

Why the need to test?

The Health & Safety Executive estimate that 25% of all reported electrical accidents at work, are as a result of faulty electrical appliances.

The Electricity at Work Regulations 1989 S.I. 635 are a legal requirement & state that all electrical systems will be maintained where this will prevent danger. It goes on to state that an electrical system includes anything that can be used to generate, provide, transmit, transform, rectify, convert, conduct, distribute, control, store, measure or use electrical energy.

Regulation 29 states that it shall be a defence if it can be proven that all reasonable steps were taken and due diligence was exercised to avoid such danger.

Q. How do you prove that you have taken the necessary steps and exercised due diligence.

A. By carrying out regular inspection & testing of such equipment.

The Electricity at Work Regulations are not only there to safeguard people against electrical faults.

Each year over 2500 people are injured or killed due to electrical fires. As if proof were needed many insurance companies now insist on a proper appliance-testing programme being in place before cover can be granted.

The Law

The Electricity at Work Regulations 1989 are different to almost any other law in the respect that you are assumed guilty and that **you** have to prove your innocence. The best way of proving your innocence or “**all due diligence**” is to carry out routine inspection and testing of all of your equipment.

The Electricity at Work Regulations 1989 are a legal requirement. Whether you are an employer, employee or self employed you are by definition of the Electricity at Work Regulations a duty holder and are required to comply with the provisions of the law.

In addition to the Electricity at Work Regulations 1989 there is another legal requirement that concerns the safety of electrical appliances;

The Provisions and Use of Equipment Regulations 1998 states that every employer shall ensure that all work equipment is so constructed or adapted as to be suitable for the purpose for which it is to be used... and goes on to say that every employer shall ensure that work equipment is maintained in an efficient state, in efficient working order and in good repair.

PORTABLE APPLIANCE TESTING.

LEGAL/TECHNICAL DEFINITIONS - Bullet-Section 1.

- ? THE LAW. The Electricity at Work Regulations 1989 is an Act of Parliament and is therefore the LAW.
- ? HSG (107) - The guidance covers drills, extension leads, floor cleaners, kettles, and other similar equipment used in all types of environments such as construction sites, factories, workshops, business and commercial premises.

The types of tests carried out on these appliances are

DESTRUCTIVE TESTS

And should not be carried out on “IT RELATED” equipment

- ? F.E.I. RECOMMENDATIONS ON BUSINESS EQUIPMENT TESTING.
The F.E.I. or Federation of Electronic Industries has produced this guidance document on the testing of IT RELATED electronic equipment.
- ? The IEE CODE OF PRACTICE FOR IN-SERVICE INSPECTION & TESTING OF ELECTRICAL EQUIPMENT.
The Institution of Electrical Engineers is the main body in this country responsible for setting the standard to be adhered to for electrical work or testing being carried out either on fixed installation or portable electrical equipment.

Under Part Two of the “IEE Code of Practice” Inspection/Testing is reduced to three main activities:

- 1) User Checks**
- 2) Formal Visual Inspections**
- 3) Combined Inspection and Tests**

Electrical Equipment

Many people think that this means anything Electrical that plugs into an electrical supply. By and large this is correct, however there are other areas such as fixed equipment that need to be considered in an inspection and testing programme.

The IEE Code of Practice groups appliances to be tested into equipment groups. Once identified in a group it then goes onto give advice on what tests should be carried out, the safe and unsafe limits of these tests and how often the tests should be carried out. These equipment groups are listed as follows;

Portable Appliances (P)

An appliance that is intended to be moved while in operation or an appliance that can easily be moved from one place to another while connected to the supply e.g. toaster, food mixer, vacuum cleaner.

Movable / Transportable Equipment (M)

This equipment is either

- (1) 18kg or less in mass and not fixed e.g. electric fire
- (2) Equipment with wheels, castors or other means to facilitate movement by the operator as required to perform its intended use.

Hand Held Appliances or Equipment (H)

This is a portable appliance or equipment intended to be held in the hand during normal use, e.g. hair dryer, drill, soldering iron, and kettle.

Stationary Equipment or Appliances (S)

This has a mass exceeding 18kg and is not provided with a carrying handle, e.g. refrigerator, washing machine.

Fixed Equipment / Appliances

This is equipment or an appliance that is fastened to a support or otherwise secured in a specified location, e.g. bathroom heater, towel rail.

Appliances / Equipment For Building In

This equipment is intended to be installed in a prepared recess such as a cupboard or similar. In general equipment for building in does not have an enclosure on all sides because on one or more of the sides, additional

Protection against electric shock is provided by the surroundings e.g. a built in electric cooker.

Information Technology (Business Equipment) (IT)

Information technology equipment includes electrical business equipment such as computers, mail processing machines, monitors, VDUs, data terminal equipment, printers, computerised kitchen equipment etc.

Extension Leads

The use of extension leads should be avoided where possible. If they are to be used 3-core leads (those including an earth wire) should be used.

