

Megger®



OTS80PB and OTS60PB OTS100AF, OTS80AF and OTS60AF

Oil test set

User Guide

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Declaration of Conformity

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The full text of Megger Instruments EU declarations of conformity are available at the following internet address:

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Contents

1. Safety Warnings	6
2. Symbols used on this instrument	7
3. General description	8
4. Features and benefits	10
5. Applications	11
6. Instrument controls and indicators	12
6.1. Keypad and internal printer panel.....	12
6.2. Rear panel.....	13
7. Preparations for use	14
7.1. Getting started	14
7.2. Supply voltage.....	14
7.3. Assembly	14
7.4. Test vessel preparation.....	15
7.5. Calibration	19
7.6. Stirrer options.....	19
7.7. Ordering Information	19
8. Operating instructions	20
8.1. Top level tabs.....	20
8.2. Navigation and character entry.....	21
8.3. Pinyin entry:.....	22
8.4. Setting favourite test standards.....	26
8.5. Performing a breakdown or withstand test.....	26
8.6. Test in progress.....	26
8.7. Test results	27
9. Manage test standards	28
9.1. Custom tests.....	28
9.2. Withstand tests.....	28
9.3. Editing test parameters	28
9.4. Basic memory functions	30
9.5. Transfer results to USB flash drive.....	30
9.6. Print quality and changing paper	31
9.7. Vessel and electrodes	31
9.8. VCM100D/VCM80D.....	31
9.9. Test vessel motorised stirrer.....	31
10. Preventive maintenance	32
10.1. General.....	32
10.2. Cleaning	32
10.3. Care for OTS electrodes	32

10.4.	New electrodes	32
10.5.	Electrode storage	32
10.6.	Cleaning oxidised/dirty electrodes	32
11.	Technical specifications	33
11.1.	VCM100D/VCM80D voltage check meters technical specification	34
11.2.	Storage and transportation	34
12.	PowerDB software	35
13.	Accessories and Equipment	36
13.1.	Factory fitted accessories	36
13.2.	Optional Accessories	37
14.	Repair and warranty	39
14.1.	Instrument repair and spare parts.....	39
14.2.	Approved repair companies	39
14.3.	Returning a test set for repair	39
15.	End of life disposal	40
15.1.	WEEE	40
15.2.	Batteries	40
15.3.	OTS60PB/ OTS80PB	40
15.4.	Declarations of conformity	40

Safety Warnings













1. Safety Warnings

Warning: the OTS must be used by only suitably trained and competent persons. If these instruments are not used in the manner specified protection may be impaired

Safety warnings and precautions must be read and understood before the OTS is used. They must be observed during use.

- The OTS must be used only in the way intended and for the stated purposes described by Megger.
- The OTS must not be used if any part of it is damaged.
- The OTS must be properly earthed. A supplementary earth terminal is provided.
- Position the OTS so that power can be easily removed.
- The OTS must not be used in wet locations or with rain falling on the instrument.
- The OTS must be used only for testing electrical grades of insulating liquids. No other objects or substances should be placed in the test chamber.
- The OTS must be used only with one of Megger's precision test vessels or VCM100D/VCM80D correctly fitted on the support horns in the test chamber.
- Replacement fuses must be of the correct type and rating.
- Calibration or repair must be carried out only by a Megger qualified repair facility.
- The test chamber must be kept clean and free from lint or other fibres.
- The OTS80PB/OTS60PB weighs between 16.8 kg and 20.8 kg.
The OTS100AF/OTS80AF/OTS60AF weighs 30 kg.
Care should be taken when lifting the instrument.
- It is prohibited to insert foreign objects into any gap on the instrument before or during a test.
- Unit must be used in a well ventilated location. Small quantities of ozone may be created after prolonged testing.

2. Symbols used on this instrument

Icon	Description
	HIGH VOLTAGE: risk of electrical shock.
	Caution: Refer to User Guide.
	Equipment complies with current EU directives.
	Equipment complies with current UKCA legislation.
	N13117 Equipment complies with current 'C tick' requirements.
	Do not dispose of to landfill, sewage systems or by fire.
	DOUBLE INSULATED. This equipment has double or reinforced insulation throughout.
	DC voltage.
	AC voltage.
	Earth terminal.
	Fuse.
	USB terminal.

General description

3. General description

Megger's Oil Test Sets are liquid dielectric breakdown and withstand testers.

The OTS80PB, OTS60PB models are portable instruments, designed for use in the field, whereas the OTS100AF, OTS80AF and OTS60AF are designed for laboratory use.

They are fully automatic, powered by battery (model dependent) or mains and facilitate accurate breakdown voltage tests and withstand voltage tests on mineral, ester and silicon insulating oils. The precision test vessel sets the accuracy standard for the liquid insulation test industry. For ease of use the instrument comes pre-programmed with a 'library' of international breakdown and withstand test standards and the ability to create custom tests.

The instrument is housed in a metal case with moulded end caps that accommodate convenient carry handles.

The test chamber is designed with an easy-clean surface and provides a drain for spilt oil through an internal pipe routed to the rear of the instrument. A beaker or similar can be used for spillage collection. The test area is covered by a plastic lid with an electrically protective inner conductive layer which, with the metal case, provides a safe equipotential enclosure for high voltage testing.

The lid allows in plenty of ambient light and users are able to view the test and witness stirring and the breakdown. The chamber lid is dual redundant safety protected with micro-switches to prevent accidental electrification.

The advanced test vessel design yields highly accurate and repeatable results. Two stirring options are available; an internal magnetic bean stirrer which is dropped into the oil and lid mounted impeller that conforms to the oil test standards. Stirring during breakdown and withstand testing is employed to produce an homogeneous distribution of contaminants within the oil and to free any carbon generated between electrodes during testing.

Electrode gap is set by precision adjustment wheels that lock in position ensuring that the electrodes do not move during a busy day in the field. It is, however, advisable to check the electrode condition and gap daily because it is a critical parameter in breakdown voltage testing. Flat anodised Aluminium gap setting gauges are supplied in popular sizes to facilitate electrode gap setting. Electrodes are detachable and are available in shapes that meet all international standards, i.e. disk, spherical and mushroom (VDE) electrodes.

A selection of international breakdown and withstand tests are chosen from a library of standard sequences and started from the user friendly menu on the LCD display. The top level test screen displays all pertinent test information to ensure the correct electrodes are used with the specified electrode gap setting.

Results are viewed on screen and printed on the internal printer following a test result. In the event of a breakdown not occurring before reaching the maximum voltage, the instrument will return maximum voltage. This is a safety measure to ensure the instrument is not driven over its designed maximum voltage.

Safety features incorporated in the design include dual safety micro-switches and zero volt touch bar, the screened chamber lid and convenient power supply On/Off switch. Pressing any button during a test will immediately remove the high voltage and terminate the test. It is important to earth this instrument using the ground connection at the rear of the instrument to ensure safe operation.



OTS PB models

The OTS60PB (60 kV) and OTS80PB (80 kV) oil test sets are small and the lightest on the market with weight ranging from 16.8 kg to 20.8 kg depending on model. There is an optional carry bag and transport case. The carry bag has pouches for electrode accessory pack, leads, quick user guide, paper roll etc. These units are available mains powered and NiMH battery operated for additional flexibility in portable applications.

Customers should be mindful of the need to maintain battery capacity. The NiMH battery should be operated from battery without line power periodically to ensure maximum battery life.

OTS AF models

The OTS60AF (60 kV), OTS80AF (80 kV) and OTS100AF (100 kV) models have much a larger test chamber for even easier access and cleaning, particularly useful in a lab environment. They are fitted with a 12 key alpha-numeric keypad to facilitate entry of test ID, file names, notes etc. Alpha characters are entered by repetitive pressing on a key, the same way as text is entered in modern cellular telephones. The AF models also have the ability to use a USB barcode reader to scan oil sample barcode labels, ideal for better integration with a LIM system.

Features and benefits

4. Features and benefits

- Fully automatic breakdown and withstand tester with test voltages up to 100 kV / 80 kV / 60 kV depending on model
- Advanced 400 ml oil vessel with accurate electrode gap setting and adjustment locking mechanism
- Flat electrode gap gauges that will not damage electrodes
- Easy clean test chamber with oil drain
- Magnetic bead stirrer or lid mounted impeller
- Rapid response to trip (<10 μ s)
- Automatic oil temperature measurement
- Intuitive user interface with backlit QVGA colour display (visible outdoors)
- Simple transfer of test results via USB flash drive
- USB barcode reader scans oil sample barcode labels (AF models only)
- Optional VCM100D/VCM80D voltage check units measure voltage directly
- Optional carry case with shoulder strap (PB models only)
- Optional transport case (PB models only)

5. Applications

The oil test set is used for determining the dielectric strength of high voltage insulating liquids, such as the insulating oils used in transformers, switchgear and other electrical apparatus. The dielectric breakdown and withstand voltage is a measure of the insulating ability of a liquid to withstand electrical stress. Contaminants such as cellulosic fibres, conducting particles, dirt, and water reduce breakdown and withstand voltage of an insulating liquid. A low result indicates the presence of one or more of these contaminants.

