

Digital Loop Testers

MEGGER[®] LT5 RS 205-384

Operating Instructions
Mode d'Emploi
Betriebsanweisung
Instrucciones de Uso



8915



RS Components

MEGGER[®]

SAFETY WARNING

- ★ ***Do not touch an installation or equipment which is being tested.***
- ★ ***When testing 3 phase supplies, test one phase at a time. Do not connect the instrument across two phases.***
- ★ ***If either neon does not illuminate, switch the supply off and check the installation's wiring connections.***
- ★ ***Replacement fuses MUST be of the correct type and rating.***

Refer also to page 10 for further explanations and other precautions. The warnings and precautions must be read and understood before the instrument is used. They must be observed during use.

NOTE

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

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GENERAL DESCRIPTION

The LT5 and LT6 Loop Testers are robust instruments built into strong plastic cases, suitable for being carried in a tool-bag and able to withstand a high degree of mechanical shock. They take power from the mains supply which is being tested and a recessed plug ('Euro plug' to BS 4491) is fitted to the top of the case for connection to that supply. A connecting lead, fitted with a 'Euro socket' at one end and a three pin plug to BS 1363 at the other, is provided with each tester. (Although for many European countries, a 'Schuko' plug is required). This test lead is used for making phase (line)—earth loop impedance tests at wiring installation socket outlets. Alternatively a dual test lead set is available in which separate leads terminated with prods, are fitted to a 'Euro socket'. One of these leads has a red, fused, retractable prod for extra safety in use. A dual test lead set is necessary for additional two-terminal loop impedance test applications. That is, phase to earth or phase to neutral loop impedance tests other than via a socket outlet, on single or three phase systems and also tests on light fittings, bonded metalwork etc. A special lead is also available which provides extra safety when testing bonded metalwork.

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Measurements of an installation phase (line) — earth loop impedance are made by connecting the instrument to the socket under test and setting the slider switch to the appropriate position (see 'Operation' page 10). Two neon lights marked 'P-E' and 'P-N' at the left of the front panel illuminate when the mains supply is connected, (and before a test is executed). They provide an automatic check of the earth circuit continuity; show that the tester fuse is intact; (the tester is protected by a 7 A fuse and a 2,5 A fuse in the instrument and a 13 A fuse in the test lead BS 1363 plug), and indicate that the phase connection is correctly wired. The circuit is so designed that it is not possible to make phase—earth loop impedance tests if the 'P-E' neon light is not illuminated).

Caution:— The illuminated neons should be taken as an indication of connection only and not as a complete proof, because there may be cases, (albeit very few), where there is sufficient capacitance between the conductors in the installation to cause the neons to illuminate even if the neutral or earth is open circuit.

When a test is executed a current of up to 25 A (half-

wave) is passed from the phase conductor, through the consumer's circuit protective conductor, earthing terminal, earthing conductor, the earth return path and back to the neutral of the supply transformer. The current flows for between 23 ms and 33 ms and its magnitude depends upon the impedance of the loop. The current passes through either 10 ohms, 100 ohms or 1 kohm resistance in the instrument (the value depends on the range selected), and the measurement is made by integrating the supply voltage when the circuit (a) is loaded and (b) is not loaded by this resistance. The voltages are fed to a ratiometric A/D converter whose output drives the digital liquid crystal display giving a reading directly in ohms. The display shows the impedance reading, with the decimal point correctly positioned, and an ' Ω ' sign. The instrument is completely electronic in function and is unaffected by variations in supply voltage. Two ranges of measurement are available, 20 Ω and 200 Ω on the LT5 and 20 Ω and 2000 Ω on the LT6. The first is suitable mainly for wiring installations constructed to the TN system where lower impedance values would be expected. The second is suitable for the higher impedance values found mainly in TT system

installations. No setting-up procedure is necessary, the measurement is made automatically approximately four seconds after the slider switch has been set to the appropriate range. The displayed measurement holds steady for several seconds allowing ample time for the reading to be taken. Eventually it will drift as the internal capacitors discharge. An indication that a measurement has been carried out is given audibly by a short 'bleep' from a buzzer. The buzzer will also sound continuously when a thermal cut-out has operated to protect the circuit from excessive heat generation by frequently repeated tests.

Each instrument is light in weight and, in addition to being suitable for hand-held operation, it is fitted with a two-position support stand that folds away into the back of the case. This support stand, when opened to its first position, enables the instrument to be propped up at an angle of about 30°. When opened fully the stand forms a loop so that the instrument may be hung from a convenient hook. Non-slip rubber feet are fitted to "grip" the bench when the instrument is used laying horizontally.

GENERAL DESCRIPTION

When fitted with a dual test lead, the tester can be left set to the range required and two hands are then free to use the prods. This makes testing easier and provides uninhibited use for both phase to earth or phase to neutral loop impedance measurements on any network or piece of equipment within the specified voltage rating. The action of connecting the test prods effectively switches the tester on and it is important to note that, in all cases when a dual test lead is used, only the 'P-E' neon will illuminate whether phase to earth or phase to neutral tests are being performed.

A test-and-carry case is available which can be supported around the operators neck to make use by one person easier.

Caution: --- The instrument circuit contains static sensitive devices. If the instrument casing is opened for any reason, (this will automatically invalidate any warranty covering the instrument), care must be exercised in handling the printed circuit board. This should be done in accordance with DEF STAN 59-98 and BS 5783, specification for handling electrostatic sensitive devices.

APPLICATIONS

The LT5 and LT6 Testers are designed for checking existing or newly installed wiring systems quickly and accurately. The tests performed comply with the requirements of the 16th Edition of the IEE Wiring Regulations for earth fault loop impedance tests, (Regulation 713-10). They may also be used for testing to the German VDE and European IEC specifications.

The instruments may be used on low voltage circuits both single phase (i.e. phase, neutral and earth) and 3-phase (i.e. phase 1, phase 2, phase 3, neutral and earth, or neutral/earth). Tests on the installation wiring are necessary to ensure that the system complies with safety standards both in the connection and current carrying capacity of the protective circuit. The instruments assist in determining whether an earth connection or earth loop has an impedance low enough to permit adequate current to flow and enable protective devices to operate in the event of an earth fault. Hence the correct type and rating of circuit protection to be installed, whether this be fuse, miniature circuit breaker or earth leakage circuit breaker, can be determined. Also impedance measurements may be made so that the prospective

short circuit current of an installation may be determined (as required by Regulations 313-01 and 434-02).

The LT6's 2000 Ω range is suitable for testing the loop impedance of circuits designed to include RCCBs providing disconnection times, under fault conditions, satisfying IEE Regulations 413-02.

