

Safety in electrical testing – products on production lines

HSE information sheet

Engineering Information Sheet No 38 (Revision 1)

Introduction

This information sheet contains specific advice about avoiding injury during the electrical testing of products on production lines.

The guidance is for those who own, manage or supervise production lines where electrical testing takes place. It is also relevant to those who carry out this type of work.

Hazards and risks

The most significant danger to people carrying out electrical testing work is electric shock. An electric shock can lead to serious, sometimes fatal, injury.

Any simultaneous contact by a part of the body with a conductor that is live at a dangerous voltage, eg connected to the mains supply, while another part of the body is connected to an earth, will result in electric shock.

There is a risk of burn injuries resulting from arcing when conductors are accidentally short-circuited. In addition, injuries can occur when a person reacts to an electric shock, eg by falling or touching another hazard.

Factors which are likely to increase the risk of electric shock include:

- People carrying out electrical testing work on production lines are often unskilled or semi-skilled in relation to electrical competence.
- Some equipment, such as washing machines or dishwashers, use water in their operation. This may lead to an increased risk of shock as water can conduct electricity and reduces the resistance of the skin.
- 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.

- For much of the equipment tested there will be large areas of earthed metal that can easily be touched. There is therefore an increased possibility of electric shock from contact with a single live conductor.
- Test equipment and instruments applied to the product being tested may themselves generate hazardous voltages.
- 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.

Risk assessment

To help you to identify the precautions that are necessary for carrying out electrical testing safely, you must make 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 given in this guidance of factors which might increase the risk.

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

- Can the work be done with the equipment dead? Where possible, the law says work should be done with the equipment dead. Otherwise, adequate precautions, which should be identified in your risk assessment, must be taken to ensure safety.
- Is it absolutely necessary for someone to be working on or near equipment that is live at dangerous voltages or current levels?
- Have you taken suitable precautions to avoid danger and prevent injury?
- Is the person doing the work competent for that type of work, or if not, adequately supervised?

Make a record of the significant findings from your risk assessment, the hazards, how people might be harmed and what controls you have in place to control

the risks. If you have fewer than five employees, you do not have to write it down, but it is useful to do this so you can review it at a later date. If you have five or more employees, you are required by law to write it down. More guidance on risk assessment can be found at www.hse.gov.uk/risk.

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:

- Where possible, units should be tested with all covers in place.
- 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.
- 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.
- 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:

- 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 a 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.
- Test equipment connecting leads, probes and connectors should be sufficiently protected to

prevent accidental contact when being applied to and removed from live parts.

- Where practicable, place the equipment under test into interlocked enclosures. This allows connections to be made while the equipment is isolated.
- 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:
 - appropriate and convenient for the intended use;
 - suitably located;
 - readily identifiable (eg by durable markings) as to which circuits or part of the test area they serve; and
 - provided with adequate means to prevent the supply isolator being switched on (either inadvertently, mistakenly, or by an unauthorised person).

Where possible, test equipment should be of a proprietary design. In this case the manufacturer should have taken account of its safety performance during use. Where applicable, test equipment should be manufactured to BS EN 61010,¹ BS EN 61557² or BS EN 61243-3.³

Purpose-built test equipment must be designed and constructed to the same standards of safety as proprietary equipment. Where equipment is mains powered, it must be safe to use as a piece of electrical equipment in its own right. In addition, the arrangements for connecting it to the equipment under test must be safe.

See also advice given in INDG354(rev1) *Safety in electrical testing at work*⁴ concerning the use of test equipment.

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 3 mA. Since 2001, test equipment manufactured to BS EN 50191⁵ has been limited to 3 mA. Test equipment manufactured to a preceding standard may only be limited to 5 mA. 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

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

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 changes to product design, methods of working and personnel.

Legal requirements

The Electricity at Work Regulations 1989 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 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 to ensure safety.

References

- 1 *BS EN 61010 Safety requirements for electrical equipment for measurement, control, and laboratory use*. Various publications for different situations (full document is in 11 parts) British Standards Institution
- 2 *BS EN 61557 Electrical safety in low voltage distribution systems up to 1000 V ac and 1500 V dc. Equipment for testing, measuring or monitoring protective measures*. Various publications for different situations British Standards Institution
- 3 *BS EN 61243-3 Live working. Voltage detectors. Two-pole low voltage type*. British Standards Institution
- 4 *Safety in electrical testing at work* Leaflet INDG354(rev1) HSE 2013
www.hse.gov.uk/pubns/indg354.htm
- 5 *BS EN 50191 Erection and operation of electrical test equipment* British Standards Institution

Further reading

HSE's electrical safety webpages
www.hse.gov.uk/electricity/index.htm

Information on managing health and safety
www.hse.gov.uk/managing/index.htm

The Electricity at Work Regulations 1989. Guidance on Regulations HSR25 HSE 2015
www.hse.gov.uk/pubns/books/hsr25.htm

Electricity at work: Safe working practices HSG85 (Third edition) HSE 2013
www.hse.gov.uk/pubns/books/hsg85.htm

Electrical test equipment for use on low voltage electrical systems GS38 (Fourth edition) HSE 2015
www.hse.gov.uk/pubns/books/gs38.htm

Further information

For information about health and safety, or to report inconsistencies or inaccuracies in this guidance, visit www.hse.gov.uk/. You can view HSE guidance online and order priced publications from the website. HSE priced publications are also available from bookshops.

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