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Detex®

Voltage detectors and Phasing Testers

Megger®

The Measure of Excellence in Electrical Testing...

The industry leader since 1895, Megger offers a comprehensive line of electrical test and measurement products, from portable instruments for use in the field to fully integrated systems for high voltage systems testing. Megger fulfills a range of requirements found in electric utility, large industrial, electrical apparatus manufacturing, military and governmental applications worldwide.

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Megger's extensive product line includes its well-known portable field test equipment, including the Megger® family of Insulation Resistance testers, which indicate the deterioration of electrical insulation; Ground Resistance Testers for installing and maintaining grounding systems; and equipment for locating faults in both power and communications cable.

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Megger operates a calibration lab traceable to the NIST to ensure the quality of its precision products, which includes the DRLO® line of digital low resistance ohmmeters.

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Megger is a leading supplier of equipment and systems for High Voltage Systems testing applications, from rigorous QC testing of manufactured power cable to demanding R&D requirements in the Aerospace industry. This range of products includes fully integrated systems for detecting minute levels of partial discharge to HV power supplies and DC dielectric, transformer turn ratio and capacitance/dissipation factor test sets for use in the field testing of large power apparatuses.

No matter whether it's a hand-held Megger® Insulation Tester or a 750 kV Partial Discharge Detection System, Megger backs it up with a full range of support services:

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Our Application Engineers can demonstrate how Megger can fulfill your testing requirements.

Customer Service

Contact one of Megger's Customer Service Representatives for quick answers to your questions regarding where to buy, order entry, delivery or warranty and repair information. They can also assist you in ordering replacement parts, accessories, operating/service manuals and product/application literature.

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Many of our products are readily available through an Authorized Stocking Distributor near you.

AND MORE…

Megger also supports you with expert calibration services traceable to the NIST, full one-year warranty, convenient leasing and much more. Because when you buy Megger, you're getting more than a quality product.

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Instruction Manual
for
Detex® Voltage Detectors and Phasing Testers

Catalog Numbers 514242, 514360, 514440, 510836 Series, 510900 and Accessories

High-Voltage Equipment
Read the entire manual before operating.

Aparato de Alto Voltaje
Antes de operar este producto lea este manual enteramente.

The information presented in this manual is believed to be adequate for the intended use of the product. If the product or its individual instruments are used for purposes other than those specified herein, confirmation of their validity and suitability must be obtained from Megger. Specifications are subject to change without notice.

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Introduction

RECEIVING INSTRUCTIONS

Check the equipment received against the packing list to ensure that all materials are present. Notify Megger of any shortage. Telephone 1-800-723-2861 or 610-676-8578.

Examine the instrument for damage received in transit. If any damage is discovered, file a claim with the carrier at once and notify Megger or its nearest authorized sales representative, giving a detailed description of the damage.

Detex® Voltage Detectors and Phasing Testers have been thoroughly tested and inspected to rigid specifications before being shipped and are ready for use upon receipt. Batteries are not installed prior to shipment in the electronic voltage detectors. Refer to Section 6 of this manual for battery installation instructions.

GENERAL INFORMATION

This manual describes Detex® Voltage Detectors and Phasing Testers. The detectors and testers are contact-type devices which indicate the presence of phase-to-ground voltages. Refer to Section 2 of this manual for safety information.

Specifications for the various instruments are delineated in Section 3. Section 4 describes the operation of the detectors and Section 5 describes the operation of the phasing testers. Section 6 contains simplified troubleshooting procedures including instructions for battery installation. Refer to Section 7 for additional technical data on phasing testers.

Section 2
Safety

Safety is the responsibility of the user.

The purpose of the detectors and testers is limited to use as described in this manual. Do not use the detectors or testers with any device other than specifically described.

The following warning and caution notices are used in this manual where applicable. These notices precede the specific instruction where the hazard is likely to be encountered.

WARNING

Warning, as used in this manual, is defined as a condition or practice which could result in personal injury or loss of life.