The instruments can be used to check the protective circuit continuity of each individual three terminal (3-pin) mains supply socket of an installation simply by selecting the appropriate range and connecting the test lead to each socket in turn. Any variation in resistance reading will indicate poor wiring or badly made contacts before any damage can be caused. It is possible to detect automatically any cases where the phase conductor is wrongly connected in the circuit under test.

Simple one-hand operation enables the LT5 or LT6 to be used under difficult conditions or in confined spaces.

When testing 3-phase systems, an instrument is used to test one phase at a time, therefore three tests are carried out in total.

When any equipment is connected to the supply

under test it is preferable to switch the equipment off. This is particularly so with large motors which can create interference ("noise") on the mains supply and possibly, therefore, affect the test result.

Using an instrument fitted with a dual test lead incorporating two prods, it is possible to test the loop impedance of light fittings. Connections are made between the phase terminal and the metalwork or earth of the fitting. Thus a check on the earth resistance of every unit in a lighting installation can be made and poor joints and connections detected and rectified. In a similar manner tests can be made on bonded metalwork in earthing systems. (Alternatively the safety earth bond test lead may be used for this purpose).

NOTE:-

It is important to use the connecting leads supplied (or spare ones), since the instrument is calibrated for use with these leads. The use of any other flexible cable will affect the calibration accuracy.

SPECIFICATION

Ranges	LT5 '20 Ω TN' '200 Ω TT' LT6 '20 Ω TN' '2000 Ω TT'	0-19,99 Ω (resolution 0,01 Ω) 0-199,9 Ω (resolution 0,1 Ω) 0-19,99 Ω (resolution 0,01 Ω) 0-1999 Ω (resolution 1 Ω)
Accuracy (at 23 °C ± 2 °C)	LT5 '20 Ω TN' range '200 Ω TT' range LT6 '20 Ω TN' range '2000 Ω TT' range	±2% of reading ± 3 digits ±2% of reading ± 1 digit ±2% of reading ± 3 digits ±3% of reading ± 1 digit
Display		3½ digit l.c.d. (max. reading 1999)
Operational Voltage		200 V to 260 V a.c. r.m.s. 45 Hz to 65 Hz (from the mains supply of the circuit under test)
Temperature Coefficient		within twice stated accuracy over the operating temperature range.
Temperature Range	operational storage	-5 °C to +50 °C -20 °C to +60 °C
Humidity Range	operational storage	80% R.H. at 40 °C max. 93% R.H. at 40 °C max.
Overload Range		will withstand transients of up to 600 V, also thermal cut-out protection to prevent overheating by excessive repetitive tests.
Interference Rejection		10 V d.c. max.

Fuses

13 A 250 V ceramic fuse 25 x 6 mm (to BS 1362) fitted in BS 1363 plug.

7 A 440 V ceramic fuse 32 x 6 mm (to DEF 63-A, max. prospective overload 33 kA) fitted into instrument. (Also safety dual test lead and earth bond test lead).

2,5 A (T) 250 V fuse 8 mm x 8,5 mm to IEC 127-3 sheet IV, fitted into the instrument (adjacent to 7 A fuse).

Safety

the instrument will in general meet the requirements of BS 4743, IEC 348 and VDE 413 part 3 specifications; with an open circuit earth, shock hazard is within zone 2 of IEC 479 Appendix A specification.

Safety Class II

Dimensions

195 x 90 x 40 mm (7,6 x 3,5 x 1,58 in) not including test lead.

Weight

350 g (12 oz approx.)

OPERATION

N.B. Before use, it is recommended that the correct operation of the instrument and lead is established by performing a test on a known good earth.

GENERAL WARNINGS AND PRECAUTIONS

1. It is not possible to make a test if the 'P-E' neon light does not illuminate when the tester is connected to a supply. If the test lead plug is connected to an installation socket and either or both of the neon lamps do not illuminate when the power is switched on, this is indicative of a fault in the wiring connections rather than the instrument. No harm to the instrument will result in this case, but the supply should be switched off and the socket wiring connections checked.
2. While performing tests on equipment connected to a supply ensure that nobody touches the equipment.
3. When performing a test on 3-phase supplies connect the test prods across one phase at a time.
4. Take great care, when using a dual test lead with prods, always connect the red prod to the 'live' terminal. Also never touch 'live' circuits.
5. If an unacceptable reading is obtained the installation wiring should be inspected. Switch the supply off before doing this. (Note:– more than one test should be obtained to verify an unacceptable result).
6. Do not leave the instrument exposed to direct heat from the sun for long periods. Instruments used in very dusty environments should be stripped and cleaned periodically. (Any warranty covering the instrument will be invalidated unless the work is done by an approved repair organisation – see page 56.)
7. The instrument, and the prod of the safety dual test lead and safety earth bond test lead, are fitted with 7 A high rupture capacity ceramic fuses to DEF 63-A (max. prospective overload 33 kA). The instrument also has a 2,5 A (T) 250 V IEC 127-3 sheet IV fuse in series with the 7 A fuse. The three pin test lead plug is fitted with a 13 A high rupture capacity ceramic fuse to BS 1362. It is essential that any replacement fuses conform to these specifications. Fuses constructed to other specifications must **not** be used. Failure to observe this may result in injury to the operator, damage to the instrument, or both.
8. The instrument circuit contains static sensitive devices and therefore requires careful handling (see page 6).

BASIC PROCEDURE

(a) Installation Three Terminal (3-pin) Socket Tests for Phase-Earth Loop Impedance.

First set the range selector switch to the "off" position, then connect the test lead to the recessed plug at the top of the instrument and plug the other end into a socket of the wiring installation under test. Check that the 'P-E' and 'P-N' neon indicator lights illuminate. An investigation as to the cause of a failure of either to illuminate should be made before a loop test is performed. A phase—earth loop test will not be able to be made unless the 'P-E' neon is illuminated. The test circuit is only in a 'ready' state under this condition.

Select the range required by sliding the switch from 'off' to the appropriate position. Approximately 4 seconds after this is done a test will automatically be carried out and the buzzer will sound momentarily to indicate that this has been done. The reading is then shown directly on the digital display. During the 4 seconds pause between selecting the range and the automatic measurement the display will show random figures which should be ignored. The '20 Ω TN' range is likely to be used primarily for installations

constructed to the TN earthing system and where low values are expected, since the resolution is greater on this range. The '200 Ω TT' ('2000 Ω TT' on LT6) range is more likely to be suitable for TT installations. The over-range condition is indicated by a '1' at the left hand side of the display with the remaining digits blank. The decimal point and the ' Ω ' symbol remain in view.

