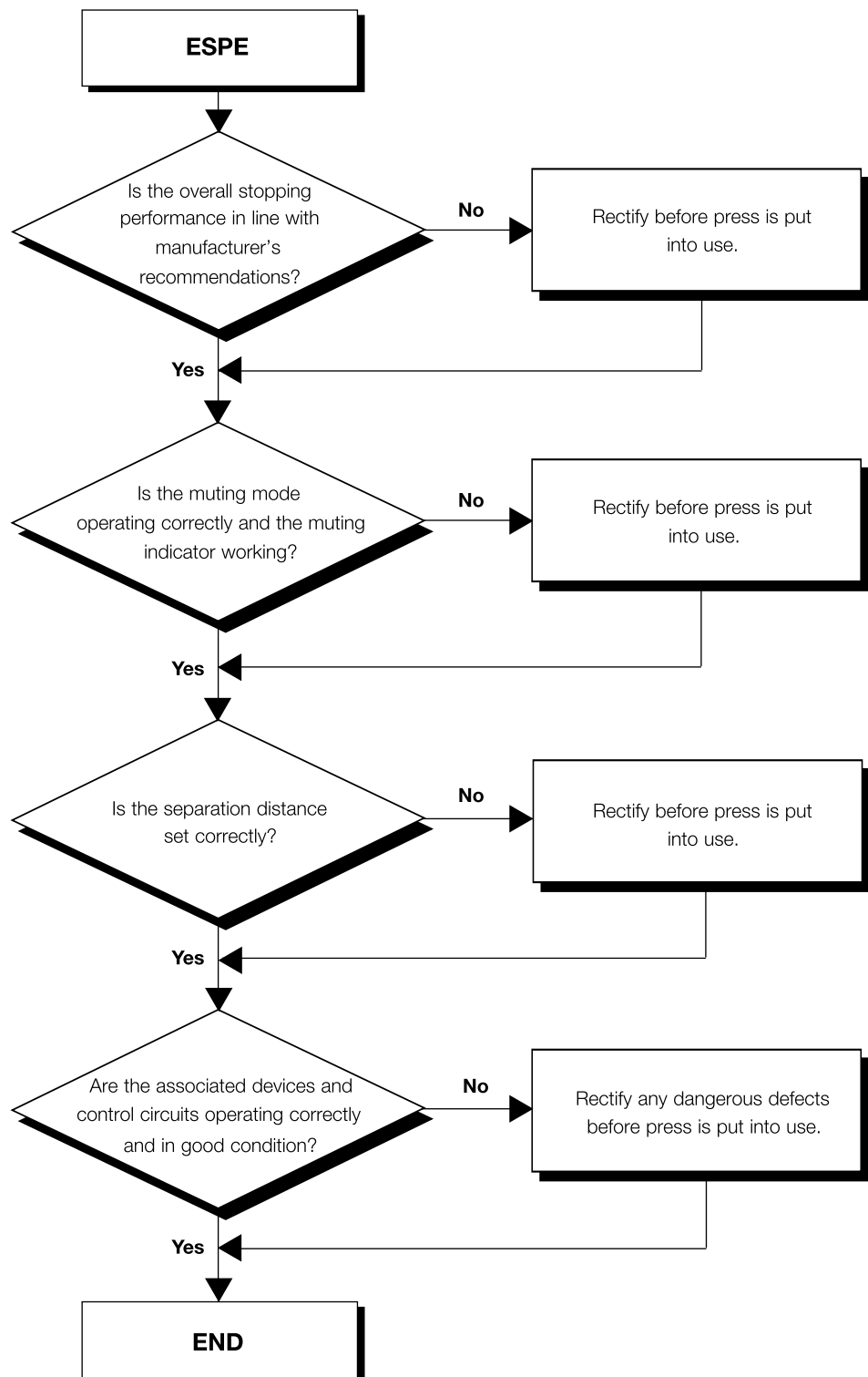
(12) The examination of labelling and marking at the power press should also ensure that the function and purpose of control switches etc are clearly indicated.