A standard 13A 3-pin extension socket-outlet with a 2-core (no earth) cable should never be used

The length of lead should not exceed the following:

<u>Core Area</u>	<u>Maximum Length</u>
1.25 mm ²	12 metres
1.5 mm ²	15 metres
2.5 mm ²	25 metres

(i.e. 1.5 mm² times by 10 = 15 metres)

If extension leads over 25 meters are to be used, they should be protected by a 30mA r.c.d. To BS707.

This electronic device is used as a safety cut out switch and does not normally come under the standard P.A.T. Testing programme.

In addition to the statutory tests extension leads should be subjected to an additional polarity test.

TABLE 1 – SUGGESTION INITIAL FREQUENCY OF INSPECTION AND TESTING OF EQUIPMENT							
TYPE OF PREMISES		TYPE OF EQUIPMENT	USER CHECKS	CLASS 1		CLASS 2 (NOTE 4)	
				Note 3	Note 5	Note 3	Note 5
		Note 1	Note 2	Formal Visual Inspection	Combined Inspection & Testing	Formal Visual Inspection	Combined Inspection & Testing
1		2	3	4	5	6	7
1	CONSTRUCTION SITES 110V EQUIPMENT }	S	NONE	1 MONTH	3 MONTHS	1 MONTH	3 MONTHS
		IT	NONE	1 MONTH	3 MONTHS	1 MONTH	3 MONTHS
		M#	WEEKLY	1 MONTH	3 MONTHS	1 MONTH	3 MONTHS
		P#	WEEKLY	1 MONTH	3 MONTHS	1 MONTH	3 MONTHS
		H#	WEEKLY	1 MONTH	3 MONTHS	1 MONTH	3 MONTHS
2	INDUSTRIAL INCLUDING COMMERCIAL KITCHENS	S	WEEKLY	NONE	12 MONTHS	NONE	12 MONTHS
		IT	WEEKLY	NONE	12 MONTHS	NONE	12 MONTHS
		M	BEFORE USE	1 MONTH	12 MONTHS	3 MONTHS	12 MONTHS
		P	BEFORE USE	1 MONTH	6 MONTHS	3 MONTHS	6 MONTHS
3	EQUIPMENT USED BY THE PUBLIC	S	NOTE 6+	MONTHLY	12 MONTHS	3 MONTHS	12 MONTHS
		IT	NOTE 6+	MONTHLY	12 MONTHS	3 MONTHS	12 MONTHS
		M	NOTE 6+	WEEKLY	6 MONTHS	1 MONTH	12 MONTHS
		P	NOTE 6+	WEEKLY	6 MONTHS	1 MONTH	12 MONTHS
4	SCHOOLS	S	WEEKLY+	NONE	12 MONTHS	12 MONTHS	48 MONTHS
		IT	WEEKLY+	NONE	12 MONTHS	12 MONTHS	48 MONTHS
		M	WEEKLY+	4 MONTHS	12 MONTHS	4 MONTHS	48 MONTHS
		P	WEEKLY+	4 MONTHS	12 MONTHS	4 MONTHS	48 MONTHS
5	HOTELS	S	NONE	24 MONTHS	48 MONTHS	24 MONTHS	NONE
		IT	NONE	24 MONTHS	48 MONTHS	24 MONTHS	NONE
		M	WEEKLY	12 MONTHS	24 MONTHS	24 MONTHS	NONE
		P	WEEKLY	12 MONTHS	24 MONTHS	24 MONTHS	NONE
6	OFFICES AND SHOPS	S	NONE	24 MONTHS	48 MONTHS	24 MONTHS	NONE
		IT	NONE	24 MONTHS	48 MONTHS	24 MONTHS	NONE
		M	WEEKLY	12 MONTHS	24 MONTHS	24 MONTHS	NONE
		P	WEEKLY	12 MONTHS	24 MONTHS	24 MONTHS	NONE
		H	BEFORE USE	6 MONTHS	12 MONTHS	6 MONTHS	NONE

(1) S STATIONARY EQUIPMENT

(2) IT INFORMATION TECHNOLOGY EQUIPMENT

(3) M MOVABLE EQUIPMENT

(4) P PORTABLE EQUIPMENT

(5) H HAND-HELD EQUIPMENT

(2) User checks are not recorded unless a fault is found.

(3) The formal visual inspection may form part of the combined inspection tests when they coincide and must be recorded see 7.2b

(4) If class of equipment is not known, it must be tested as a Class 1.

(5) The results of combined inspections and tests are recorded see 7.2c

(6) For some equipment such as children's rides, a daily check may be necessary.

(+) By supervisor/teacher/member of staff.

110v earthed centre tapped supply. 230v portable or hand-held equipment must be supplied via a 30mA r.c.d. and the intervals between inspections and tests reduced.

The information on suggested initial frequencies given above is more detailed and specific guidance, but is not considered inconsistent with it.

PORTABLE APPLIANCE TESTING.

“WHAT ARE PORTABLE APPLIANCES” - DEFINITIONS

- Bullet-Section 2.

