

Portable Appliance Tester **MEGGER® PAT2/2**

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*Operating
Instructions*

MEGGER®

SAFETY WARNING

- ★ *Ensure that no electrical or mechanical hazard will arise if the appliance being tested operates while being tested (e.g. on OPERATION or as a result of a fault).*
- ★ *The PAT2/2 must be connected to earth.*
- ★ *Do not touch an appliance while it is being tested.*
- ★ *Maintain the test probes in good condition. Hold and use them correctly. Do not leave them connected to the instrument when they are not being used.*
- ★ *Tests must be performed in the correct sequence. STOP TESTING if a fault occurs.*
- ★ *The Earth Bond test lead and high voltage test probe for flash testing must only be connected while they are being used for a test.*
- ★ *Ensure that the correct supply voltage is used.*
- ★ *Replacement fuses must be of the correct type and rating.*
- ★ *Power supply for the PAT2/2 should be via an external Residual Current Circuit Breaker (trip level ≤ 30 mA) to enhance the protection of the operator from a faulty appliance.*

Refer also to page 13 for further explanations and other precautions. The warnings and precautions 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 Tester PAT2/2 is a robust and reliable instrument, built into a strong case with a carrying handle and a hinged, detachable lid. It operates from the mains supply and performs five basic safety tests selected, in order, by a rotary switch:-

- (i) Earth Bond test
- (ii) Insulation test
- (iii) Load test
- (iv) Operation test
- (v) Flash test

Versions of the PAT2/2 are manufactured to suit the supply voltages and supply outlet socket types found in many parts of the world.

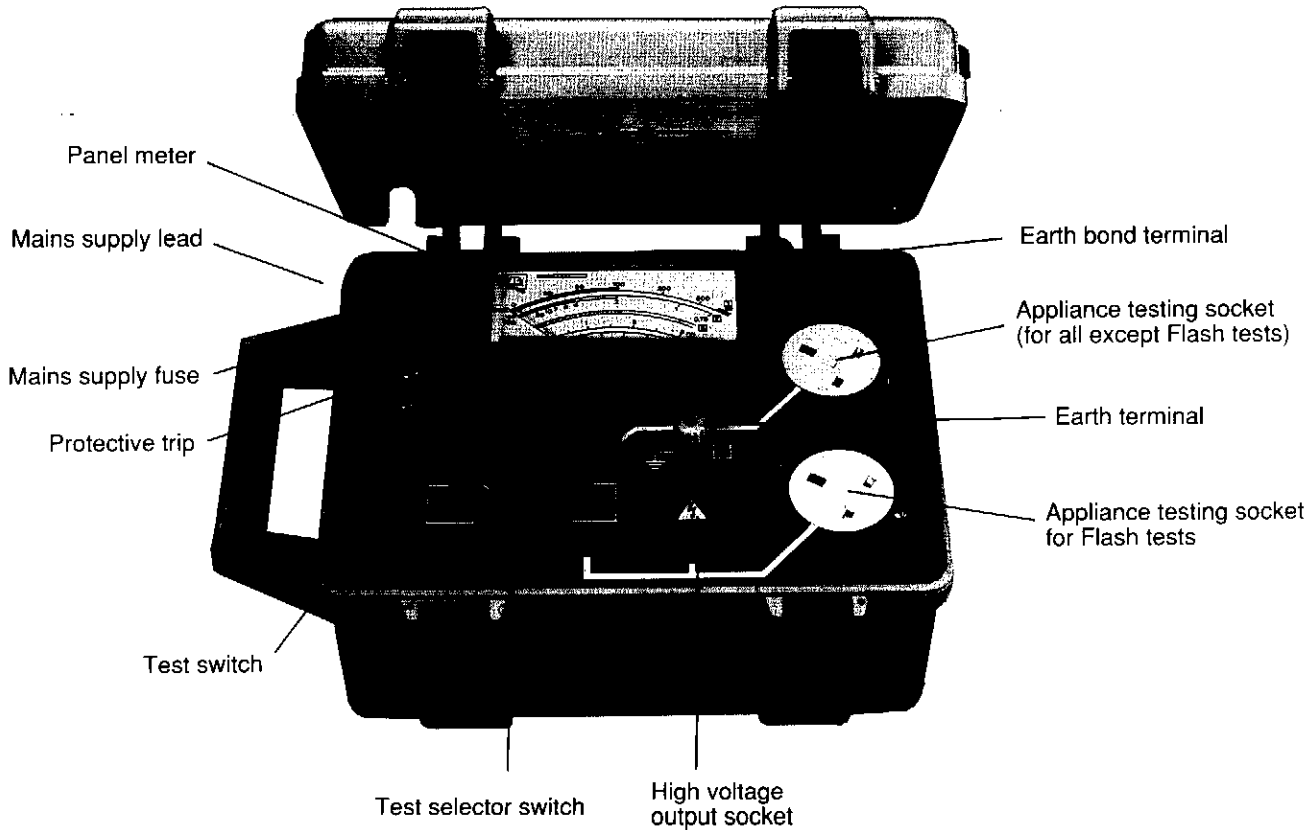
Appliances are tested through their normal supply leads and plugs. For certain tests it will be necessary to use one additional test lead.

It is important that the instrument is connected to earth. This is normally done through the three-core power supply lead, but, it is recommended to use the earth terminal provided on the front panel for a separate direct connection to earth.

After connection to a mains power supply, a biased 'Test' switch is pressed to energize the instrument and make a test. This switch illuminates to indicate that the test voltage is being applied.


Each test result is shown on the analogue panel meter, with separate, calibrated, scales for each measurement function. The Earth Bond and Insulation test scales are also marked with green areas. These 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 circuit incorporates a protective trip to give protection to the appliance and the instrument if heavy currents are drawn from the supply during the 'Operation' test. The circuit has been designed with "built-in" protection for the instrument and in such a way that the output for each function is kept to a minimum for safety.