Appendix 4: Thorough examination – Electrical control system aspects









Appendix 5: Press design and maintenance intervals

1 The maintenance intervals that can be applied will be determined by the factors outlined in paragraphs 24-25 in Part 1 and consideration of the hazards and risks associated with possible faults that may occur in safety-related control circuits. This requires consideration of a safety-related control circuit in terms of both its configuration and ability to tolerate faults. For example, a safety-related control circuit that relies upon single components to carry out a safety function requires checking more frequently than a redundant circuit, which is able to tolerate a single fault.

2 Similarly, a safety-related control circuit, which has been poorly designed, may be susceptible to faults that cannot be readily identified from normal operation of the press so that it is necessary to perform maintenance checks in order to detect these faults. For example, while redundant circuits provide some immunity to single faults it will be necessary to perform independent checks where each channel of a redundant circuit is disabled in turn, so as to determine the presence of undetected faults.

3 The following table provides some recommendations for maintenance intervals that can be applied to presses:

<i>Control circuit configuration</i>	<i>Susceptibility to latent faults</i>	<i>Maintenance check interval</i>
<i>Single</i>	High	Monthly
<i>Single</i>	Low	Six-monthly
<i>Dual (redundant)</i>	High	Six-monthly
<i>Dual (redundant)</i>	Low	Annual

You can get information on the configuration of your presses' safety-related control circuits and their susceptibility to latent faults from your maintenance contractor or competent person.

4 The susceptibility to latent faults can be reduced by introducing additional monitoring (for example stopping performance monitoring) within the safety-related control circuit to detect the presence of faults that may adversely effect safety at the tools. These additional features can also improve productivity and efficiency of a power press.

5 Further information on functional checks to ensure that safety-related control circuits perform correctly and that devices, such as interlocking switches, are properly adjusted and installed in accordance with the manufacturer's instructions is provided in the checklist in Appendix 3.

6 This guidance considers that dual circuits are normally appropriate to provide the safety performance required for power presses. Other circuit configurations, such as a single channel with high failure coverage that relies upon programmable electronic systems (for example a programmable logic controller) may be appropriate, providing they comply with other relevant guidance and standards (for example BS IEC 61508 *Functional safety of electrical/electronic/programmable electronic safety-related systems*¹¹).

7 Some dual monitored valves controlling presses have means by which each valve can be tested and re-set to confirm that the monitoring of the valve is effective, and that a fault will be recognised and the press will be shut down. Where valves are fitted with a test button or with other inbuilt test facilities on the valve itself, these should be tested by the competent person as part of the thorough examination.

Some electrically interlocked guards may depend on a single electrical solenoid. If it fails, the press can operate when the guard is open. Back-up protection can be added which will improve the level of safety and reduce the frequency of electrical maintenance. This back-up protection comprises a pneumatic valve operated non-electrically by the guard, and is fitted in the airline to the clutch, upstream of the solenoid control valve. Whenever the guard is open, this valve cuts off the upstream air supply to the clutch and opens the downstream system to atmosphere. This protects against electrical failure of the system – but not mechanical failures of the clutch and brake mechanism.

8 Many presses fitted with interlocked guards are fitted with two switches at the guard connected in series to a single valve. This controls the clutch with a pneumatically operated guard lock to hold the guard closed until the press is stopped at top dead centre. When the guard is open, the level of safety is reduced to single mode failure because in many designs the guard lock will be ineffective should a fault occur in the control circuit or pneumatic valve that causes the clutch to engage. Single mode failure should be avoided by, for example, fitting a second pneumatic control valve connected in series to the original clutch control valve and controlled by a separate pneumatic valve operated by the guard to give a dual channel arrangement.

9 Many full revolution clutch presses are fitted with pneumatic cylinder operation of the clutch extractor. Operation of the extractor before the guard is fully closed and the clutch scotch fully disengaged can result in wear of the extractor and scotch. This could result in the clutch being engaged before the guard is fully closed. A pneumatic control valve operated by the guard shutter should be fitted in series with the foot pedal so that the extractor cylinder can only operate when the guard is fully closed.