- ? **“P”** EVERYDAY ELECTRICAL APPLIANCES i.e. Toaster, Food Mixer, Vacuum Cleaner etc.
- ? **“M”** MOVEABLE/ TRANSPORTABLE EQUIPMENT - 18KG or less in mass and not fixed, i.e. Electric Fire.
- ? **“H”** HAND HELD APPLIANCE OR EQUIPMENT - This is portable equipment intended to be held in the hand during normal use, e.g. Hair Dryer, Drill, Soldering Iron and Kettle.
- ? **“S”** STATIONARY EQUIPMENT OR APPLIANCES - This has a mass exceeding 18KG and is not provided with a carrying handle e.g. Refrigerator, Washing Machine.
- ? **“IT”** INFORMATION TECHNOLOGY (BUSINESS EQUIPMENT) – General office equipment and new styles of cooking/kitchen equipment.
- ? APPLIANCES/EQUIPMENT FOR “BUILDING IN” - This is equipment intended to be installed in a prepared recess such as a cupboard, e.g. Built-in Fridge, Built-in Freezer.
- ? FIXED EQUIPMENT/APPLIANCES - This includes items such as Hand Dryers in public places, Bathroom Heater, Heated Towel Rail.
- ? EXTENSION LEADS - If they are to be used 3-core leads (those including an earth wire) should be used!

A polarity test on 3 core Power/Extension leads is required to determine whether the leads phase (Live), neutral and earth conductors are in tact and connected correctly.

PORTABLE APPLIANCE TESTING.

TRAINING DEFINITIONS - Bullet-Section 3.

- ? **USERS** - Person using the appliance. Upon finding a fault the faulty equipment **MUST NOT** be used and reported without delay to the responsible person. No record of a user check needed if appliance Ok.

- ? **MANAGERS** -
i.e Managers of the premises,
Managers of the inspection and test organisation.
Those who inspect and test equipment.

- ? **INSPECTORS** - The importance must be stressed of recording inspection and test results, labelling and reporting to Managers for action on defects, trends or changes in their assessment of risk.

Appliances Classifications

In order to understand what tests to carry out on any given appliances it is necessary to identify the 'class' of the equipment to be tested.

Electrical appliances are grouped into three main classifications.

These are as follows:

Class 1 / Earthed Equipment

Class 1 equipment is equipment that is protected against electric shock by means of a protective earth conductor (wire) being connected between the supply plug and the conductive (metal parts) of the equipment. This conductor is in addition to a basic insulation and is designed to protect the user should the basic insulation fail.

Typically Class 1 equipment has exposed metal parts, although not in all instances. The supply cable in a Class 1 appliance carries three wires Phase (Live), Neutral and Earth. Examples of Class 1 equipment would be; kettles, irons, toasters, computers, monitors, power/extension leads etc.

Class 2 Equipment / Double Insulated

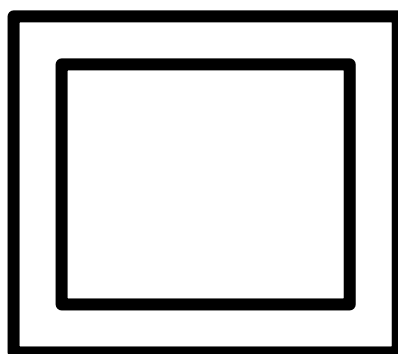
Class 2 equipment is equipment in which protection against electric shock is provided by basic insulation and additional safety precautions such as double insulation or reinforced insulation.

In Class 2 equipment there is no provision for a protective earthing conductor. The supply cable in this instance only carries two wires; phase (Live) and neutral.

Class 2 equipment by and large are encased in non-conducting material such as plastic or rubber. Such equipment is referred to as insulation encased Class 2.

Sometimes Class 2 appliances have a metal casing. This equipment is called metal-cased Class 2 equipment. Examples of Class 2 equipment would be electric drills, hair dryers etc.

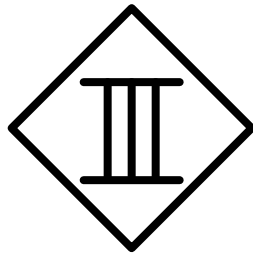
To identify the appliance as being Class 2 sometimes the following construction will be displayed on the appliance;



Class 3 Equipment / Separated Extra Low Voltage

Class 3 equipment relies for protection against electric shock on supply from a SELV (separated extra low voltage) source.

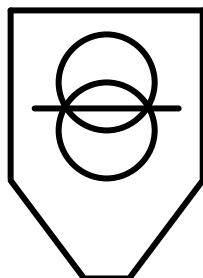
The Class 3 construction mark is as follows:



SELV voltages will not exceed 50 V and in many installations will be required to be below 24 or 12 V. SELV systems require specialist design and there must be no earth facility in the distribution of a SELV circuit or appliance.

Class 3 Equipment must be supplied from a safety- isolating transformer to BS3535. The safety-isolating transformer will have the following mark on it.

