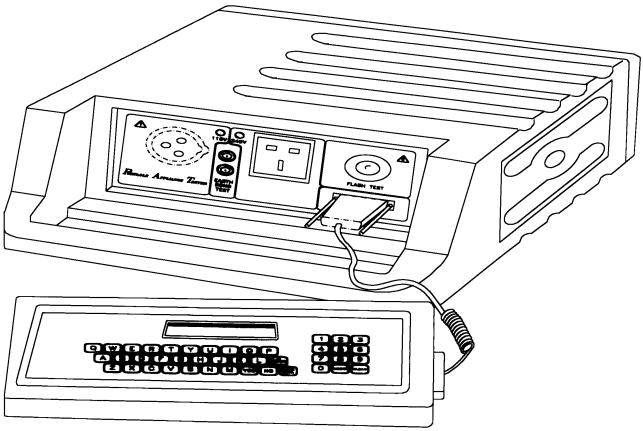
PAT2000i
PORTABLE APPLIANCE TESTER

221A910

OPERATING INSTRUCTIONS



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NOTICE

Data may be lost or altered in virtually any electronic memory under certain circumstances. Therefore Seaward Electronic assumes no responsibility for financial losses or claims due to data lost or otherwise rendered unusable whether as a result of abuse, improper use, defects, disregard of operating instructions or procedures, or any other allied causes.

The information in this manual is subject to change without prior notice.

PAT INTERNAL BATTERY

The Portable Appliance Tester contains an internal rechargeable battery to maintain the memory when the unit is switched off. In order to ensure that this battery maintains operability the following procedure should be followed:

1. On receipt of the PAT tester, clear the memory and leave the unit switched on for 16 hours.

2. If the PAT will not be in use for weeks at a time the previous test results should be downloaded onto a printer or computer prior to the unit being stored, otherwise the unit should be switched on for 16 hours to ensure full charge.

3. If the PAT has not been used for some weeks, the battery can become heavily discharged, causing a possible loss of data. If test data is still intact it is advisable to download it. When the PAT is known to be in a discharged state, power it up to charge the battery for at least an hour prior to carrying out testing, or leave to charge for 16 hours.

TABLE OF CONTENTS

SAFETY

Read instructions before use.

Due to the potential hazard associated with any electrical circuit it is important that a user is familiar with the instructions covering the capabilities and operation of this instrument. The user should ensure that all reasonable safety precautions are followed and if any doubt exists should seek advice before proceeding.

The PAT2000i performs a number of electrical tests which involve high voltages and high currents. Never touch the appliance being tested while the testing procedure is being followed.

This product is designed for use by suitably trained competent personnel.

Symbols used on this equipment.

⧈ - Equipment protected throughout by double or reinforced insulation.

⚠ - Caution risk of electric shock (Test voltage of 1500 V AC may be present).

⚠ - Caution (refer to accompanying documents).

GETTING STARTED.

- On receiving your tester:
- Read the instructions.
- Assemble tester with interconnection lead between keypad and main unit.
- Plug in tester and leave for a maximum 16 hours to charge backup battery.
- Clear Memory.
- Set computer and printer communications.

FEATURES

DESCRIPTION

The PAT2000i is one of the most advanced portable appliance testers available, performing nine functions and providing a comprehensive guide to the electrical safety of 230V, 110V and (with 3 phase adaptor lead) 400V appliances of Class I or ll construction.

The Instrument is microprocessor controlled and enables the user to select either the automatic testcode or manual mode of operation which gives control of the testing sequence to the instruments microprocessor or the operator. Alternatively the PAT2000i can be controlled by a computer via the RS232 link.

All internal power and test outputs for both all rated appliances are derived from 230v 50Hz supply.

The equipment performs the test selected by the user and records the results in its internal memory which is capable of storing up to 1000 sets of test results.

To speed up data entry, the appliance number, test code number and user code can all be entered into the PAT2000i by a bar code reader.

In addition to test results the memory also records the appliance number, the test number and the date of testing. Selectable preset pass/fail limits have been programmed into the PAT2000i and the test result is clearly displayed on the instruments liquid crystal display and on any hard copy printout.

A fully charged battery backed memory will store results for up to six months without being reconnected to the supply for re-charging, however it is recommended that the contents of the memory is printed out or down loaded to a PC daily.

The PAT2000i performs tests to levels and thresholds as described in the IEE publication:

”CODE OF PRACTICE FOR IN SERVICE INSPECTION AND TESTING OF ELECTRICAL EQUIPMENT”.

This code of practice details the testing required for electrical equipment that is “IN SERVICE” as well as testing required by “AS NEW and REPAIRED” equipment.

Particular features of this product are:

- Testing to IEE recommended new / service levels.
- Dual voltage output.
- Rugged Enclosure.
- Compatibility with PATS & PATS+ software.
- Bar code reader input.
- Remote control facility.
- IT Test facility
- IEC Lead test

LAYOUT

The PAT2000i is contained in a robust polyethylene moulded case with an integral carrying handle and separate keypad. Power supplies, 230V/110V sockets and high voltage/power components are housed in the main enclosure. Two indicators show which of the test sockets is in use. The microprocessor, keypad input, display and i/o port are housed in the smaller keypad enclosure. The keypad has a “qwerty” layout with the numbers grouped on the right hand side.

The keypad is held in place by two over-centre latches.

The mains input connector and test leads are housed behind two side panels held in place by quick release fasteners. Hand tools are not requipped to operate or access the PAT2000i.

The main unit is connected to the keypad by a 25 way screened interconnection lead as show in fig 1.

The PAT2000i performs nine functions which include:

- Visual inspection
- Earth bond
- Earth screen
- Insulation
- Flash test
- Load test
- Operation test
- Earth leakage test
- IEC Lead / Extension Lead continuity/polarity test

The control and use of the instrument is extremely simple with clear explicit prompts on the large liquid crystal display.