If this indication appears while using the '20 Ω TN' range, the test should be repeated at the '200 Ω TT' ('2000 Ω TT' on LT6) setting. In the unlikely event of the over-range indication appearing again, then the impedance is $>200 \Omega$ ($>2000 \Omega$ on LT6) and is beyond the limits of the tester.

If either of the instrument's protecting fuses has ruptured then the neon lights will not illuminate nor will a measurement be made when it is switched on. If the circuit has been correctly wired and no 'life' appears in the instrument then the fuses should be checked. (Disconnect the tester from the socket first).

To repeat a test simply switch to the 'off' position and then switch back to the range required. A thermal

OPERATION

switch will operate to protect the circuit from over heating if too many tests are repeated too frequently, although this is not likely to be experienced very often. Whilst in this condition the buzzer will sound continuously as a warning and the display will show over-range. Once this has happened further measurements cannot be made until the tester cools sufficiently which will take a few minutes. The buzzer ceases to operate when the tester is ready for use again. (It is suggested that the tester is disconnected while cooling to avoid the annoyance of a continuous buzz).

After a few operations the outside of the tester case will become quite warm to the touch. This is normal and does not mean that a fault exists.

An alternative method when many sockets in an installation are to be tested, is to set the range switch first and then connect to the sockets one at a time. The action of unplugging from one socket and plugging into the next is equivalent to switching the instrument off and on. (The polarity of the installation should be verified first, since with the range pre-selected as soon as the instrument is plugged in it will

begin its test routine provided there is a correct phase connection).

(b) Loop Tests Using Dual Test Lead Set

Use of one of these lead sets enables any loop tests, other than those at a socket outlet, to be performed whether these be phase to earth or phase to neutral. The basic procedure is as before except that the range must be selected first and the action of connecting and disconnecting the test prods onto a "live" circuit switches the instrument on and off. This convenient connection method may cause a spark as connection is made. The spark is limited to 10 ms and is therefore quite safe in ordinary environments. The sparking can be avoided by making the circuit connections before selecting the test range. This may require using the optional black crocodile clip, part no. 6121-047.

NOTE:-

Because a two terminal measurement is being made, when the test leads are connected only the 'P-E' neon will illuminate, (the 'P-N' neon will remain out). This occurs for both phase to earth and phase to neutral tests. If the 'P-E' neon light

does not illuminate no test will be executed and a fault in the installation wiring or a ruptured fuse in the instrument should be suspected. The former is the more likely, therefore switch the supply off and investigate.

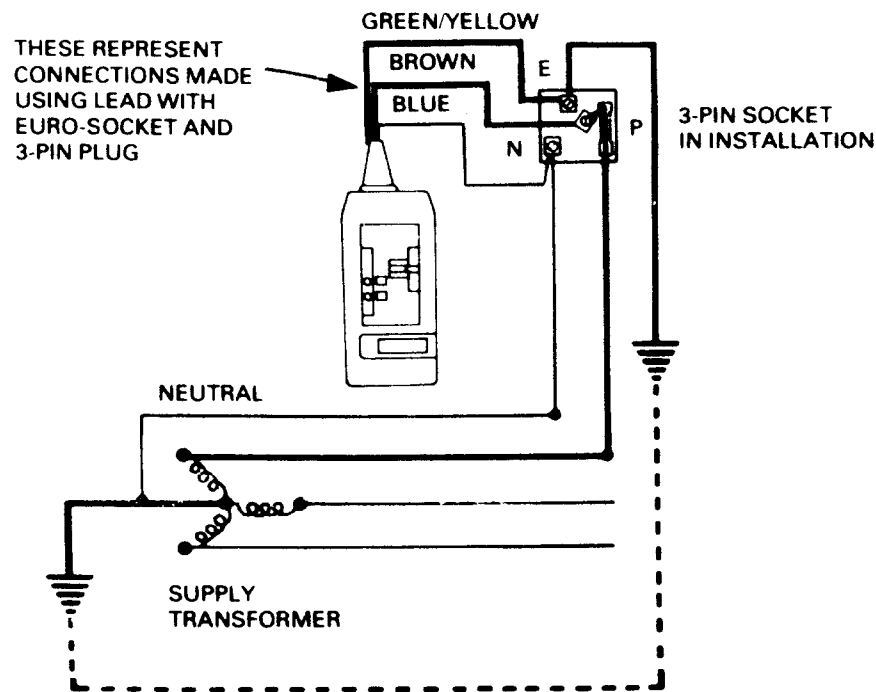


Fig. 1. Testing the earth fault loop impedance at a 3-pin socket

(c) Bonded Metalwork Tests

A special safety earth bond lead is available for bonded metalwork tests. The basic procedure is as before, but the lead is connected as detailed on page 17.

THREE TERMINAL (3-pin) SOCKET PHASE—EARTH LOOP IMPEDANCE TEST (single phase 200 V — 260 V a.c. outlets) — see fig. 1.

Connecting the Instrument

1. Connect the test lead socket to the recessed plug in the instrument.
2. Ensure that the slider switch on the instrument is set to 'off'.
3. Connect the plug at the other end of the test lead to the socket of the installation under test.

Polarity and Earth Continuity Test

4. Switch the socket on. Both the 'P-E' and 'P-N' neon indicator lights should illuminate. If either does not, switch the supply off and investigate the reason.

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5. If the 'P-N' neon light does not illuminate, but the 'P-E' does, either: (i) the neutral is not connected in the socket or is open circuit; (ii) the phase and earth are interchanged or (iii) all three connections are incorrect. Check the socket wiring and correct if necessary.
6. If the 'P-E' neon light does not illuminate, but the 'P-N' does, either: (i) the earth is not connected in the socket or the circuit protective conductor is open circuit; (ii) the phase and neutral are interchanged or (iii) all three connections are incorrect. Check the socket wiring and correct if necessary.
7. If both neon lights do not illuminate, either: (i) the phase is not connected in the socket or is open circuit; (ii) the neutral and earth connections are both open circuit or (iii) the instrument fuses (or supply plug fuse) may have ruptured. Correct if necessary before proceeding further.

Phase—Earth Loop Impedance Test

8. With both neon lights illuminated set the switch to the appropriate range.

For all the remaining tests described a dual test lead set must be used.