This Equipment is normally used in Fixed Installations



“APPLIANCE CLASSIFICATION” DEFINITIONS

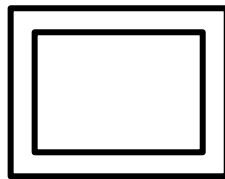
- Bullet-Section 4.

? CLASS 1/EARTHED EQUIPMENT - Equipment supplied with an earth conductor(s). This has no symbol.

? CLASS 2 EQUIPMENT, DOUBLE INSULATED - Class 2 equipment is equipment in which protection against electric shock is provided by basic insulation and additional safety precautions such as double insulation or reinforced insulation. This type has no earth conductor.

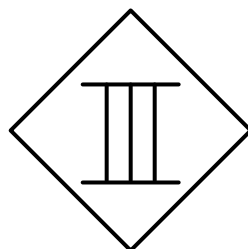
? Sometimes Class 2 appliances have a metal casing. This equipment is called metal-cased Class 2 equipment

? CLASS 2 SYMBOL



? CLASS 3 EQUIPMENT, SEPARATED EXTRA LOW VOLTAGE - Class 3 equipment relies for protection against electric shock on supply from a SELV (separated extra low voltage) source. THESE ITEMS ARE NOT NORMALLY TESTED.

? CLASS 3 SYMBOL



Inspection & Testing

User Checks

The user check is one of (if not **the** most) the most important safety precautions and should not be overlooked. No record of the user check is required unless part of the inspection is found to be unsatisfactory.

The procedure for a user check is outlined as follows:

- (2) Inspect the flex – is it in good condition. Is it free from cuts or fraying? Is it too long or too short?
- (3) The plug – any signs of overheating. Free from cracks or damage. Is the cable secure.
- (4) The socket outlet – any signs of overheating. Free from cracks and damage.
- (5) The appliance – does it work Is it free from cracks or damage that could result in access to live parts
- (6) Environment – is the equipment suitable for its purpose
- (7) Suitability for the job – is the equipment suitable for the work for which it is required.

If any appliance is found to be faulty the following procedure must be followed:

- (1) Switch off and unplug the appliance from the supply
- (2) Label the item to identify that it must not be used
- (3) Report the fault to a responsible person

Formal Visual Inspections

Before the appliance is tested it must have been thoroughly inspected visually and the findings recorded.

Albeit common sense the visual inspection can never be taken for granted. If done properly 90% of faults should be picked up at the visual inspection stage.

Some of the main points to pay attention to are:

Condition of the supply lead – loose connections, bare or frayed wire, flat spots?

Case – is the appliance case secure, free from damage or dirt
Plug top – is the plug top free from damage or cracks?

Any signs of overheating?

Are the plug pins insulated?

Wiring – is the plug wired correctly Are there the right number of wires for the class of the appliance. Are the wires going to the correct terminals and secure. Is the cable grip secure?

On/off switch – does it operate as it should do?

Cable size – is the cable the right length and thickness for the appliance?

Fuse rating – does the appliance have the correct rated fuse,?

WHAT FUSE WOULD YOU USE IN THE PLUG-TOP ATTACHED TO THESE APPLIANCES?

APPLIANCE	TELEVISION	800W DRILL	COMPUTER	KETTLE	HEATER	DESK LAMP
FUSE SIZE (AMP)						
<u>ACTUAL FUSE SIZE (AMP)</u>						

How to work out your fuse size

1 Amp = 240 Watts	(Black Fuse)
5 Amps = 1200 Watts	(Black Fuse)
3 Amps = 720 Watts	(Orange/Red Fuse)
13 Amps = 3120 Watts	(Brown Fuse)

1000 milli-Amps = 1 Amp

To summarise:- A 60 Watt light bulb = $\frac{1}{4}$ of an Amp (or 250milli-Amps)

