



INSPECTION AND TESTING OF PORTABLE ELECTRICAL EQUIPMENT		Cross-References
Key Words	Electricity, Electrical Safety, Electrical Equipment, Electrical Appliances, Inspection, Testing, PAT Testing, Competent Person, Qualified Person, Spur, Class I, Class II	
POLICY	All portable electrical equipment owned by the University; or in use on University premises by staff (outside their private residential accommodation), or students (outside their study bedrooms), must be inspected and, if necessary, tested as part of a maintenance programme.	Definitions H&S Manual E2 , E5
Responsibility for Implementation	Heads of Departments and Colleges	
Standards		
<input type="checkbox"/>	1 In order to carry out inspections and testing, at least one of the following arrangements must be in place at each department and college: <ul style="list-style-type: none"> • An adequate number of qualified and/or competent staff. • A suitable arrangement with a University-approved contractor. 	Definitions
<input type="checkbox"/>	2 All portable electrical equipment must be subject to a user check in the prescribed manner and at the prescribed intervals.	Appendix 1 Appendix 2
<input type="checkbox"/>	3 All portable electrical equipment must be inspected and tested by competent or qualified people in the prescribed manner and at the prescribed intervals.	Appendix 1 Appendix 3 Appendix 4
<input type="checkbox"/>	4 Records of inspections and tests must be kept.	
<input type="checkbox"/>	5 All inspected / tested electrical equipment must carry a label detailing: <ul style="list-style-type: none"> - date of inspection /test - name of inspector - date of next inspection / test All new equipment not yet requiring inspection / testing must carry a label detailing: <ul style="list-style-type: none"> - date of first proposed inspection / test 	
<input type="checkbox"/>	6 Equipment failing inspection / testing must be taken out of use and labelled until either repair followed by re-inspection / testing by a qualified person, or correct disposal.	H&S Manual W1
<input type="checkbox"/>	7 All meters and other equipment used for electrical testing purposes must be calibrated at appropriate intervals.	
Definitions	<p>Competent Person Competent persons do not need to be electrically or technically qualified. Suitable candidates will be deemed competent to carry out formal visual inspections and tests, provided they satisfactorily complete a training course organised by the Health and Safety Service.</p> <p>Any user can carry out a user check.</p> <p>Qualified Person Qualified persons must have suitable electrical qualifications or experience. Time-served electricians and technicians with qualifications in electronics or electrical engineering will be so qualified.</p> <p>Portable Electrical Equipment Equipment in any of the following categories, sub-divided for inspection and testing purposes into “portable”, transportable” and “special cases”:</p>	

- **Portable**
Equipment which can be connected to a fixed electrical supply or generator via a flexible cable and **either** a plug and socket outlet **or** directly via a fused spur.
- **Transportable**
Equipment which can be connected to a fixed electrical supply or generator via a flexible cable and **either** a plug and socket outlet **or** directly via a fused spur, but which is **not** intended, or likely to be, moved while connected to the supply
- Extension cables and boards.

Note:

Equipment not owned by the University, but which is hired or brought onto University premises for routine and / or long-term use – such as vending machines, photocopiers and water coolers – must comply with these standards. Suitable arrangements must be made with the suppliers to comply, but if necessary, departments and colleges must carry out this work themselves.

University-approved contractor

From 17/03/2008 to 28/02/2010, this is:
 Portable Appliance Safety Services (PASS)
 1 Hunters Buildings
 Bowesfield Lane
 Stockton-on-Tees
 TS18 3QZ
 Tel. 0870 143 1860
b.atkins@pat-services.co.uk

