Safety in electrical testing: Products on production lines

Engineering Information Sheet No 38

What is this guidance about?

This information sheet contains specific advice about some of the ways of avoiding injury during the electrical testing of products on production lines. Further advice is given in *Safety in electrical testing at work: General guidance*[1] and other guidance on electrical safety listed under 'Where can I get more information' on page 3.

How can injuries happen during testing?

The most significant danger to people carrying out electrical testing work is that they might suffer an electric shock. Any simultaneous contact of a part of the body with a conductor that is live at a dangerous voltage, eg as one that is connected to the mains supply while another part of the body is connected to an earth, will result in an electric shock. There is also a risk of burn injuries resulting from arcing when conductors are accidentally short-circuited.

An electric shock can lead to serious injury, sometimes fatal. Injuries can also occur when a person reacts to an electric shock, for example by falling or touching another hazard. Factors which are likely to increase the risk of receiving an electric shock include the following:

(a) People carrying out electrical testing work on production lines are often unskilled or semi-skilled in relation to electrical competence;

(b) Some equipment, such as washing machines or dishwashers, could also be using water in its operation. This may lead to an increased risk of shock because water can conduct electricity and reduces the resistance of the skin;

(c) Serious injury can also occur if accidental contact is made with the two poles of a supply, whether the supply is earth-referenced or not. Similarly, contact with both poles of internally generated sources can cause electric shocks;

(d) For much of the equipment tested there will be comparatively large areas of earthed metal that may be easily touched. There is therefore an increased possibility of electric shock from contact with a single live conductor;

(e) Test equipment and instruments applied to the equipment being tested may themselves generate hazardous voltages;

(f) As well as the risk of accidental contact by authorised test operatives, unauthorised people might have ready access to a test station on a production line.

Carrying out a risk assessment

To help you to identify the precautions that are necessary for carrying out electrical testing work safely, you need to do an assessment of the risk of injury posed by the work being done. When assessing the risk, you need to think about the hazards that are present, who may be harmed and how, and the effectiveness of existing precautions. Bear in mind the examples of factors given in this guidance which might increase the risk.

When carrying out a risk assessment for electrical testing, ask yourself the following questions:

(a) Can the work be done with the equipment dead?

(b) Can the testing be done automatically, without human intervention?

(c) Is it absolutely necessary for someone to be working on or near equipment that is live at dangerous voltages or current levels?

(d) Have suitable precautions been taken to avoid danger and, where necessary, to prevent injury?

(e) Is the person doing the work competent for that type of work, or, if not, adequately supervised?

What precautions should I take?

Where possible, the work should be done with the equipment dead (this is a requirement of the Electricity at Work Regulations 1989[2]). Otherwise, adequate precautions, which should be identified in your risk assessment, must be taken to ensure safety.

The following precautions are recommended as part of a safe system of working for electrical testing of this equipment.

Test areas

Wherever testing is to be done on a production line, the test area should be clearly designated as such, to reduce the risk of unauthorised people entering it. This is usually done by using fixed barriers to prevent unauthorised access. Make sure that the barriers are sited so that enough space is left around the testers to allow them to work safely.

In addition, use visual indicators, such as warning lights, to show when testing is being done.

Access to live parts

Where testing is carried out on live equipment, the risk is most effectively controlled by preventing access to the live parts. This can be achieved in a number of ways:

(a) Where possible, units should be tested with all covers in place;

(b) Where this standard cannot be achieved, cover exposed conductors during the testing procedure. This protection can be in the form of temporary insulation, for example purpose-built attachments that can be quickly attached before the test and then removed once testing is complete;

(c) Where equipment has to be worked on for a longer period of time, transparent screens with apertures for applying test instrument probes can be used;

(d) Suitable precautions should be taken to minimise exposed earthed metalwork in the test areas.

Test equipment

Test equipment, leads and cables should be handled carefully to avoid injury. The following precautions are recommended:

(a) All leads and cables which can be energised at dangerous voltages should be robustly insulated and properly terminated. All connections of conductors which can be energised at dangerous voltage should be electrically and mechanically robust to prevent conductors becoming accidentally exposed. There should be no exposed conductors at dangerous voltages at any purpose-built connectors or jigs into which the product is fixed for testing;

(b) Test equipment connecting leads, probes and connectors should be sufficiently protected to prevent accidental contact when being applied to and removed from live parts;

(c) Where practicable, place the equipment under test into interlocked enclosures. This allows connections to be made while the equipment is isolated;

(d) Where practicable, apply test leads while the equipment is isolated and then energise it. To make sure that the equipment is isolated a suitable isolating device should be used which must be:

  (i) appropriate and convenient for the intended use;

  (ii) suitably located;

  (iii) readily identifiable (eg by durable marking) as to which circuits or part of the test area is served;

  (iv) provided with adequate means to prevent the supply isolator being switched on (either inadvertently, mistakenly, or by an unauthorised person).

High-voltage insulation (flash) testing

This type of testing is required for the majority of products and should be done using proprietary test equipment. To prevent dangerous shocks the test instrument output current should be limited to no greater than 5 mA (traditionally 5 mA ac has been used, but since May 2001[3] new equipment should be limited to 3 mA ac). Proprietary equipment has this feature, which allows simple hand-held test probes to be used when the current is automatically limited to these values.

Where a higher test current is absolutely necessary, additional precautions will be needed. These precautions will include the use of heavily shrouded and insulated test probes. The tips of the probes should be covered by retractable, insulated sleeving. The test voltage may be applied by a switch built into the insulated handles of the probes.

People doing the testing need to be thoroughly trained. It will be necessary to prevent the test operator, and others, from coming into contact with all hazardous voltages present during testing. It may be necessary to discharge safely any stored energy which may remain in the equipment after the test has been carried out before allowing any further contact with the equipment.

Supplementary protection

(a) Where practicable, the power supplies to all the equipment should include a residual current device (RCD) with a rated tripping current of, at most, 30 mA.

(b) The level of supervision and monitoring will vary depending on the protection arrangements adopted. The risk assessment will need to take account of this when the test facility is being set up. Ensure that the assessment is revised to take into account any product design changes, methods of working and changes of personnel.

What are the legal requirements?

The Electricity at Work Regulations 1989[2] are the principal legislation relating to electrical testing activities and regulation 14 is particularly relevant to live testing activities. In addition, employers are required under regulation 3 of the Management of Health and Safety at

Work Regulations 1999[4] to assess the risks to the health and safety of their employees while they are at work, in order to identify and implement the necessary precautions for ensuring safety.

References

1 *Safety in electrical testing at work: General guidance* Leaflet INDG354 HSE Books 2002 (single copy free or priced packs of 5 ISBN 0 7176 2296 7)

2 *Memorandum of guidance on the Electricity at Work Regulations 1989. Guidance on Regulations* HSR25 ISBN 0 11 883963 2

3 BS EN 50191: 2001 *Erection and operation of electrical test equipment*

4 *Management of health and safety at work*. *Management of Health and Safety at Work Regulations 1999*. *Approved Code of Practice and guidance* L21 (Second edition) HSE Books 2000 ISBN 0 7176 2488 9

Where can I get more information?

Electrical test equipment for use by electricians Guidance Note GS38 ISBN 0 7176 0845 X

Electricity at work: Safe working practices HSG85 ISBN 0 7176 0442 X

While every effort has been made to ensure the accuracy of the references listed in this publication, their future availability cannot be guaranteed.

Further information

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British Standards are available from BSI Customer Services, 389 Chiswick High Road, London W4 4AL Tel: 020 8996 9001 Fax: 020 8996 7001 Website: www.bsi-global.com

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

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