To make deciding on what fuse to use, we can make it simpler by saying:-

An appliance that generates a load of under 700 Watts = **3 Amp fuse**

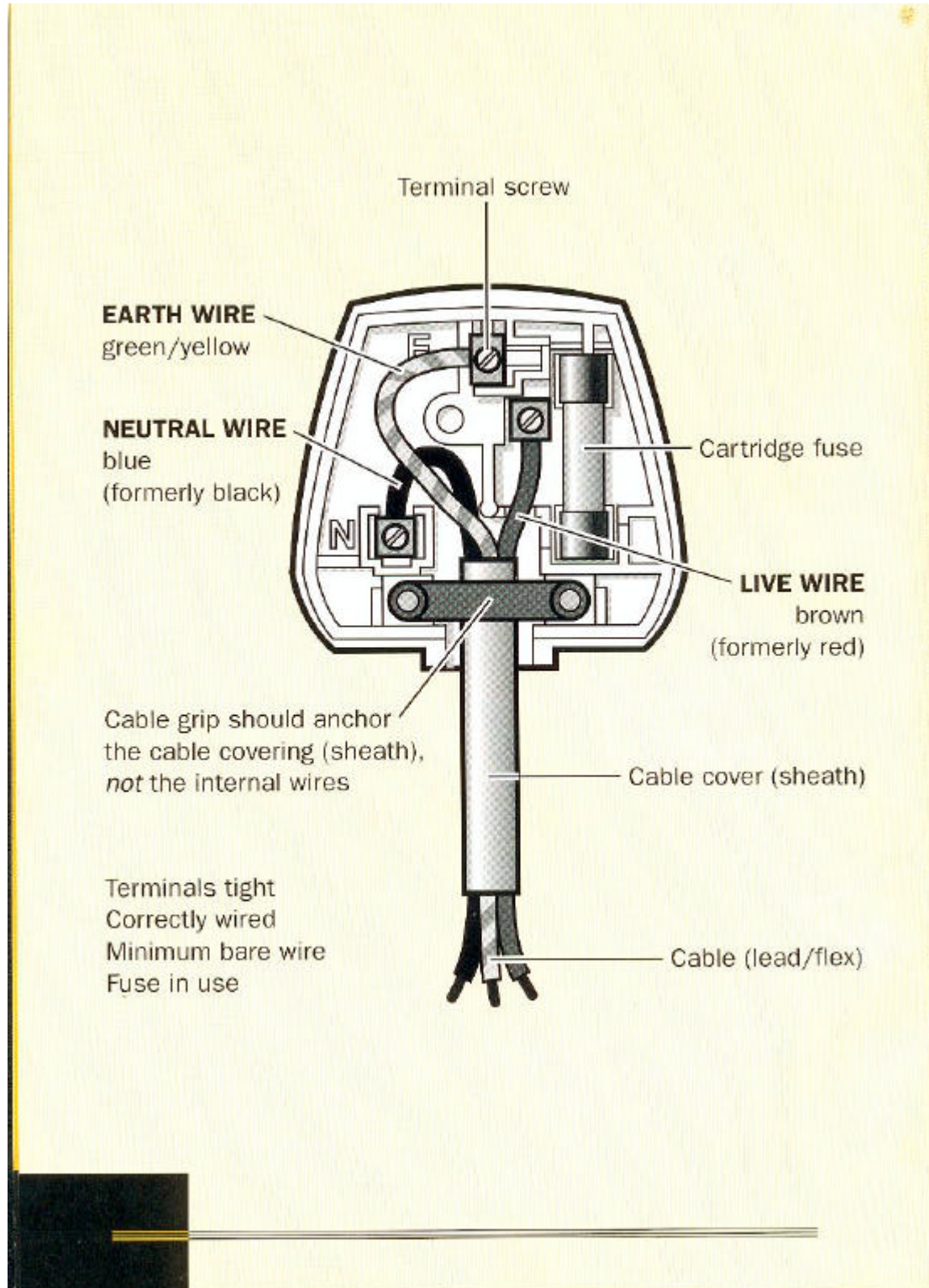
Examples: Lamps, desk fans, T.V.s, Videos, chargers, blender.

An appliance that generates a load of over 700 Watts = **13 Amp fuse**

Examples: Kettle, Iron, toaster, fridge, industrial, heaters.

All appliances must have a load of less than 3120 Watts if they have a standard 3-pin plug top fitted.

Inside A Typical Plug Top



Earth Testing (Class 1 Appliances Only)

Following the completion of a formal visual inspection a Class 1 appliance must be subjected to an earth continuity test sometimes referred to as the earth bond test.

The Earth test is carried out to prove that should the appliance become live (a live wire on a fridge for example touches the metal casing) the Earth path would be able to withstand the flow of current and in turn blow the fuse.

For a Class 1 appliance apart from a basic insulation the appliance relies on protection from an earth conductor. This is a wire that is connected between the supply plug and a metal part of the appliance.

Class 1 Continuity Test (reading taken in Ohms)

Class 1 continuity testing is carried out on I,T, (information technology) equipment only.

This test is a **non-destructive** test, and only verifies that the asset has a continuity of earth from a part of its chassis or case down the lead and back to the fuse (distribution) board.

A continuity measurement with an Earth test current within the range 20 - 200mA (0.02 to 0.2 Amps).

Class 1 Bond Test (reading taken in Ohms)

This test is carried out exactly the same as the continuity test, and for the same reasons.

THIS TEST HOWEVER IS A DESTRUCTIVE TEST

This destructive test is carried out only on Appliances that are **NON** “I,T,” based, e.g. Kettles, fridges, toasters, floor scrubbers.

An earth bond measurement with an Earth test current not less than 1.5 times the fuse rating of the appliance under test and no greater than 25A for a minimum of 5 seconds.

With any Earth test (continuity/Bond) test you are looking for a very low resistance reading.

The lower the reading the better the earth conductor this can be summarised as below:

<u>Appliance Rating</u>		<u>1-13Amp</u>
Pass Limit		< 0.3 Ohms

Whether carrying out an Earth continuity or Earth Bond test, ideally the reading should be less than 0.3 ohm's

Please note this table does not apply to extension leads.