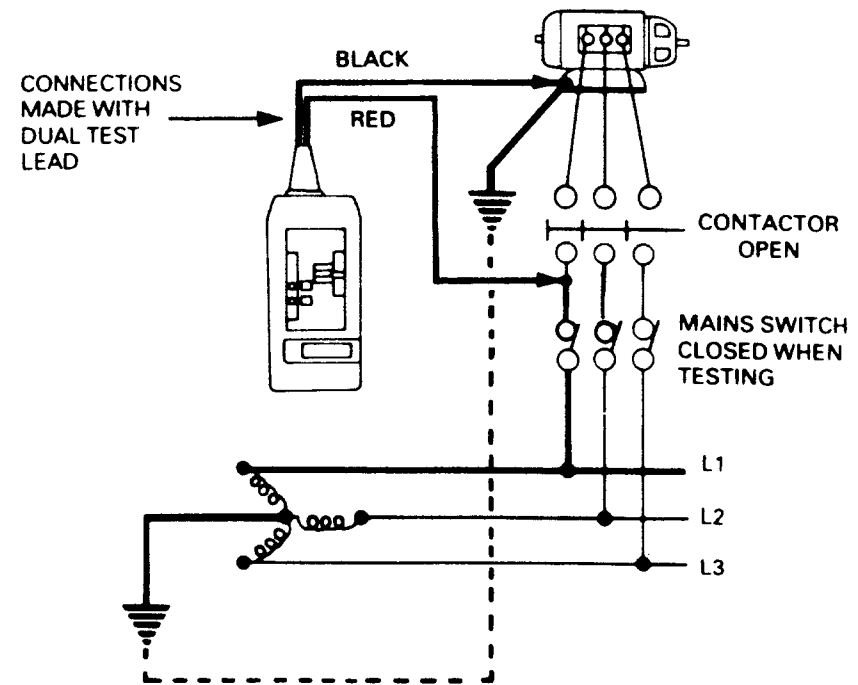


Fig. 2. Testing the earth fault loop impedance of 3-phase equipment

9. After approx. 4 seconds a measurement of the phase—earth loop impedance will be made and the reading appears on the display. A buzzer will sound briefly to indicate when the measurement is made.
10. To repeat a test, switch to the 'off' position and back to the range setting again.

3-PHASE LOOP IMPEDANCE TESTS (348 V — 450 V a.c. circuits) — see fig. 2

Caution: never connect the instrument directly across two phases, also never touch the equipment etc. when under test.

Preparing for a Test

1. The contactor of any equipment connected to the 3-phase supply should be opened. The main switch should be closed when testing.
2. Connect the dual test lead socket to the recessed plug in the instrument.
3. Set the slider switch to the appropriate range.

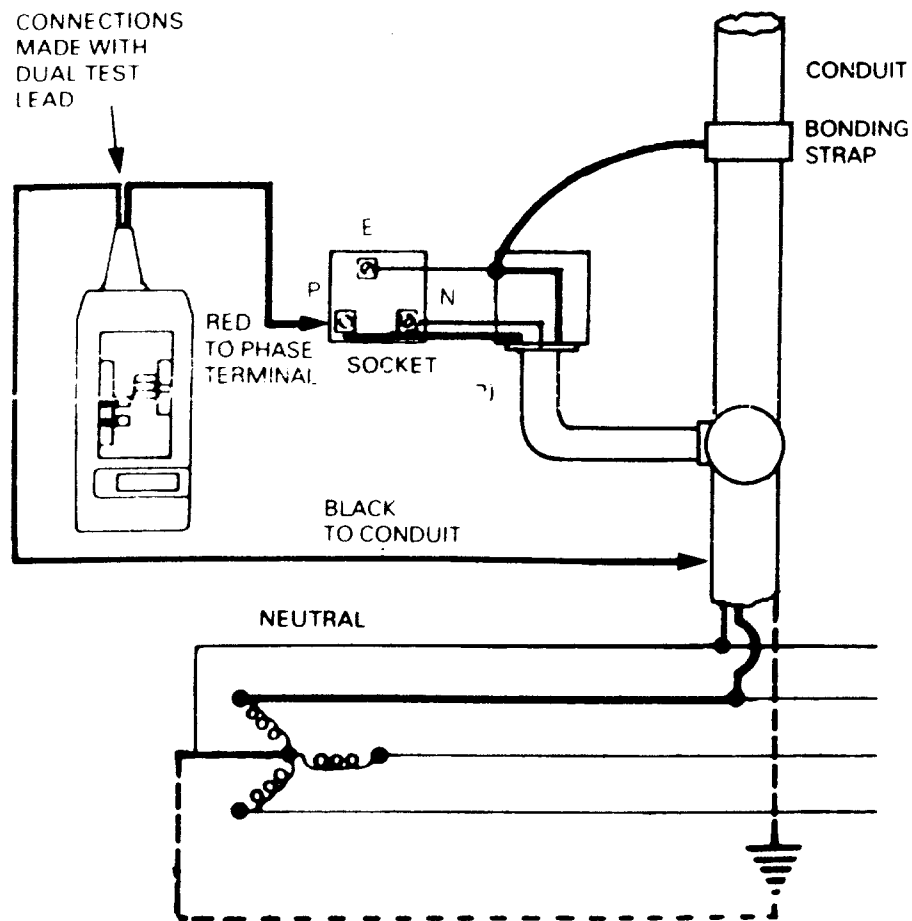
Earth Continuity and Phase—Earth Loop Impedance Test

4. Connect the black prod to the earth terminal in the contactor, the metal frame of the equipment or the earth terminal in the main switch if the supply is being tested independently. (Connecting to the metal frame of the equipment means that the connection between the frame and earth terminal is included in the test).
5. Connect the red prod to each phase in turn in the main switch, so making three separate tests.

NOTE:-

- Always make the connections this way round. Reversing the polarity will give the same result but means that the instrument circuit is elevated to 240V above earth, — (this could result in interference affecting the readings).
6. When the connections have been made the 'P-E' neon light should illuminate and after approximately 4 seconds a loop test will be executed and the measured value displayed.
 7. If the 'P-E' neon light does not illuminate there is a disconnection of either the earth or phase. Testing the other two phases and establishing a

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reading for them indicates that the fault lies in the connection of the first phase. If the other phases similarly produce no illumination of the 'P-E' neon light then the problem is in the earth connection.

No test will be made unless the 'P-E' neon light illuminates.

8. To repeat a test simply disconnect and then reconnect one of the prods.

NOTE:-

Single phase equipment is tested in the same manner.

TESTING BONDED METALWORK (conduit) — see fig. 3.

Preparing for a Test

1. Obtain a convenient access to the supply phase connection in the circuit, somewhere adjacent to the bonding to be tested.
2. Connect the dual test lead socket into the recessed plug in the instrument.
3. Set the slider switch to the appropriate range.