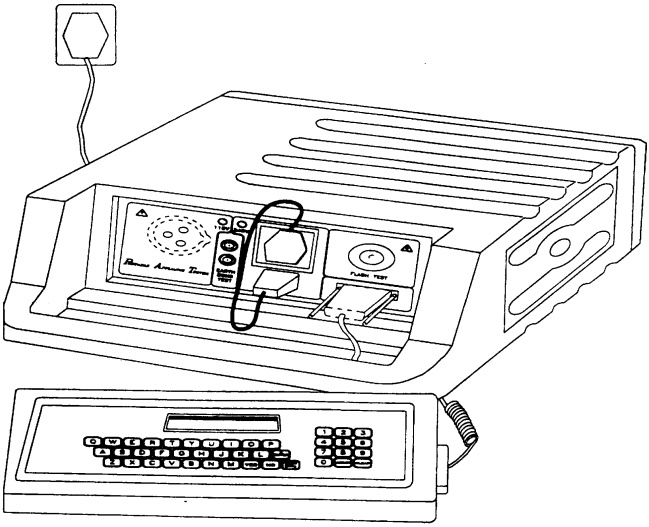
SAFETY FEATURES

A number of safety features are included in the instrument design and these include:

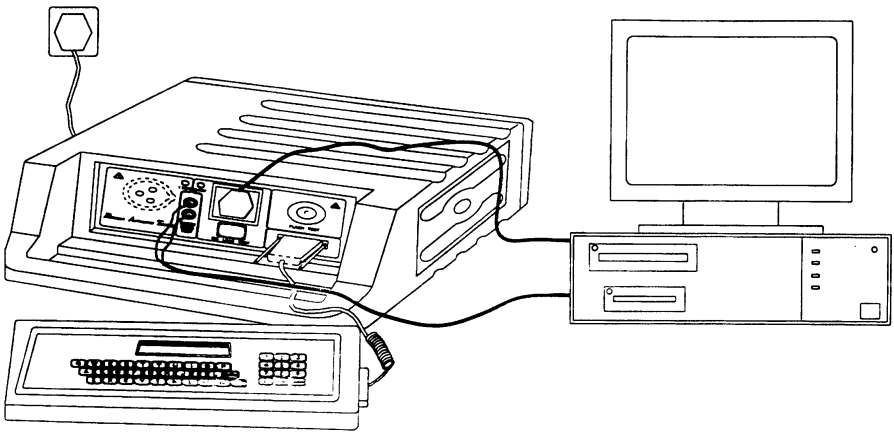
- Fuse protection.
- A monitor between neutral and earth connection to the PAT2000i which inhibits testing if a potential of greater than a nominal 50V exists (as with a reversed polarity connection). The inhibit can be overridden if the user decides it is safe to continue e.g. When using an isolating transformer.
- The unit has a default Pass/Fail level for each test. In addition a preset trip level has also been incorporated for each test which will terminate the test if the measured level exceeds this value. The exact trip level will vary according to test but will normally be approximately 120% of the maximum Pass/Fail level.
- An electronic cutout which provides rapid disconnection of internal relays where test results are detected which are in excess of 5 times the fail limit.
- Sensing circuitry to detect overvolts on the 110V output.

110V APPLIANCES

IEC LEAD TEST

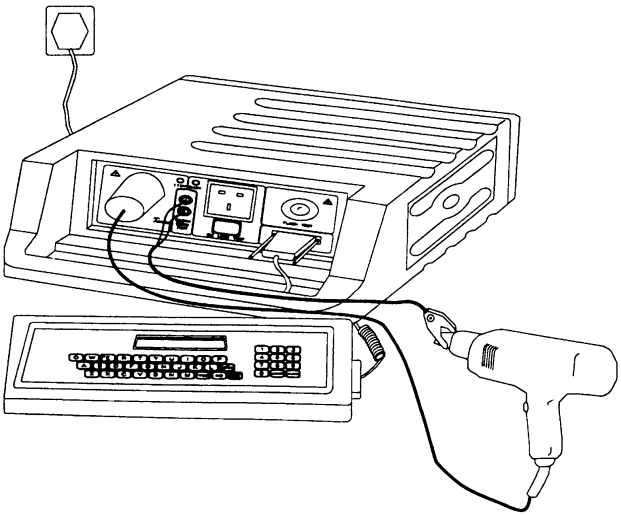


EARTH SCREEN TEST
FOR IT EQUIPMENT

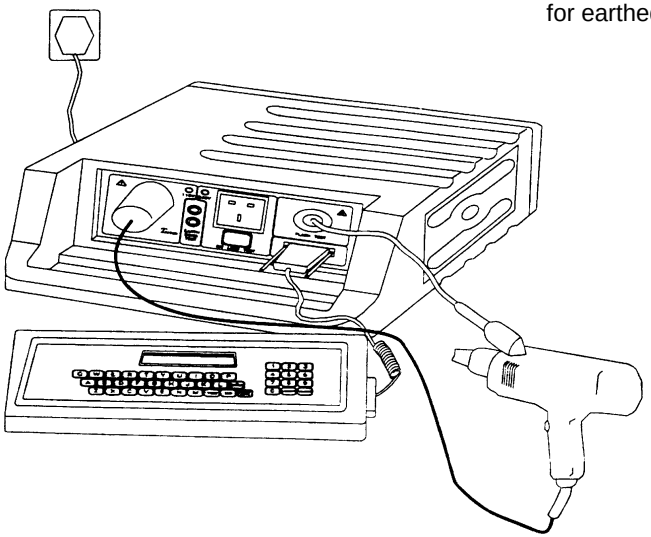


110V APPLIANCES

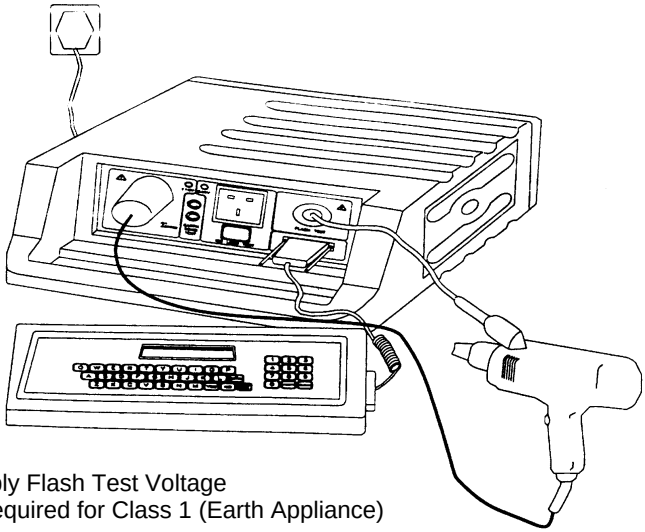
EARTH BOND TEST



INSULATION TEST 500V DC
(Probe not needed
for earthed appliances
i.e. Class 1)