(Normally leads that are over 25 metres in length)

Insulation Resistance Test (reading taken in Ohms)

The insulation resistance test applies to Class1 and Class 2 equipment.

THIS TEST IS A DESTRUCTIVE TEST AND SHOULD NEVER BE PERFORMED ON I,T, EQUIPMENT

The insulation resistance test may be checked by Application of a test voltage – measuring resistance.

This involves applying a voltage of 500V d.c.

With Class1 appliances an appliance tester will short together phase (Live) and neutral conductors and measure the resistance to the earth conductor.

Class 2 insulation testing involves shorting together phase (Live) and neutral and measuring the resistance against an external probe (Earth).

Like the earth test a resistance measurement is being taken however a high reading is now looked for. The safe limits are listed in Table 3 of the Code of Practice. This can be summarised as below:

Pass Levels	Class 1	Class2
Standard Appliance	>1 Megohms	>2 Megohms
Cooking/Heating	> 0.3 Megohms	N/A

> Means greater than

If applied voltage is used (500Volt Insulation resistance test) on I,T, equipment damage to the appliance under test may well occur due to excessive voltage

Functional Test

A functional test is simply to check that the appliance works properly.

Following on from the visual earth and insulation tests we have yet to check if the appliance actually works. This test is carried out to satisfy not only the Electricity at Work Regulations 1989 but also the Provisions and Use of Equipment Regulations 1998 which state that equipment must be in efficient working order and in good repair.

The functional test must be carried out whenever possible. As we cannot carry out the destructive tests on I,T, equipment, we have to verify in other ways that the appliance is safe to use.

Carrying out the functional test on the appliance ensures that the appliance actually works, but in the case of I,T, equipment we can also take a further reading that verifies that excessive dangerous currents are not being produced by the equipment.

This reading is known as Earth Leakage.

Earth Leakage is normally produced by appliances that are Class 1(Earthed) and contain semi-conductors (I,T related).

This test is carried out in place of the Insulation resistance test, and so ensuring that all criteria are met when testing all appliances.

For IT equipment the earth leakage method should be used.

Polarity Test

On IEC moulded supply leads and extension leads it is almost impossible to physically check the wiring inside the plug top simply because there's no access therefore an additional test is required. A polarity test is required to determine whether the leads phase, neutral and earth conductors are in tact and connected correctly.

Flash Test

The flash test is similar to the insulation test in so much that it is a destructive test. The flash test calls for a high voltage to be applied; 1500 V on Class 1 appliances, 3000 V on Class 2.

The test is a British Standard Type Approval test for manufacturers only. There is no call for flash testing on appliances as part of a preventative maintenance programme and indeed this is not a recommended test in the Code of Practice. With very few exceptions the flash test should not be carried out at all.

Damaged or Faulty Equipment

Should an appliance fail, an assessment must be made by a responsible person as to the suitability of the equipment for the use / location.

Any items found to be faulty should be brought to the attention of the responsible person

How do I Carry Out Testing?

By far the easiest way of carrying out appliance testing is to use a purpose built portable appliance tester.

These test units will perform all of the tests required and range in price and specification.

Because the regulations demand the keeping of up to date and accurate records, many portable appliance testers have the facility of storing the results in their memory enabling the user to download the information directly into record keeping software.

When selecting an appliance tester you have to be careful to consider all of the factors that could influence the job that it is intended for such as;

- (1) What equipment are you going to be testing 110V / 240 V or both
- (2) What environment are you going to be working in
- (3) How many items will you be testing? Do you need to have the data storage facility

There are still few of the older style of appliance tester in circulation that do not fully comply with the guidance notes as they only give a pass or fail indication and not a reading.

This makes it impossible to compare previous years results and hinders the recommendation of preventative action. These testers should be avoided at all costs.

Calibration

With any portable appliance tester you need to be sure that the readings that are given are accurate.

A calibration certificate proves that the tester readings against a known source were accurate.

A portable appliance tester would normally be calibrated annually

How Often Should Testing Be Done?

Testing should be carried out at regular intervals throughout the lifetime of an appliance, again a number of factors come into play when determining the frequency of test:

- (1) The environment – appliances in offices will be less susceptible to damage than equipment in an arduous environment
- (2) The users – If equipment is likely to receive unreported abuse, more frequent testing will be required.
- (3) Equipment type – hand held equipment is more likely to be damaged than fixed equipment therefore warrants more frequent testing.

A frequency chart detailing equipment types, premises and appliances classes is listed in the Code of Practice. See the Frequency of test table (page 9).

Record Keeping

As important as the actual testing is the record keeping.

The IEE Code of Practice outlines the importance of keeping accurate and up to date records following the testing of electrical equipment.