Applications

The PAT2/2 is used to check the electrical safety of portable appliances including domestic appliances, industrial appliances and power tools. Appliances and electrical equipment with Safety Class I and Safety Class II insulation may be tested. These classes of safety are defined in various IEC and BS safety specifications and in general are:-

- | | |
|--------------|---|
| Class I | Appliances which have a functional insulation throughout and an earth connected case, i.e. 'earthed appliances'. |
| Class II | 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  . |
| Class I / II | Appliances having part of the enclosure which meets Class I requirements and part which meets Class II. |

The instrument may be used to test equipment to parts of the following specifications:-

BS 415	BS 2769
BS 3456/IEC 335-1	BS 4533
BS 5850	H.S.E. PM32

Whilst the instrument will perform a wide range of standard electrical safety tests, it will not, however, meet the *full* requirements of all of the standard specifications. The instrument is designed to include the essential tests necessary for routine safety testing of portable electrical appliances.

Regular planned testing (periodic testing) is essential and the demand for it is backed by legislation. Implicit in this is the requirement to keep records of the results obtained when an appliance is tested and it is for this reason that the scale of the PAT2/2 is calibrated as well as having "pass" areas marked in green. The "pass" areas are for general guidance and should not necessarily be taken as a definitive pass or failure. To aid the user in keeping records of results, AVO MEGGER INSTRUMENTS LIMITED have a suitable log book available.

The advantage in having a calibrated meter scale is (i) that it helps show up borderline cases, (ii) that it allows the effect of long supply cables to be sensibly evaluated (iii) that it gives flexibility in coping with slightly different requirements which may arise when using different test specifications and, most importantly, (iv) that it allows proper records to be kept which could show gradual deterioration of the appliance.

It may prove helpful for the operator of this instrument to familiarise himself with other information relating to portable appliances and their safety testing; e.g. publications produced by the Health & Safety Executive entitled, 'Essentials of Health & Safety at Work' and 'The Safe Use of Portable Appliances'. Also the Application Note (No. 1) on Appliance Safety Testing and 'Electricity in the Workplace and Portable Appliance Testing' available from AVO MEGGER INSTRUMENTS LIMITED.

The tests performed on appliances by the instrument are as follows:-

Earth Bond Test

This test is for checking the earth lead continuity and earth connection (or bonding) to the metal parts of an appliance. A voltage is established between the appliance's mains supply plug earth pin and its metal parts (case).

The Earth Bond tests passes 25 A through 100 m Ω and 10 A through 500 m Ω (these are approximately the requirements of several BS and IEC specifications). The current is intended to fuse weak joints and hence, where light duty cables are used for appliances rated less than 5 A, the cable must not be stressed with this

current too frequently or for too long, (not less than monthly and for not more than 5 seconds).

The Earth Bond test is only carried out on earthed appliances (i.e. Safety Class I).

Insulation Test

This test checks the integrity of the appliance's insulation. For Class I the test voltage is applied between the appliance's mains supply plug P (phase) and N (neutral) pins connected together, and the E (earth) pin which is held at earth potential. For Class II appliances the Earth Bond lead is used to make the return connection from an exposed metal part of the appliance to the earth terminal on the instrument.

The instrument develops 500 V d.c. into 2 M Ω .

Load Test

In this test the appliance is supplied from 6 V a.c. (via its three pin mains supply plug). This low voltage test establishes whether the appliance has in fact been switched on (a necessary requirement for all but the Earth Bond test) and that its fuse is intact. More importantly it enables the appliance to be safely assessed under load conditions without the dangers that might arise if the full operating voltage were used,

i.e. the drawing of high current under fault conditions.

For this test the meter scale has a shaded green/outline green/outline black arc. Readings in the shaded green band imply that all is well, though it should be noted that, for example, an appliance containing relay operated loads will have insufficient voltage to switch the load in (the upper limit of this band implies a current of 13 A flowing at nominal supply voltage). If the reading is in the outline green band the appliance may or may not be satisfactory e.g. if the appliance is an inductive stalled motor then further tests may be carried out with caution. However, a reading in the outline black band indicates that a fault is present which under normal operating voltage would cause a very heavy current to flow.

Operation Test

This test indicates the power consumption of the appliance so that it can be compared with the figure shown on the rating plate. The test, although not mandatory, confirms that excessive current is not being drawn by the appliance and prevents an item being passed which either fails to work or is operating incorrectly.

The normal mains supply is fed to the appliance under test via its supply plug and the load current being drawn

is measured. In certain cases, such as electric drills, the rating stated is usually for the appliance when under load conditions e.g. when drilling and this fact should be taken into account.

Flash Test

The flash test shows the response of the insulation to high a.c. voltage stress, indicates the effects of capacitive current, and gives an early warning of insulation problems which may develop in the appliance. The PAT2/2 provides the generally accepted standards for flash testing, namely 1,5 kV a.c. for earthed appliances and 3 kV a.c. for double insulated appliances, (there are numerous test voltages required by individual BS and IEC specifications). Because the voltage levels used for flash testing stress the insulation and can weaken it, this test is not recommended as a routine one.

For safety reasons a separate 3-pin socket is used for connecting the appliance for a Flash test. For Class I equipment the test voltage is applied between the mains supply plug P and N pins connected together and the E pin which is held at earth potential. For Class II equipment the high voltage probe is used and the test voltage is applied between it and the P and N pins connected together. It is important that the high voltage probe is unplugged after completing the flash test.

Test Order

It is important for safety reasons that tests are carried out in the correct sequence i.e.:-

- Earth Bond test
- Insulation test
- Load test
- Operation test
- Flash test.

For double insulated appliances the Earth Bond test is omitted.

If a fault on an appliance is discovered, testing must be stopped and the fault corrected. Testing should then recommence from the start.

If an earth bond fault is found it is possible that any metal parts of the appliance could give rise to a dangerous voltage, especially if an insulation test or flash test is performed without correcting the fault. If an insulation test or a flash test fail, there is a leakage path to earth somewhere on the appliance and this is likely to produce an electric shock to the operator. An excessive current in the operation test would cause undue heating in the appliance and result possibly in sparking or fire hazards.