Fig 3. Testing bonded metalwork

Earth Continuity and Phase-Earth Loop Impedance Test

4. Connect the black prod to the bonded metalwork to be tested.
5. Connect the red prod to the phase termination.
Caution: never touch the metalwork etc. when under test.

NOTE:-

Always make the connections this way round. Reversing the polarity will give the same result, but means that the instrument circuit is elevated to 240V above earth, — (this could result in interference affecting the readings).

6. When the connections have been made the 'P-E' neon light should illuminate and after approximately 4 seconds a loop test will be executed and the measured reading displayed.
7. If the 'P-E' neon light does not illuminate there is a disconnection in the earth circuit, bonding or possibly the phase connection.

No test will be made unless the 'P-E' neon light illuminates.

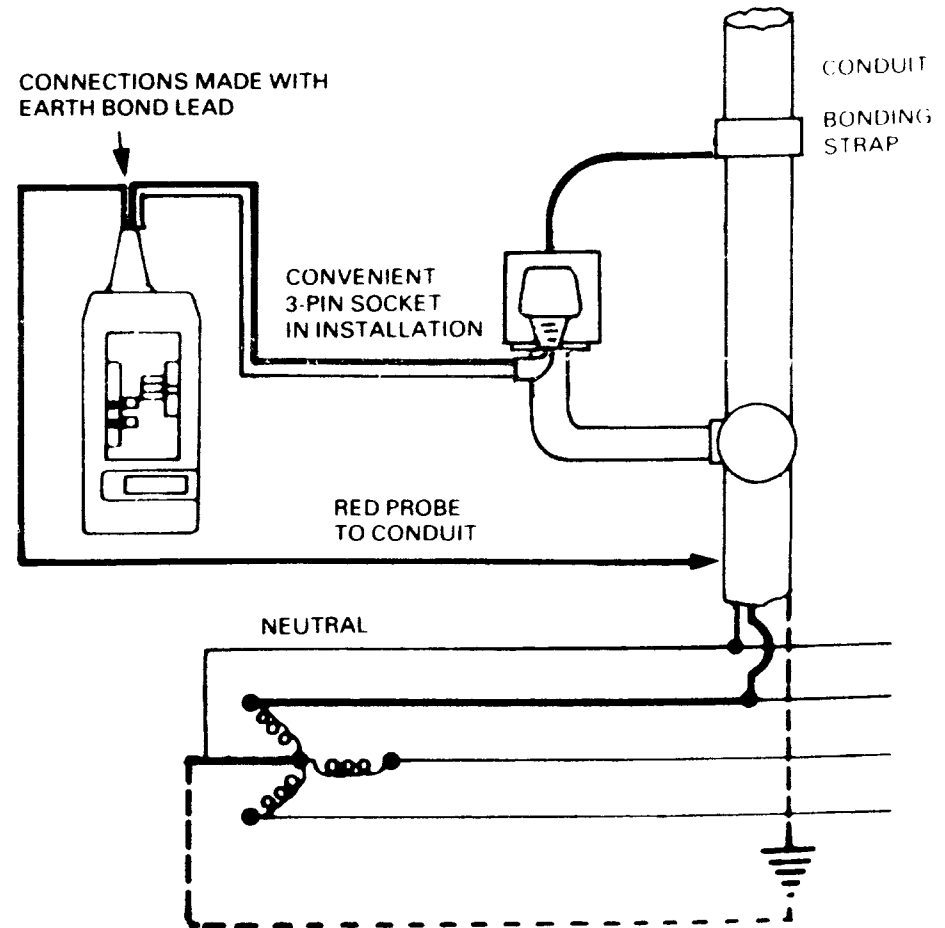


Fig. 4. Testing bonded metalwork

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8. To repeat a test simply disconnect and then re-connect one of the prods.

TESTING BONDED METALWORK (conduit) — Alternative Method Using the Safety Earth Bond Test Lead — see fig. 4.

Preparing for a Test

1. Locate a convenient 3-pin mains supply socket outlet, somewhere adjacent to the bonding to be tested.
2. Connect the safety earth bond lead socket into the recessed plug in the instrument.
3. Set the slider switch to the appropriate range.

Earth Continuity and Phase-Earth Loop Impedance Test

4. Connect the test lead 3-pin plug to the convenient mains supply socket outlet.

Warning: never touch prod tip when the 3-pin plug is connected to a mains supply.

5. Connect the red prod to the bonded metalwork to be tested.

Caution: never touch the metalwork etc. when under test.

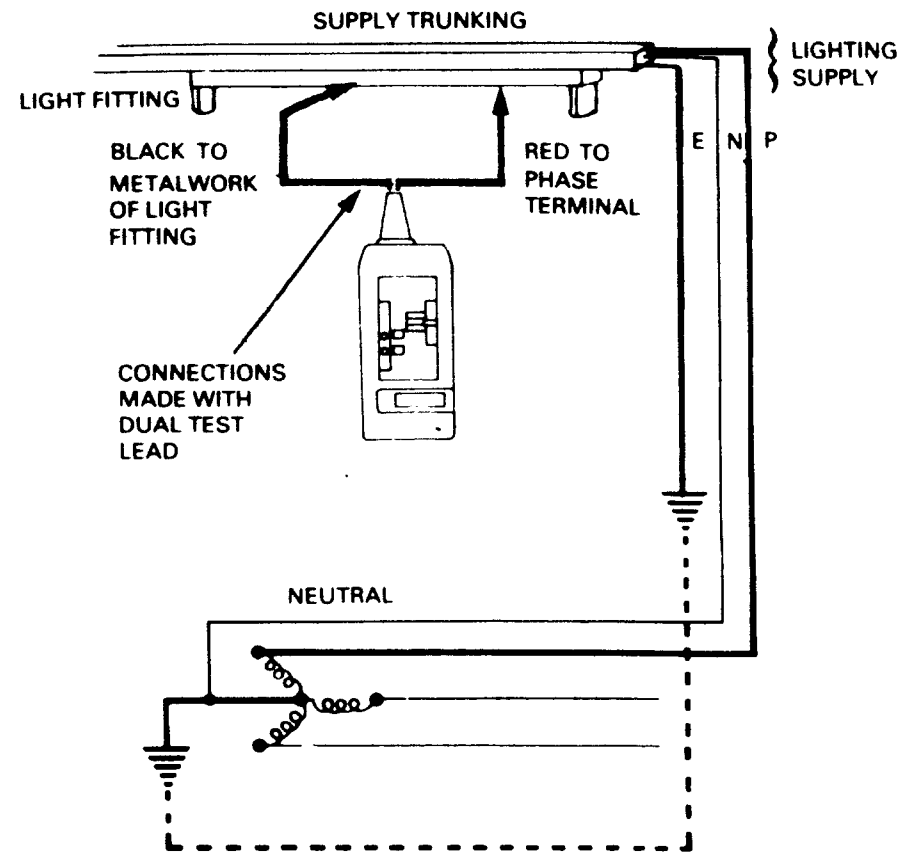


Fig. 5. Testing the earth connection of a light fitting.