The test set is fully automatic. The operator has simply to prepare the test vessel, load it with sample oil, place it in the test chamber, select the appropriate specification for the tests and then start the test sequence. The test set automatically carries out the sequence of tests as defined by the pre-selected national specifications. Oil testing specifications, for which the sets are pre-programmed, are as follows:

- ASTM D 1816-12
- ASTM D 1816-12E (Ester oil)
- ASTM D 877A-19
- ASTM D 877B-19
- AS1767.2.1
- BS EN 60156-96
- BS 5730a AD 30 kV
- BS 5730a AD 40 kV
- BS 5730a BCEF 22 kV
- BS 5730a BCEF 30 kV
- BS 148 / EN 60156
- CEI EN 60156-95
- Custom 5, 6 and 10
- GB/T 507-2002
- GOST 6581-75
- IEC 60156-95
- IEC 60156-2018
- IEC 60156-2018V
(High viscosity oils)
- IEC 60156-2018 Annex A
- IEC 60156-2018 Annex A (V)
(High viscosity oils)
- IRAM 2341
- IS 6792-2017
- IS 6792-2-2017
- JIS C 2101-99 (M) (Mineral)
- JIS C 2101-99 (S) (Silicone)
- NF EN 60156
- PA SEV EN60156
- SABS EN60156
- UNE EN 60156
- VDE0370 part 5
- Withstand A
- Withstand B

A critical factor with respect to field testing of oil is its temperature, because samples from a transformer taken shortly after switch off can be many degrees hotter than equivalent room temperature laboratory tests performed at 20 °C to 23 °C.

Note: Certain standards require field tests to be performed between 20 °C and 30 °C.

Instrument controls and indicators

6. Instrument controls and indicators

6.1. Keypad and internal printer panel

The control panel, illustrated below, is located to the front right side of the instrument and contains a QVGA colour screen (1), navigation keypad with 'OK' button and a 'TEST' button. The operation is user friendly and driven from six top level windows. A start-up LED is used during instrument initialisation. The lower, vertical section of the front panel houses an ON/OFF power switch and a USB Type A interface socket

OTS PB models item description

Item	Description
1	3.5 inch, backlight, bright colour QVGA display
2	On/Off LED
3	External power LED / icon
4	TEST' button with associated red warning LED
5	USB socket
6	Navigation keypad with 'OK' select button
7	ON/OFF

OTS AF models item description

Item	Description
1	3.5 inch, backlight, bright colour QVGA display
2	On/Off LED
3	External power LED / icon
4	TEST' button with associated red warning LED
5	12 key alphanumeric keypad
6	Navigation keypad with 'OK' select button

The instrument printer panel, houses the internal printer. The printer is a dot matrix impact printer with 57.5 mm wide paper roll. Paper results printed on this printer will not blacken in high temperatures. The panel has two locking studs and a control print advance button.



6.2. Rear panel

The rear panel illustrated below accommodates all connections to the instrument with the exception of a front facing USB interface.

OTS PB model item description



Item	Description
1	Ground connection with cable lug
2	IEC line power socket
3	Fuses
4	USB Type A socket
5	USB Type B socket

OTS AF model Item description



Item	Description
1	Ground connection with cable lug
2	IEC line power socket
3	Fuses
4	USB Type A socket
5	USB Type B socket

It is mandatory for safe operation that an earth ground cable is attached to this instrument before performing tests. The ground connection is identified as item 1 in the illustration. Attention must be paid to product warnings and markings.

Line power is applied via an IEC socket (2) and is fused (3). Two USB interface connectors, one type A (4) and one type B (5), offer USB host and device interfaces. A second USB type A (host) interface is located on the front of the instrument for user convenience. The USB type A interface (4) is used for a flash/hard disk drive.

Preparations for use

7. Preparations for use

7.1. Getting started

It is important to read the user guide thoroughly before operating the Oil Test Sets for the first time.

The safety warnings are particularly important.

7.2. Supply voltage

Before connecting line power to the instrument, the ground connector should be connected to a suitable earth point. Both the AF and PB models are designed to operate on 50/60 Hz AC line power in the range 90 to 265 V AC.

For PB models, a 12 V DC power circuit for battery charging is fitted. The battery can be charged from mains power.

7.3. Assembly

- Unpack instrument and contents of the packing box.
- Ensure that the instrument is placed on a solid surface or table with sufficient working space.
- Connect ground to a suitable earth connector.
- Fit selected electrodes to the threaded shafts in the test vessel taking care not to scratch electrode surfaces. Electrodes should be hand tightened onto the shafts to prevent any movement during use.
- Adjustment of the electrode gap should be done with the feeler gauges provided, adjustment wheels locked and the gap rechecked.
- Fit test vessel into instrument chamber.
- If batteries are fitted, before switching on the instrument for the first time, connect power and leave for a period of at least four hours. This will ensure a full charge of the battery. (PB models only)
- Read the section in this document entitled, "Instrument Operation" before powering up the Oil Test Sets for the first time.
- Connect line power.
- Turn on the instrument.
- Follow the instrument setup procedure detailed below.

7.4. Test vessel preparation

When unexpected results are experienced in testing the dielectric breakdown of oil samples the cause can often be traced to insufficient attention to one or more of the following key elements of vessel preparation:

1. Storing and subsequent cleaning
2. Setting the electrode Gap
3. Ensuring thorough rinsing of the test vessel and then **immediately** filling the vessel with the oil sample to be tested.
4. Exclusion of all air from contact with the oil sample and prevention of air/ moisture contamination; (particularly relevant when using an impeller to stir the insulating oil sample).
5. Selecting the optimum stirring option for the insulating oil sample and test standard required.

Any of these elements have the potential to cause an un-expected drop in breakdown voltage level. Therefore it should be verified that each aspect has been properly considered and implemented.

Taking each of these elements in turn:-

Storing and subsequent cleaning



Fig 1: IEC Storing oil samples

IEC 60156 recommends that a separate test vessel assembly is used for each type of insulating fluid that is to be tested. The standard requires that the test vessels are filled with dry insulating fluid of the appropriate type, then covered and stored in a dry place.

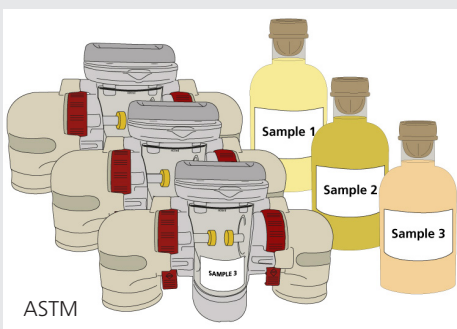


Fig 2: ASTM Storing oil samples

ASTM offers an alternative option of storing the vessels empty in dustfree cabinet.

Preparations for use

Immediately prior to testing, vessels stored full of oil must be drained and all internal surfaces, including the electrodes, rinsed with fluid taken from the sample to be tested.

The vessel should then be drained again. Swiftly and carefully fill with the test sample, taking particular care to avoid the formation of bubbles. If the vessel was stored empty, or if it is to be used for a different type of fluid from that with which it was filled during storage, it should be cleaned with an appropriate solvent before rinsing and filling.

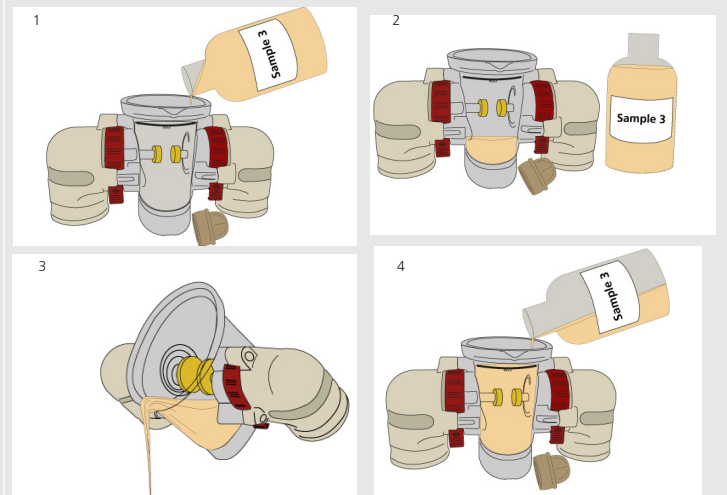


Fig 3: Preparing the vessel

ASTM D1816 specifies the use of a dry hydrocarbon solvent such as kerosene, which meets the requirements of D235. Solvents commonly used include acetone and, in the USA, toluene. Toluene is banned in Europe.

Solvents with a low boiling point should not be used as these evaporate rapidly, cooling the vessel and giving rise to the risk of condensation.

Use lint-free clean-room wipes to clean the vessel. Do not use paper towels as they may introduce particles that hold moisture, causing breakdown values to be dramatically reduced.

Touching the electrodes or the inside of the vessel should be avoided and during cleaning, the electrodes should be checked for pitting or scratches that may cause breakdown voltage values to be decreased. Remember that the rules of cleaning apply to all parts that will come in contact with the oil sample during testing.

Setting the electrode gap

Setting the electrode gap accurately is very important; the results obtained are only valid if the gap is correct. A big problem is movement of the electrodes after the gap has been set and for this reason, many users of oil test sets check the electrode gap frequently – sometimes before every test. A better solution is to use test sets where the electrodes can be locked in position, such as the instruments in Megger's latest OTS range.

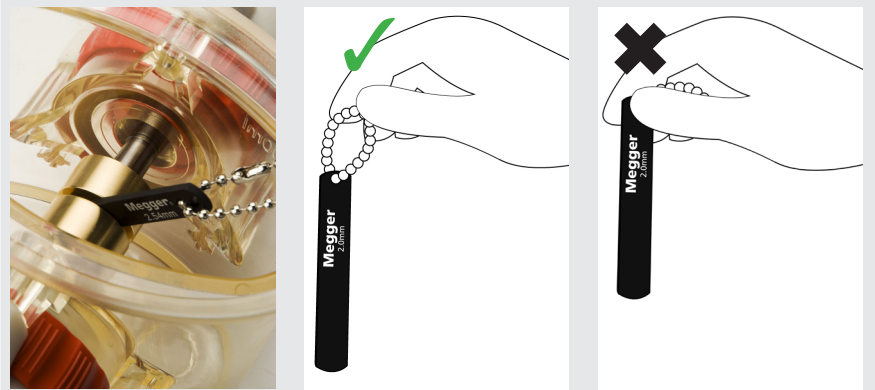


Fig 4: Megger electrode gap gauge

Megger recommends the use of flat, smooth gap gauges. The latest Megger gauges have a black anodized coating, which not only provides a smooth surface but also shows when the gauge is worn, as the shiny aluminium starts to show through the coating.

