



Portable Appliance Testers PAT3 & PAT3/DV

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Operating
Instructions

MEGGER

SAFETY WARNING

- ★ The PAT3 and PAT3/DV must be properly earthed. Check this by an Earth Bond test with the test clip connected to the mains supply earth. Reading must be $< 0,5 \Omega$.
- ★ Ensure that no hazard can be caused if the appliance operates as a result of a fault.
- ★ Do not touch an appliance while it is under test.
- ★ Tests must be performed in the order (i) Continuity (ii) Earth Bond test (if appropriate) (iii) Insulation test. If a fault is discovered, testing must be stopped and the fault corrected. Testing must then re-commence from the start.
- ★ DO NOT press the three test buttons at once.
- ★ Connection should only be made to the Earth Bond terminal when carrying out (a) an Earth Bond test or (b) an Insulation test on a double insulated appliance.
- ★ Ensure that the correct supply voltage is used (for instrument and appliance). The supply must be via a three-terminal plug (with phase, neutral and earth connections) wired correctly. The supply outlet socket used must have a protective earth conductor correctly connected and preferably an on/off switch.
- ★ If the casing is opened for any reason the instrument must first be disconnected from the supply.
- ★ Whenever it is likely that the protection has been impaired, the instrument must not be used.
- ★ Maintain the Earth Bond test lead in good condition.
- ★ Replacement fuses must be of the correct type and rating.



Refer also to page 8 for further explanations and other precautions.

The warnings must be read and understood before the instrument is used. They must be observed during use.

NOTE

This instrument is only to be used by a suitably trained and competent person.

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General Description

The Portable Appliance Testers PAT3 and PAT3/DV are very robust and reliable instruments, built into strong plastic cases with moulded carrying handles and hinged detachable lids. Fitted to the lid is an accessory pouch containing the test leads and probes.

The basic PAT3 instrument, which operates from a 240 V 50 Hz mains power supply will perform three tests on an appliance.

These tests are:—

- Continuity Test
- Earth Bond Test
- Insulation Test

There are various versions of the PAT3 designed for use with the different supply voltages found in many parts of the world. They all perform the same tests as the basic instrument and their construction is similar, except that the appliance socket fitted in the front panel is one which is commonly found in the 'territory of use' of that particular version. Also the front panel is marked in an appropriate language and a specific model number is assigned to each version. The table opposite gives details of the variations.

The tester is simple to use and the number of connections required to perform a test sequence has been kept to a minimum. Apart from connecting the tester to a mains supply and plugging the appliance to be tested into the three pin socket on the front panel, the only additional connection necessary is a lead for Earth Bond tests on 'earthed' appliances and Insulation tests on double-insulated appliances.

An illuminating switch (biased to the 'off' position) together with push-buttons are used to energize the instrument and make a test. The readings from each test are shown on an analogue

Model number	Territory of use	Nominal mains supply voltage	Appliance connecting socket fitted	Graphics language
PAT3 UK240	United Kingdom	240 V 50 Hz	BS 1363 13 Amp	English
PAT3 UK110	United Kingdom	110 V 50 Hz	BS 4343/CEE 17	English
PAT3 EUR220	Finland, Netherlands, Portugal, Spain, Sweden	220 V 50 Hz	CEE7 Sheet IV	English
PAT3 UK220	Republic of Ireland	220 V 50 Hz	BS 1363 13 Amp	English
PAT3 F220	France and Belgium	220 V 50 Hz	CEE7 Sheet VI	French
PAT3 NZ230	New Zealand	230 V 50 Hz	AS C112 10 Amp	English
PAT3 UK230	Nigeria, India, Bahrain, Abu Dhabi, Pakistan, Singapore	230 V 50 Hz	BS 13 Amp (Flat pin)	English
PAT3 SA230	South Africa	230 V 50 Hz	BS 15 Amp	English
PAT3 AUS240	Australia	240 V 50 Hz	AS C112 10 Amp	English

panel meter, the scales of which are marked with green areas as well as the calibration. These green areas are "pass bands" with limits derived from various national testing specifications and they enable the operator to easily identify a successful test (according to the specification being used). However, actual measurements need to be made and recorded to comply with the requirements of many testing specifications now in force.