Accessories

SUPPLIED WITH THE INSTRUMENT

- Earth Bond test lead with crocodile clip
part no. 6231-043
- Flash test lead with retractable tip probe
part no. 6420-061
- Accessory pouch, PVC
part no. 6420-035
- Operating instruction book
part no. 6171-505

AVAILABLE AS AN OPTIONAL EXTRA

- Earth Bond test lead with probe
part no. 6331-229
- 'Safebloc' adaptor lead
part no. 6331-230
- Accessory pouch, leather
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
- Publication entitled "Electricity in the Workplace and
Portable Appliance Testing"
part no. 6131-883
- Video on Portable Appliance Testing
part no. 6171-553



Specification

Tests Available

- (1) Earth Bond test
- (2) Insulation test
- (3) Load test
- (4) Operation test
- (5) Flash test

Earth Bond Test

Meter Reading Range	0 to 500 m Ω
Pass Band Limit	100 m Ω
Open Circuit Voltage	6 V a.c. r.m.s. (nominal)
Short Circuit Current	38 A (nominal) (at 100 m Ω current is 25 A nominal)

Insulation Test

Meter Reading Range	0,75 M Ω to 20 M Ω and ∞
Pass Band Limits	2 M Ω , 4 M Ω and 7 M Ω
Open Circuit Voltage	630 V d.c. (nominal) (at 2 M Ω voltage is 500 V d.c. nominal)
Short Circuit Current	1,3 mA (nominal)

Load Test

Meter Reading Range	Shaded green/outline green/outline black arc
Open Circuit Voltage	6 V a.c. r.m.s. (nominal)
Short Circuit Current	330 mA (nominal for 220 V-240 V supply) 700 mA (nominal for 110 V-120 V supply)

Operation Test

Meter Reading Range	0 to 3 kVA
Output Voltage	Supply voltage
Output Current	Limited by protective trip to 6 A and fuse to 12,5 A.

Flash Test

Meter Reading Range	0 to 5 mA
Output Voltages	1,5 kV a.c. r.m.s. (nominal) for Class I 3 kV a.c. r.m.s. (nominal) for Class II
Short Circuit Output Current	Limited to 5 mA max. for Class I and Class II

Temperature Range

Operation -5 °C to +50 °C
Storage -40 °C to +70 °C

Humidity Range

Operation 90% RH at 25 °C

Safety

The instrument will, in general, meet the requirements of BS 4743 (1979), IEC 348 (1973) and IEC 1010-1 (1990)

Fuse

12,5 A ceramic HBC 32 mm x 6 mm

Supply Voltage

Mains power supply - dependent on model
Voltages, currents and meter deflections are affected in direct proportion to supply voltage variations. Supply voltage variations $\pm 6\%$ in the U.K.

Dimensions

344 mm x 245 mm x 192 mm
(13 $\frac{1}{2}$ in x 9 $\frac{5}{8}$ in x 7 $\frac{1}{2}$ in approx.)

Weight

6 kg (13 $\frac{1}{4}$ lb approx.)

Operation

WARNINGS

1. The user of this instrument must ensure that the appliance to be tested is in a safe situation, so that no hazard will be presented to himself or another person if, while being tested, the appliance operates as a result of a fault condition or the normal running condition.
2. For safety the PAT2/2 **MUST BE PROPERLY EARTHED**. (See note on separate earth on page 4). Therefore only use a supply socket outlet that has a protective earth conductor. Check this by plugging the PAT2/2 into the socket and performing an Earth Bond test with the earth bond lead connected to a known good earth point. This will check the earth continuity to this point. A reading of $< 0,1 \Omega$. should be obtained. Do not use the instrument if a faulty earth is found. Connect the green/yellow earth terminal on the front panel of the PAT to a known good earth if there is any doubt as to the integrity of the supply earth. It is advisable to do this anyway when conducting Flash tests. Do not use extension leads. Disconnection of the protective earthing conductor intentionally or otherwise during measurement is likely to create a dangerous condition.
3. Ensure that the supply voltage is correct for the PAT2/2 version used and that this is compatible with the appliances to be tested.
4. Do not use dirty or damaged test probes and leads; maintain these in good condition. Use the probes correctly holding them by their handles and away from the tip. **A PROBE OR LEAD MUST ONLY BE CONNECTED TO THE INSTRUMENT FOR THE DURATION OF THE TEST FOR WHICH IT IS NEEDED.**
5. Do not touch an appliance while it is under test. The instrument generates up to 1,5 kV with respect to earth, during flash testing. These dangerous voltages will exist on the appliance being tested. Under fault conditions, physical contact with the appliance may give an electric shock. Similarly, during insulation testing the appliance can be subjected to 600 V d.c.
6. For safety, tests must be performed in the correct order (see the 'Appliance Testing Procedure' given later). If an appliance fails a

test, the fault causing the failure must be corrected before any further tests are made. When this has been done the testing sequence should recommence from the start.

7. The 'Test' switch **MUST BE RELEASED** before the function selector switch is changed to another position; before the appliance's supply plug is removed from either socket and before either of the test probes is connected or disconnected from the instrument.
8. Replacement fuses must be of the correct type and rating as given in the 'Specification' section.
9. Do not open the Instrument while it remains connected to a power supply. To do so will expose "live" parts of the circuit. Any adjustment or repair to the instrument must be carried out by a qualified and skilled instrument technician who is aware of the potential hazards involved in working with exposed conductive parts and who understands the importance of observing safe working practices. Remember, capacitors inside the instrument may still remain charged
10. even when the supply has been disconnected, particularly under fault conditions. The electrical safety level of the Instrument must be maintained after repair.
10. When it is likely that safe operation of the instrument is no longer possible and that it is likely that the protection has been impaired, it must be taken out of service and secured against re-use until properly repaired. It can be assumed that safe use is no longer possible when the instrument shows obvious signs of damage, when it no longer functions correctly, after it has experienced prolonged storage under adverse conditions or after severe transport stress.
11. Some deflection of the meter should always be observed on the Earth Bond range and also at least a small deflection into the black segment on the insulation test range. If these do not occur a fault on the instrument exists.
12. Power supply for the PAT2/2 should be via an external Residual current circuit breaker (trip level $\leq 30\text{mA}$) to enhance the protection of the operator from a faulty appliance.