When setting the electrode gap using the Megger gauge - See Figure 4

- Ensure the gap is set in an empty vessel and before pouring in the sample to be tested to avoid contaminating the sample with the gap setting process.
- Hold the gap gauge with the key chain and place between the electrodes. This enables better view of the gap gauge and prevents the gauge being forced into the existing electrode gap.
- Carefully adjust the electrode gap without over tightening. The gap gauge should just be able to slide between the electrodes with little force required to move it, while it is held from the chain. If force is required over tightening has resulted and the electrodes must be adjusted to release this and rechecked ensuring that only a light force is needed to move the gauge.

- Finally remove the gap gauge. This should continue to move with barely a detectable drag between the electrodes.

When setting the electrode gap, it is very important that the gap gauge barely touches the electrodes, with only the slightest drag as it passes between them when held vertically in such a way as to minimise friction. Any significant pressure could result in the electrodes springing towards each other after the gauge has been removed. Do not breathe on the vessel when doing this to avoid moisture contamination, or lean on its rim or other parts to avoid mechanical distortion.

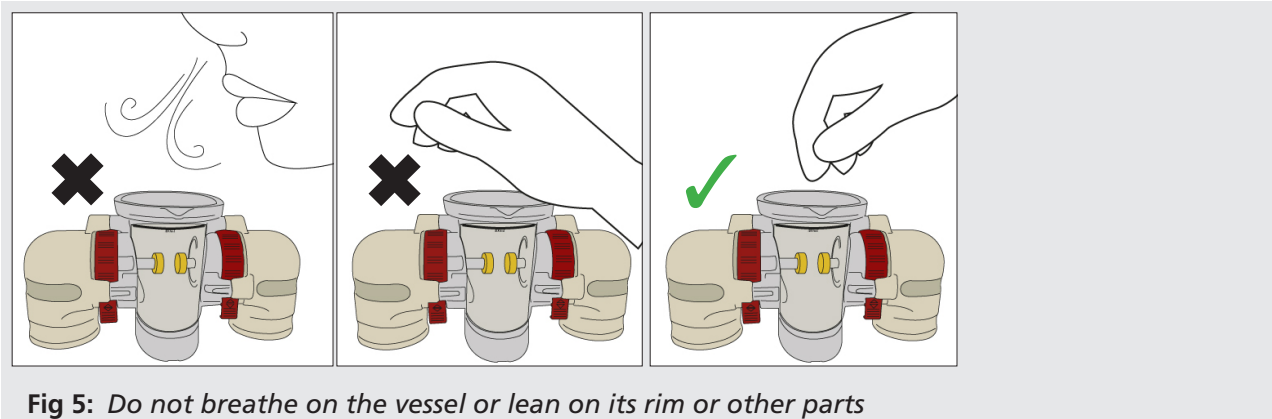


Fig 5: Do not breathe on the vessel or lean on its rim or other parts

Note: If the OTS is moved for one location to another please ensure the electrode gap is re-checked as described above as a precaution.

Rinsing and then immediately filling the test vessel with the insulating fluid sample

Prior to filling the test vessel it is important to rinse the vessel with clean dry oil or with some of the sample oil about to be tested. Rinsing should always be performed before each test, even if performing repetitive testing in an oil test laboratory.

Remember that when rinsing the vessel, equal attention should be given to any magnetic bead, impeller, baffle plate, lid and to the electrodes, not just the vessel walls. Rinsing should be applied to any surfaces that will come in contact with the oil sample during testing.

After rinsing the test vessel with the sample oil it is most important to ensure it is immediately filled with the oil sample to be tested. Any significant delay, (even a few minutes), may result in the oil film on the vessel's walls absorbing water from the air; since the walls have a large surface area, this is likely to contaminate the oil sample and reduce the breakdown voltage once it has been mixed with the sample. Just 30 parts per million, (ppm), of water is sufficient to halve the breakdown values.

In fact, ASTM D1816 specifies that the test vessel must be filled with the oil sample within just 30 seconds of the rinsing taking place.

When filling, pour the oil sample into the vessel swiftly but with minimum turbulence so as not to entrap air.

Place the lid on the oil vessel, this will prevent contamination, then allow the sample to stand for a few minutes before testing. Leaving the oil to stand will allow any air bubbles to clear from the oil.

However it is important not to leave the sample to stand for longer than absolutely necessary as it may absorb water from the air in the headspace above it, again reducing the breakdown voltage. The baffle/lid must be fitted to prevent air contact whilst the oil is left to stand to allow any bubbles to clear.

Preparations for use

Excluding air from circulating oil when using an impeller to stir the insulating fluid sample.



Fig 6: Baffle plate must come in contact with the oil

If you are using an impeller stirrer that utilises a baffle plate to exclude air from the oil sample, ensure that oil does not pass over the upper surface of the baffle plate.

It is also important that the oil sample is in full contact with the underside of the baffle plate.

This will prevent moisture being absorbed from the contact of circulating oil with air as intended by the test standard.

- Fill the test vessel running the oil down the side wall so as not to cause splashing that will introduce unwanted air bubbles into the test sample
- Fill the test vessel to the 400 ml fill line, DO NOT OVERFILL (see figure 7)
- Gently place the stirrer lid onto the test vessel so that the baffle plate contacts the oil slowly, again so as not to cause splashing that will introduce unwanted air bubbles into the test sample
- Periodically remove baffle plate from the stirrer lid and clean thoroughly.

NOTE: If the oil is poured too fast, turbulence may generate bubbles which should be avoided.

NOTE: If the oil is poured too slowly the large surface area of the oil exposed to the air will absorb moisture. This should be avoided.

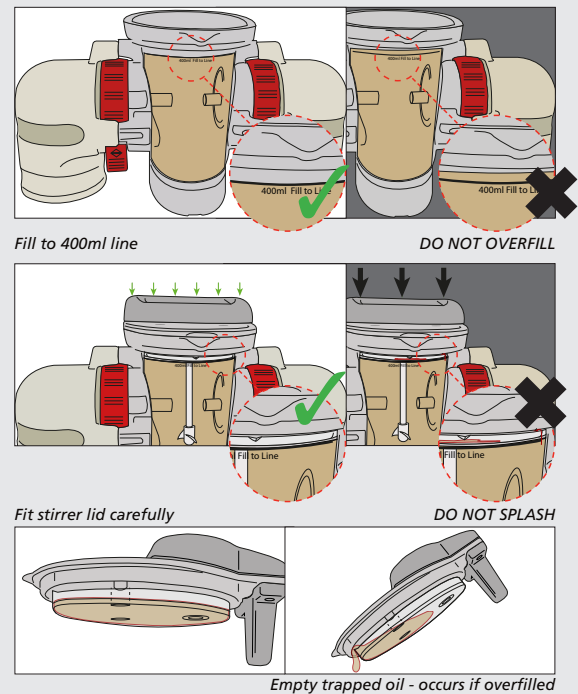


Fig 7: Filling the test vessel

Selecting the optimum stirring option for the insulating oil sample to minimise air/moisture contamination

When testing to IEC 60156:

IEC 60156 allows the optional use of a stirring impeller, the use of a magnetic bead stirrer or even no stirring at all. The standard states that differences between tests with or without stirring have not been found to be statistically significant. The use of a magnetic stirrer is only permitted when there is no risk of removing magnetic particles from the oil sample under test. When oil is used as a coolant as well as an insulator it may be useful to stir the sample during testing. For example oil from a transformer is normally circulated in use to help cool the transformer, but in doing so might also pick up contaminants and debris with it; so to achieve the most realistic breakdown results an oil sample taken from such a device would normally be stirred during test to ensure the best chance of detecting any detrimental effects of particle contamination. Oil from a circuit breaker is normally static in use, so particles would naturally fall to the bottom where they are unlikely to cause a problem. So in static use applications, an oil sample would not usually be stirred during testing.

The use of a magnetic bead for IEC60156 is recommended where possible as oil will circulate in the lower portion of the test vessel, whereas the impeller will circulate all of the oil in the test vessel. The magnetic bead therefore has the advantage that any moisture absorbed by oil in contact with air is not stirred into the sample, avoiding unwanted contamination. If the impeller is used it is vital that air is prevented from coming into contact with the surface of the oil by fitting the baffle plate and ensuring that the oil level is sufficient to make contact with the bottom surface of

the plate without flowing over its top surface.

When testing to ASTM D1816:

ASTM D1816 specifies that the oil is stirred throughout the test sequence, and a two bladed motor-driven impeller is specified. The standard prescribes the impeller dimensions and pitch as well as the operating speed, which must be between 200 rpm and 300 rpm. But remember, with this stirring requirement it is vital that air is prevented from coming into contact with the oil as described above.

When testing to ASTM D877:

ASTM D877 does not specify oil sample stirring

7.5. Calibration

The Oil Test Sets are calibrated in the factory prior to delivery so there is no need to calibrate on initial setup.

A calibration certificate is supplied.

7.6. Stirrer options

Megger supplies a range of impellers to optimise the stirring set-up.



Fig 8: Impeller and bead

Megger supplies as standard with the stirrer lid assembly two impellers.

The Impeller on the left is optimised for IEC 60156, whilst the one on the right is ideal for ASTM D1816.

Vigorous circulation can exacerbate the inclusion of any moisture captured on the surface film of oil left behind after rinsing at the vessel preparation stage, making the need for rapid filling even more critical, so as not to detrimentally affect breakdown results.

7.7. Ordering Information

For ordering information please refer to OTS60PB--OTS80PB--OTS60AF--OTS80AF--OTS100AF Datasheet.