6. When the connections have been made the 'P-N' and 'P-E' neon lights should illuminate and after approximately 4 seconds a loop test will be executed and the measured reading displayed.
7. If the 'P-E' neon light does not illuminate there is a disconnection in the earth circuit, bonding or possibly the phase connection. No test will be made unless the 'P-E' neon light illuminates.
8. To repeat a test simply disconnect and then reconnect the prod.

LIGHT FITTINGS (luminaire) LOOP IMPEDANCE TESTS — see fig. 5.

The test is performed in the same way as for testing bonded metalwork after access to the light fitting terminations has been obtained. The black lead is connected to the earth terminal and/or the fitting metalwork. The red lead is connected to the phase terminal.

Caution: never touch the light fitting when under test.

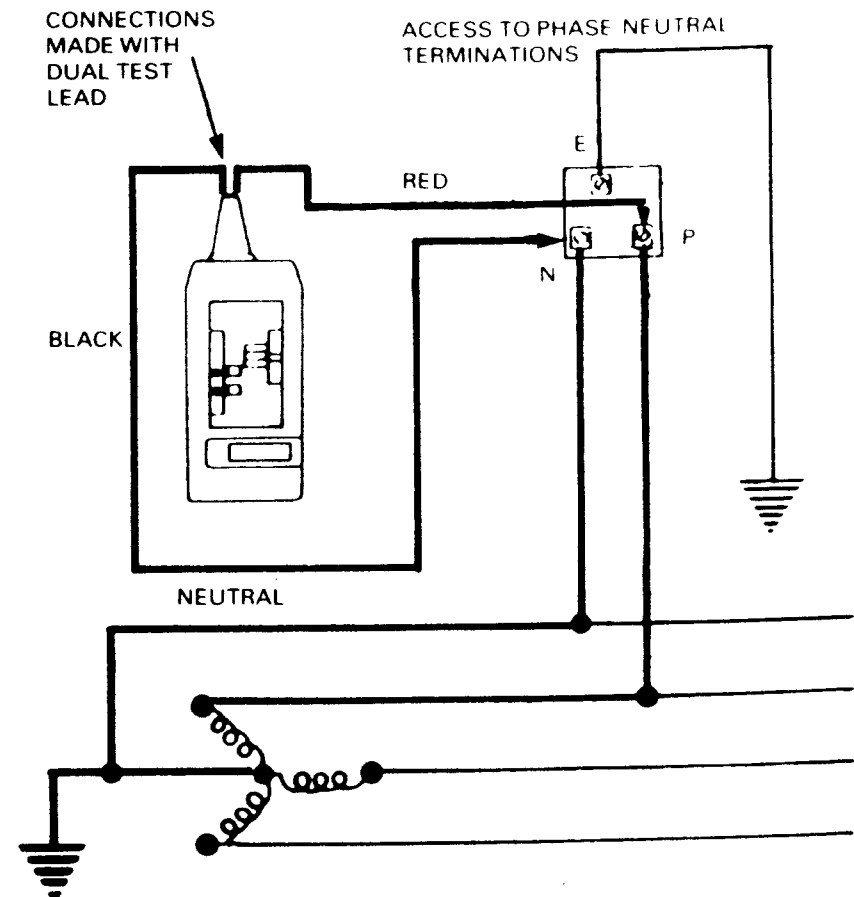


Fig. 6. Phase neutral loop testing

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PHASE—NEUTRAL LOOP TESTS — see fig. 6.

The tests are performed in a similar manner to the previous 3-phase, bonded metalwork and light fitting tests.

The black prod is connected to the neutral termination and the red prod to the phase termination. A test is made in the same way as before and the result obtained is the phase to neutral loop impedance.

NOTE:

When the connections are made to the circuit the 'P-E' neon light illuminates not the 'P-N' one as might be expected. If the light does not illuminate the cause should be investigated

Phase to neutral tests may be performed at any point in an installation circuit — at outlet sockets, distribution boards or at the terminals of equipment.

VERIFICATION OF PROSPECTIVE SHORT CIRCUIT CURRENT ESTIMATION

It is a requirement of the 16th Edition IEE Wiring Regulations that the prospective short circuit current should be determined (Regulations 313-01 and 434-02 - see page 54). This is the current which would flow under a fault condition of negligible impedance. The

value of this short circuit current is limited by the impedance of the phase—neutral circuit up to the point of the fault and includes both cables and supply transformer etc.

The Regulations require the knowledge of the prospective short-circuit current for both new installations and extensions to existing installations so that a suitable protection device may be provided. Perform a test in the same way as the previous phase—neutral test i.e. the black prod is connected to the neutral terminal or conductor of the installation under test and the red prod is connected to the phase terminal or conductor. Select the '20 Ω TN' range.

NOTE:-

When this has been done, the 'P-E' lamp will illuminate not the 'P-N'.

When the reading has been obtained, use the table (fig. 8) or graph (fig. 7) to obtain the prospective short circuit current.

The graph is reproduced on the instruction label at the back of the instrument.

The table and graph are based on Supply Authority and Electricity Council recommendations E.R. P25 for