PRECAUTIONS

1. The protective trip mounted on the front panel should not be used as an on/off switch. To do so frequently will reduce its working life and hence its reliability. Only in an emergency, e.g. if the 'Test' switch fails to de-energize the circuit, may the circuit breaker be used instead.
2. In cases where appliances contain interference suppressors, the Flash test may need to be omitted if the voltage withstand rating of the suppressor is not high enough. Alternatively these components may be disconnected. **DO NOT PERFORM A FLASH TEST IF THERE IS ANY DOUBT** since this may damage the appliance under test or give misleading results.
3. Unauthorised repair will invalidate any warranty covering the instrument. All repairs should be carried out by AVO MEGGER INSTRUMENTS LIMITED or one of their approved agents.

GENERAL TESTING INFORMATION

Note:- The appliance under test must be considered to be the appliance plus its means of connection to a supply outlet. The PAT2/2 therefore checks both the appliance and its supply lead. If an appliance uses a separate supply lead, then that lead must:

1. Be used during the test
2. Marked as tested. Only tested leads to be used

For earthed appliances, i.e. those designated Class I appliances, testing must commence with the Earth Bond test. For double insulated appliances, i.e. those designated Class II appliances (symbol mark ) testing should commence with the Insulation test.

TESTS MUST BE PERFORMED WITH THE APPLIANCE SWITCHED ON!

If it is found, when the Operation VA test is performed that the appliance does not operate, and that this is because it was not switched on or its supply line fuse had ruptured, then the test procedure should be repeated from the start in the correct manner, i.e. with a sound fuse and the appliance switched on.

Note:- The Earth Bond test will be valid irrespective of the position of the appliance's on/off switch.

A test is performed only when the 'Test' switch is pressed. This switch is biased in the off position so that switch-off is automatic upon release.

For an appliance to pass an Earth Bond or Insulation test the instrument readings should normally be within one of the green areas on the meter scale. That is, unless the specification to which the appliance is being tested dictates otherwise.

A protective trip gives protection against fault conditions in the appliance under test. An internal thermal switch also gives protection during prolonged use of the Earth Bond test. If the 'Test' switch has no effect wait a few moments for the instrument to cool and try again.

The mains supply lead for the instrument is stored under the closed lid. Coil the lead around on the top of the front panel and insert the mains supply plug into the socket on the panel. (except U.K. 110V)

PRELIMINARY TESTING PROCEDURE

1. Ensure that the meter's mechanical zero is set correctly. The pointer must lie over the extreme left hand scale graduation. The mechanical zero adjuster is located centrally below the meter scale and may be turned with a screwdriver.
2. Plug the appliance to be tested into the upper socket on the instrument's front panel and switch the appliance on.
3. Plug the PAT2/2 into the mains power supply and switch the supply on.
4. Ascertain the type of appliance to be tested, i.e. whether it is earthed or double insulated.

APPLIANCE TESTING PROCEDURE

Earth Bond Test (for earthed appliances only) - see Fig. 1

5. Turn the selector switch to the 'EARTH BOND' test position.
6. Attach the Earth Bond test lead hook connector to the blue 25 A terminal. Connect the crocodile clip to the appliance metalwork. If the alternative Earth Bond probe lead is used this is attached in the same way and the probe tip held in contact with the appliance metalwork.
7. Press the 'Test' switch and note the reading on scale '1' of the meter. For a successful test the reading should be in the solid green area. However, **the actual value in ohms should be taken and recorded.**

Note:- The whole black area at the start of the scale is the 'Zero' mark.

8. Some deflection should be observed on the earth bond test. This is a live zero to indicate the presence of volts. No deflection will indicate an instrument fault.

Note:- Only the correct test leads supplied with the instrument should be used, otherwise the accuracy will be impaired.