Oil dielectric breakdown voltage testing can provide a quick, first line evaluation of the condition of insulating oils.

However, cleanliness, and good preparation is key to obtaining accurate and meaningful test results. Information on the Megger range of test instruments can be found on the Megger website www.megger.com. Further information can be found on the Megger booklet "The Megger guide to insulating oil dielectric breakdown testing", part number 2003-149.

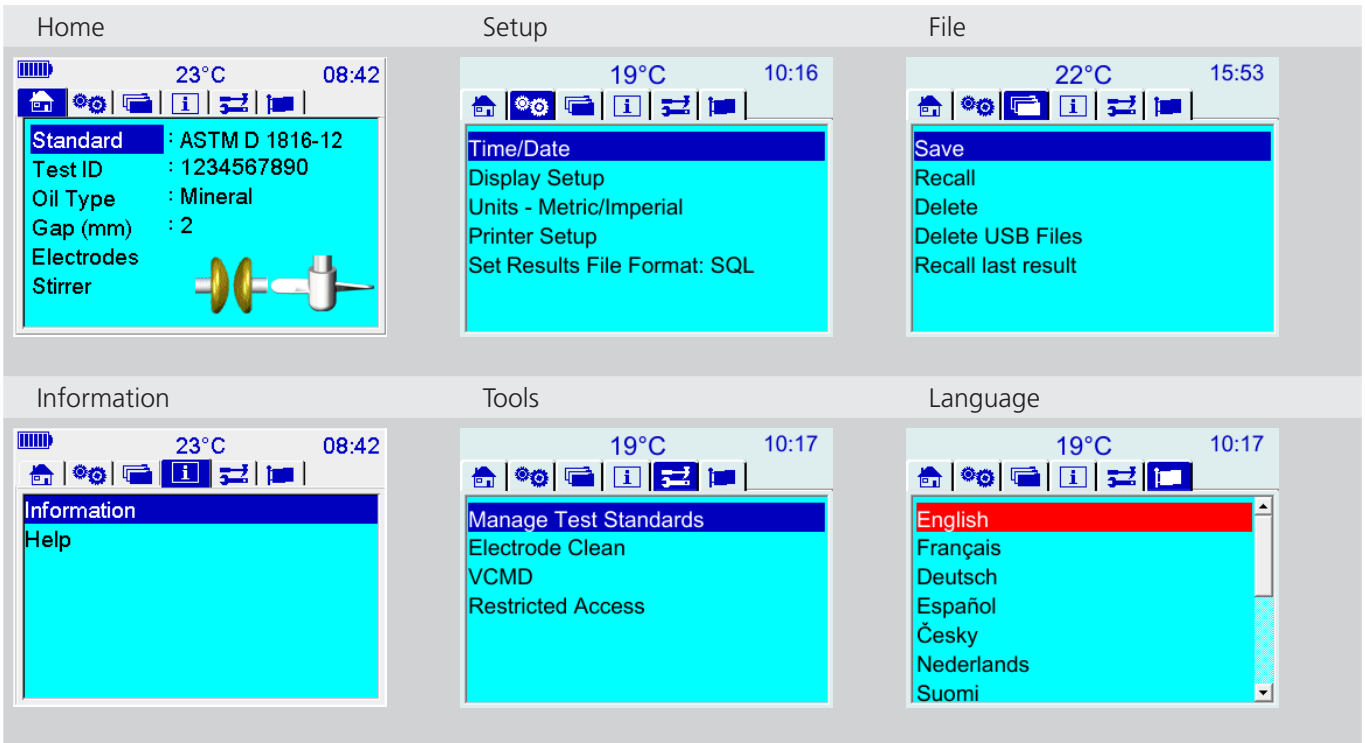
Operating instructions








8. Operating instructions

8.1. Top level tabs

The user is presented with a set of six tabbed, top level windows as depicted below which facilitate instrument control.

Left and right arrow keys navigate between tabs.



	The home tab contains summary information for each showing the selected automatic test standard, ID of the asset the insulating liquid comes from, the type of insulator, electrode gap and the stirrer if required. This is the main screen from which tests are run.
	Setup window offers instrument settings of time/date, display, units, printer and a setting for results file format.
	Users can print, save, recall, delete and download results to a USB drive from the file window.
	The Information window offers details about the instrument software configuration/version as well as a help function that serves as an indexed user guide.
	The tools window offers the ability to manage test standards including the ability to define custom tests, favourite tests and add and remove new standards and standard upgrades via USB disk. An automatic electrode clean function is included as a means of removing deposits from electrode surfaces. This window also runs a test using the VCM100D/VCM80D voltage testers to check output voltage at the electrode barrier.
	The flag symbol is used as an icon representing language option. Simply use the right arrow button to navigate to across the tabs to the language symbol. Then up/down arrow buttons to select the required language and press 'OK'.
	The battery symbol will be shown on PB models only.

8.2. Navigation and character entry

The keypad consists of arrow keys surrounding an 'OK' button used for navigating the screens and selecting functions and options. These six buttons fully control the instrument.

Within each user interface window the up and down arrow buttons are used to navigate up and down the functions listed on the left side of the screen.

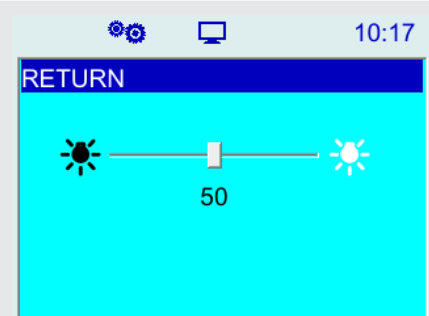
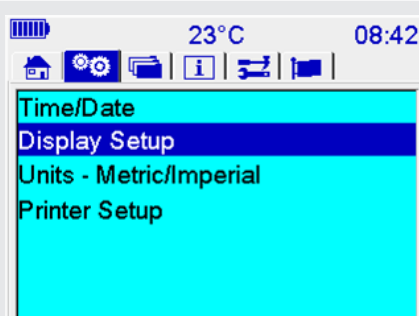


The 'OK' key either scrolls through options associated with each function or enters a lower level window to perform a function.

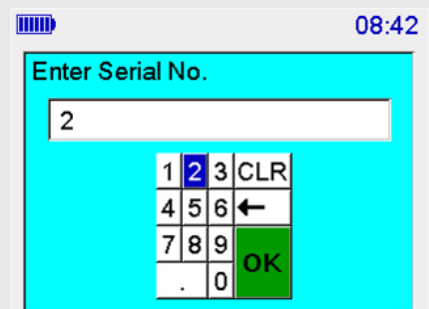
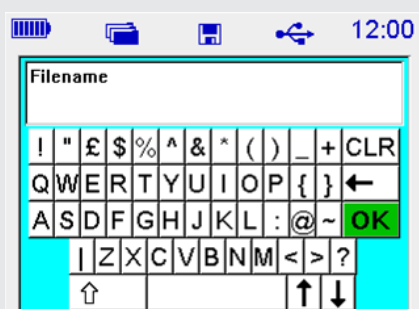
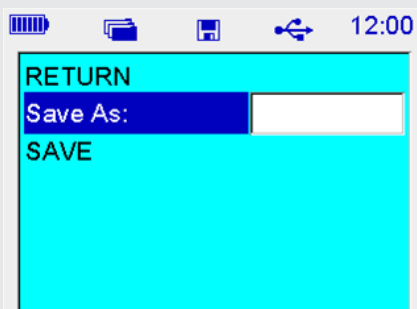
Left and right arrow buttons navigate between tabs on the top level window for optimum speed. Individual tab windows save the highlight function and return to the same position on each screen.

Users can navigate into lower level windows using the up/down arrow buttons and the 'OK' button to reach, for example, the 'Display Setup' function.

The user navigates to 'Display Setup' and presses 'OK' to get to the display setup window. The up/down or the left/right buttons adjust brightness with a bar indicator showing brightness percentage. The 'OK' button is used to set brightness after adjustment and subsequent return to the settings window.



The following images illustrate data entry for the PB models:



A virtual QUERTY keypad that facilitates alphanumeric entry to specify asset ID, filename and custom test name. A character is selected by navigating to it, current character shows with a blue background, and pressing the 'OK' button. After typing the required characters the virtual keyboard 'OK' is selected to return to previous window.

Numeric entry is via a virtual keypad as shown to the right. Digit entry is the same as the full virtual keypad with a keypad 'OK' activating a return to previous window.

AF models:

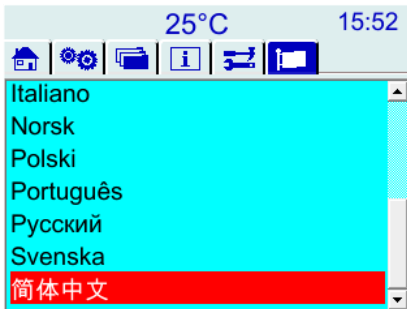


Keypad entry is via the 12 button keypad. If an alpha character is required the relevant key is pressed until the character appears in the screen entry field. Uppercase alpha characters are default and lower case mode is entered by pressing the shift (↑) key before entering the desired character. Pressing shift again will enter numeric digit entry mode, and a further press will enter Pinyin Text entry mode.

Operating instructions

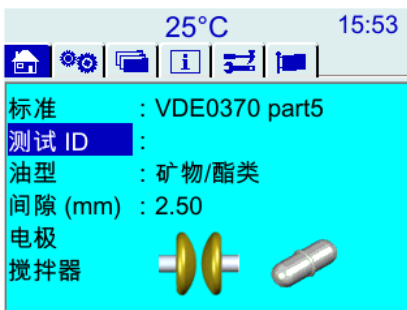
8.3. Pinyin entry:

Note: Pinyin is only available when Chinese Language is selected



Pinyin entry is available in the following edit fields - Test ID; Test Notes and USB filename.