The PAT3/DV is the same as the PAT3 except that it is able to test 240 V a.c. and 110 V a.c. rated appliances. It is fitted with two testing sockets; a BS 1363 socket on the front panel for 240 V a.c. appliances and a BS 4343/CEE17 socket in the side of the case for 110 V a.c. appliances.

When using a PAT3/DV do not have two appliances connected at the same time, otherwise incorrect readings will result. These operating instructions apply to both the PAT3 and PAT3/DV.

Specification

Tests Available	(1) Continuity test (2) Earth Bond test (3) Insulation test	Safety	The instrument will, in general, meet the requirements of BS 4743 (1979) and IEC 348 (1978), Safety Class 1
Continuity Test		Fuse	3,15 A 20 mm x 5 mm ceramic HBC, IEC 127/1. (3-pin mains supply plug to BS 1363 for UK220, UK230 and UK240 versions has a 3 A ceramic fuse to BS 1362 (1973).
Meter reading range	Pass/fail (full/no deflection)	Supply Voltage	Mains power supply — dependent on model (refer to instrument front panel). All supply voltage variations affect voltages, currents and meter deflections in direct proportion.
Pass band	Full deflection	Dimensions	344 mm x 245 mm x 158 mm (13 1/2 in x 9 5/8 in x 6 1/4 in approx.)
Open circuit voltage	100 V nominal	Weight	4 1/2 kg (10 lb) approx.
Short circuit current	0,5 mA nominal		
Earth Bond Test			
Meter reading range	0 to 0,5 Ω (actually 0 to ∞ but 0,5 Ω is the highest calibration)		
Pass band limit	0,1 Ω		
Open circuit voltage	6 V a.c. r.m.s. nominal		
Short circuit current	38 A nominal (at 0,1 Ω current is 26 A nominal) (at 0,5 Ω current is 10 A nominal)		
Insulation Test			
Meter reading range	0,75 M Ω to ∞ (20 M Ω is the highest calibration)		
Pass band limits	2 M Ω , 4 M Ω and 7 M Ω		
Open circuit voltage	600 V d.c. nominal, 500 V d.c. nominal at 2 M Ω		
Short circuit current	1 mA nominal		
Temperature Range			
Operating	-5 $^{\circ}$ C to +50 $^{\circ}$ C		
Storage	-40 $^{\circ}$ C to +70 $^{\circ}$ C		
Humidity Range			
Operating	90% RH at 25 $^{\circ}$ C		
Storage	95% RH at 25 $^{\circ}$ C, 93% RH at 40 $^{\circ}$ C		

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Applications

The PAT3 and PAT3/DV are used to check the electrical safety of portable appliances by performing three tests, i.e. a test of the continuity of the connections and fuse, a test of the earth bonding (**required on earthed appliances only and not on double insulated appliances**) and an insulation test. The tests are simply carried out and the instrument is very easy to operate.

Appliances with Safety Class 1 and Safety Class 2 insulation may be checked.

These classes of safety are defined in various IEC and BS safety specifications and generally are:—

- Class 1 appliances which have a functional insulation throughout and an earth connected case, i.e. *earthed appliances*.
- Class 2 appliances which have both functional and additional insulation and where any metal parts cannot become 'live' under fault conditions. This is *double insulation*, symbol mark \square , and in this type of appliance there is no earth connection.

Class 1/2 appliances having part of the enclosure which meets Class 1 requirements and part which meets Class 2.

Whilst the tester will perform the standard electrical safety tests, it will not however meet the *full* accuracy requirements of standard specifications. (To do so would require a much more sophisticated and expensive tester which might probably also be much less robust.)

The tests performed on appliances are as follows:—

Continuity test — This is a test to check that the appliance's fuse is intact and its connections sound. A d.c. voltage is established between the appliance's supply plug phase and neutral connections.

Earth Bond test — This is to test the connection (or bonding) of any external metal parts of an appliance to the Earth conductor. A voltage (6 V a.c. r.m.s. on open circuit) is established between the appliance's supply plug connection and any exposed metal parts. The current is intended to fuse weak joints and hence, for appliances where light duty supply cables, i.e. those rated < 5 A, are likely to be over-stressed by passing a relatively heavy current, the test should not be performed too frequently, i.e. not more than monthly, nor for too long a period, i.e. for no more than 5 seconds.