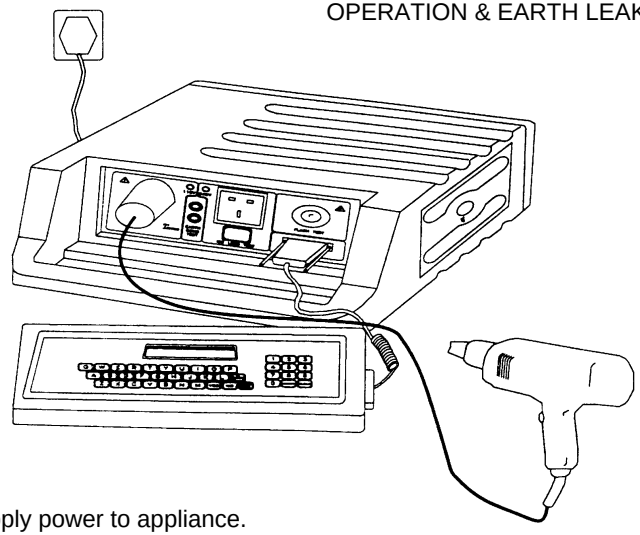
A.C. FLASH TEST
1.5KV Class 1
3.0KV Class 2



Note:
1. Press # to apply Flash Test Voltage
2. Probe is not required for Class 1 (Earth Appliance)

Warning: Do not touch probe tip or appliance during test and allow time for any internal capacitors to discharge after test is complete.

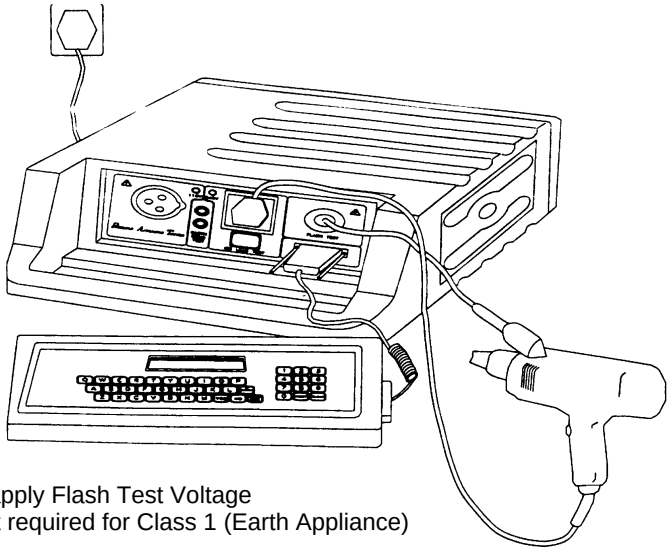
OPERATION & EARTH LEAKAGE TEST



Note:
1. Press # to apply power to appliance.

Warning: Ensure that no hazard will occur when the appliance operates.

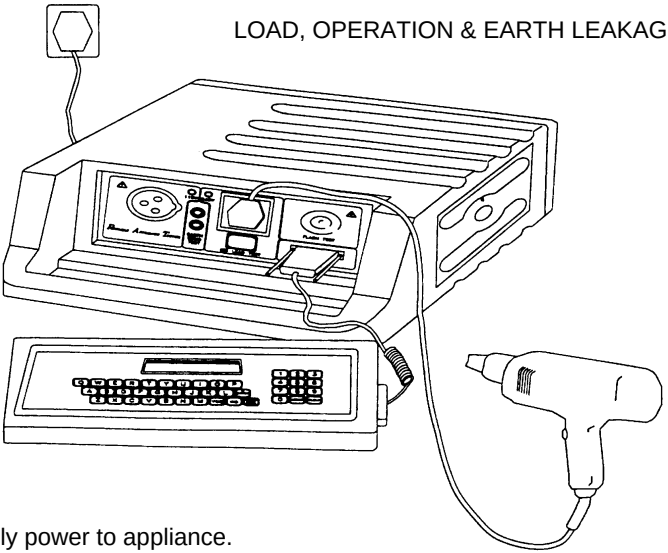
A.C. FLASH TEST
1.5KV Class 1
3.0KV Class 2



Note:
1. Press # to apply Flash Test Voltage
2. Probe is not required for Class 1 (Earth Appliance)

Warning: Do not touch probe tip or appliance during test and allow time for any internal capacitors to discharge after test is complete.

LOAD, OPERATION & EARTH LEAKAGE TEST

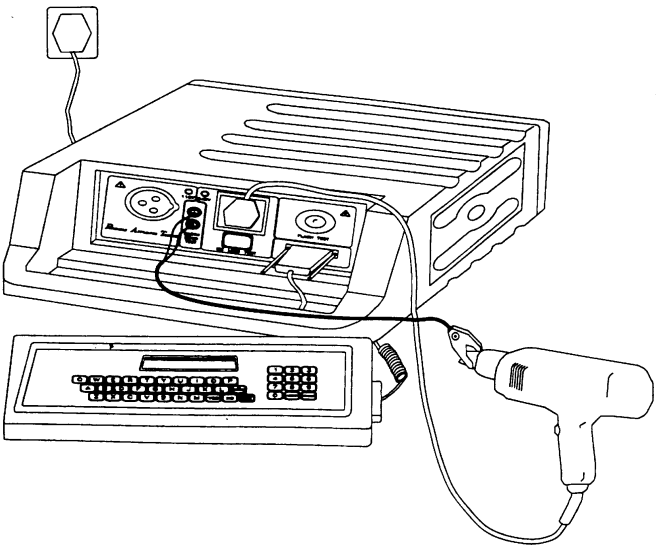


Note:
1. Press # to apply power to appliance.

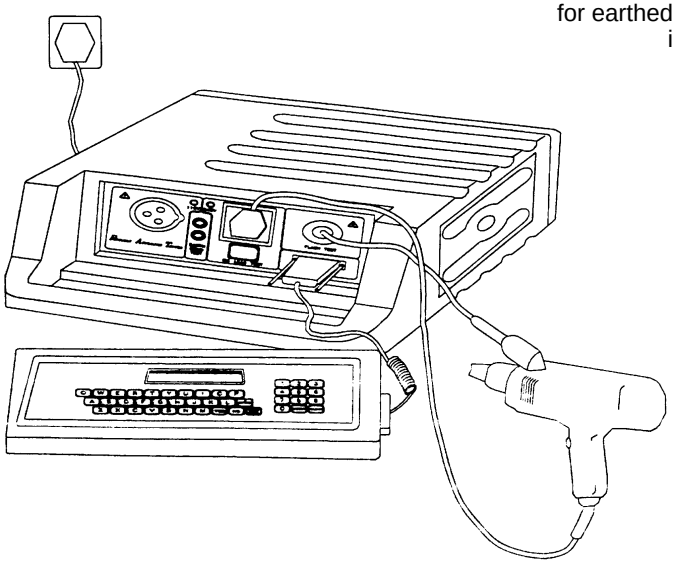
Warning: Ensure that no hazard will occur when the appliance operates.