CAUTION

Caution, as used in this manual, is defined as a condition or practice which could result in damage to or destruction of the equipment or apparatus under test.

- Use with extreme care. If in doubt, stop.
- Check detectors and testers for correct operation before and after use.
- Ground the circuit under test before working on it.
- These detectors and testers should be used only by personnel familiar with safe methods of approach to live equipment and conversant with safety precautions in performing live line operations.
- Follow all applicable safety rules.

These voltage detectors and phasing testers are intended to be connected to sources of high-voltage electrical energy and all persons making or assisting in the tests must use all practical safety precautions to prevent contact with energized parts of the test equipment and related circuits. If the detectors and testers are operated properly, test personnel need not wear rubber gloves. As a routine safety procedure, however, some users require that rubber gloves be worn when making connections to high-voltage equipment. Megger considers this an excellent safety practice.

Users of high-voltage equipment should note that high-voltage discharges and other sources of strong electric or magnetic field may interfere with the proper functioning of heart pacemakers. Personnel with heart pacemakers should obtain expert advice on the possible risks before operating this equipment or being close to the equipment during operation.

Attention is drawn to the safety warnings marked on the body of the detectors. In particular, the detectors must be held below the line marking the safe limit for handling when applying to live apparatus. Telescopic pole models must be extended correctly, and detector head models must be attached to a hot line pole, as required by the voltage of the apparatus under test.

WARNING

The test equipment must be held on the power line for a minimum of 3 seconds.

The detectors and testers are contact devices; they are not proximity devices. Therefore, their fork or hook terminals must actually touch the bare conductor being tested for at least 3 seconds to work properly.

Voltage detectors are designed to operate only on systems referenced to ground. Erroneous indications will occur when testing ungrounded delta or wye systems. Correct indications by the instruments depends on their being used with the correct system.

Cat. No. 514360-5, 514360-6, 514360-7 & 514360-8, 514440-3, 514242-1 & 514242-2 instruments (those supplied with or without integral poles) are showerproof. They are not waterproof and could be rendered inoperative if immersed. When using these detectors and testers in rain or snow, care must be taken to follow all safety precautions as suggested by the manufacturer of the hot line pole being used. In particular, make sure that the hot line pole used has a wet rating at least equal to the voltage of the system under test. Also make sure that it is clean and free from imperfections, such as cracks and chips.

Cat. No. 510836-1 instrument should not be used in rain or snow. It does not have a wet rating.

When checking for the absence of voltage, detectors and testers should be tested both before and after use to make sure they are operating properly. It is best to make this test on a live portion of the same circuit being tested. This will ensure that the sensitivity of the detector is satisfactory for the particular application. As an alternative, make the tests on another circuit of similar rating and in similar lighting conditions.

Before touching or working near de-energized circuits or apparatus, make sure that they are grounded using appropriate safe grounding techniques. Conductors and cables used for grounding must be capable of handling the maximum possible current.
Make sure that the nominal voltage of the apparatus under test is within the voltage range specified on the instrument.

NOTE

The voltage specified on voltage detectors refers to nominal system line voltage. The actual operating voltage range of the detector is the voltage specified, divided by 1.73.

Section 3
Equipment Tabulation and Specifications

VOLTAGE DETECTORS

(For ac use only, grounded circuits only)

Cat. No	Type	Operating Range (kV) ph-ph	Style	Weight lb (kg)
514242-1	Electronic	67 to 235	Spline Fitting	1.5 (0.67)
514242-2	Electronic	225 to 550	Spline Fitting	1.5 (0.67)
514360-8	Electronic	2.4 to 6.9	Telescopic Pole 30 to 46.4 in. (75 to 118 cm)	2.2 (0.99)
514360-5	Electronic	4 to 14	Spline Fitting	1.1 (0.50)
514360-6	Electronic	11 to 36	Spline Fitting	1.1 (0.50)
514360-7	Electronic	24 to 72	Spline Fitting	1.1 (0.50)
514440-3	Electronic	4.16 to 34.5	Telescopic Pole 30 to 46.4 in. (75 to 118 cm)	2.1 (0.95)

Detectors are supplied with vinyl carrying cases.