**Appendix 6: PUWER 98 Part IV: Power presses – Schedule 3
(regulation 34(1)(b))**

Information to be contained in a report of thorough examination of a power press, guard or protection device

- 1 *The name of the employer for whom the thorough examination was made.*
- 2 *The address of the premises at which the thorough examination was made.*
- 3 *In relation to each item examined –*
 - (a) *that it is a power press, interlocking guard, fixed guard or other type of guard or protection device;*
 - (b) *where known its make, type and year of manufacture;*
 - (c) *the identifying mark of –*
 - i) *the manufacturer*
 - ii) *the employer.*
- 4 *In relation to the first thorough examination of a power press after installation or after assembly at a new site or in a new location –*
 - (a) *that it is such thorough examination;*
 - (b) *either that it has been installed correctly and would be safe to operate or the respects in which it has not been installed correctly or would not be safe to operate;*
 - (c) *identification of any part found to have a defect, and a description of the defect.*
- 5 *In relation to a thorough examination of a power press other than one to which paragraph 4 relates –*
 - (a) *that it is such other thorough examination;*
 - (b) *either that the power press would be safe to operate or the respects in which it would not be safe to operate;*
 - (c) *identification of any part found to have a defect which is or could become a danger to persons, and a description of the defect.*
- 6 *In relation to a thorough examination of a guard or protection device –*
 - (a) *either that it is effective for its purpose or the respects in which it is not effective for its purpose;*
 - (b) *identification of any part found to have a defect which is or could become a danger to persons, and a description of the defect.*
- 7 *Any repair, renewal or alteration required to remedy a defect found to be a danger to persons.*
- 8 *In the case of a defect which is not yet but could become a danger to persons –*
 - (a) *the time by which it could become such danger;*
 - (b) *any repair, renewal or alteration required to remedy it.*
- 9 *Any other defect which requires remedy.*
- 10 *Any repair, renewal or alteration referred to in paragraph 7 which has already been effected.*

- 11 *The date on which any defect referred to in paragraph 8 was notified to the employer under regulation 34(1) (a).*
- 12 *The qualification and address of the person making the report; that he is self-employed or, if employed, the name and address of his employer.*
- 13 *The date of the thorough examination.*
- 14 *The date of the report.*
- 15 *The name of the person making the report and where different the name of the person signing or otherwise authenticating it.*

Appendix 7: PUWER 98 Part IV: Power presses – Schedule 2 (regulation 31)

Power presses to which regulations 32 to 35 do not apply

- 1 *A power press for the working of hot metal.*
- 2 *A power press not capable of a stroke of greater than six mm.*
- 3 *A guillotine.*
- 4 *A combination punching and shearing machine, a turret punch press or a similar machine for punching, shearing or cropping.*
- 5 *A machine other than a press brake, for bending steel sections.*
- 6 *A straightening machine.*
- 7 *An upsetting machine.*
- 8 *A heading machine.*
- 9 *A riveting machine.*
- 10 *An eyeletting machine.*
- 11 *A press-stud attaching machine.*
- 12 *A zip fastener bottom stop attaching machine.*
- 13 *A stapling machine.*
- 14 *A wire stitching machine.*
- 15 *A power press for the compacting of metal powders.*

Appendix 8: PUWER 98 Part IV: Power presses – Regulation 32(4)(a)(iii) – Exceptional circumstances

Requirement for a thorough examination

1 The exceptional circumstances which might require a thorough examination and test under regulation 32(4)(a)(iii) of PUWER 98 should be considered in a similar way to regulation 6(2)(b) of PUWER 98 with respect to whether an inspection is required. Guidance is given in *Safe use of work equipment: Provision and Use of Work Equipment Regulations 1998. Approved Code of Practice and guidance*⁹ (pages 26-30).

2 The requirement in regulation 32(4)(a)(iii) relates to whether or not employees could be subject to a foreseeable 'significant risk' due to 'exceptional circumstances' and the resulting need to have a press thoroughly examined. A significant risk is one which could result in a major injury or worse. Major injuries are listed in Schedule 1 of the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR). The list is also reproduced in Appendix 1 of *Safe use of work equipment: Provision and Use of Work Equipment Regulations 1998. Approved Code of Practice and guidance*.⁹ Injuries at the tools of a power press are normally 'major'.