Relevant Legislation	Provision and Use of Work Equipment Regulations 1998 Electricity at Work Regulations 1989	
Additional Information	<p>Maintaining portable and transportable electrical equipment, HS(G)107</p> <p>Maintaining portable electrical equipment in offices and other low-risk environments, IND(G)160L</p> <p>Maintaining portable electrical equipment in hotels and tourist accommodation, IND(G)164L</p> <p>Electrical Safety and You, INDG231</p> <p>Safety in Electrical Testing at Work, INDG354</p> <p>Electrical Test Equipment for Use by Electricians, GS38</p> <p>Electrical Safety at Places of Entertainment, GS50</p> <p>Electrical Safety for Entertainers, INDG247</p> <p>Electricity at Work, Safe Working Practices, HSG85</p> <p>Maintaining portable electrical equipment in offices and other low-risk environments, INDG236</p> <p>Maintaining portable electrical equipment in hotels and tourist accommodation, INDG237</p> <p>Maintaining portable and transportable electrical equipment, HSG107</p> <p>From the Institution of Electrical Engineers: Code of Practice for In-service Inspection and Testing of Electrical Equipment, 3rd Edition. ISBN: 978-0-86341-833-4</p> <p>From the Institution of Engineering and Technology and BSI: BS 7671:2008 Requirements for Electrical Installations (IEE Wiring Regulations, 17th Edition)</p>	<p>All available via OHSIS</p>
Review Date	October 2012	

FREQUENCY OF INSPECTION AND TESTING

A PORTABLE EQUIPMENT

Equipment which can be connected to a fixed electrical supply or generator via a flexible cable and **either** a plug and socket outlet **or** directly via a fused spur and is

- hand-held or hand-operated while connected to the supply, or
- intended to be or likely to be moved while connected to the supply.

Categories	User Check	Inspection	Inspection and Test
Normal			
The base level for "portable" equipment.			
Class 1 (earthed)	Yes	-	1 year
Class II (double insulated)	Yes No	1 year 3 years	3 years No
Enhanced			
An intermediate class reserved for limited special cases where local risk assessment shows that the risk of damage or interference justifies an extra vigilance beyond the "normal" category: e.g. laboratory, workshop and catering equipment.			
Class 1 (earthed)	Yes	Intermediate, where indicated by local risk assessment	6 months
Class II (double insulated)	Yes	Intermediate, where indicated by local risk assessment	1 year
Higher			
Reserved for portable equipment where there is a significant risk of damage or interference. This includes:			
<ul style="list-style-type: none"> • Hand-held power tools, similar equipment and related extension leads • Equipment used in wet conditions or other physically challenging environments • Equipment subjected to heavy wear and tear and potential abuse 			
Class 1 (earthed)	Yes	Before each use	At least every 3 months, but more often where indicated by local risk assessment
Class II (double insulated)	Yes	6 months	At least every 6 months, but more often where indicated by local risk assessment

B TRANSPORTABLE EQUIPMENT

Equipment which can be connected to a fixed electrical supply or generator via a flexible cable and **either** a plug and socket outlet **or** directly via a fused spur, but which is **not** intended, or likely to be, moved while connected to the supply. E.g. freezers, refrigerators, photocopiers, water coolers, vending machines and some catering equipment).

Categories	User Check	Inspection	Inspection and Test
Normal The base level for "transportable" equipment.			
Class 1 (earthed)	No	No	At least every 3 years but more often where indicated by local risk assessment
Class II (double insulated)	No	3 years	No

C SPECIAL CASES

Categories	User Check	Inspection	Inspection and Test
Computer work stations: <ul style="list-style-type: none">• computers• screens• desk top printers• desk top scanners• related peripherals	On installation and relocation	5 yearly	No
Laptop computers	No	Before first use on University premises	No
"Permanent" extensions with flexes and socket block fastened in position -used for pc work stations and similar equipment in an office environment.	No	No	Prior to installation and if relocated. Otherwise 5 yearly.
"Permanent" extensions with flexes and socket block fastened in position -typically for low powered electronic equipment on research rigs etc	No	1 year	Prior to installation and if relocated. Otherwise at least every 5 years but local risk assessment may increase frequency where enhanced risk of damage.
Desk lamps in college rooms <ul style="list-style-type: none">• class 1• class II	No No	- 1 year	1 year 3 years
Transportable equipment supplied via fused connection unit e.g. vending machines, water coolers.	No	On initial installation, after any relocation, then 3 yearly	No
Fixed equipment supplied via a fused spur connection unit e.g. warm air hand driers.	No	-	1 year (earth test only), but local risk assessment may increase frequency where enhanced risk of damage.
Portable extensions other than those covered in the "high" risk group in Part A	No	Before first use.	1 year

D ADDITIONAL NOTE

Equipment connected directly via a fused spur need only be tested using the Earth Continuity Test. Frequencies and other details are as equipment provided with a plug.