PHASING TESTERS

(For ac use only, grounded or ungrounded circuits)

Cat. No	Type	Operating Range (kV)	Style	Weight lb (kg)
510836-1	LED	2 to 36	Two Pole	3.0 (1.4)
510900	LCD	10 to 30	Spline fitted for attachment to universal hot line pole	3.0 (1.4)

Testers are supplied with plastic carrying cases.

ACCESSORIES

Cat. No. 512117 Pneumatic Rubber Glove Tester
Size: 5-1/2 in. (14 cm) high; 5 in. (12.7 cm) diameter
Weight: 1-1/2 lb (0.7 kg)

Figure 1: Pneumatic Rubber Glove Tester

Section 4
Description and Operation of the Detex® Voltage Detectors

PRECAUTION

Be sure to read and understand Section 2, Safety, of this manual before operating the voltage detector. Even after determining that a circuit is de-energized by use of the detector, it may still carry an induced voltage, a capacitively coupled voltage, or an applied voltage lower than the operating range of the detector. The circuit under test must be grounded before being touched.

ELECTRONIC VOLTAGE DETECTORS

These single-pole voltage detectors are used to verify the absence of voltage in the detector's range on a line or terminal of any grounded ac electrical system. The presence of ac voltage is detected with respect to ground by making contact between the detector and the live equipment. The three-step procedure of testing the detector, testing for absence of high voltage, and testing the detector again should be strictly observed.

Cat. No. 514360, 514242 and 51440 series detectors, see Figure 1, use an electronic detection circuit powered by batteries enclosed in the assembly. The presence of voltage is indicated by an audible signal sounding and by a red light-emitting diode (LED) flashing. Absence of these signals indicates that the conductor or termination under test is free of voltage above the low voltage limit of the detector.

To activate the detector test system, briefly press the red TEST button. The audible signal sounds and the red LED flashes for a short time. The green LED lights for approximately two minutes indicating that the detector is operational and ready for use. The green LED extinguishes when the presence of voltage is detected as indicated by the audible signal sounding and by the red LED flashing. Note that the Cat. No. 514242 series detectors have four red LEDs for ease of visibility.

Except for the Cat. No. 514360-8 and Cat. N° 514440-3 detectors, which are equipped with a telescopic pole, detectors with spline fittings must be attached to a universal connection on the end of the proper length hot line pole rated for the voltage of the system being tested.

Figure 2: Detex® LED Voltage Detector

The electronic detectors Cat. No. 514440-3 and Cat. No. 514360-8 are equipped with a telescopic pole which is marked with a series of rings graduated in kilovolts, indicating the minimum safe length required for each voltage range. These demarcations assist the user in adjusting the pole to the exact length required by operating conditions.

Figure 3: Detex® Electronic Voltage Detectors

OPERATING CONDITIONS

WARNING

Keep your hands behind the guards on the poles. Follow all safety precautions for high-voltage equipment. Ground circuit before touching using a safe grounding method.

WARNING

The test equipment must be held on the power line for a minimum of 3 seconds.

The forked terminal must touch the bare conductor under test for proper operation of the detector for at least 3 seconds.

The operating parts of the detector are enclosed in an insulated and watertight assembly which protects them from external damage and the effects of humidity. If the detector gets wet, all external surfaces should be dried before normal operations are resumed.

Electronic voltage detectors with Cat. No. 514360-5, 514360-6, 514360-7, 514242-1, and 514242-2 are showerproof. They are not waterproof and could be rendered inoperative if immersed. When using the detectors in rain or snow, follow all safety precautions as directed by the manufacturer of the hot line pole being used. In particular, make sure that the hot line pole used has a wet rating at least equal to the voltage of the system under test. Also, make sure that it is clean and free from imperfections, such as cracks and chips.

Do not use the electronic voltage detectors equipped with the telescopic pole (Cat. No. 514360-8 and Cat. No. 514440-3) in rain or snow. They do not have a wet rating.