Insulation test — Approximately 600 V d.c. on open circuit (500 V d.c. at 2 M Ω) is established between the appliance's supply plug phase and neutral connections joined together and its earth connection.

For the Continuity and Insulation tests the appliance on/off control must be in the "on" position.

The PAT3 and PAT3/DV will be of use in periodic tests of appliances in factories, local education authorities, hospitals etc. also routine testing before and after hiring appliances, basic testing following appliance repair or testing prior to dispatch of appliances from manufacturers and distributors.

⚠ It is most important that the tests are performed in the correct sequence and that if any fault in an appliance is discovered, testing is stopped and the fault corrected. Testing should then re-commence from the start. The correct sequence is: Continuity test, Earth Bond test (omitted for Class 2 appliances) and then Insulation test.

If an earth bond fault is found it is possible that any metal parts of the appliance could rise to a dangerous voltage, especially if an Insulation test is performed. If an insulation test fails, there is a leakage path to earth somewhere on the appliance and this is likely to produce an electric shock to the operator.

Accessories

Supplied with the instrument

Earth Bond test lead with crocodile clip	part no. 6231-043
Mains supply lead	(suitable for the country of use)
Accessory pouch (PVC)	part no. 6420-035
Operating instruction book	part no. 6171-372

Supplied as an optional extra

Leather accessory pouch	part no. 6430-193
Appliance safety log book (complete)	part no. 6131-813
Test sheets (pack of 30 extra sheets) for above log book	part no. 6171-417
Test stickers (pack of 3 extra sheets - 72 stickers) for above log book	part no. 6171-418
Open learning course "Electricity in the Workplace and Portable Appliance Testing"	part no. 6131-883
Video on Portable Appliance Testing	part no. 6171-553

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Operation

WARNING

1. The user of this instrument must ensure that the appliance to be tested is in a safe state both electrically and mechanically, so that no hazard will be presented to himself or to any other person if, while being tested, the appliance operates as a result of a fault condition.
2. Do not use dirty or damaged test leads. Maintain these in a good clean condition.
3. For safety the PAT3 and PAT3/DV must be properly earthed. Check this by performing an Earth Bond Test with the probe connected to the mains supply earth and obtaining a reading of $< 0,5 \Omega$.
4. Connection should only be made to the Earth Bond terminal when carrying out (a) an Earth Bond test or (b) an Insulation test on a double insulated appliance. At all other times, i.e. when performing an Insulation test on an earthed appliance or when performing a Continuity test, the Earth Bond terminal should not have a lead connected to it.
Because the Earth Bond test current can flow between the Earth Bond terminal and anything connected to the mains supply earth, it is not advisable to maintain a connection to the Earth Bond terminal in case it inadvertently becomes shorted to earth.
5. **If an appliance fails a test, the fault causing the failure MUST be corrected before any further tests are made.**
6. In cases where appliances have light duty cables i.e. 5 A, the 'Earth Bond Test 1' should not be prolonged (5 s maximum) or repeated frequently (no more than monthly).

THE DETACHABLE LID

The lid hinges are fitted with spring loaded clips and are designed in this way for two reasons. Firstly, if the lid is accidentally thrown open to its full extent, the hinges will not be strained or broken but the lid will be safely unclipped. Secondly, the lid can purposely be removed, if required, when the tester is in use by simply opening it up to its full extent and gently pressing down on the opening edge while holding the tester body firm. The hinges will then unclip.

To replace the lid simply hold it vertically and push the hinges back into their clips again; then fold the lid shut.

GENERAL INFORMATION

Tests must be performed with the appliance switched on and the supply line fuse intact.

A test is performed only when the 'Test' switch is pressed (and illuminates).

To pass an Earth Bond or Insulation test, appliances should give readings within one of the green areas on the appropriate meter scale, unless their specification dictates otherwise. However, the actual value should be taken and recorded.

A thermal switch gives protection to the instrument during prolonged use of the Earth Bond test. If the 'Test' switch has no effect wait a few moments for the instrument to cool.

PRELIMINARY PROCEDURE

1. Ensure that the meter is set to the mechanical zero i.e. the extreme left hand graduation on the scale. The mechanical zero adjuster is located centrally below the meter scale and may be turned with a screwdriver.
2. Plug the appliance into the instrument and switch the appliance on.
3. Plug the instrument into the mains power supply (of the correct rating) and switch the supply on.
4. Ascertain the type of appliance to be tested, i.e. whether it is earthed or double insulated.
For a double insulated appliance omit the Earth Bond test.