USER CHECKS

1 SERIOUS DEFECT - EQUIPMENT TO BE WITHDRAWN FROM USE IMMEDIATELY

- a **plug** which is non-standard, chipped or broken, has parts missing, more than one cable connected to it or is wrongly wired.
- a **cable/flex** with bare wires, inadequate insulation, kinked, taped or "chocolate block" joints, not properly fixed, running between rooms, through doors, across corridors or stairs, or a three-core flex with the earth removed.
- **cable/flex** which has been damaged by heat, cold, abrasion or has been cut.
- home-made or wooden-based extension boards.
- obvious defects or damage, such as bare wires in the base of a table lamp, loose parts, overheating or burn marks.
- equipment with intermittent fault.

2 Other defects requiring check and repair

- **cable/flex** not properly clamped in the plug.
- two core **cable/flex**, e.g. lighting flex, on equipment which should be earthed.

3 Some potential defects which may require professional advice

- wall sockets and/or plugs showing signs of scorching or burning.
- home-made equipment.
- equipment which has overheated or been abused.
- equipment which will be used in wet conditions or has been damaged by water.
- wrong cable in use, e.g. non-flexible (grey) supply cable connected to portable appliance.


NOTE:

- 1 **You do not need to dismantle the plug** as part of a user check unless you are suspicious of its condition.
- 2 If a fuse in a plug has been replaced with a nail or paper clip, etc., or the fuse rating is too high, then have the equipment checked BEFORE USE.
- 3 "**Block Adaptors**" are prohibited for use within the University, and should be replaced by 13 amp extension boards to B.S. 1363A, if sufficient wall-mounted sockets are not available.

Fuse rating examples

3 amp fuse	Desk lamp, radio/cassette player, Hi-fi	up to 600 Watts
5 amp fuse	Iron, TV	up to 1000 Watts
7 amp fuse	Hair drier	up to 1400 Watts
13 amp fuse	Kettle	up to 3000 Watts

FORMAL VISUAL INSPECTION

- 1 Check the action of the ON/OFF switch - if unsatisfactory **FAIL** and refer for repair.
- 2 **DISCONNECT THE EQUIPMENT AND REMOVE THE PLUG FROM THE SOCKET.**
- 3 Check the whole length of the cable for cuts, abrasions, nips, perished areas, taped joints. If present - replace. Pay particular attention to the entries to the equipment and the plug and integrity of cable grips, grommets, etc. Check that any cable couplers are of approved pattern (male connections on machine side, female on the supply side). If in doubt, consult a qualified person. (Consult H.S.E. Guidance Note GS 37, flexible leads, plugs, sockets, etc.).
- 4 Check that double-insulated flex or lead is used, i.e. each conductor is insulated and there is a second layer of insulation around all the conductors. If not double-insulated remove and replace.
- 5 If twin-flex (i.e. two conductors with no third earth conductor) is used on equipment, which does not bear the double-insulated stamp  (Class II equipment) refer the equipment to a qualified person. Single-insulated twin-flex is not now acceptable on mains powered equipment and must be changed.
- 6 Where equipment is easily portable and may be moved while switched on or connected to the mains, e.g. desk lamps, the underneath of the base must be included in the visual inspection.

INSPECTION OF PLUG

- 7 Visually inspect the plug - if the plug is broken or cracked, any parts are missing, or there are burn marks around the pins, **FAIL** the plug and fit a new one. All new 13-amp plugs should have partially shielded pins.
- 8 Dismantle the plug and check that the internal wiring is firm, well-made and the leads go to the correct terminals:

Live	-	brown	(red)
Neutral	-	blue	(black)
Earth	-	green/yellow	(green)

If a lead with other coloured conductors is present, consult a qualified person and label the lead.

- 9 Check that there are no loose strands of wire which could cause an internal short.
- 10 Check the fuse rating. If this is not marked on the appliance, check the power rating and fit a fuse according to the table below:-

Wattage	Fuse Rating	Examples
Up to 400	2 amp	Desk lamps, radios/cassette recorders
400 - 600	3 amp	Laboratory hot plates, isomantles
600-1000(1KW)	5 amp	Refrigerators, irons, TV sets, overhead projectors
1KW - 2KW	10 amp	Water baths
2KW - 3KW	13 amp	Electric fires, cookers, kettles, vacuum pumps

Certain equipment may give surge currents when switching on which may exceed the current indicated by the wattage.