NOTE

Cat. No. 514440-3 is not approved for use on reactors manufactured by Trench Limited.

Section 5
Description and Operation of the Detex® Phasing Testers

PRECAUTION

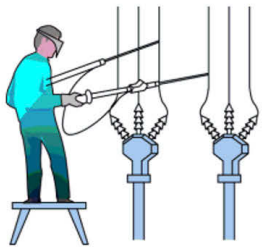
Be sure to read and understand Section 2, Safety, of this manual before operating the phasing tester.

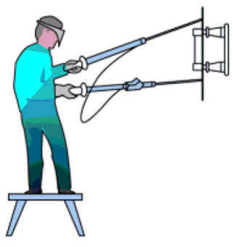
LED PHASING TESTER

Description

The Cat. No. 510836-1 LED phasing tester is designed for use on grounded and ungrounded systems. It consists of two 43 in. long poles with a flexible insulated cable connecting them. Hand guards are provided for safety. The indicator lamp is easily visible in testing situations with poor lighting. Applications include detection using one or two poles, checking high-voltage fuses, testing for correct phase connections, and testing for absence of high voltage on de-energized lines or apparatus. The LED phasing tester is shown in Figure 3.

Figure 4: Detex® LED Phasing Tester





SINGLE POLE PHASE COMPARATOR

Instructions for use:

Test: Press the <<RESET-TEST>> push-button, then release. All the <<M>>, <<C>>, and <<I>> lamps should come on and a fast audible signal should be heard.

Change the battery (type LF22 9 V) in the event of non-blinking.

Check the correct attachment of the end electrode.

Note: During test, the continuity of the rod is not checked.

Before performing any "reference phase" memorizing operations, it is indispensable to operate the push-button:

This will have the following effect:
start-up of the equipment
and/or clearing of the memory.

The phasing comparator shall be used with an isolating stick, the length of insulating element (according to CEI60855-CEI61235) shall be ≥ 525 mm.

The limit mark (red ring or adapter) is the distinctive mark to indicate to the user the physical limit to which the phase comparator may be inserted between live parts or may touch them.

If no action is carried out on the push-button or on the contact between the electrode and an H. V. potential for a period of 2 minutes or so, your CL-7 checking device will switch to the OFF mode, this state being signaled by an "MCI" flashing signal on the display associated with an audible signal.

IN PHASE SINGLE-POLE CHECK

This search is carried out in two phases:

STEP 1:

Memorization of a reference phase.
Bring the electrode into contact with the reference phase. The orange "M" will flash on the left of the display indicating that memorization is underway. Maintain contact during the memorization operation, which may last several seconds.
Memorization ends when:

- the orange "M" lights up steadily
- the buzzer emits a slow beep (Hz)

In the event of a difficulty in memorization, it is advisable to move the electrode/reference phase to contact point.

IMPORTANT: *The user has 15 seconds starting from leaving the live part to seek the phase concordance. Beyond this period, any display will go out after a "MCI" flashing signal associated with an audible signal. Then the user will have to carry out further memorization after operating the push-button.*

STEP 2:

Location of phase in phase concordance with the phase that has just been memorized.
The orange "M" lights up steadily.

Bring the electrode into contact with the phase to be compared:

- Green lighting of "C" + slow beeping : in phase
- Red lighting of "I" + continuous sound : in phase opposition
- If "MCI" signal appears and the buzzer operates, rerun the memorization process after having pressed the push-button. This signal indicates either the memory time is over or the frequency has shifted or any other bad functioning.

IMPORTANT: *Depending on the voltage level, the concordance or non-concordance lights may light up just before contact*.

CL-7 may perform several sequences of phase relationships keeping always the same phase as reference if:

- the push-button has not been actuated
- the time between two tests doesn't exceed 15 s
- "MCI" flashing signal does not appear.

Actuate the push-button for resetting the memory unit and record a new phase reference.
In no case may this device be used as a voltage detector. This device must be used only within its range of voltage marked on the indicator body. Networks under comparison between several parts of an installation involve running an exhaustive set of tests (9 tests) before drawing any conclusion.