Test ID entry example:

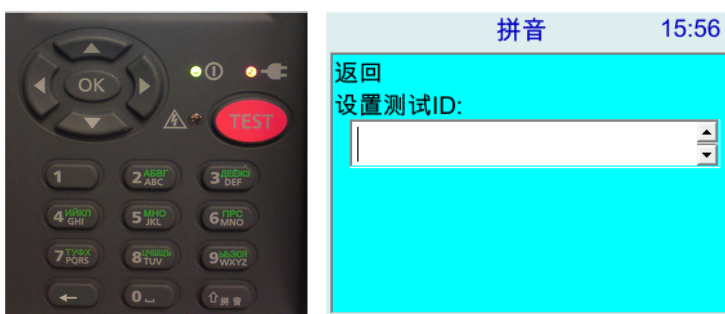


AF Models:

Although a user can select Chinese in OTS language setting, Chinese pinyin entry is not automatically applied to edit fields.

The bottom right “Shift 拼音 (⇧)” key toggles between

ABC; → abc; → 123; → 拼音; (for Pinyin entry)



In the edit field type in the syllable e.g. mei and Chinese characters will appear for selection. Moving DOWN from the edit box will select the left most Chinese character (most frequent used).

Note: '>' only appears (bottom right) when there are more characters than available boxes



Move UP; DOWN; LEFT; RIGHT to navigate and press OK to select the required character



Use the same process to enter more Chinese characters.
When entering/editing a syllable, it is not possible to move the cursor to Chinese characters already entered in the edit field. To edit the Chinese characters, user needs to ensure there is no syllable, and if there is, use the backspace button (bottom left button) to delete the syllable first.



The cursor can now move anywhere in the edit field.



Using "Shift 拼音" key, it is possible to switch between alphanumeric and pinyin modes anywhere in the edit field. Alphanumeric characters can be used as a prefix or suffix to the Chinese characters according to your requirement e.g.



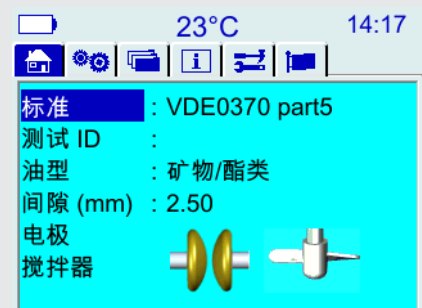
Press OK to complete editing or select RETURN to go back to the Home Screen. The Test ID entry will now be displayed in the Home screen



Operating instructions

PB Models:

This is home screen on a PB model. Move the highlight using navigation buttons to Test ID (测试 ID) and press OK.



Test ID field default keyboard



Navigate to shift key to toggle to pinyin keyboard. Empty top row indicates pinyin mode.



Type a syllable, eg. mei, a list of Chinese characters will fill the top row.

Note: The most frequently used character for the entered Pinyin Syllable is the automatically highlighted character located on the far left of the top row.

The ">" symbol indicates more characters are available. Use the navigation buttons to move UP; DOWN; LEFT; RIGHT and press physical OK button to select the character.

NOTE: Not the OK on the virtual keyboard below. The chosen Chinese character will be placed in the edit field. Repeat the same process for more characters.



A useful shortcut tip:

When entering the last letter of a syllable, DOUBLE press on the physical OK quickly (<0.5s) to select that letter and the highlight will jump to the left most Chinese character on the top row. This shortcut feature helps speed up Chinese character entry for users.

When entering/editing a syllable, it is not possible to move the cursor to Chinese characters already entered in the edit field. To edit the Chinese characters, a user needs to ensure there is no syllable, and if there is, use the virtual backspace button to delete the syllable first.



Operating instructions

Once deleted, it is possible to move the cursor back in between characters by using the left arrow highlighted as shown below.



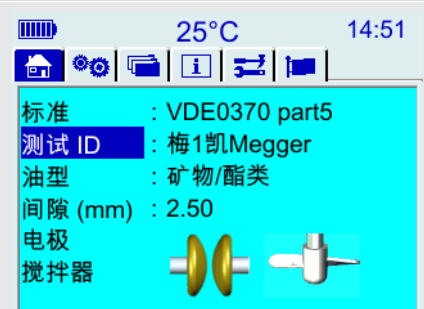
While editing it is possible to switch between keyboard modes, for example, combination of alphanumeric and Chinese characters.



To accept the entered test ID, navigate the highlight to the virtual keyboard "OK" and press the physical OK button.



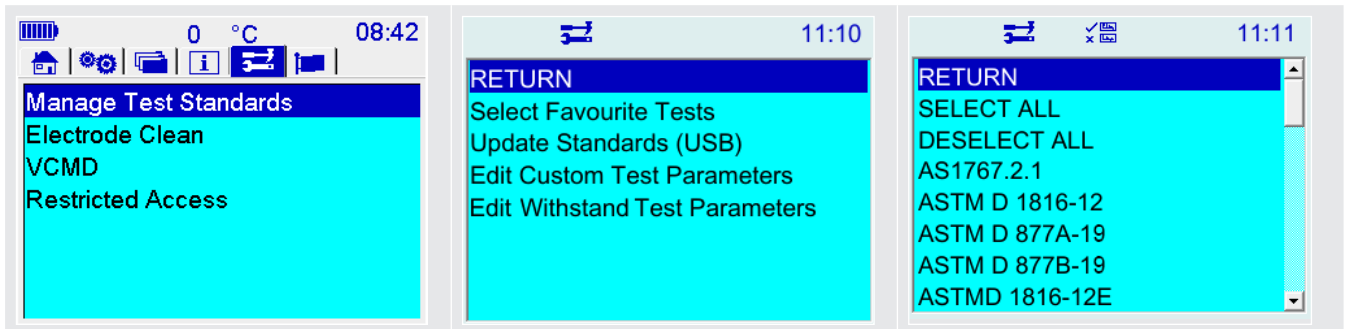
The instrument returns to home screen with the entered test ID.



Operating instructions

8.4. Setting favourite test standards

It is important to setup favourite test standards from the standards library to avoid navigating through the entire list each time you want to change to a different test. To do this navigate to the 'Tools' top level window and select 'Manage test standards'. Then move down to 'Select favourite tests' and choose only those tests which you require, making sure you have the most recent version of each test, unless you specifically want to use an old test standard. Tests are greyed out when selected. Simply return to the previous screens to save your selection. The screens below illustrate this process.

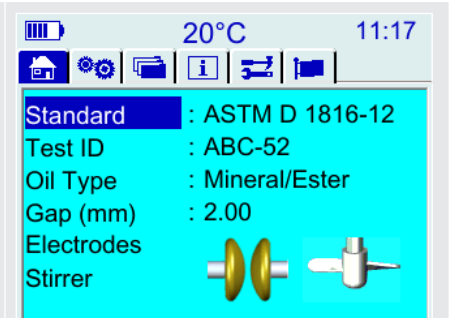


8.5. Performing a breakdown or withstand test

Select the 'Home' tab window using the arrow keys and 'OK' button. This window offers a summary of information required for a measurement. The following image shows a typical setup with the selected standard test, the test identification or asset ID comprised of an asset number and two digit serial number, the type of oil, required electrode gap, electrode shape and finally the stirrer.

When the user selects a particular standard only valid options are presented with respect to gap setting, electrodes and stirrer options.

Navigation is simple; up and down arrow buttons move up and down the left side of the window whilst options for each line can be scrolled through using the 'OK' key, or information entered in the case of Test ID.

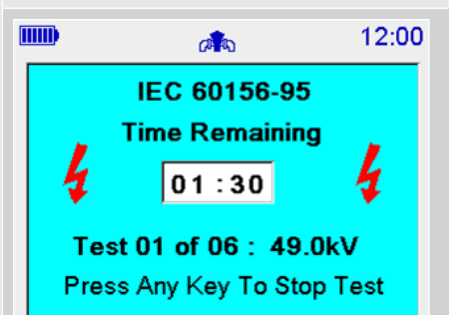
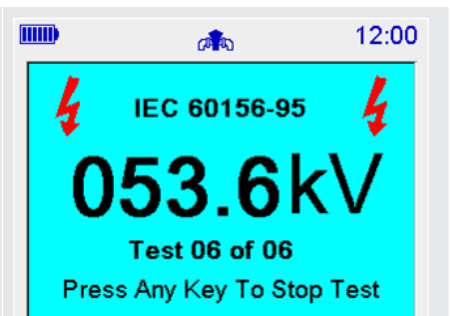


8.6. Test in progress

During a test the screen flashes red warning HV symbols to remind the user that a high voltage test is in progress. As a safety measure, any key press will immediately halt the test.

The electrode potential difference is displayed as it ramps up in over-sized digits to emphasise the presence of high voltage.

Between tests there is a dwell time and possibly a stirring action. A count down timer indicates period of dwell or stirring remaining.

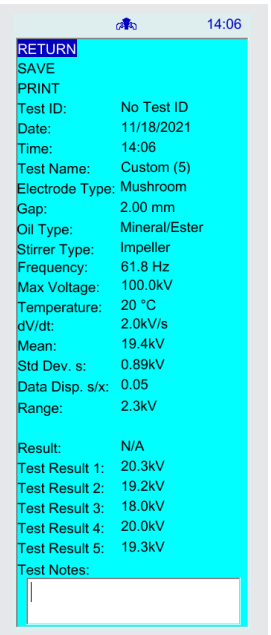


8.7. Test results

At the end of any test results are shown on the screen. A typical example shows the complete on-screen information presented to the user however the screen size is naturally smaller so a slider function enables the user to navigate through the result and print it if required.

All screen based test results use only the relevant data to produce statistics i.e. statistics of mean breakdown voltage, data dispersion, range and standard deviation.

Printing a result can be selected as default or from the PRINT function within the results window.