240V APPLIANCES

EARTH BOND TEST



INSULATION TEST 500V DC
(Probe not needed
for earthed appliances
i.e. Class 1)



Use of the PAT2000i is straight forward. Plug the tester into a suitable outlet and follow the instructions on the LCD display.

Variations of the standard instrument are available to suit international voltages and connecting sockets, details of those available at this time are listed under the section Specifications.

APPLICATIONS

The PAT2000i is designed to check the electrical safety of portable appliances and its comprehensive testing routine allows for appliances of safety Class I and Class ll insulation to be checked.

As a guide BS and IEC standards define these two categories of insulation as follows:

Class l: Appliances which have a basic functional insulation throughout and which include a means for the connection of exposed conductive parts to earth via the fixed wiring installation. These are often described as earthed appliances.

Class ll: Appliances which have both basic functional and additional supplementary insulation . These appliances have no provision to connect exposed conductive surfaces to a protective conductor.

The symbol ⧈ represents double insulation and no earth connection is present in this type of appliance.

Different regulations and standards describe a variety of tests for electrical appliances and in general cover type approval tests. Such testing involves prolonged sophisticated techniques. It is generally recognised that for periodic inspection to ensure that the safety of the appliance is maintained tests of the type performed by the PAT2000i are realistic and satisfactory.

The same sequence of tests can be carried out for either 230V or 110V appliances. 400V appliances are restricted to non loading tests only, as described in the instructions for the Seaward 3 phase adaptor.

Nine different tests are performed by the PAT2000i and these are described as follows:

VISUAL INSPECTION

The objective of the visual checks is to confirm that the appliance under test is not damaged and thereby safe to test. The user is asked to check the lead, case and fuse. If any of the three checks is answered “no” then a fail is recorded in the test results.

EARTH BOND TEST

The objective of this test is to ensure that the connection between the earth or protective conductor of the appliances mains plug earth pin and the metal casing of the appliance is satisfactory and of low enough value to satisfy accepted safety standards.

The PAT2000i applies a low voltage of approximately 6 volts ac rms between the earth pin of the mains supply plug and the lead connected to the earth bond test terminal, a high current is allowed to flow for a period of 5 seconds which can be either approximately 6 amps, 12 amps or 25 amps depending on which range is selected. The objective of the high current is to test under load conditions and the duration of the test is limited to 5 seconds to prevent damage or over stressing which may be caused by testing for prolonged periods.

The IEE recommends that if testing the protective earth of an appliance results in a marginal fail, then the appliance should be retested taking into account the length and cross sectional area of the appliance supply cord. The PAT2000i will automatically prompt the user if a marginal fail occurs and an appropriate message will be appended to the stored results if a retest is actioned.

Appendix A details the Earth Continuity Thresholds applicable to each group of appliances.

EARTH SCREEN TEST

The objective of this test is to ensure that the connection between the earth or protective conductor of the appliances mains plug earth pin and the metal casing of the appliance is satisfactory and of low enough value to satisfy accepted safety standards.

The PAT2000i applies a low voltage of approximately 100mV ac rms between the earth pin of the mains supply plug and the lead connected to the earth bond test terminal, a maximum current of 100mA is allowed to flow for a period of 5 seconds. The objective of this test is check the earth screen connection using a current which will prevent damage or over stressing which may be caused by testing using currents suitable for earth bond testing.

INSULATION TEST

In the insulation test a nominal voltage of 500V dc is applied between the earth pin and both the live and neutral pins of the appliance mains supply plug. 110V appliances have the insulation voltage applied to the earth and the line pins. The PAT2000i displays the resistance measured and allows the user to confirm sufficient insulation exists. For Class ll appliances the flash probe replaces the earth pin in the plug, and the default pass level in manual and automatic modes changes to the appropriate new / service value.

When the instrument is operating in automatic or manual modes the default insulation test thresholds are set to the following values.

INSULATION TEST THRESHOLDS		
	Class I	Class II
AS NEW APPLIANCE	2.0 MΩ	7.0 MΩ
IN SERVICE APPLIANCE	0.5 MΩ	1.0 MΩ

Appendix B details the Insulation Test Thresholds applicable to each group of appliances.

FLASH TEST

A wide variety of tests are specified under different BS and IEC specifications. For this reason test voltages have been selected for the PAT2000i which are common for routine testing without overstressing and potentially weakening appliances insulation levels. A nominal test voltage of 3kV for Class ll appliances is applied and 1.5kV for Class I appliances.

NOTE: This particular test may be omitted when testing equipment incorporating electronics or interference suppressors. This action may be necessary where the voltage withstand rating of the components fitted to the appliance is insufficient to accommodate the test without damage.

The IEE recommends that flash testing is not required for in service equipment.

LOAD TEST

Before switching full power on to an appliance the load test is conducted which applies a voltage through a current limiting resistor to the mains supply plug and checks that the current flow will not be excessive when full voltage is applied.

The result of this test is not displayed unless the tester detects a potentially high current in which case the user can determine whether it is safe to continue. This test is for 230V appliances only.

OPERATION TEST

The appliance under test is energised at either 110V or 230V depending on the voltage selected through the mains supply plug for a period of 8 seconds. The PAT2000i measures the power taken by the appliance after 4 seconds and displays the reading in KVA based on a nominal supply voltage.

LEAKAGE TEST

During the operation tests described in the above section the PAT2000i monitors the current flow through the earth lead of the appliance and displays the result on the screen with a pass or fail indication.

NOTE: The IEE recommends that information technology equipment not constructed to BS EN 60950 may be damaged by applied voltage testing. It is recommended that earth leakage measurement is performed on this type of equipment.

This particular test is of value when an appliance incorporates a number of sequences which may change the characteristics of the product during its operation. As such these defects would not be apparent under normal passive testing.

Appendix C details the Earth Leakage limits applicable to each group of equipment.