SPECIFICATIONS

Battery: 6LR61battery type (9 V)

Frequency: 50 and 60 Hz ± 1%

Voltage range: refer to indication worn on the housing

Use: Indoor/Outdoor

Climatic category: N (-25, +55° C)

Class: Refer to indication worn on the housing

	Concordance	*Non-concordance*
Class A	*± 10°*	*+ 30 à + 330°*
Class B	*± 10°*	*+ 60 à + 300°*
Class C	*± 10°*	*+ 110 à + 250°*
Class D	*Other: angles defined by agreement between manufacturer and customer*	

TRANSPORTATION AND CLEANLINESS

After use, always store the phase comparator in its carrying case. We recommend to wash the phase comparator and its accessories periodically (detergent, alcohol). Thoroughly dry the items and polish them with a silicon cloth (ref.: 95-1208).

IN SERVICE CARE

Depending on the use conditions, it is recommended to rerun safety test according to IEC 61481 within 24 to 36 months from the delivery or the previous safety check.

Changing batteries:

- Unscrew the back cover on the detector and take the front façade out in order to reach the battery.
- Assemble in the opposite order, ensuring that the cover is secure

Section 6
Troubleshooting and Repair

TROUBLESHOOTING

Voltage Detectors

Check operation of the voltage detector on a live portion of the same circuit under test. If there is *no* indication on the detector, check the following:

1. Using a light shield if necessary, confirm that the LED detector is *not* illuminating.

   In strong daylight, it is sometimes very difficult to determine if the unit is operating properly and extra light shielding may be required or an electronic detector must be used.

2. Voltage detectors will not work properly on ungrounded circuits since they operate on the very small capacitance current running from the line under test to ground. If ungrounded circuits have to be tested, it will be necessary to use a two-pole phasing tester.

3. Make sure there is sufficient line voltage for operation. For example, the minimum operating voltage for the LED voltage detector is 2100 V to ground such as can be found on a 2400/4160 V grounded wire system. This instrument will not operate properly on a 2400 V delta system even though this system is grounded through a grounding transformer since such a system would have a phase voltage to ground considerably below 2000 V.

4. If the preceding checks have been made and the LED detector still does not illuminate properly, the LED indicator may be faulty, although this is rare. In such cases, it is recommended that the instrument be returned to the factory for repair.

5. With electronic voltage detectors, replace batteries and recheck. If the detector still does not operate properly, consult the factory.

To install batteries in electronic voltage detectors:

For Cat. No. 514242 series detectors:

1. Unscrew the black front ring of the housing.

2. Remove the body of the indicator from the housing.

3. Snap on the battery connection and place the battery in its compartment. Replace only with 9-V Duracell alkaline battery MN1604 (6LR61) because of confined space in the meter housing.

4. Reassemble the body and ring into the housing.

5. Press the TEST button to check instrument is working correctly.

For Cat. No. 514360 series detectors:

1. Remove front probe (if attached), unscrew rear retainer ring, and carefully withdraw the sensor/detector section from its housing.

2. Remove the battery holder from its compartment and install four “AA” alkaline batteries in accordance with polarity indicators.

3. Replace battery holder in its compartment.

4. Slide the sensor/detector section back into its housing being careful to align the orange color keyed tab with its mating slot on the housing. The section should settle in and the forward hex portion should seat in its recess.

5. Replace the rear retainer ring.

LED Phasing Tester

1. For illumination failure of the LED phasing tester, steps 1, 2, and 3 of the procedure for voltage detectors generally also apply when using the phasing tester in the single-pole mode of operation, keeping in mind that the threshold voltage of the detector in this mode is 3000 V to ground. When the two-pole mode of operation is used, this threshold voltage is reduced to 2000 V and it is not necessary that the system be grounded.

2. Make sure that the adjusting knob is properly set to the voltage of the system. The indicator lamp will flash brightest when this knob is set properly so do not set to a voltage either appreciably greater or less than the circuit voltage.