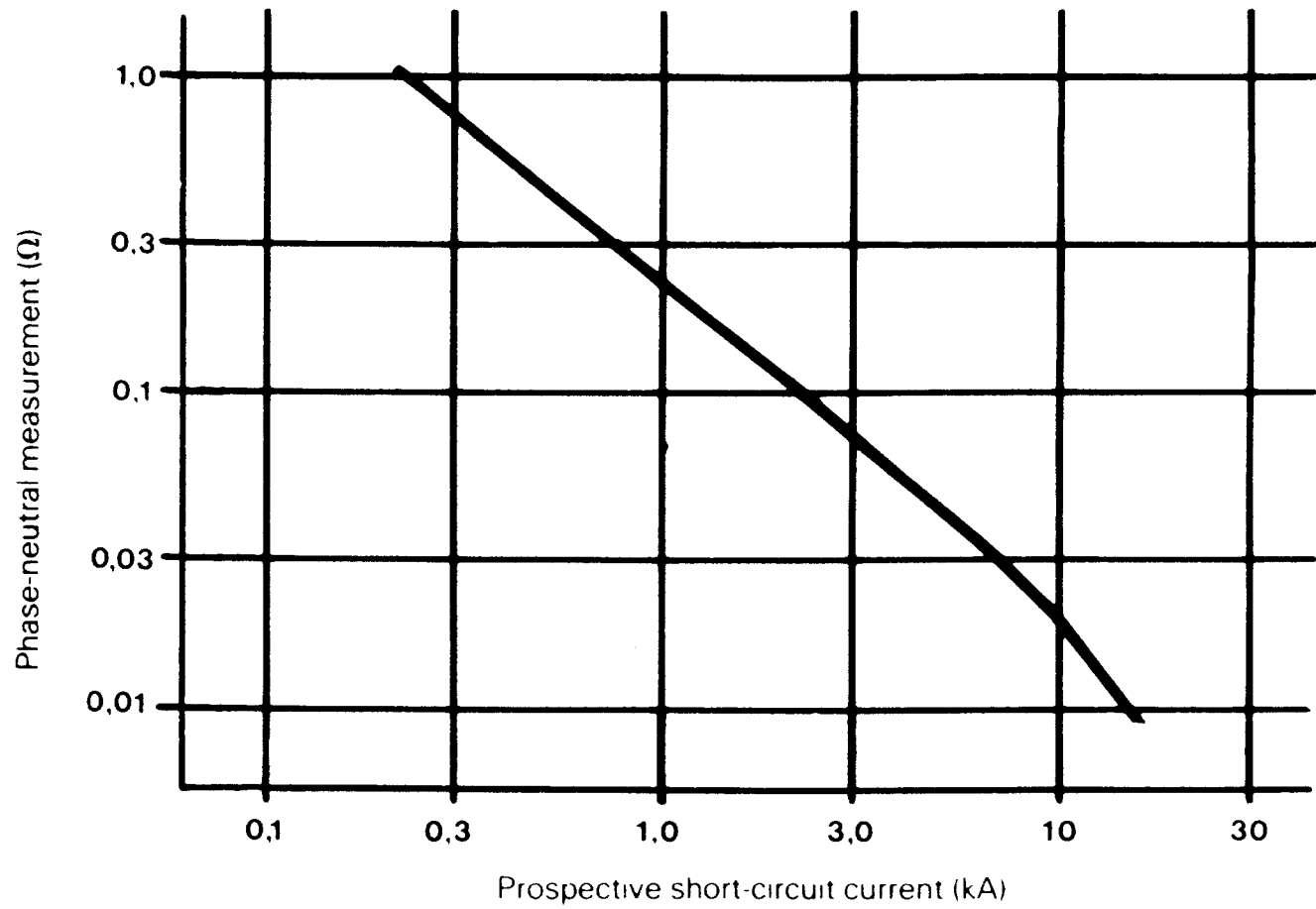


Fig. 7. Graph for determining prospective short-circuit current

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phase—neutral measurements (Ω)	prospective short-circuit current at 240 V a.c. supply (kA)
0,01	14,9
0,02	10,1
0,03	7,3
0,04	5,7
0,05	4,6
0,06	3,9
0,07	3,4
0,08	2,9
0,09	2,6
0,1	2,4
0,2	1,2
0,3	0,80
0,4	0,60
0,5	0,48
0,6	0,40
0,7	0,34
0,8	0,30
0,9	0,27
1,0	0,24

Fig. 8. Table of prospective short-circuit current values against instrument readings.

240 V a.c. single phase installations up to 100 A assuming 16 kA at the point of connection of the distributing main and the service line, (25 mm² copper service cable or 35 mm² aluminium service cable).

It must be remembered that the prospective short-circuit current may be subject to change because of alterations in the supply conditions, e.g. when the supplying sub-station is nearer or farther away from the installation or when the sub-station capacity is increased.

When very low values of phase to neutral impedance are obtained, an average of three or four readings should be taken.

REPLACING THE FUSES

The fuse fitted into the test lead three pin plug is changed in the normal way. This fuse is a 13 A ceramic fuse 25 x 6 mm (to BS 1362).

The internal 7 A ceramic 32 x 6 mm fuse is fitted in the compartment under the cover on the rear of the case. It is a 440 V high breaking capacity type. It should never be replaced by one of lower specification. (A spare fuse is provided in the fuse compartment).

The internal 2,5 A (T) 8 mm x 8,5 mm fuse to IEC 127-3 sheet IV is fitted adjacent to (and in series with) the 7 A fuse. It must only be replaced by one of the same type.

If a fuse ruptures then carefully carry out the following procedure:—

Disconnect the instrument from any external circuit, turn it on to its face and remove the fuse cover by releasing the screw in the centre and lifting off. Remove the ruptured fuse from its clips, replace with a new one and refit and secure the cover.

Set the instrument to its 20 Ω range first and then attempt a measurement by connecting to a known, good socket outlet. **Do not** select the 200 Ω range (2000 Ω range, LT6). If the instrument fails to perform correctly with the replacement fuse fitted, then this indicates the presence of a fault internally. The instrument should be returned to the manufacturer or his agent for repair, (see page 56).

A similar 7 A fuse is fitted into the red prod on the safety dual test lead and safety earth bond test lead. To gain access to the fuse simply unscrew the barrel of the prod at the centre, taking care not to lose the internal spring.

EARTH FAULT LOOP IMPEDANCE TESTING

IEE WIRING REGULATIONS

Extract from the British IEE Regulations for Electrical Installations in Building (16th Edition), where they appertain to Earth Fault Loop Impedance testing and determination of prospective short circuit current for which the LT5 or LT6 is suitable, are given below. (For full information reference to the current edition of the regulations should be made).

713-10 Earth fault loop impedance

713-10-01 Where protective measures are used which require a knowledge of earth fault loop impedance, the relevant impedances shall be measured, or determined by an alternative method. Where the alternative method described in Regulation 413-02-11 (see Table 41C) is used, the impedance of the protective conductor of the circuit concerned shall also be measured.

413-02 Protection by earthed equipotential bonding and automatic disconnection of supply

General 413-02-04 The characteristics of the protective devices for automatic disconnection, the earthing arrangements for the installation and the

relevant impedances of the circuits concerned shall be co-ordinated so that during an earth fault the voltages between simultaneously accessible exposed and extraneous conductive parts occurring anywhere in the installation shall be of such magnitude and duration as not to cause danger.