9. Release the 'Test' switch and **remove the Earth Bond lead from the appliance and from the instrument.**

TEST 1 EARTH BOND
25 A ~

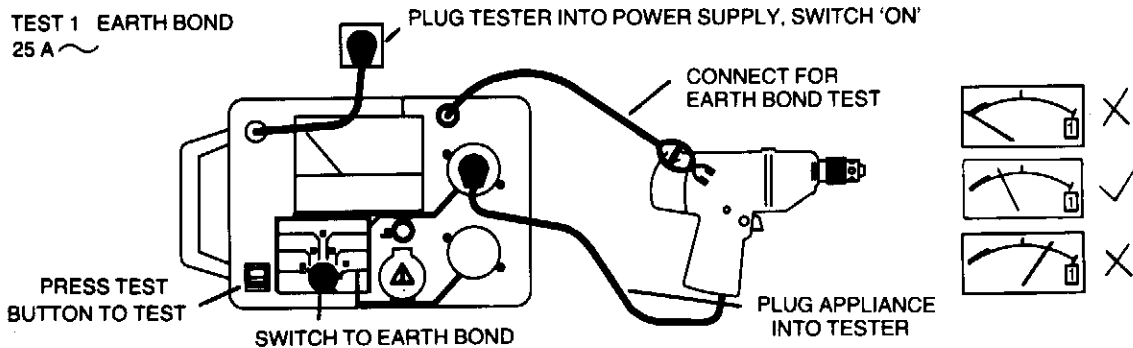


Fig. 1 Earth Bond Test

TEST 2 INSULATION
500 V AT 2 MΩ ☰

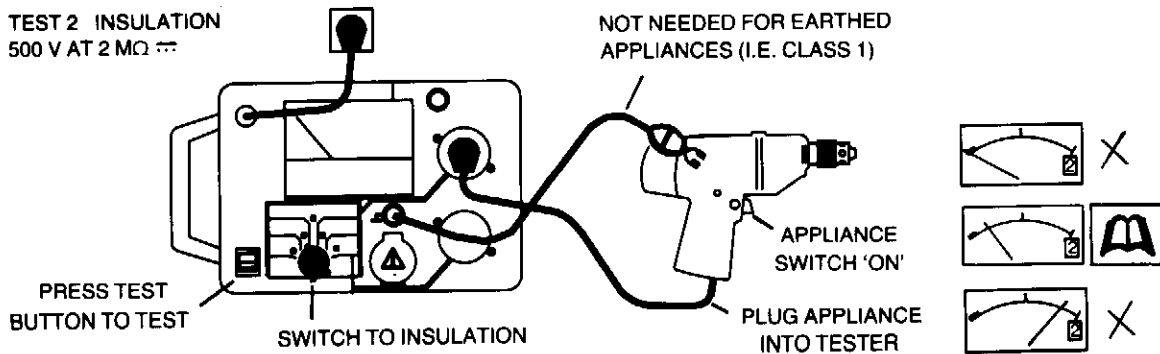


Fig. 2 Insulation Test

Insulation Test - see Fig. 2

10. Turn the selector switch to the 'INSULATION' test position.
11. For a Class I appliance press the 'Test' switch and note the reading on scale '2' of the meter. For a successful test the reading should be within one of the three 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 taken and recorded** (see the first note on page 18).

For a Class II appliance connect the Earth Bond lead (or probe if available) to the earth terminal on the front panel and probe areas of likely leakage in the insulation areas i.e. joins and apertures and also test any exposed metal parts. Press the 'Test' switch and note the reading on scale '2' of the meter. For a successful test the reading should be within the solid green area, or shaded green area for luminaries, of the scale (or according to the specification to which the test is being carried out). **The actual value in megohms should be taken and recorded** (see the first note on page 18).

12. Release the 'Test' switch and **remove the Earth Bond lead from the appliance and from the instrument.**

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 $> 2 \text{ M}\Omega$, i.e. a reading in any of these three green areas is satisfactory. Similarly a Class II appliance should have an insulation resistance $> 7 \text{ M}\Omega$, therefore a reading in the solid green area is necessary. Where Class II appliances are luminaries, as a rule above $4 \text{ M}\Omega$ is allowable, hence satisfactory readings will be in either the solid green or shaded green areas. A small deflection of the meter in the initial black segment of the insulation test range should be observed. If there is no deflection this indicates a fault in the instrument.

Load Test - see Fig. 3

13. Turn the selector switch to the 'LOAD' test position.
14. Press the 'Test' switch and note the position of the meter pointer over the shaded green/outline green/outline black arc band, scale '3'. A reading within the shaded green band indicates a satisfactory result. A reading in the outline green band is generally not satisfactory unless the appliance under test is known to have an inductive

Operation

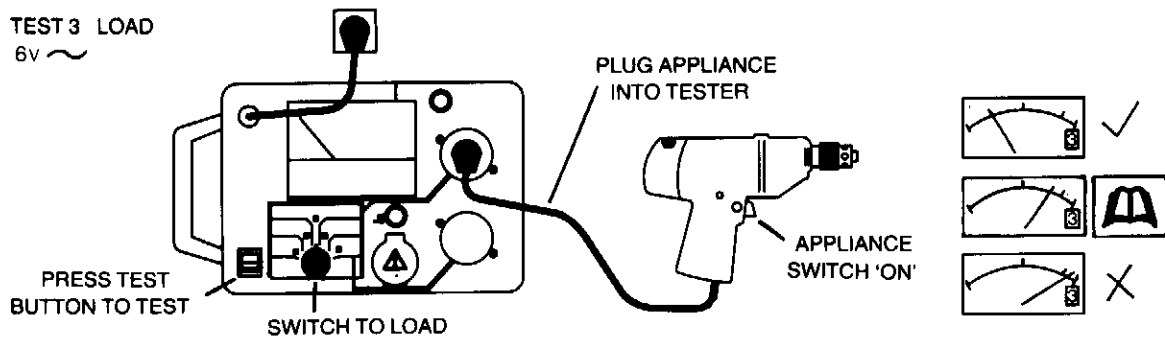


Fig. 3 Load Test

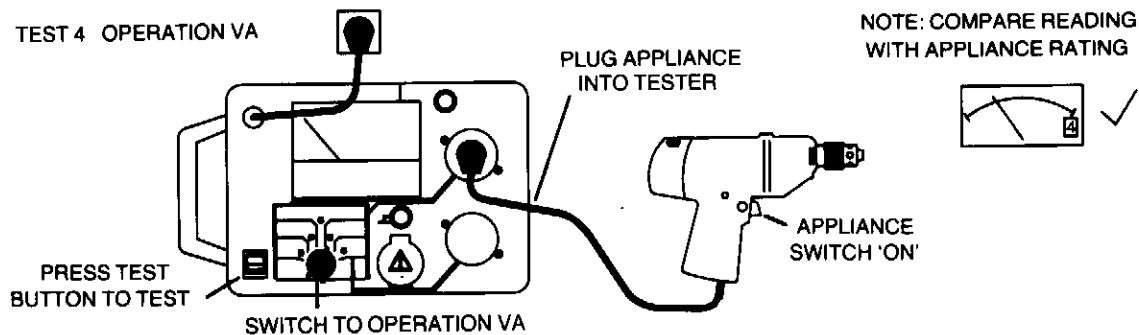


Fig. 4 Operation Test

stalled motor or is a cold high power lamp, or similar device, in which case testing procedure may continue with caution. If the meter pointer indicates in the outline black band then a serious fault exists which should be investigated before moving further in the procedure.

15. Release the 'Test' switch and record the result. **Operation Test** - see Fig. 4
16. Turn the selector switch to the 'OPERATION' test position.
17. Press the 'Test' switch, note the reading in kVA on scale '4' of the meter and compare it with the value shown on the appliance rating plate. If necessary calculate the current being drawn from the supply, by dividing this value by the supply voltage, and compare this with the rating of the appliance as well. (Remember that with some appliances, e.g. electric drills, the rating given is under load conditions. In such cases the reading obtained will be less than that stated on the appliance).

Caution:- The appliance will operate when this test is performed, therefore ensure that in doing so no harm or damage can result.