- It is important for complete testing that the appliance is switched on for the duration of the test cycle.
- At the end of the leakage test a warning may be given ‘Low Load, check fuse’. If the appliance is known to be less than 50VA rating the fuse may be found to be healthy and the test has been valid.
- It should be noted that the variety of appliances on the market is such that it is unlikely that one default testing routine will satisfy all users appliances, therefore if any doubt exists as to exactly which tests are to be performed on a specific appliance, the manufacturer of the appliance under test should be consulted for a definitive answer.

IEC LEAD CONTINUITY / POLARITY TEST

The lead is connected to the 230V socket and the IEC connector a current of 500mA is passed through the live and neutral conductors and a check is made to ensure that there is no breaks or cross wiring.

WARNINGS

- Do not touch the appliance while testing is in progress. A high voltage of 1.5kV is applied with respect to earth during flash test and a nominal 500V DC during insulation test.

- Ensure that the earth clip of the bonded earth test cable is securely attached to the appliance. A poor connection may introduce arcing of the contact.
- The appliance will be automatically energised during the load test. Care should be taken that no ill effects can occur when the appliance commences operation.
- Certain appliances may contain interference suppressors which may be damaged by the flash test if their components are not rated to withstand this type of test. Under these conditions the flash test may be skipped.
- Where it is unclear which class of insulation applies to the appliance being tested it is recommended that the manufacturers operating instructions be consulted.
- It is recommended that the PAT2000i is periodically checked by testing an appliance of known electrical characteristics or by using an approved check box.
- Tests should not be carried out while a printer or computer is connected to the instruments serial port.
- The instrument is designed to output a nominal 230V or 110V only from the appropriate socket and various features are incorporated to ensure this. It is extremely dangerous to connect a 110V appliance to 230V and this must **NOT** be done in any circumstances.
- The side panels are fitted with quick release fasteners to allow access to test leads etc. Do not attempt to release any fasteners within the side enclosures.
- Some I.T. Equipment may require a low current earth screen test only.

OPERATING PROCEDURES

GENERAL

The PAT2000i is microprocessor controlled and is designed to be extremely user friendly by asking a series of questions which will guide the operator through the testing sequence.

The instrument will make clear statements concerning the test or condition of the equipment and ask the operator to confirm or deny the status, e.g. in the case of setting the test mode the display prompts automatic test ?Y/N.

The operator can use either the YES and NO keys or the Y and N characters in answer to the required questions.

If the operator wishes to use the automatic test sequence he presses the Y and the instrument records the choice and proceeds to the next step.

If the operator wishes to use the manual test mode he presses N.

In this case the display will present the message manual test mode? Y/N. The operator then will press the Y to confirm that he wishes to use the manual test sequence. Should the operator wish to change his mind he should press N and go back to the beginning of the sequence.

If the PAT2000i has been unused for several months it is recommended that it be switched on for 16 hours before use to ensure the memory backup battery is in a healthy state of charge. Check memory for corruption and if in doubt clear before use. (See note on inside front cover)

(The Hash (#) sign represents the enter command and advises the microprocessor that

a selection has been made and it should action the request. NOTE: no action will follow unless the hash (enter) key has been pressed.

PROCEDURE

STEP 1

Connect the PAT2000i to the mains supply. On power up the unit will display:
SEAWARD TESTER
PAT2000i
Then the memory is tested, if all ok message 'PASS DATA CHECKSUM' is displayed. On power up the PAT2000i may display:

VOLTS ON NEUTRAL
PRESS # ONLY IF SAFE

ONLY proceed if the reasons are known.

The unit will then prompt:

IS THIS RIGHT Y/N
16 MAR 95 (16:03:95)

If the date is correct press the Y key and the program will sequence to the next instruction. If the date is not correct press the N key and the instrument will then lead the operator through a sequence of setting the day, month and year. At the end of this sequence the new date will be displayed and the user asked to confirm whether it is correct or not. (Should the user make an error during the set up procedure of the date he will now have the opportunity to correct this.)

DIRECT USER CONTROL MODE.

At the prompt PRESS # FOR NEW TEST, press the D on the keypad. The following message will appear; DIRECT USER CONTROL! TESTS ARE NOT LOGGED

followed by the following screen;
1 =A1 2A;2=A230V;3=ETH
4=INS;5=FL;6=LD;7=CNT

Pressing 1 will change the earth current
Pressing 2 will toggle between 230V and 110V test sockets
Pressing 3 will perform an earth test at the current selected by 1
Pressing 4 will perform an insulation test
Pressing 5 will perform a flash test
Pressing 6 will perform a load and leakage test
Pressing 7 will perform a continuity test on an IEC lead

LEGISLATION SELECT

At the prompt PRESS # FOR NEW TEST, press the L on the keypad.
Pressing N key will cyclically prompt two options:

IN SERVICE TEST? Y/N
'AS NEW' TEST? Y/N

Pressing the Y key will select the displayed option.

NOTE: The selected option will be remembered only whilst the unit is powered. At power up the PAT2000i defaults to the "IN SERVICE" test thresholds for

manual and automatic test modes. See the IEE publication “CODE OF PRACTICE FOR IN SERVICE INSPECTION AND TESTING OF ELECTRICAL EQUIPMENT” for further information.

STEP 2

Display: INPUT TEST ITEM NUMBER, PRESS # OR USE WAND.
(Each appliance may be allocated an alpha numeric code of up to ten digits).
When the desired code is entered press # ONCE only to enter code into memory, (if entered manually). The instrument will ask “Is this right? Y/N”. The user may then re-check and respond accordingly.

STEP 3

Display: INPUT TEST CODE? Y/N
At this stage the operator is being asked to select either the test code or normal operation. If normal operation is required then answer ‘N’ and proceed to step 4. The test code can be entered via the keypad or a bar code reader. The test code has been added to save time by avoiding the requirement for repeated input of information and takes the form of a ten digit number, the PAT2000i codes are as follows

Digit	Value and Test
1	Visual inspection 1 = This indicates that PAT2000 codes are to be used 2 = 230V Appliance including visual inspection 3 = 230V Power lead including inspection 4 = 230V Appliance, no visual inspection 5 = 230V Power lead, no visual inspection 6 = 110V Appliance including visual inspection 7 = 110V Power lead including visual inspection 8 = 110V Appliance, no visual inspection 9 = 110V Power lead, no visual inspection
2	Earth integrity test, current selection 0 = Class II no Earth Integrity test 1 = 0.1 A 2 = 6A 3= 12A 4 = 25A 5 - 9 = N/A
3	Earth integrity test, pass limit selection 0 = class 2 no Earth Integrity test 1 = 0.1Ω 2 = 0.265Ω 3 = 0.5Ω 4 = 2.0Ω 5 - 9 = N/A
4	Insulation test voltage selection 0 = Omit insulation test 1 = 2 = 500V 3 - 9 = N/A