413-02-08 Regulation 413-02-04 is considered to be satisfied if the characteristic of each protective device and the earth fault loop impedance of each circuit protected by it are such that automatic disconnection of the supply will occur within a specified time when a fault of negligible impedance occurs between a phase conductor and a protective conductor or an exposed-conductive-part anywhere in the installation. This requirement is met where the following condition is fulfilled:

$$Z_s \leq \frac{U_0}{I_a}$$

Where:

Z_s is the earth fault loop impedance.

I_a is the current causing the automatic operation of the disconnecting device within the time stated in

Table 41A as a function of the nominal voltage U_o or, under the conditions stated in Regulations 413-02-12 and 413-02-13, within a time not exceeding 5s.

U_o is the nominal voltage to Earth.

TABLE 41A
Maximum disconnection times for TN Systems
(See Regulation 413-02-09)

U_o (volts)	t (seconds)
120	0.8
220 to 277	0.4
400	0.2
greater than 400	0.1

413-02-09 The maximum disconnection times of Table 41A shall apply to a circuit supplying socket-outlets and to other final circuits which supply portable equipment intended for manual movement during use, or hand-held Class I equipment.

This requirement does not apply to a final circuit supplying an item of stationary equipment

connected by means of a plug and socket-outlet where precautions are taken to prevent the use of the socket-outlet for supplying hand-held equipment, nor to the reduced low-voltage circuits described in Regulation 471-15.

413-02-10 Where a fuse is used to satisfy the requirements of Regulation 413-02-09, maximum values of earth fault loop impedance (Z_s) corresponding to a disconnection time of 0.4s are stated in Table 41B1 for a nominal voltage to Earth (U_o) of 240 V. For types and rated currents of general purpose (gG) fuses other than those mentioned in Table 41B1, and for motor circuit fused (gM), reference should be made to the appropriate British Standard, to determine the value of I_a for compliance with Regulation 413-02-08.

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TABLE 41B1

Maximum earth fault loop impedance (Z_s) for fuses, for 0,4s disconnection time with U_0 240 V (see Regulation 413-02-10)

(a) General purpose (gG) fuses to BS 88 Parts 2 and 6

Rating (amperes)	6	10	16	20	25	32	40	50
Z_s (ohms)	8,89	5,33	2,82	1,85	1,50	1,09	0,86	0,63

(b) Fuses to BS 1361

Rating (amperes)	5	15	20	30	45
Z_s (ohms)	10,9	3,43	1,78	1,20	0,60

(c) Fuses to BS 3036

Rating (amperes)	5	15	20	30	45
Z_s (ohms)	10,0	2,67	1,85	1,14	0,62

(d) Fuses to BS 1362

Rating (amperes)	13
Z_s (ohms)	2,53

413-02-11 Where a circuit-breaker is used to satisfy the requirements of Regulation 413-02-09, the maximum value of earth fault loop impedance (Z_s) shall be determined by the formula of Regulation 413-02-08. Alternatively, for a nominal voltage to earth of 240 V and a disconnection time of 0,4s, the values specified in Table 41B2 for the types and ratings of circuit-breaker listed may be used instead of calculation.

TABLE 41B2

Maximum earth fault loop impedance (Z_s) for miniature circuit-breakers, for disconnection times of both 0,4s with U_0 240 V (see Regulation 413-02-11) and 5s (see Regulations 413-02-12 and 413-02-14)

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(e) Type 1 miniature circuit-breakers to BS 3871

Rating (amperes)	5	6	10	15	16	20	30	32
Z_s (ohms)	12	10	6	4	3,75	3	2	1,88

Rating (amperes)	40	45	50	63	I_n
Z_s (ohms)	1,5	1,33	1,2	0,95	$60/I_n$

(f) Type 2 miniature circuit-breakers to BS 3871

Rating (amperes)	5	6	10	15	16	20	30	32
Z_s (ohms)	6,86		3,43		2,14		1,14	
		5,71		2,29		1,71		1,07

Rating (amperes)	40	45	50	63	I_n
Z_s (ohms)	0,86		0,69		$240/(7 I_n)$
		0,76		0,54	

(g) Type B miniature circuit-breakers to BS 3871

Rating (amperes)	6	10	16	20	32	40	45	50
Z_s (ohms)	8,0	4,80	3,0	2,40	1,50	1,20	1,07	0,96

Rating (amperes)	63	I_n
Z_s (ohms)	$0,7648/I_n$	

(h) Type 3 and Type C miniature circuit-breakers to BS 3871

Rating (amperes)	5	6	10	15	16	20	30	32
Z_s (ohms)	4,80		2,40		1,50		0,80	
		4,00		1,60		1,20		0,75

Rating (amperes)	40	45	50	63	I_n
Z_s (ohms)	0,60		0,48		$24/I_n$
		0,53		0,38	

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313 NATURE OF SUPPLY

313-01-01 The following characteristics of the supply or supplies, from whatever source, and where appropriate the normal range of those characteristics, shall be determined by calculation, measurement, enquiry or inspection:

- (i) the nominal voltage(s).
- (ii) the nature of the current and frequency.
- (iii) the prospective short-circuit current at the origin of the installation.
- (iv) the earth fault loop impedance of that part of the system external to the installation (Z_e).
- (v) the suitability for the requirements of the installation, including the maximum demand.
- (vi) the type and rating of the overcurrent protective device acting at the origin of the installation.

434-02 Determination of prospective fault current

434-02-01 The prospective fault current, under both short-circuit and earth fault conditions, at every relevant point of the complete installation shall be

determined. This shall be done by either calculation or measurement.

ACCESSORIES

SUPPLIED WITH THE INSTRUMENT

Mains supply lead fitted with 'Euro-socket' and three pin plug	part no. 6131-970
Operating instruction book	part no. 6171-089
Zip-up carry case	part no. 6420-078

AVAILABLE AS AN OPTIONAL EXTRA

Safety dual test lead with 'Euro-socket' and fused prod	part no. 6280-294
Safety earth bond test lead with fused prod	part no. 6220-344
Test-and-carry case	part no. 6420-040
GS38 Red probe	part no. 8100-754
Crocodile clip, red, for use with safety dual test lead	part no. 8100-870
Crocodile clip, black, for use with safety dual test lead	part no. 8100-871

INSTRUMENT REPAIRS AND SPARE PARTS

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

AVO MEGGER INSTRUMENTS LIMITED

Archcliffe Road,
Dover,
Kent CT17 9EN,
England.

Tel: Dover (0304) 202620

Fax: Dover (0304) 207342

Telex: 96283 Avomeg G

Approved Repair Companies

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

Overseas

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

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

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

**NEW INSTRUMENTS ARE GUARANTEED FOR
12 MONTHS FROM THE DATE OF PURCHASE BY
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