Manage test standards

9. Manage test standards

9.1. Custom tests

Custom tests are tests that can be defined by a user by giving the user control over the range of parameters set in a test. Three custom tests and 6 withstand tests have been pre-programmed for user definition;

- Custom (5) – this test contains 5 successive breakdown tests
- Custom (6) – this test contains 6 successive breakdown tests
- Custom (10) – this test contains 10 successive breakdown tests

9.2. Withstand tests

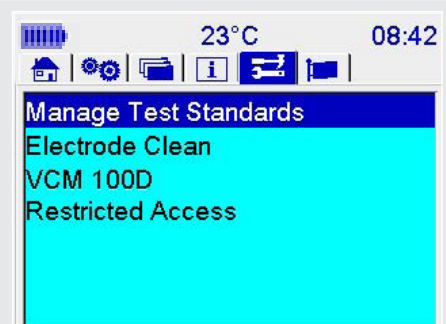
Withstand tests are defined tests that can be modified that meeting standards.

- Withstand A
- Withstand B
- BS 5730a AD 30 kV
- BS 5730a AD 40 kV
- BS 5730a BCEF 22 kV
- BS 5730a BCEF 30 kV

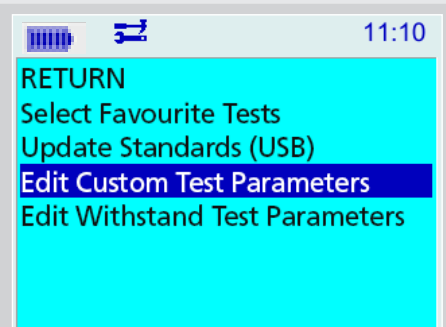
9.3. Editing test parameters

Navigate to the Tools top level screen as illustrated below.

Select, "Manage Test Standards" by pressing the OK button.



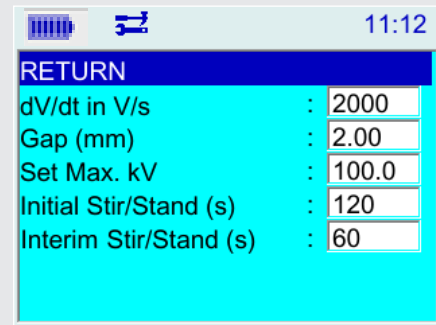
To edit custom tests select "Edit Custom Test Parameters" and press the OK button.



The custom parameters screen shows a set of variables that control a breakdown test. Each variable is user settable, simply navigate down to the required setting, press the OK button and proceed to change the value as required.

For numeric entry on the OTS AF models the decimal point can be entered by quickly pressing the digit '1' twice. So to enter 2.5 mm gap setting the user enters the following sequence:

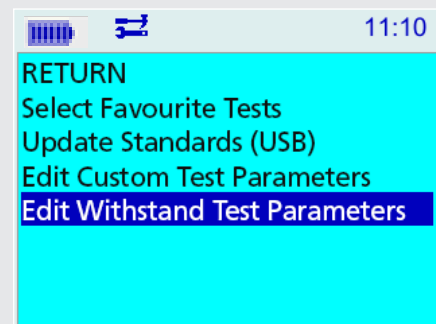
- 2
- 1, 1
- 5
- OK



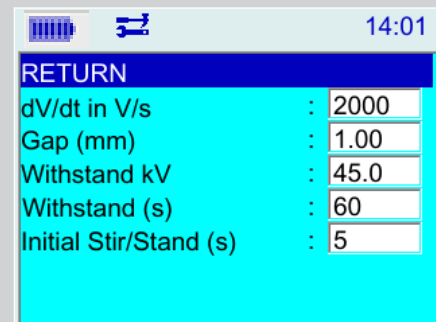
In the customs test parameters screen 'set max. kV' may appear as, 'set kV (max. xxx)' in certain versions of firmware.

All entry fields in the custom test parameters screen are range checked to ensure it is valid. When all values are set the user navigates back to the Tools screen via the RETURN function.

To edit withstand tests select "Edit Withstand Test Parameters" and press the OK button.



The withstand parameters screen shows a set of variables that control a withstand test. Each variable is user settable, simply navigate down to the required setting, press the OK button and proceed to change the value as required.



All entry fields in the withstand test parameters screen are range checked to ensure it is valid. When all values are set the user navigates back to the Tools screen via the RETURN function.

Note : The user should ensure that the relevant custom or withstand tests are selected as favourite tests before leaving the manage test standards screen.

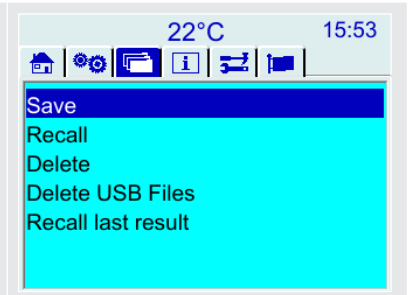
Manage test standards

9.4. Basic memory functions

The internal memory is limited to fifty test records where a record represents a full result of one of the programmed standard tests. Best practice is to backup internal results on a daily basis by saving onto a USB memory device. When saving to USB memory device, a filename in the format of a maximum eight characters is required and the filename entered must only contain characters A-Z, a-z and 0-9.

Memory functions are accessible from the files menu and include the following:

- Save
- Recall
- Delete
- Recall last result



The user can select between internal memory and a USB memory device for the save, recall and delete functions. After selection of a memory location the relevant files are displayed on screen. Navigation is via the arrow keys as follows:

Up and down arrow move up and down one item at a time. Left and right arrows implement a page up and page down function to assist navigation where large numbers of file are present.

In the delete function window the user can select all, deselect all or select one file at a time. Select a single file by navigating to the file (blue highlight) and pressing OK to select (red highlight changing to grey when navigating away from the selected file.)

The recall function operates on one file at a time.

9.5. Transfer results to USB flash drive

Users may want to copy results from internal memory to a USB memory device as either an end-of-day procedure or whenever the 50 result file limit is reached. The following procedure will backup files to a USB memory device:

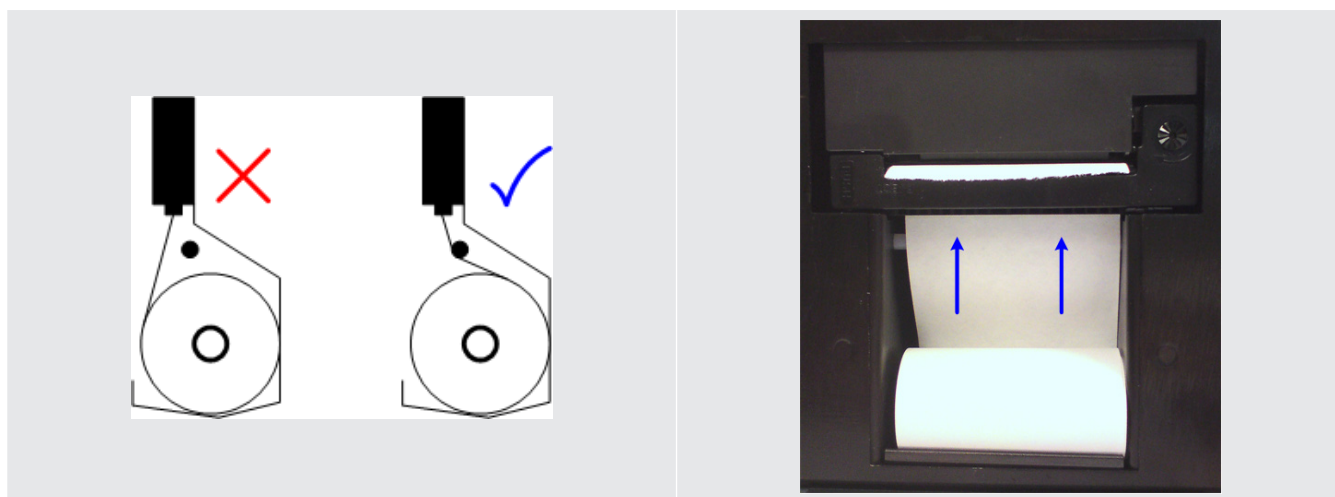
1. From the file menu, select 'Save'
2. Then 'Select USB'
3. Enter a filename using only characters A-Z, a-z, 0-9 and Pinyin entry via the virtual keypad on the PB models or the actual keypad on the AF models, and return to save function screen
4. Navigate down to 'Select Results' – a full list of internally saved results are presented by TestID.
5. Select required results and then 'SAVE' to transfer the results to filename (as entered) on the memory device.
6. Navigate back to top level functions and remove the memory device (if required)

9.6. Print quality and changing paper

The printer cover is removed by turning the two fasteners and pulling the panel off.

The printer ribbon may need to be moved on to improve print quality. To do this, remove the printer cover and turn the right hand rotary winder in direction indicated on the ribbon case. To change the printer ribbon, simply press the ribbon assembly where it says, "PUSH EJECT," to remove the old ribbon and replace with a new one. The part is an Epson ERC-09, Megger part number 25995-002.

Paper is fed into the housing with the loose paper facing the rear of the instrument. Ensure that the paper is neatly cut and not curled up at the end.



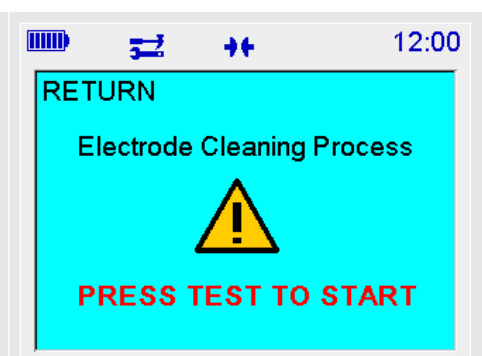
Holding the end of the paper roll, insert the paper under the cross bar and into the printer slot as shown (blue arrows) in the drawing opposite. Press the print feed key repeatedly until the paper is just visible feeding through the print mechanism.