3. Inspect the extension rods for good physical contact at their mating ends.

4. If the tester still does not illuminate properly, the indicator lamp is probably defective and the tester should be returned to the factory for repair.

REPAIR

Megger offers a complete repair service and recommends that its customers take advantage of this service in the event of any equipment malfunction. When returning an instrument to the factory for repair, please indicate all pertinent information, including problem symptoms and attempted repairs. Equipment returned for repair must be shipped prepaid and insured and marked for the attention of the Repair Department Manager.

PREPARATION FOR SHIPMENT AND STORAGE

Remove batteries from battery powered detectors or testers before shipment or before long-term storage. Place the detector or tester in its carrying case and pack in a carton (original shipping carton if available) with adequate dunnage in accordance with best commercial practice. Seal the container with waterproof tape.

Section 7
Technical Data on Phasing Testers

This section describes factory tests and calculations. They are presented for better understanding and as an aid to users who wish to set up their own test program. Megger will assist users who require technical assistance concerning specific test methods.

TEST 1 RESISTOR ELEMENT (REMOVABLE ROD)

The following tabulation gives the values of the resistance in megohms for the phasing tester. Resistive tolerance is ±5 percent.

	Resistance (MΩ)	
Phasing Tester	**Detector**	**Auxiliary**
Cat. No.	**Element Pole**	**Element Pole**
510836-1	25	25

Figure 5 shows the test setup for measuring the value of protection resistance of the phasing tester antenna element using an ohmmeter.

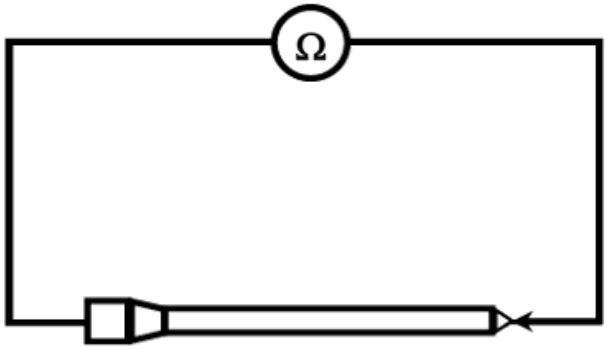


Figure 5: Test Setup Using Ohmmeter

WARNING

Tests 2, 3, and 4 involve dangerous high voltages. These tests must be set up and performed only by qualified personnel in accordance with all safety precautions.

WARNING

The test equipment must be held on the power line for a minimum of 3 seconds.

TEST 2 INSULATION OF THE CONNECTING CABLE

Figure 6 shows the test setup for testing the insulation of the connecting cable using an ac milliammeter with suitable scale. Test voltage is 1.2 times maximum nominal phase to ground voltage for 1 minute; leakage current is less than 500 µA.

For example, test voltage for the Cat. No. 510836-1 tester is:

$$\frac{36000\ V}{\sqrt{3}} \times 1.2 = 25000\ V$$

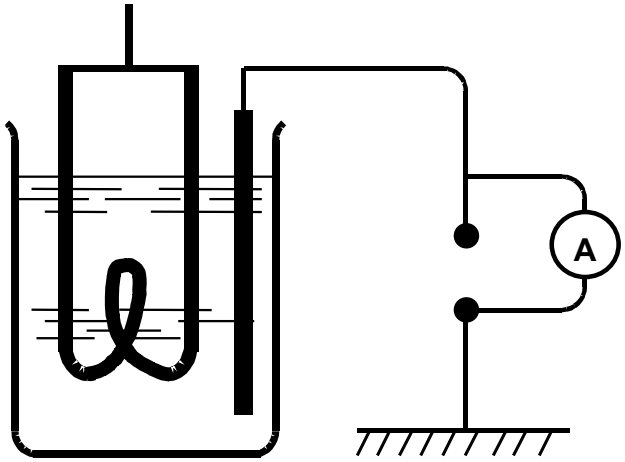


Figure 6: Connecting Cable Insulation Test Setup

TEST 3 POLE INSULATION

Figure 7 shows the test setup for checking pole insulation using earthed poles. Test voltage is 1.2 times maximum nominal phase to ground voltage for 1 minute; leakage current is less than 125 µA.