APPLIANCE TESTING PROCEDURE

Continuity Test — see fig. 1

1. Press the 'Test' switch and the 'Continuity' push-button together and note that the meter pointer deflects over the bottom scale numbered (1). The meter pointer should deflect to the right hand side, but, if there is no deflection, first check that the appliance is switched on, then suspect the continuity of the appliance's internal fuse or supply plug fuse, supply lead or the appliance itself e.g. an open circuit kettle element.

Note:— For normal appliances the meter pointer will deflect to full scale, but for very low current consuming appliances, or appliances with solid state control circuits, a smaller deflection may be observed.

Earth Bond Test — see fig. 2

2. Connect the Earth Bond test lead to the 'Earth Bond' terminal on the front panel, and connect the crocodile clip to the metalwork of the appliance.
3. Press the 'Test' switch and note the meter reading on the top ' Ω ' scale numbered (2). For a successful test the

reading should be in the solid green area; the actual value in ohms should be recorded.

4. Release the switch and remove the Earth Bond test lead.

Insulation Test — see fig. 3

5. For double insulated appliances, connect the Earth Bond test lead to the Earth Bond terminal and use this lead to make the return path for the test by connecting its crocodile clip to the point of test on the appliance. For earthed appliances the lead is not needed because the connections exist within the 3-pin socket.
6. Press the 'Test' switch and the 'Insulation' push-button together and note the meter reading on the ' $M\Omega$ ' scale numbered (3). For a successful test the meter reading should be within one of the green areas of the scale (or according to the specification to which the test is being carried out); the actual value in megohms should be recorded.
7. Release the switch and push-button; the test sequence is now completed. Remove the test lead.

Note:— There are three green areas shown on the insulation scale — solid green, shaded green and outline green. As a general rule a Class I appliance should have an insulation resistance $> 2 M\Omega$, i.e. a reading in any of these three green areas is satisfactory. Similarly a Class II appliance should have an insulation resistance $> 7 M\Omega$, therefore a reading in the solid green area is necessary. Where Class II appliances are luminaries, as a rule above $4 M\Omega$ is allowable, hence satisfactory readings will be in either the solid green or shaded green areas.