Replace the printer front cover by first locating it at the base of the panel and secure it with the fasteners which are turned to secure the panel in place. Finally press the paper feed button to advance the paper through the front cover paper slot.

9.7. Vessel and electrodes

The oil test vessel and electrodes require no maintenance other than cleaning. Electrodes can be unscrewed and replaced with another shape electrode. Electrodes should be examined regularly to ensure no pitting has occurred and the electrodes renewed where pitting is evident.

The instrument includes a built in electrode cleaning function which can be activated from the tools menu. This function will perform 24 sequential breakdowns to remove deposits on electrode surfaces.



9.8. VCM100D/VCM80D

The VCM100D/VCM80D are not user serviceable items but may require periodic cleaning using a clean cloth dampened with Isopropyl Alcohol (IPA).

9.9. Test vessel motorised stirrer

Megger's motorised stirrer is integrated into a modified lid assembly and simply replaces the vessel lid. Power is connected via a flush mounted rear insert and is disconnected as the stirrer assembly is lifted. This unit is not user serviceable.

Preventive maintenance

10. Preventive maintenance

10.1. General

The OTS is a HV instrument generating up to 100 kV (model dependent) and is not user serviceable. The user should ensure that the lid is not cracked or distorted before use. The only internal part of the instrument that is accessible to the user is the printer paper housing allowing renewal of paper and ribbon when required. Opening the instrument is strictly forbidden and will constitute a breach of warranty. There is no need for any tools to be used with this instrument other than the supplied gauges and magnetic bean retriever. Printer cover locks can be turned using a screwdriver.

10.2. Cleaning

To clean the outer surfaces of the instrument, first disconnect from line power and then wipe the instrument using a clean cloth dampened with Isopropyl Alcohol (IPA).

The user must ensure that the test chamber is always kept clean, particularly prior to a test. Wipe away any spilt oil in the chamber or on the outside of the test vessel with a lint free cloth. When a lot of oil is spilt in the test chamber the unit is designed with a drain facility at the rear. Simply unclip the clear tube and drain oil into a beaker or other suitable container.

To clean the inside of the test vessel follow the instructions given in the relevant test specification or, in the case of no instructions, cleaned with a small volume of the next sample of oil to be measured.

10.3. Care for OTS electrodes

Brass electrodes supplied with the Megger oil test sets will show signs of deposits built up from insulating oil breakdown testing. If left they will oxidise and appear dull.

10.4. New electrodes

Megger electrodes are supplied in a kit with gap gauges and magnetic stirrer beans and retrieval stick. The electrodes have different shapes but are cared for in the same way. If new electrodes require cleaning, isopropyl alcohol (IPA) may be used to clean them off. It is advisable to immerse the electrodes in clean insulating oil for a couple of hours prior to use.

10.5. Electrode storage

Electrodes may be stored in a suitable container or immersed in clean mineral insulating oil. Electrodes in a test vessel left to stand overnight may be left with the last oil sample tested in the vessel.

10.6. Cleaning oxidised/dirty electrodes

Dirty electrodes may be cleaned with a clean, soft cloth and brass cleaner but care should be taken to use minimal pressure to avoid removal of excessive electrode material. After removing the dirt clean the electrodes with a clean cloth and IPA. It is advisable to immerse the electrodes in clean insulating oil for a couple of hours prior to use.

If electrodes are pitted or scratched they should be discarded and new electrodes fitted.

11. Technical specifications

Specification	Detail										
The following technical specifications apply to the OTS AF and PB models, unless otherwise stated:											
Test voltage:	<p>PB models: 0 to 60 kV rms maximum (30 kV – 0 – 30 kV) 0 to 80 kV rms maximum (40 kV – 0 – 40 kV)</p> <p>AF models: 0 to 60 kV rms maximum (30 kV – 0 – 30 kV) 0 to 80 kV rms maximum (40 kV – 0 – 40 kV) 0 to 100 kV rms maximum (50 kV – 0 – 50 kV)</p>										
Voltage rise time	0.5 kV/s, 2.0 kV/s or 3 kV/s depending on selected test standard and 0.5 kV/s up to 10 kV/s in custom test										
Voltage rise time accuracy	better than 5%										
Voltage resolution and accuracy	Up to 5 kV/s: 0.1 kV +/- 1% +/-2 digits 5 kV/s up to 10 kV/s: 0.1 kV +/- 1% +/-4 digits										
Vessels:	400 ml (standard) 150 ml (option) Carefully designed test vessels manufactured from the most chemical resistant clear polymer on the market provides tried and tested reliable test results. Featuring precision electrode alignment and adjustment wheels that lock electrodes in position, the option of a 150 ml vessel for low volume oil samples is also available										
Temperature measuring range	10 °C to 65 °C (ASTM D877 requires oils to be within 20 °C and 30 °C) (IEC 60156 required oil to be within 15 °C and 25 °C)										
Temperature sensor resolution:	1 °C										
Power supply:	Line voltage 85 to 265 VAC Line frequency 50/60 Hz										
Fuses:	2 x 4 A CFST ceramic, 20 mm x 5 mm, for 250 V										
Batteries (PB model only):	NiMH 24 V 2 Ah										
DC power supply (PB model only):	12 V DC, 60 V A – used to charge battery only										
Power source:	85 V – 265 V 50/60/400 Hz input. Portable unit can be powered from 85 V – 265 V or its internal battery.										
Battery life:	10 test sequences up to 70 kV using 2 Ah battery										
Charge retention at 20°C:	NiMH 50% discharged after 1 month										
Battery charging:	Automatic when connected to power source. Charge time 16 hours slow or 2 hour fast charge to >90%										
Interface	2 x USB type-A (Flash drive, printer) , 1 x USB type-B (Factory use)										
Internal printer:	Dot matrix impact printer Paper 57.5 mm wide										
External printer:	supports PCL3, PCL6, PS and EPS										
Protection:	Dual safety micro switches on chamber cover										
Display:	3.5 in display. 320 x 240 QVGA colour display with backlight										
Dimensions (W x H x D):	<table border="0"> <tr> <td>OTS60PB</td> <td>520 mm x 340 mm x 250 mm</td> </tr> <tr> <td>OTS80PB</td> <td>520 mm x 380 mm x 250 mm</td> </tr> <tr> <td>OTS60AF</td> <td>580 mm x 420 mm x 290 mm</td> </tr> <tr> <td>OTS80AF</td> <td>580 mm x 420 mm x 290 mm</td> </tr> <tr> <td>OTS100AF</td> <td>580 mm x 420 mm x 290 mm</td> </tr> </table>	OTS60PB	520 mm x 340 mm x 250 mm	OTS80PB	520 mm x 380 mm x 250 mm	OTS60AF	580 mm x 420 mm x 290 mm	OTS80AF	580 mm x 420 mm x 290 mm	OTS100AF	580 mm x 420 mm x 290 mm
OTS60PB	520 mm x 340 mm x 250 mm										
OTS80PB	520 mm x 380 mm x 250 mm										
OTS60AF	580 mm x 420 mm x 290 mm										
OTS80AF	580 mm x 420 mm x 290 mm										
OTS100AF	580 mm x 420 mm x 290 mm										

Technical specifications

Weight:	OTS80PB 20.8 kg OTS60PB 16.8 kg OTS100AF 30 kg OTS80AF 30 kg OTS60AF 30 kg Test Vessels 1.1 kg (400 ml and 150 ml)
Operating temperature:	0 °C to +50 °C
Storage temperature:	-30 °C to +65 °C
Humidity non-condensing conditions:	80% RH at 40 °C operation 95% RH at 40 °C storage
Altitude:	1000 m
IP rating:	IP30
Safety:	Designed in accordance with IEC61010
EMC	Light industrial IEC 61326-1 Class B, CISPR 22, CISPR 16-1 and CISPR 16-2

11.1. VCM100D/VCM80D voltage check meters technical specification

The VCM100D and VCM80D are OTS accessories that enable the voltage output of the oil test set to be checked by measuring the actual voltage at the HV electrodes. The calibration meters fit in the oil test set chamber in place of a standard vessel and are designed to ensure that the load on the OTS transformer is similar to the load during an oil dielectric strength test.

Meter type:	Proprietary 100 kV/80 kV Megger OTS voltmeter with 4 seven-segment digit digital readout
Accuracy at 23 °C:	2.0% plus 2 digits to 50 kVrms 2.5% plus 2 digits > 50 kVrms to 75 kVrms 3.0% plus 2 digits > 75 kVrms to 100 kVrms (VCM100D only above 80 kV)
Operational temperature range:	0 °C to 40 °C
Storage temperature range:	30 °C to +70 °C
Operational humidity range:	50% RH at 20 °C
Storage humidity range:	93% RH at 40 °C
Safety:	The meter is only approved for use with Megger oil test sets
Dimensions (W x H x D):	250 mm x 150 mm x 115 mm
Weight:	1.8 kg

11.2. Storage and transportation

The Oil Test Sets are precision instrument that generates HV to 100 kV and needs to be transported and stored carefully.

For PB models, a transportation case is available as an option and required by customers wanting to transport the OTS80PB or OTS60PB by road, rail or air. A soft, shoulder carry case is provided as an option with the OTS80PB or OTS60PB. It opens up to facilitate running a test without removal of the instrument and provides two side pouches for storage.