3 When exceptional circumstances occur, the employer should make an assessment of the situation to determine the steps they need to take (required under the Management of Health and Safety at Work Regulations 1999). The purpose of such a thorough examination in these circumstances would be to allow the competent person to provide advice or make judgements about the condition of the press or its safeguarding arrangements in order to control the potential risk to employees. In particular it will allow the competent person to:

- make an assessment of any damage to a press so that appropriate repairs etc can be specified; and/or
- confirm that the repairs/remedial action have been undertaken properly.

4 The list of exceptional circumstances given in *Safe use of power presses. Provision and Use of Work Equipment Regulations 1998 as applied to power presses. Approved Code of Practice and guidance*⁹ is not exhaustive. In some cases more than one of the examples may apply to a given situation. For example, if a press was suspected of sustaining serious damage as a result of overloading, a thorough examination is likely to be required to determine the exact nature and extent of the damage and the remedial action necessary to ensure that the press can be safely used. At this stage, the competent person may make a judgement that the press should also be thoroughly examined again following repair, for example if the press frame or other parts were welded or modified in some way – where subsequent failure may foreseeably result in a 'significant risk'.

5 In cases where guards or other protective devices are renewed following serious damage they would require thorough examination – this would be needed to comply with regulation 32(2) where guards are being used on the press for the first time.

6 In cases where repairs are 'less serious' and the employer can determine with confidence that no significant risk would result, ie the repairs have been carried out to appropriate standards (workmanship and design), then a thorough examination would not be necessary until the next periodic thorough examination and test is required.

7 Normal 'running' repairs and routine maintenance would not require a thorough examination over and above the periodic intervals, for example replacement of brake linings or a clutch key before failure.

8 The guidance also refers to a 'substantial change in the nature of use' as being 'exceptional circumstances'. Again the nature of the change in use has to be considered within the context of 'significant risk'. If the press (capacity, operating mechanisms etc) is suitable for the new service conditions and the existing safeguards adequately control any additional risks, eg from new hazards following the change of use, then a thorough examination would not normally be required. Major changes in the application of the machine, for example integration into an automatic line, would probably require a thorough examination because new or substantially modified guarding arrangements would need to be provided – but regulation 32(2) would then be more relevant.

9 In cases where users have doubts about the need for a thorough examination they should discuss the matter with the 'competent person'.

References

Further information about the law on work equipment can be found in references 8 and 9 below. You will need to look at both of them to understand the full extent of your legal duties.

- 1 BS EN 45004: 1995 *General criteria for the operation of various types of bodies performing inspection* British Standards Institution
- 2 *Buying new machinery: A short guide to the law and some information on what to do for anyone buying new machinery for use at work* Leaflet INDG271 HSE Books 1998 (single copy free or priced packs of 15 ISBN 0 7176 1559 6)
- 3 BS EN 61496-1: 1998 and BS IEC 61496-2: 1997 *Safety of machinery – Electro-sensitive protective equipment* British Standards Institution
- 4 *Application of electro-sensitive protective equipment using light curtains and light beam devices to machinery* HSG180 HSE Books 1999 ISBN 0 7176 1550 2
- 5 *Procedures for daily inspection and testing of mechanical power presses and press brakes* INDG 316 HSE Books 2003 (single copy free or priced packs of 10 ISBN 0 7176 1780 7)
- 6 *Electricity at work: Safe working practices* HSG85 (Second edition) HSE Books 2003 ISBN 0 7176 2164 2
- 7 *Use of contractors: A joint responsibility* Leaflet INDG368 HSE Books 2002 (single copy free or priced packs of 10 ISBN 0 7176 2566 4)
- 8 *Safe use of power presses. Provision and Use of Work Equipment Regulations 1998 as applied to power presses. Approved Code of Practice and guidance* L112 HSE Books 1998 ISBN 0 7176 1627 4
- 9 *Safe use of work equipment. Provision and Use of Work Equipment Regulations 1998. Approved Code of Practice and guidance* L22 (Second edition) HSE Books 1998 ISBN 0 7176 1626 6
- 10 BS EN 983: 1996 *Safety of machinery: Safety requirements for fluid power systems and their components. Pneumatics* British Standards Institution
- 11 BS IEC 61508: *Functional safety of electrical/electronic/programmable electronic safety-related systems* British Standards Institution

Useful information

BS EN 692: 1997 *Safety of machine tools: Mechanical presses*

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