5	Insulation test, pass limit 0 = Omit insulation test 1 = 2 MΩ 2 = 4 MΩ 3 = 7 MΩ 4 = 1 MΩ 5 = 0.5 MΩ
6	Flash test voltage and pass limit selection 0 = Omit Flash test 1 = 1500V, 3mA 2 = 1500V, 5mA 3 = 3000V, 3mA 4 = 3000V, 5mA
7	Operation test, pass limit selection 0 = Omit Operation test 1 = 0.5 kVA 2 = 1.0 kVA 3 = 1.5 kVA 4 = 2.0 kVA 5 = 2.5 kVA 6 = 3.12 kVA 7 = 3.3 kVA 8 9
8	Earth Leakage test, pass limit selection 0 = Omit Earth leakage test 1 = 0.25mA 2 = 0.75mA 3 = 3.50mA 4 = 9.90mA (Top of range) 5 - 9 = N/A A = 0.5 mA B = 1.5 mA G = 2.25 mA
9	Repeat Selection 0 = No repeat test 1 = Repeat Earth integrity 2 = Repeat Earth Integrity and insulation 3 = Repeat Earth Integrity and Flash 4 = Repeat Earth Integrity, Insulation and Flash 5 = Repeat Insulation 6 = Repeat Flash 7 = Repeat Insulation and Flash 8 - 9 = N/A

10	Polarity Selection - Full Test Repeat Selection 0 = Polarity test excluded 1 = Polarity test included 2 = Polarity test excluded and repeat full test 3 = Polarity test included and repeat full test 4 - 9 = N/A

For compatibility the PAT2000i will accept PAT2000 codes, but note that the PAT2000i codes are the preferred ones and should be used for all new tests.
The PAT2000 codes are as follows:

Digit	Value and Test
1	1 = NO TEST (must be 1)
2	0 = visual check omitted 1 = visual check included
3	0 = 230V socket 1 = 110V socket
4	0 = Class ll 1 = Class I 0.1Ω 2 = Class I 0.5Ω 3 = Class I 2.0Ω 4 = Class I 0.1Ω up to 3 tests 5 = Class I 0.5Ω up to 3 tests
5	0 = insulation omitted 1 = 7MΩ pass level 2 = 2MΩ pass level 3 = 4MΩ pass level 4 = 7MΩ pass level up to 3 tests 5 = 2MΩ pass level up to 3 tests 6 = 4MΩ pass level up to 3 tests 7 = 1 MΩ pass level 8 = 0.5MΩ pass level
6	0 = flash test omitted 1 = 3mA pass level 2 = 5mA pass level 8 = 3mA pass level up to 3 tests 4 = 5mA pass level up to 3 tests
7	0 = load test omitted 1 = 0.5kW pass level 2 = 1.0kW pass level 3 = 2.0kW pass level (230V) or 1.8kW (110V) 4 = 3.2kW pass level (230V) or 1.8kW (110V)

8	1 = 0.75mA leakage pass level 2 = 3.50mA leakage pass level 3 = 9.90mA leakage pass level
9	0 = no repeat test 1 = repeat test
10	spare, but must be 1

Proceed to STEP 7 if visual check included or STEP 8 if visual check excluded.

STEP 5

Display: AUTOMATIC TEST Y/N or MANUAL TEST Y/N Instrument will default to the last used option.
At this stage the operator is being asked to select either the automatic sequencing of tests or the manual sequence.

An automatic sequence will allow the tester to apply 5 second test sequences of each test and will only ask for a prompting at the flash test stage and at the load test in Class 1 and also at each stage for repeat test option in Class ll.

Manual mode allows the operator to perform repeat tests. If repeat tests are not required answering 'N' will cause initialisation of the next test sequence.

Manual mode allows the operator to "Backstep" using the B key to the previous test. This will overwrite the previous result(s). Backstep can be repeated until the first test in the sequence is reached.

It should be noted that for safety reasons tests are only performed in the sequence detailed under the section headed Applications.

STEP 6

The instrument will display:

APPLIANCE TEST ? Y/N or IEC LEAD TEST ? Y/N.

Pressing the N key will cyclically present each option, pressing the Y key will accept the option. The operator is asked to choose between testing an appliance or an IEC lead. The instrument will default to the last used option.

STEP 7

The instrument will display: 230V TEST Y/N or 110V TEST Y/N. The instrument will default to the last option used.

At this stage the operator is asked to choose which of the output sockets is required. An indicator next to each socket will show which one is in use at any time. Once the operator has selected the appropriate output, it needs to be confirmed by pressing the YES key.

STEP 8

The instrument will display:

CLASS I TEST Y/N or CLASS II TEST Y/N
The instrument will default to last used option.
(The tester is now asking the operator to advise it which class of insulation applies to the appliance to be tested)

Pressing the N key will cyclically present the option of Class I or Class ll testing Press the Y key to accept the displayed option. If Class I is selected then the user will be prompted to set the earth bond current, options are 0.1A, 6A, 12A, 25A. The display will cycle through the options when the N key is pressed. The user should press the Y key when the required current level is displayed.

The user is now prompted to set the pass/fail level, the options are 0.1 Ohm and 0.5 Ohms by answering Y or N to the questions asked.

STEP 9

The instrument will display:

VISUAL CHECK Y/N

The PAT is now asking the operator if a visual inspection is to be carried out. By pressing the Y key, the following questions are then asked:

IS CASE OK ? Y/N
IS LEAD OK? Y/N
IS FUSE OK ? Y/N

In automatic mode tests will be terminated if any of the questions are answered with a NO. In test code mode display will only show questions:

IS CASE OK ? Y/N
IS LEAD OK? Y/N
IS FUSE OK ? Y/N

Memory will record visual inspection as pass, fail or skip.

STEP 10

The instrument will display:

CONNECT TEST ITEM
PRESS # TO START.

If a Class I test has been selected then the Protective Earth measurement is performed.
The user will be prompted to:

CONNECT EARTH LEAD
PRESS # WHEN READY

If an earth test results in a failure within 0.2 Ohms of the selected threshold the PAT2000i prompts the user:

APPLIANCE EARTH
RESISTANCE TOO HIGH!