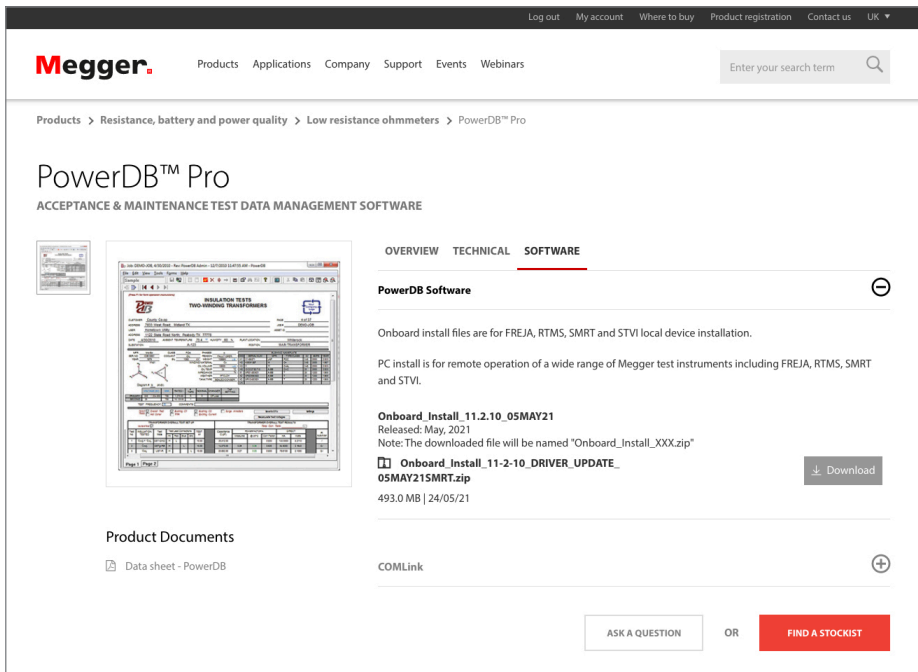
The unit should be stored in a room or area where the environment is within the temperature range of -30 °C to 65 °C and maximum humidity of 95% at 45 °C.

The OTS80PB or OTS60PB has batteries fitted it should be fully charged at least once every three months to maintain full battery capacity.

12. PowerDB software

You can now download direct from the Megger website to ensure that you have the most recent version available.

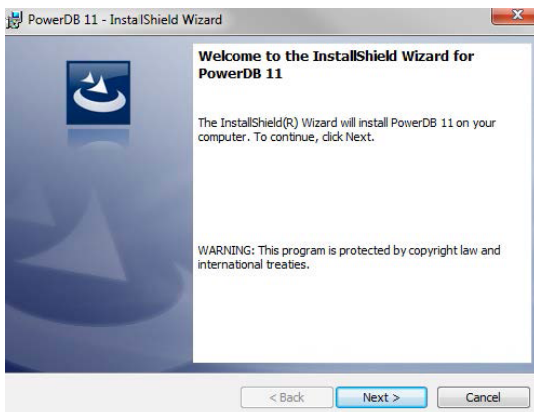
Visit megger.com/powerdb



The latest edition will be at the top. Click the “download” button beside the file.

This will ask if you want to open or save the file. By clicking “Save” you will begin to download the installation package.

Then just follow the onscreen instructions to complete installation.



Accessories and Equipment

13. Accessories and Equipment

Only Megger supplied accessories can be used with the OTS range.
Non approved equipment cannot be guaranteed to work with the OTS.

13.1. Factory fitted accessories

Included accessories (OTS PB models)

Item
Vessel 400 ml assembly (stirrer lid fitted)
Full electrode set - IEC and ASTM
IEC and ASTM impeller
Printer
NiMH battery
Electrode gauge set
Calibration certificate
Power DB guide
Quick Start Guide
OTS Vessel Preparation Guide

Included accessories (OTS AF models)

Item
Vessel 400 ml assembly (stirrer lid fitted)
Printer
Full electrode set - IEC and ASTM
Electrode gauge set
IEC and ASTM impeller
Calibration certificate
Power DB guide
Quick Start Guide
OTS Vessel Preparation Guide

13.2. Optional Accessories

Item	Order No.
OTS IEC60156 Electrode set contents - supplied in accessory case 12.7 mm spherical electrodes (2) 36 mm mushroom electrodes (2) Magnetic stirrer bar (2) Magnetic stirrer bar retriever (1) Gap gauge set	1001-477
OTS ASTM D877/D1816 Electrode set contents – supplied in accessory case 25.4 mm standard (sharp edges) cylindrical electrodes (2) 25.4 mm non-standard (round edges) cylindrical electrodes (2) 36 mm mushroom electrodes (2) Magnetic stirrer bar (2) Magnetic stirrer bar retriever (1) Gap gauge set	1001-478
Full electrode set (covers IEC and ASTM standards) 12.7 mm spherical electrodes (2) 36 mm mushroom electrodes (2) 25.4 mm standard (sharp edges) cylindrical electrodes (2) 25.4 mm non-standard (round edges) cylindrical electrodes (2) Magnetic stirrer bar (2) Magnetic stirrer bar retriever (1) Gap gauge set	1001-479
Vessel lid mounted impeller (ASTM or IEC) for use with 400 ml vessel	1001-102
Carry bag (padded) OTS80PB	1001-476
Carry bag (padded) OTS60PB	1001-480
Vessel 400 ml assembly (no electrodes supplied)	1001-473
Vessel 150 ml assembly (no electrodes supplied)	1001-474
VCM100D digital voltage checker	1001-105
VCM80D digital voltage checker	1001-801
Printer paper, 20 rolls (4 rolls supplied if printer configured)	1008-030
Printer Ribbon Cassette	25995-002
Barcode reader, USB	1001-047
Transport case (with wheels)	1001-475
ASTM alternative propeller shaft assy	1007-153
IEC alternative propeller shaft assy	1007-154
Electrodes - Spherical (pair)	6220-484
Electrodes - Mushroom (pair)	6220-580
Electrodes - Cylindrical (pair)	6220-483
Electrodes - Non-standard cylindrical with 0,5 mm edge radius (pair)	6220-538
Electrode gauge set 1, 2, 2.5, 2.54, 4 mm	1002-144
Calibration Certificate OTS AF	1001-921
Calibration Certificate OTS PB	1001-920
UKAS Calibration Certificate OTS60 AF	1000-089
UKAS Calibration Certificate OTS80 AF	1000-091
UKAS Calibration Certificate OTS100 AF	1000-088
UKAS Calibration Certificate OTS60 PB	1000-090
UKAS Calibration Certificate OTS80 PB	1005-943

Repair and warranty

14. Repair and warranty

The Test set circuit contains static sensitive devices, and care must be taken in handling the printed circuit board. If the protection of a product has been impaired it should not be used, and be sent for repair by suitably trained and qualified personnel. The protection is likely to be impaired if, for example, the product shows visible damage, fails to perform the intended measurements, has been subjected to prolonged storage under unfavourable conditions, or has been exposed to severe transport stresses.

New products are guaranteed for 1 year from the date of purchase by the user.

Note: Any unauthorized prior repair or adjustment will automatically invalidate the warranty.

Note: Please ensure when returning an instrument for repair or warranty it is adequately packed. It is recommended that the original packaging is taken note of, or retained, in case it is required. The instrument should be carefully boxed and protected, and then be securely strapped to a pallet. Please note that damage caused in transportation due to poor packaging may invalidate a warranty claim."

14.1. Instrument repair and spare parts

For service requirements contact:–

Megger Limited

Archcliffe Road
Dover
Kent
CT17 9EN
U. K.
Tel: +44 (0) 1304 502 243
Fax: +44 (0) 1304 207 342

OR

Megger

Valley Forge Corporate Centre
2621 Van Buren Avenue
Norristown
PA 19403
U. S. A.
Tel: +1 610 676 8579
Fax: +1 610 676 8625

or an approved repair company.

14.2. Approved repair companies

A number of independent companies have been approved for repair work on most Megger products, using genuine Megger spare parts. Consult the Appointed Distributor / Agent regarding spare parts, repair facilities and advice on the best course of action to take.

14.3. Returning a test set for repair

If returning a test set to the manufacturer for repair, it should be sent freight pre-paid to the appropriate address. A copy of the invoice and of the packing note should be sent simultaneously by airmail to expedite clearance through customs. A repair estimate showing freight return and other charges will be submitted to the sender, if required, before work on the instrument commences.

15. End of life disposal

15.1. WEEE

The crossed out wheeled bin placed on the **Megger** products is a reminder not to dispose of the product at the end of its product life with general waste.



Megger is registered in the UK as a Producer of Electrical and Electronic Equipment.

The Registration No is WEE/HE0146QT

15.2. Batteries

The crossed out wheeled bin placed on the batteries is a reminder not to dispose of them with general waste at the end of their life.

15.3. OTS60PB/ OTS80PB

THE OTS60PB and OTS80PB are supplied with a NiMH battery pack fitted.

All OTS variants have been fitted with a lithium Ion memory backup cell, 3V 220mAh CR2032 type. The CR2032 battery replacement should only be performed by a Megger authorised repair agent, who will correctly dispose of the spent battery.

For end of life disposal only the CR2032 backup cell is located in the front panel module mounted behind instrument's display. These are classified as Portable Batteries and should be disposed of in the UK in accordance with Local Authority requirements

The NiMH battery pack replacement should be performed only by a Megger authorised repair agent, who will correctly dispose of the spent battery.

Spent NiMH batteries are classified as Industrial Batteries. For disposal in the UK contact Megger Ltd.

For disposal of batteries in other parts of the EU contact your local distributor. Megger is registered in the UK as a producer of batteries. The registration number is BPRN00142

15.4. Declarations of conformity

Hereby, **Megger Instruments Limited** declares that radio equipment manufactured by Megger Instruments Limited described in this user guide is in compliance with Directive 2014/53/EU. Other equipment manufactured by Megger Instruments Limited described in this user guide is in compliance with Directives 2014/30/EU and 2014/35/EU where they apply.

The full text of Megger Instruments EU declarations of conformity are available at megger.com/eu-dofc

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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 a registered trademark

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