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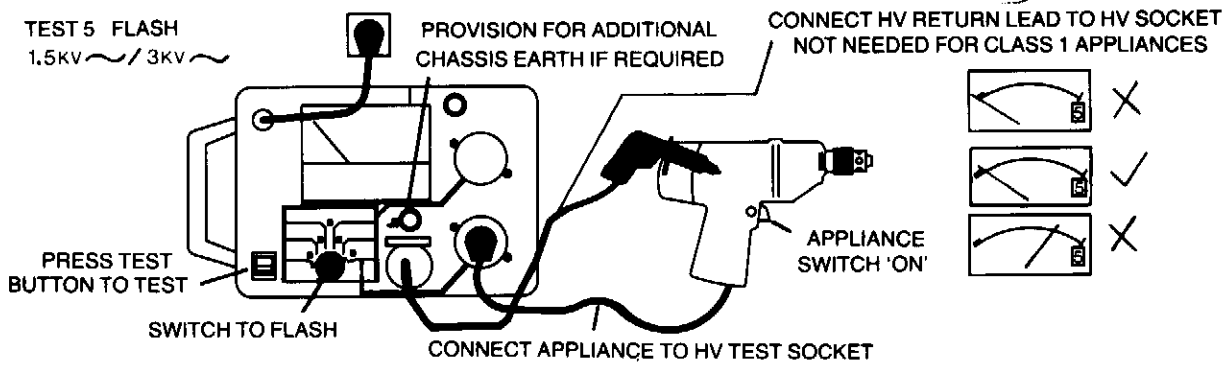


Fig. 5 Flash Test

18. Release the 'Test' switch and record the result.

Note:- The 6 A circuit breaker will allow at least 2 seconds for a reading to be taken for loads up to 13 A. Typical disconnection times for greater loads are; 0,2 seconds for 36 A and < 0,01 seconds for 60 A. (The breaker is re-set simply by pressing the green push-button).

Operation of the protective trip and/or blowing of the mains supply fuse indicates that a heavy current is being drawn by the appliance under test. CORRECT THE FAULT BEFORE REPEATING THE TEST SEQUENCE.

Flash Test - see Fig. 5

19. Move the appliance supply plug to the lower socket on the instrument's front panel. Ensure that the appliance is still switched on.
20. Turn the selector switch to the 'FLASH' test position.
21. Connect external earth if required (see warning 2)
22. For Class 1 appliances press the 'Test' switch and note the reading on scale '5' of the meter. Typically currents of up to 0,25 mA may be

present due to capacitances in the appliance under test. If higher levels of current are measured, the reasons for them should be investigated.

For Class II appliances attach the high voltage probe lead plug connection to the high voltage output socket. Probe suspect areas of insulation such as joints and exposed metal parts. Apply the probe tip to the appliance (pull the trigger to cause the tip to be exposed). Press the 'Test' switch and note the reading as for Class I appliances.

23. Release the 'Test' switch and **remove the high voltage probe from the appliance and from the instrument.** Record the result.

RESISTANCE OF SUPPLY LEADS

The table on page 23 shows the nominal resistance of various appliance supply cable protective conductors (figures are for cables to BS 6500).

The table gives figures for the nominal resistance of the protective conductors 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. Remember, however that contact and connection resistances are still included.

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			
		5	207,5			
0,75	28	1	28	6	0,21	24
		1,5	42			
		2	56			
		2,5	70			
		3	84			
		5	140			
1,0	21,5	1	21,5	10	0,21	32
		1,5	32,25			
		2	43			
		2,5	53,75			
		3	64,5			
		5	107,5			
1,25	17,5	1	17,5	13	0,26	24
		1,5	26,25			
		2	35			
		2,5	43,75			
		3	52,5			
		5	87,5			

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
1,5	15,5	1	15,5	15	0,26	30
		1,5	23,25			
		2	31			
		2,5	38,75			
		3	46,5			
		5	77,5			
2,5	9	1	9	20	0,26	50
		1,5	13,5			
		2	18			
		2,5	22,5			
		3	27			
		5	45			
4	5,5	1	5,5	25	0,31	53
		1,5	8,25			
		2	11			
		2,5	13,75			
		3	16,5			
		5	27,5			

Circuit Description

GENERAL

The PAT2/2 has, in addition to the fuse in its supply plug, both a 12,5 A ceramic HBC fuse and a protective trip mounted on the front panel. The trip protects the instrument against over-current. There is therefore a high degree of protection when the instrument is in use.

The incoming supply rating is marked, along with the fuse rating on the label adjacent to the mains supply cable entry. It is important that the fuse is replaced with one of the correct specification. If the fuse blows or the protective trip operates, check that a short circuit has not been applied to the Operation test.

EARTH BOND

A high current is passed through the earthing system of the appliance under test. The voltage across the resistance in the path of this current is rectified and displayed on the meter.

INSULATION

A d.c. voltage is generated and applied via current limiting resistors to the appliance under test. The voltage across one of these current limiting resistors is then monitored by the panel meter and varies in relation to the insulation resistance of the appliance.

LOAD

A low voltage is applied between the phase and neutral of the appliance under test. The current being drawn by the appliance is monitored by measuring the voltage across a series resistor.

OPERATION VA

The incoming mains is applied to the appliance under test via a contactor and the current being drawn is monitored. The voltage across a low value series resistor is amplified and displayed on the meter.

FLASH

High voltages are generated either side of the earth point by a centre tapped transformer with its tapping earthed. The voltage across a series resistor in the transformer secondary is amplified and monitored by the meter, displaying leakage current. A separate 3-pin socket is used for flash testing to provide isolation within the instrument.

Instrument Repairs and Spare Parts

The manufacturer's service and spare parts organisation for MEGGER® instruments:-

AVO MEGGER INSTRUMENTS LIMITED

Archcliffe Road,
Dover,^{***}
Kent CT17 9EN,
England.
Tel: 0304 202620
Fax: 0304 207342

Approved Repair Companies

A number of independent instrument repair companies in the U.K. have been approved for repair work on most MEGGER® instruments. using genuine MEGGER® spare parts. Their names and addresses are listed in the Warranty Card supplied with each new instrument.

Overseas

Instrument owners outside the U.K. should consult the appointed Distributor/Agent for their country regarding spare parts and repair facilities. The Distributor/Agent will advise on the best course of action to take.