The following records must be kept:

- (1) Record of inspections – a comprehensive list of all equipment that has been tested
- (2) Test results – results from these tests must be kept for analysis
- (3) Repairs – any work carried out on any appliances in the form of repairs etc must be recorded
- (4) Purchased equipment record – all new equipment bought must be recorded. In event of a large testing programme being in place you must be aware of all equipment that needs testing whether it has been tested before or not.

These records can be kept either on record cards, logbooks or the most common method by pc software package.

Following the completion of a test the appliance must be labelled with the id number, test date, by whom and retest date.

The label must be applied to a section of the appliance where it can be easily seen and checked by the user.

QUESTION:		ANSWERS
1	Is the electricity at work regulations 1989 a legal requirement?	
2	What is the name of the legal document that must be adhered to regarding Portable Appliance Testing?	
3	What is the most important part of P.A.T. Testing:- (a) earth test, (b) insulation test (c) visual test?	
4	List three USER checks?	
5	List three Formal Visual Checks?	
6	What fuse would you fit to a standard plug top fitting to an appliance with a load of 900 watts?	
7	What fuse would you fit to a standard plug top fitting to an appliance with a load of 60 watts?	
8	What is the maximum length of cable allowed when the core area of the cable is 1.0mm ² ?	
9	What extra test is applied to extension leads?	
10	What is the symbol for CLASS 2 equipment?	
11	If a protective earth wire is connected to the metal parts of the equipment and the plug top, what Class of equipment is this?	
12	What current range <u>could</u> a 13amp fuse blow at?	
13	What is the maximum reading that can be considered as a PASS when carrying out an earth test?	
14	What voltage do we carry out insulation testing at?	
15	What is the minimum insulation resistance reading for a CLASS 1 appliance?	

- ? USER - Person using the appliance.
- ? FORMAL VISUAL INSPECTION - Before the Appliance is tested it must have been thoroughly inspected visually and the findings recorded.
- ? FUSE SIZE: Appliance with a load below 700w = 3Amp fuse
Appliance with a load over 700w = 13Amp fuse
- ? EARTH CONTINUITY TESTING/CLASS 1 APPLIANCES ONLY
**20 – 200Ma Continuity measurement carried out on IT Based equipment (office and new style kitchen appliances).
Typical reading less than 0.3 ohm.**
- ? EARTH BOND MEASUREMENT/CLASS 1 APPLIANCES ONLY
10 – 25A Bond measurement (1.5 times the fuse rating)
Typical appliances include Kettles, fridges, toasters etc.
Typical reading less than 0.3 ohm.
- ? INSULATION RESISTANCE TEST (500Volt)
The insulation resistance test applies to Class 1 and Class 2 equipment with exception to IT Based equipment.
Class 1 equipment, check reading greater than 1 Mega-ohm.
Class 2 equipment, check reading greater than 2 Mega-ohm.
- ? EARTH LEAKAGE METHOD
In the case of IT related equipment, the Earth Leakage Method should be taken instead of the insulation resistance test. This is carried out when the Appliance is switched on and measurement taken. Typical reading less than 3.5 Milli-amps
- ? FUNCTIONAL TEST: A functional test is simply to check that the appliance works properly.
- ? FLASH TEST :In standard Appliance testing, flash testing should never be carried out.
- ? CALIBRATION: A calibration certificate proves that the testers readings against a known source were accurate. Calibration would normally be carried out annually.

Label Information

The IEE code of Practice indicates that ideally, on a PASS label, that the label should include the following:

Asset Number

Date Tested

Who Tested the appliance

The Date of Re-test

Diagram 1

APPLIANCE TESTED PASSED
No.....
Date Tested.....
By.....
Re-test Date.....

Should an Appliance fail, again ideally the following information should be displayed

Diagram 2

<p><u>DANGER</u> DO NOT USE</p> <p>FAILED ELECTRICAL SAFETY TEST</p> <p>SIGNED: _____ DATE: _____</p> <p>ELECTRICITY AT WORK REQ.</p>
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The filled out “APPLIANCE PASSED/FAILED” label, must then be fixed on a visible area of the asset.

ASSET	GROUP	NOTES/ADVICE
EXTENSION LEAD 1-4 WAY CLASS 1	EL1	SURGE PROTECTION CAN GIVE 0.3Mohm's INSULATION = PASS
POWERLEAD	EL1	
COMPUTER	IT	CHECK MONITOR O/P FROM PC EARTH PIN CONTINUITY
MICROWAVE OVEN	IT	ADD A CUP OF WATER FOR OPERATION TEST
MONITOR/COMPUTER	IT	
CLASS 1 PRINTER PRINTER NO EARTH	IT CHK	CAN BE EITHER "IT" OR "CHK"
CLASS 1 SCANNER SCANNER ADAPTER	IT SC2	CAN BE EITHER "IT" OR "CHK"
CLASS 1 TILL CLASS 2 TILL	IT CHK	CAN BE EITHER "IT" AND "CHK"
CLASS 1 LAMP	SC1	
FAN CLASS 1	SC1	FAN MAY HAVE 3-CORE CABLE, BUT NO METAL CASING OR CONNECTION, USE SC2 IN THIS CASE.
FRIDGE/FREEZER	SC1	
HEATER/RADIATOR. CONVECTION	SC1	
KETTLE /IRON	SC1	RUN KETTLE FROM MAINS SOCKET TO CHECK THERMOSTAT.
TOASTER/GRILL	SC1	CHECK TOASTER OPERATION FROM MAINS.
ADAPTER POWER SUPPLY	SC2	DISCONNECT DEVICE FROM PSU
CLASS 2 LAMP	SC2	
FAN CLASS 2	SC2	
MODEM ADAPTER	SC2	DISCONNECT FROM MODEM.
SATELITE RECEIVER	SC2	DISCONNECT DISH, COAX, AND SCART LEAD
STEREO SYSTEM	SC2	
TELEVISION	SC2	
VACCUM CLEANERS	SC2	