Note:

All flexible leads and extension cables should be included in the test programme and they should comply with HSE Guidance Note GS37.


ELECTRICAL SAFETY TEST

The test carried out depends upon the type of apparatus:-

a) Class I

Metal-cased equipment which relies on insulation and the connection of metal parts to the earth lead.

b) Class II

Double-insulated appliances marked with the  symbol. Class II appliances have only two wires (live and neutral) and will often be made of plastic or other electrically-insulating materials. There is no earth lead. External metalwork is insulated from live parts.

a) Class I Appliances

Class I appliances should have three leads in the cable/flex (live, neutral and earth) - if only two are fitted **REFER** to **qualified person** to test.

Two tests are required:-

1. Earth Continuity Test

The requirement is that the resistance between exposed metal parts of the apparatus and the earth pin of the plug should not exceed **0.1 ohm**.

- Appliances with a long mains lead may fail this test even though in good order. Appliances failing this test should be referred to a **qualified person** who can decide whether a resistance of up to **0.25 ohm or even 0.5 ohm** is acceptable in particular circumstances.
- Appliances with a smooth metal surface where clipping of the test lead cannot be achieved, or where metal parts are not accessible must be tested by a **qualified person**.
- The test device usually puts 25 amps for 5 seconds through each circuit for this test.

2. Insulation Test

The requirement is that the measured insulation resistance between the (temporarily) shorted live and neutral pins, and the earth pin shall exceed **1 Meg ohm at 500 volts**.

- **Electronic equipment may be damaged by this test.** Refer to qualified person.
- Some test meters have **1000V** test settings. This setting should only be used by **qualified persons**, is not normally necessary and can damage equipment.


TEST PROCEDURE

Follow the instructions printed on or with the tester.

- **Competent persons** as distinct from **qualified persons** should only perform the earth continuity test at **25 amps** (with the exception of low power electronic equipment and audio-visual equipment) and the insulation test at **500V**.
- With kettles and water heating equipment, the earth test lead must be clipped to the outside of the heater element.
- Appliances failing must be referred to a **qualified person** for further test or repair and must be marked '**FAIL**', and taken out of service.
- If in doubt, refer to a **qualified person**.

Note: Results of all tests should be recorded.

b) Class II Appliances

Double-insulated appliances marked  are more difficult to test as there is no earth lead and consequently the earth pin in the plug is not used. Earth continuity impedance is not measured.

- If the appliance has a completely insulated case, carry out a visual inspection and plug check only.
- If the appliance has exposed metal work then the insulation resistance may be measured between the temporarily connected live and neutral pins and the external metal work but the advice of a qualified person should be sought prior to this test. There is a possibility that this test could damage audio-visual, electronic and computing equipment.
- In any case, carry out visual and plug inspection.
- If recessed screw heads are the only metalwork, then carry out a visual and plug inspection.

Record result.

NOTES FOR PAT TESTERS USING MEGGER PAT32 INSTRUMENT

1. Carry out full visual inspection – if item fails do not proceed (remove from service or label and tell owner to refer to workshop).
2. Switch item **ON** and plug into tester socket.
3. If Class 2 (earthed) clip earth test lead to metal parts of apparatus, select appropriate test current (10 Amps for up to 1 Kilowatt power – 25 Amps for >1 Kilowatt) and press **earth** test button for 5 seconds. **A value of less than 100milliOhms is required.** Repeat on any additional metal parts. Note reading.

For Class 2 (double insulated equipment) **omit this test.**

4. Press **Insulation** test button for 5 seconds and note reading. A value of 2 MegOhms is required for Class 1 (earthed) equipment and >7 MegOhms for Class 2 (double insulated).
5. Unplug item under test **and switch it off.**
6. Record barcode number of equipment, visual inspection result (PASS/FAIL) earth test value (milliOhms), insulation value (MegOhms) and any additional comments you wish to add.