If returning an instrument to Britain for repair, it should be sent, freight pre-paid, to the address shown opposite. A copy of the Invoice and of the Packing Note should be sent simultaneously by airmail to expedite clearance through the U. K. Customs.

A repair estimate showing return freight and other charges will be submitted to the sender, if required, before work on the instrument commences.

**NEW MEGGER® INSTRUMENTS ARE
GUARANTEED FOR 12 MONTHS FROM THE DATE
OF PURCHASE BY THE USER.**

Components List

(Components are common to all models except where stated).

MAIN P.C.B.

R1	Potentiometer	5 k Ω		
R2	Resistor	200 Ω	$\pm 1\%$	1/4 W
R3	Resistor	20 M Ω	$\pm 5\%$	1/2 W
R4	Resistor	9 k 1 Ω	$\pm 1\%$	1/4 W
R5	Resistor	91 k Ω	$\pm 2\%$	2 W
R6	Resistor	dependent on model		
R7	Resistor	130 k Ω	$\pm 1\%$	1/4 W
R8	Resistor	9.1 k Ω	$\pm 1\%$	1/4 W
R9	Resistor	82 k Ω	$\pm 1\%$	1/4 W
R10	Resistor	82 k Ω	$\pm 1\%$	1/4 W
R11	Resistor	3.9 k Ω	$\pm 1\%$	1/4 W
R12	Resistor	33 M Ω	$\pm 5\%$	1/2 W
R13	Potentiometer	2 k Ω	$\pm 20\%$	
R14	Potentiometer	50 k Ω	$\pm 20\%$	
R15	Potentiometer	2 k Ω	$\pm 20\%$	
R16	Resistor	33 M Ω	$\pm 5\%$	1/2 W
R17	Resistor	33 M Ω	$\pm 5\%$	1/2 W
R18	Resistor	270 k Ω	$\pm 5\%$	1/2 W
R19	Resistor	160 k Ω	$\pm 1\%$	1/4 W
R20	Resistor	0R1 Ω	$\pm 5\%$	6 W
R21	Resistor	0R1 Ω	$\pm 5\%$	6 W
R22	Resistor	51k Ω	$\pm 2\%$	2 W
R23	Resistor	51 k Ω	$\pm 2\%$	2 W
R24	Resistor	270 k Ω	$\pm 1\%$	1/4 W
R25	Resistor	2 k 7 Ω	$\pm 1\%$	1/4 W
R26	Resistor	100 k Ω	$\pm 1\%$	1/4 W
R27	Resistor	8 k2 Ω	$\pm 1\%$	1/4 W
R28	Resistor	200 k Ω	$\pm 1\%$	1/4 W
R29	Resistor	100 k Ω	$\pm 1\%$	1/4 W
R30	Resistor	dependent on model		
R31	Potentiometer	50 k Ω	$\pm 20\%$	
R32	Resistor	8k 2 Ω	$\pm 1\%$	1/4 W

C1	Capacitor	22 μ F	50 V d.c.
C2	Capacitor	68 nF	630 V d.c.
C3	Capacitor	22 μ F	50 V d.c.
C4	Capacitor	680 nF	630 V d.c.

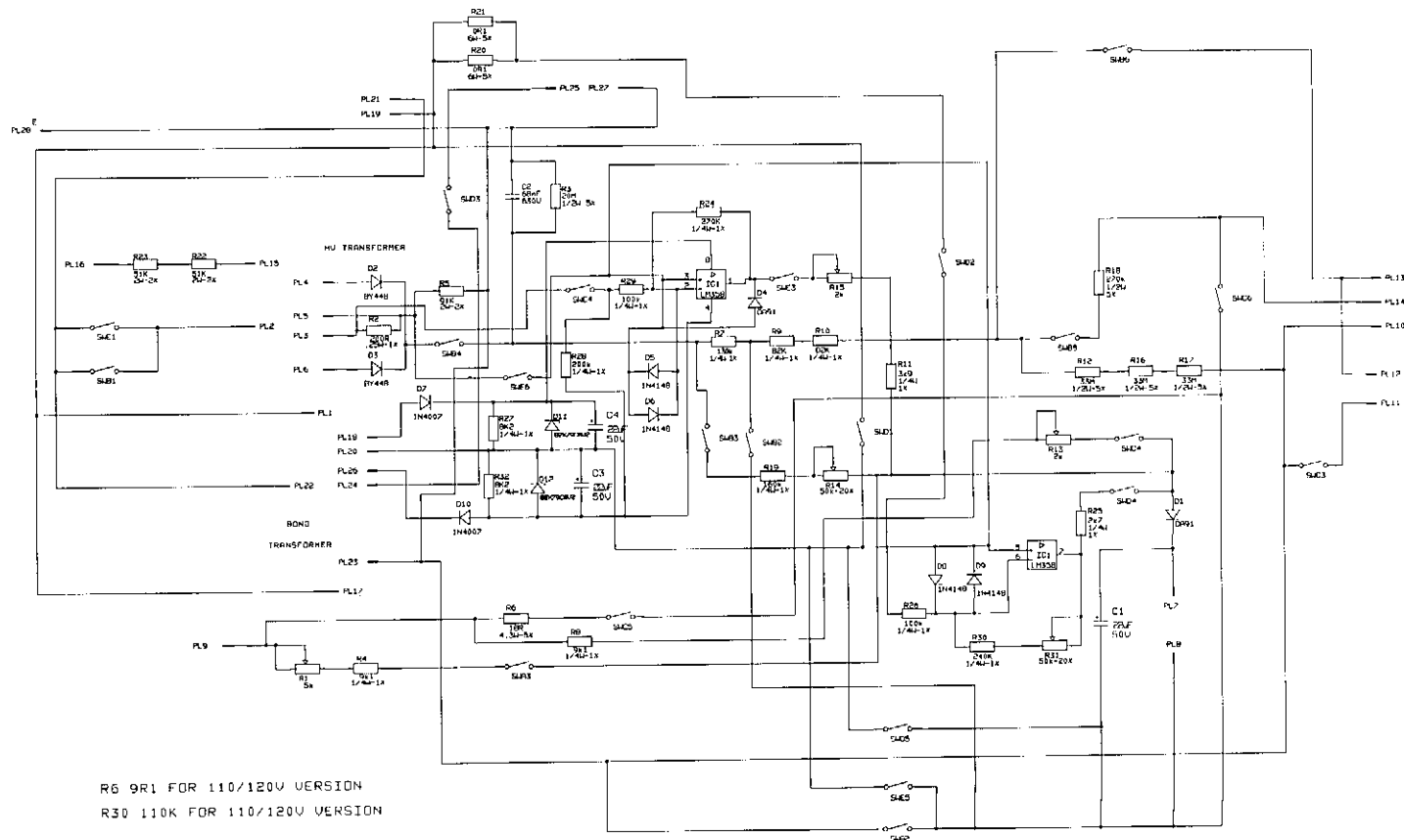
D1	Diode	OA 91
D2	Diode	BY 448
D3	Diode	BY 448
D4	Diode	OA 91
D5	Diode	IN 4148
D6	Diode	IN 4148
D7	Diode	IN 4007
D8	Diode	IN 4148
D9	Diode	IN 4148
D10	Diode	IN 4007
D11	Diode	BZX 79C8V2
D12	Diode	BZX 79C8V2