TEST GROUPS

TG10/1 (applicable to AVO PAT4 DV Tester)

GROUP	DESCRIPTION	VOLT	CLASS	BOND AMP	TESTS	LIMITS
SC1	STANDARD CLASS 1 EARTHED EQUIP. E.G. SOLDER IRON, HAND DRYER, FRIDGE	230	1	25A	VISUAL	YES
					CONTIN.	---
					BOND	<0.3 OHM
					INSUL.	>1 M
					OPER.	<3000 VA
					FLASH	---
					EXTEN.	---
					POL.	---
E.L.	<0.5 mA					
EL1	EXT. LEADS AND POWER LEADS	230	1	25A	VISUAL	YES
					CONTIN.	---
					BOND	<0.3 OHM
					INSUL.	>1 M
					OPER.	---
					FLASH	---
					EXTEN.	YES
					POL.	YES
E.L.	---					
IT	IT EQUIP. SENSITIVE TO INS. TESTING This test for general office equipment i.e. Computers, Monitors, Copiers etc	230	1	200Ma- or 0.2Amps	VISUAL	YES
					CONTIN.	<0.3 OHM
					BOND	---
					INSUL.	---
					OPER.	<3000 VA
					FLASH	---
					EXTEN.	---
					POL.	---
					E.L.	<3.5 mA
SC2	STANDARD CLASS 2 DOUBLE INSULATED EQUIPMENT EG:- VACCUM CLEANERS, LAMPS	230	2	---	VISUAL	YES
					CONTIN.	---
					BOND	---
					INSUL.	>2 M
					OPER.	<3000 VA
					FLASH	---
					EXTEN.	---
					POL.	---
					E.L.	---

TEST GROUPS TG10/2 (applicable to AVO PAT4 DV Tester)

GROUP	DESCRIPTION	VOLT	CLASS	BOND AMP	TESTS	LIMITS
VIZ	VISUAL ONLY (I.E. Servers, hubs and equipment that cannot be turned off)				VISUAL	Yes
					CONTIN.	----
					BOND	-----
					INSUL.	-----
					OPER.	-----
					FLASH	-----
					EXTEN.	-----
					POL.	-----
TO1	110V EARTHED TOOLS	110	1	25A	VISUAL	YES
					CONTIN.	---
					BOND	<0.1 OHM
					INSUL.	>1 M
					OPER.	<2000 VA
					FLASH	---
					EXTEN.	---
					POL.	---
E.L.	<3.5 mA					
TO2	110V DOUBLE INS. TOOLS	110	2	---	VISUAL	YES
					CONTIN.	---
					BOND	---
					INSUL.	>2 M
					OPER.	<2000 VA
					FLASH	---
					EXTEN.	---
					POL.	---
E.L.	<0.5 mA					
EL2		230	2	---	VISUAL	YES
					CONTIN.	---
					BOND	---
					INSUL.	>5 M
					OPER.	---
					FLASH	---
					EXTEN.	YES
					POL.	YES
E.L.	---					
CHK	OPERATION AND E.L. ONLY	230	2	---	VISUAL	YES
					CONTIN.	---
					BOND	---
					INSUL.	---
					OPER.	<3000 VA
					FLASH	---
					EXTEN.	---
					POL.	---
E.L.	<3.5 mA					

Form Vb

Equipment Formal Visual and Combined Inspection and Test Record.

Equipment Inspection and Test Record							1 Register No.							
2 Description of equipment				3 Construction Class		4 Equipment type		5 Location and particular requirement of locations			6 Frequency of Formal visual inspection.....mm		Combined inspection and test.....m	
7 Make..... * Model Serial No.....				8 Voltage.....V Rating.....A Fuse RatingA		9 *Date of purchase			10 *Guarantee					
Inspection						Test								
11	12	13	14	15	16	17	18		19		20	21	22	23
Date	Environment/ use	Dis- connect	Socket	Plug	Flex	Body	Continuity		Insulation		Functional check	Comments/other tests	OK To use	Signature
							?	v	M?	A				

Note: (v) Indicates pass (x) Indicates fail (N/A) No Applicable (N/C) Not Checked

*** To be completed by client.**