Operation

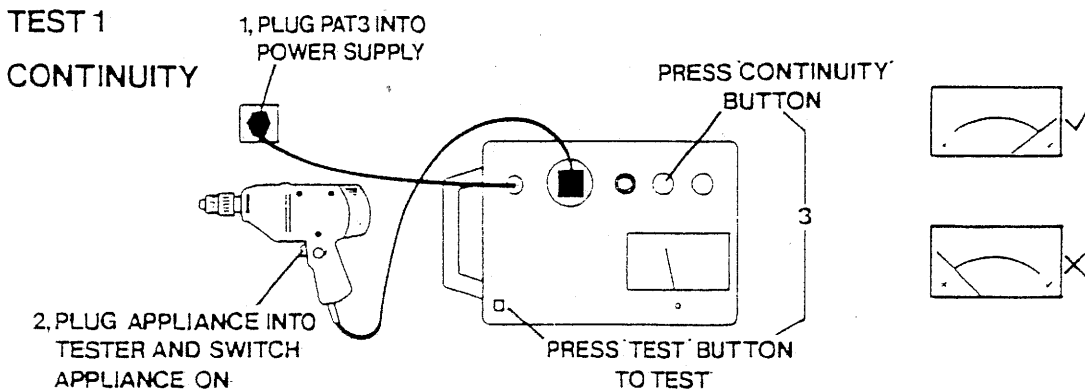


Fig. 1: Continuity Test

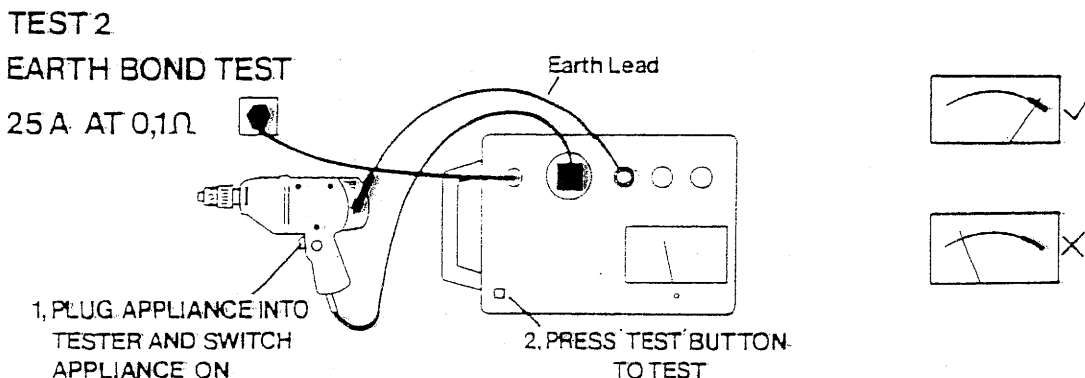
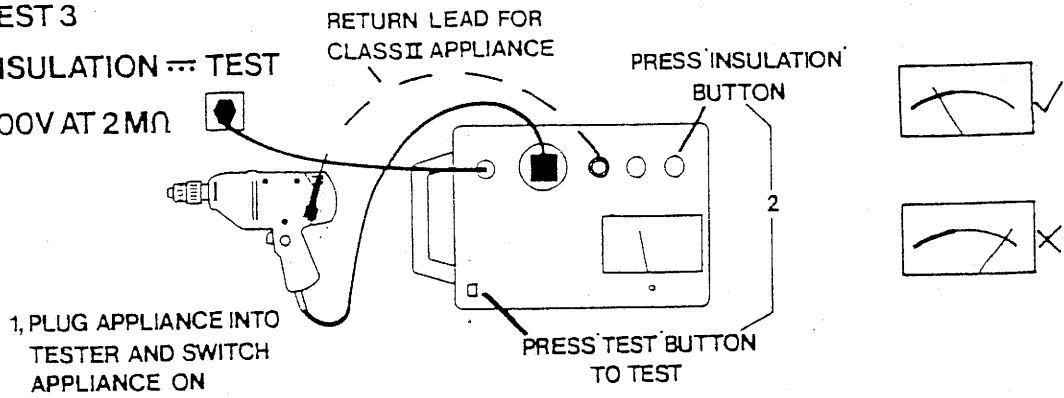


Fig. 2: Earth Bond Test

TEST 3

INSULATION TEST

500V AT 2MΩ



1, PLUG APPLIANCE INTO TESTER AND SWITCH APPLIANCE ON
PRESS TEST BUTTON TO TEST

Fig. 3: Insulation Test

Operation

RESISTANCE OF SUPPLY LEADS

Table of nominal resistances of appliance supply cable protective conductors (figures are for cables to BS 6500)

Nominal conductor c.s.a. mm ²	Nominal conductor resistance mΩ/metre	Length metres	Resistance mΩ	Max. current carrying capacity A	Max. dia. of individual wire in conductor mm	Approx. no of wires in conductor
0.5	41.5	1	41.5	3	0.21	16
		1.5	62.25			
		2	83			
		2.5	103.75			
		3	124.5			
0.75	28	1	28	6	0.21	24
		1.5	42			
		2	56			
		2.5	70			
		3	84			
1.0	21.5	1	21.5	10	0.21	32
		1.5	32.25			
		2	43			
		2.5	53.75			
		3	64.5			
1.25	17.5	1	17.5	13	0.26	24
		1.5	26.25			
		2	35			
		2.5	43.75			
		3	52.5			
1.5	15.5	1	15.5	15	0.25	30
		1.5	23.25			
		2	31			
		2.5	38.75			
		3	46.5			
2.5	9	1	9	20	0.25	50
		1.5	13.5			
		2	18			
		2.5	22.5			
		3	27			
4	21.5	1	5.5	25	0.31	53
		1.5	8.25			
		2	11			
		2.5	13.75			
		3	16.5			
		4	22			
		5	27.5			

The above table gives figures for the nominal resistance of the protective conductor per metre length and for various lengths of cable that may be fitted as supply leads to appliances. Having performed an Earth Bond Test the approximate resistance of

the protective conductor can be found and deducted from the test result to give a more realistic figure for the resistance of the earth bonding of the appliance.