IC1 Integrated Circuit LM 358

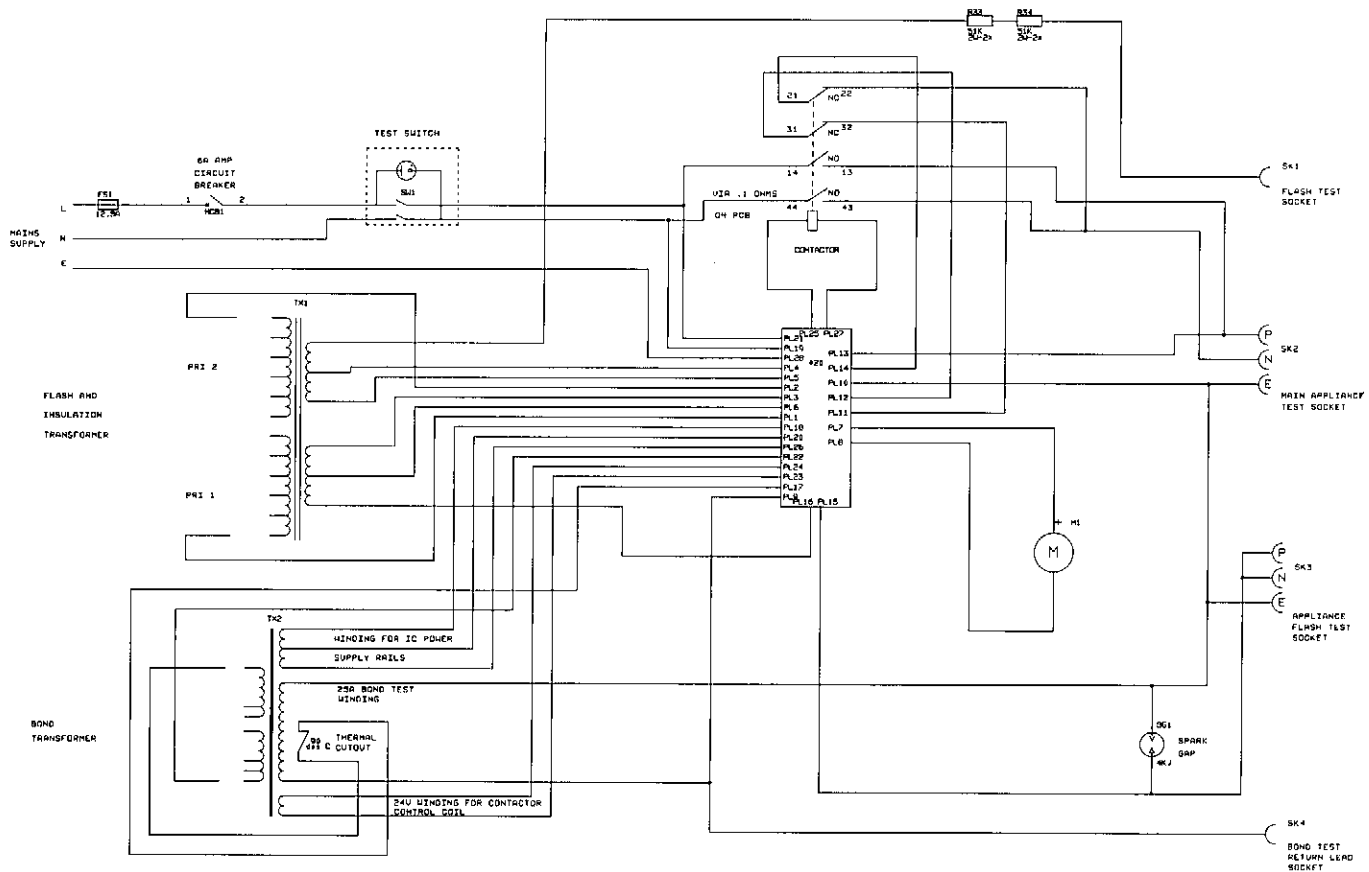
OTHER COMPONENTS

CB1	Circuit Breaker	part no. 25472-738
CT1	Contactors	part no. 25980-032
FS1	Fuse (12,5 A ceramic HBC)	part no. 25955-016
M1	Meter	part no. 6380-126
SW1	Switch (test)	part no. 25975-019
TX1	Transformer (High Voltage)	part no. 6231-477
TX2	Transformer (Earth Bond)	part no. 6231-478

Circuit Diagrams



Circuit Diagrams





AVO MEGGER INSTRUMENTS LIMITED

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This instrument is manufactured in the United Kingdom.

*The company reserves the right to change the specification or design without prior notice.
MEGGER is the registered Trade Mark of AVO MEGGER INSTRUMENTS LIMITED.*

This data uses the comma as the decimal marker to align with general European usage.

Parts of this instrument are the subject of patent applications.

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MEGGER