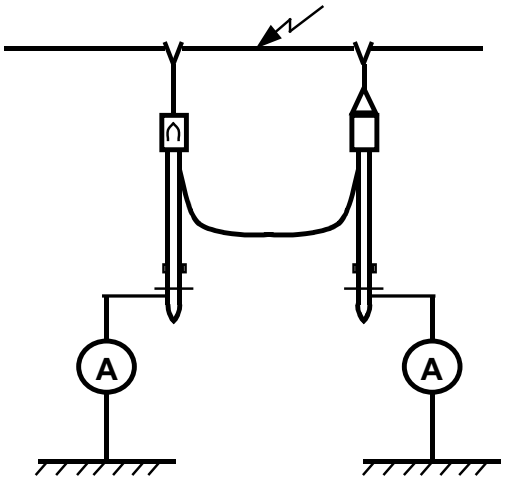


Figure 7: Pole Insulation Test Setup

TEST 4 OPERATING CURRENT

Figure 8 shows the operating current test setup. At maximum nominal voltage, current through the phasing tester is approximately 1 mA.

TEST 5 MAXIMUM FAULT CURRENT CALCULATIONS

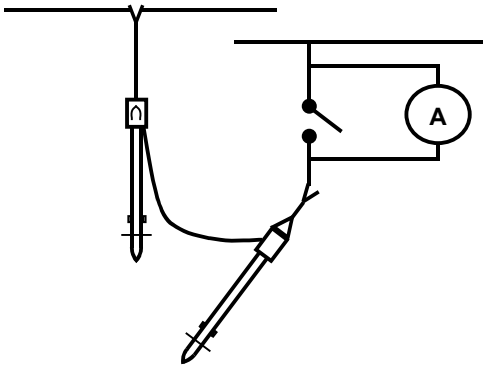


Figure 8: Operating Current Test Setup

Figure 9 shows the conditions for calculating maximum fault current which could flow accidentally at Test Point A with a faulty cable. The maximum fault current would be:

$$\frac{\text{maximum nominal voltage}}{\sqrt{3} \times \text{auxiliary element resistance}}$$

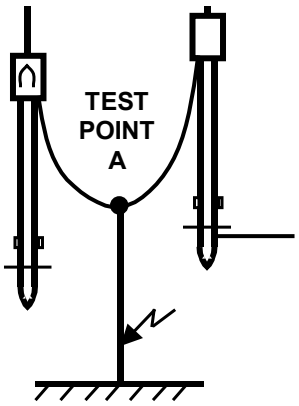


Figure 9: Conditions for Maximum Fault Current

TEST 6 VOLTAGE-ADJUSTING KNOB

To check the correct operation of the voltage-adjusting knob on the LED phasing tester, the following procedure should be performed for at least four different settings over the full range of adjustment.

a. Set the voltage-adjusting knob to the desired setting.

b. Touch the detector element to a variable source of high voltage (the auxiliary element being held clear).

c. Raise the voltage to a value equal to the knob setting. Observe the lamp; it should be flashing at its maximum rate.

d. Touch the auxiliary element simultaneously to the same electrode as the detector element. The lamp should extinguish. A faint flash may still be observed but the difference between this faint flash and maximum intensity flash is considerable and easily discernible.

Refer to Section 6, Troubleshooting, if the tester fails these checks.

WARRANTY

Products supplied by Megger are warranted against defects in material and workmanship for a period of one year following shipment. Our liability is specifically limited to replacing or repairing, at our option, defective equipment. Equipment returned to the factory for repair must be shipped prepaid and insured. This warranty does not include batteries, lamps or similar items, where the original manufacturer's warranty shall apply. We make no other warranty. The warranty is void in the event of abuse (failure to follow recommended operating procedures) or failure by the customer to perform specific maintenance as indicated in this manual.

Megger

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