DO YOU WANT TO ALLOW
FOR EARTH LEAD? Y/N

Pressing the N key will prompt:

NO ALLOWANCE FOR
EARTH LEAD - FAIL

Pressing the Y key will prompt the tester:

EARTH LEAD AREA
IS 0.5 / 0.75 / 1.0 / 1.25 / 1.5 / 2.5 / 4 sq mm ? Y/N

Pressing the N key cyclically presents all values. Pressing the Y key accepts an area and then prompts:
EARTH LEAD LENGTH
IS 1.0 / 1.5 / 2.0 / 2.5 / 3.0 / 4.0 / 5.0 m ? Y/N

Pressing the N Key cyclically presents all values. Pressing the Y key accepts a length and then prompts:

ENTER ALLOWANCE FOR
EARTH LEAD

The earth reading is then corrected to include the lead resistance and the new result is presented.

The instrument will prompt:
SWITCH ON APPLIANCE
PRESS # WHEN READY

The tester will perform insulation and flash tests for a 5 second period, the load test is applied for 8 seconds the KVA reading is taken after 4 seconds.
Before depressing the hash key the operator should ensure that all connections are correct and that the appliance is switched on.

The flash test probe need only be applied to a Class ll appliance for insulation and flash tests.

In manual mode and test code mode up to 3 earth bond tests, 3 insulation tests and 3 flash tests are available.
The results of each test will be displayed with either a pass or fail indication depending upon whether the measurement is within or outside the preset limits.

The display will prompt and the audio sounder operates when the flash test is reached. The user must press the # key to apply the high voltage. This operation applies even in the automatic test mode.

When a test fails the PAT2000i will stop and skip all further tests in the automatic and testcode modes or prompt to proceed in manual mode. This action is taken on the grounds of safety and the operator should consider whether it is wise to proceed.

STEP 11

The operator will be prompted to enter a user code of up to ten alpha-numeric characters (see step 2). If no code is given 0000000000 is recorded. This code can be used to identify locations, re-test dates, departments, users etc. If more than ten characters are inserted then the last ten will be recorded as the code.

NOTE: If using PATS or PATS+ software, section 5.4 Systems Options, Multi Site Settings, must be set up to accept whatever the user wishes to put in this data field.

STEP 12

The user is prompted to enter TEXT, if not required press N. Text can be entered as 4 lines of ten characters with a prompt for each line. When entering text the SEND DATA key may be used as a space key and the CLEAR key to backspace.

RANGE LIMITS

Upper and lower limits have been set for each range; readings above the upper level are held at the upper level preceded by '>'. Readings below the lower level are held at the lower level preceded by'<'.
e.g. if the upper earth impedance level is set to 20 and the lower earth impedance is set to 0.02 then a measured value of 25 is shown as '>20.00', a measured value of 1.00 is shown as '1.00' and a measured value of 0.01 is shown as '<0.02'.

OTHER COMMANDS

Pressing this key will result in the test sequence being interrupted and the program being reset.

Data Transfer: Using this key the operator will be put in command of recalling the test results contained within memory. The program will lead the user through a series of steps which allows for recall on the display or onto a printer (see Memory Recall).

Space: When entering text, appliance number or user code the SEND DATA key may be used to enter a space into a string.

Memory Clear: This is used to clear the contents of memory or file at the prompt:

PRESS # FOR NEW TEST

pressing CLEAR will prompt:

CLEAR MEMORY, FILE OR
BOTH. PRESS M,F,B or No

Pressing 'M' will clear only the test results.
Pressing 'F' will clear only the test file (App No. / TestCodes)
Pressing 'B' will clear both test results and test file.

Backspace: When entering text, testcodes, appliance number or user code the CLEAR key may be used to backspace over the previous entry.

MEMORY RECALL

Up to 1000 test results can be recorded in the instruments memory. To review the information press the data send key at the 'PRESS # FOR NEW TEST' prompt.
The display will prompt with a question confirming the send data procedure. Press Y to proceed or N to return to the test sequence.
The display will then prompt with a question asking if the information is to be sent to the serial port. Press Y to confirm. Press N if the data is to be displayed on the LCD. The user is asked if the data is to be sent from the start. Press Y to confirm. Pressing N will result in a prompt for the test item number. Once entered, press # and data will be sent from this test item number.

By depressing the # key the display will move through each line of the test results, holding the key down will cause the display to move rapidly through the test results. The data will continue until all results have been displayed

To exit this stage press the ABORT key.
NOTE: When multiple tests have been performed the instrument will automatically output the worst case.

SETTING COMPUTER AND PRINTER COMMUNICATIONS

At the PRESS # FOR NEW TEST prompt pressing the S key will allow the user to set the baud rate and handshaking for interface to a computer or printer.

The user is presented first with the computer options and then the printer options.

For use with the PATS / PATS+ software the computer option should be set to 9600 / NONE, and the printer option to 1200 / none.

The settings are retained by the PAT2000i.

PRINTOUT FORMAT

NUMBER 0001	Test number auto increment
DATE 14-MAR-95	Set by operator
APP NO $$$$$$$$$$	Any 10 character string
TEST MODE AUTO	Selectable from AUTO / MAN / TEST
VISUAL CHECK P	Visual check result
EARTH CURRENT 12A	Test Current
EARTH XX.XXX OHM P	Measured value + result
EARTH XX.XXX OHM P	
EARTH XX.XXX OHM P	
INS XXX.XX MEG P	Measured value + result
INS XXX.XX MEG P	
INS XXX.XX MEG P	
FLASH X.XX mA P	Measure value + result
FLASH X.XX mA P	
FLASH X.XX mA P	
LOAD XX.XX KVA P	Measure value+result
LKGE X.XX mA P	Measured value + result
LEAD CONTINUITY P	Result
USER $$$$$$$$$$	User identity string
TEXT $$$$$$$$$$	Text entered by user up to
TEXT $$$$$$$$$$	4 lines of 10 characters
TEXT $$$$$$$$$$	
TEXT $$$$$$$$$$	
TEXT $$$$$$$$$$	Earth Acceptable

NOTE: P = Pass test.
S = Skip, test not performed.
F = Fail test.
T = Terminate test if load or leakage pretest fail.
A = Aborted test by user.

$ = Alphanumeric character.
xx . xx = Measured result value.

DATA I/O

A 9 pin 'D' type connector is located at the right hand end of the keypad.

The data output uses RS232 levels using ±5VDC The pin connections are as follows:

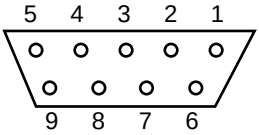
Pin 517 Ground, Earth

Pin 3 Data out

Pin 2 Busy/Data in

Pin 1,4,6,8 NO connection

Pin 9 +5V (0.5A max)



Serial Data Connector View
Looking at Socket

The set-up data for computer/printer is as follows:

Baud rate 9600 for computer I/0,1200 for printer output.

Start bits 1

Stop bits 2

Data bits 8

No parity

For a bar code reader the data set-up is as follows:

Baud rate 9600

Stop bits 2

Data bits 8

Intercharacter delay 20mS

HP BAR CODE READER SET- UP

At the prompt 'PRESS # FOR NEW TEST' plug the barcode reader into the serial port on the KEYPAD. Press the 'W' key on the keyboard.
The instrument will now automatically send the required codes for bar code reader set-up and the bar code reader will now be configured.
Test the barcode reader on a suitable barcode for verification.

MAINTENANCE

The PAT2000i is a rugged quality instrument, however care should be taken, failure to do so will reduce the instruments life and hinder its reliability.

- Always check all test leads for signs of damage prior to use.
- Keep the instrument clean and dry.
- Avoid testing in conditions of high electrostatic or electromagnetic fields.
- Check memory for corruption prior to each period of operation. If in doubt clear memory.
- No attempt should be made to gain access to the instrument while under test conditions.
- Maintenance should only be performed by an authorised recognised member of personnel.

The PAT2000i contains no user replaceable parts.

NOTE: Warranty excludes the internal rechargeable battery.

Should the PAT2000i require service, repair or calibration return the equipment to a recognised dealer or to

Seaward Electronic Limited
Bracken Hill,
South West Industrial Estate,
Peterlee,
County Durham,
SR8 2JJ,
England.

The product should be returned post paid where, upon receipt, the owner will be advised of any costs prior to work commencing.

SPECIFICATION

Safety Earth Test.

Measuring Range:	10m Ohms - 20.0 Ohms,1 milli-ohm resolution
Accuracy:	+10% +2 digits on 1Ohm range
Test Voltage:	6Vrms nominal open circuit
Output Current:	6.0,12.0 and 25A nominal into short circuit
Pass Range:	0.1, and 0.5 Ohms in manual and automatic modes

Earth Screen Test.

Measuring Range:	10m Ohms - 20.0 Ohms, 1 milli-ohm resolution
Accuracy:	+10% +2 digits on 1 ohm range
Test Voltage:	100mV rms nominal open circuit
Output Current:	100mA nominal into short circuit
Pass Range:	0.1, and 0.5 Ohms in manual and automatic modes

Insulation Test.

Measuring Range:	0.1 - 300 Mohms
Accuracy:	+8% +2 digits 0.1-50 Mohm
Test Voltage:	500Vdc nominal
Pass Range:	0.5 Mohms Class l,1.0 Mohms Class ll.

Flash Test.

Measuring Range:	0.3 - 6mA
Accuracy:	+8% +60uA
Test Voltage:	1.5KVrms for Class I operation 3.0KVrms for Class ll operation
Pass Range:	3, 5mA selectable

Load Test.

Test Voltage:	230V for 13A style plugs
Test Current:	230mA at 230V short circuit

Operations Test

Measuring Range:	0 - 3.3kVA
Accuracy:	+5% +130VA
Pass Range:	500W, 1 kW, 2kW, and 3.3kW (this is predetermined by the power handling capabilities of the instrument).

Leakage Test.

Measuring Range:	0.5 - 9.9mA
Accuracy:	+ 10% +60uA
Test Voltage:	Mains supply
Pass Range:	3.50mA Class I 0.75mA Class ll On auto and manual

IEC Lead Test.

Polarity Check
L-L 0.5A, 6V
N-N 0.5A, 6V

Pass Range:	Pass or Fail

GENERAL

Dimensions:	410mm x 370mm x 160mm
Weight:	10kg
Physical Environment:	Operating Temperature Range 0°C to 40°C Relative Humidity max 80% up to 31°C Decreasing to 50% at 40°C For indoor use only Altitude < 2000 M
Electrical Environment:	Installation Category ll Pollution Degree 2
Construction Category:	IEC1010

Appendix A

PROTECTIVE EARTH THRESHOLDS

	STANDARD	RESISTANCE THRESHOLD
BS3456 BS EN 60335	Household electrical Appliances BS 3456 Clause 27.5	(0.1 +R)Ω
BS4533	Luminaries Clause 7.2.3	0.5Ω (including cable)
BS 2769	Hand held motor operated tools Clause 25.4	(0.1+R)Ω
BS415	Mains operated electronic and related apparatus Clause 15.2	(0.5+R)Ω
BS EN 60950	Information technology equipment Clause 2.5.11	(0.1 +R)Ω

Note R is the resistance of the appliances flexible cable.

Appendix B:

INSULATION TEST THRESHOLDS

STANDARD		INSULATION THRESHOLD			
		Class I		Class II	
		As New	In Service	As New	In Service
BS3456 BS EN 60335	Household electrical appliances BS3456 Clause 16.3	2MΩ	0.5MΩ	7MΩ	1MΩ
BS4533	Luminaries Clause 10	2MΩ	0.5MΩ	4MΩ	1MΩ
BS2769	Hand held motor operated tools Clause 15	2MΩ	0.5MΩ	7MΩ	1MΩ
BS415	Mains operated electronic and related apparatus	2MΩ	0.5MΩ	4MΩ	1MΩ
BS EN 60950	Information technology equipment	2MΩ	0.5MΩ	2MΩ	1MΩ

Appendix C:

EARTH LEAKAGE LIMITS

	STANDARD	Class I		Class II
		Hand held / portable	Stationary	
BS3456	Household Electrical Appliances Clause 16.2	0.75 mA	0 75mA or 0.75mA / KVA(1)	0.25mA(2)
BS4533	Luminaries Clause 10.3	1.0 mA	N/A	0.5mA
BS2769	Hand held motor operated tools Clause 12	0.75 mA	N/A	0.25mA
EN60950	Information technology equipment Clause 5.2	0 75 mA	3.5 mA[3]	0.25mA

NOTES:

[1] For heating elements 0.75mA or 0.75mA / KVA with a maximum of 5mA.

[2] If protected against moisture; ordinary appliance 5.0mA, others 3.5mA.

[3] Stationary equipment connected by a BS EN60309-2 connector may have a maximum leakage current of 5% of input current per phase.

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