

Testing an electrical installation (Electricians)

Objective

To, detail the electrical tests that must be completed before electrical work can be connected to supply.

Method

If it is necessary to conduct a visual examination of the installation, then Visual Electrical Safety Inspections - BEMSPRAC022 Visual Electrical Safety Inspections will be used. Where the task requires testing, the relevant live form is to be selected from the \\BEMS Workshop\Electrical Safety directory. This completed document must then be provided to the CQ HHS QTP.

Examples of testing forms include:

- BEMSF006 BEMS Emergency Generator Test Sheet
- BEMSF045 BEMS Test and Tag Sheet
- BEMSF046 BEMS Residual Current Devices (RCD)
- BEMSF065 BEMS High Voltage Fuel Use
- BEMSF067 BEMS Body Protection Area Inspection Sheet 2011
- BEMSF069 BEMS Electrical Test Sheet
- BEMSF077 BEMS Body Protection Area Inspection Sheet 2018
- BEMSF078 BEMS Body Protection Area Inspection Sheet 2003
- BEMSF079 BEMS High Voltage Generator Sheet
- BEMSF080 BEMS Body Protection Area Inspection Sheet Results 2003
- BEMSF083 BEMS Cardiac Protection Area Inspection Sheet 2011
- BEMSF084 BEMS Cardiac Protection Area Inspection Sheet 2018
- BEMSF085 BEMS Cardiac Protection Area Inspection Sheet 1985
- BEMSF086 BEMS Cardiac Protection Area Inspection Sheet 1999

This testing practice is derived from AS/NZS 3000, AS/NZS 3003 and AS/NZS 3017. It has been arranged so that testing and checking may be carried out in a logical and orderly manner. However, it is acceptable to vary the written practice providing the same results are achieved, the intent of the practice is satisfied, and the installation is electrically safe. The inspection process should be "results orientated" and not necessarily procedural orientated.

Testing practices

This testing practice can be used for the testing of new installations or for a full electrical test on an existing installation.

Advise the client that it is necessary to disconnect the electricity supply for a short period of time. Ensure testing equipment is currently in-test and that tools are in good condition.

Note the position of protective devices as to whether any were isolated. Leave installation in condition as it was found.

If supply is connected isolate supply at the service fuse. Disconnect any earth bond to the neutral on an aerial supply.

Visual

If the installation is new, a visual check of the installation shall be made to ensure that the work is complete and that all cables are terminated. Follow BEMSPRAC009 Visual Electrical Safety Inspections, where applicable.

Earthing continuity

A bonding or equipotential conductor is to ensure all metal is at the same potential. An earthing conductor carries any return or fault current.

- Isolate supply and remove the main earthing conductor and the main neutral conductor, from the earth and neutral links respectively. Where practicable, disconnect any earth bond conductor (e.g. water heater earth).
- test continuity of the main earthing conductor between the electrode adjacent to the main earth connection, and the disconnected main earthing conductor. Maximum resistance 0.5 Ω.

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- Test continuity between the main earthing conductor at the switchboard and any portion of metallic water piping required to be bonded i.e. any copper water pipe leaving the ground and entering the building. Maximum resistance 0.5 Ω .
- Test continuity between the main earth link at the switchboard and all accessories and permanently connected appliances that are required to be earthed, e.g. HWS, socket outlets, lights, motors, range etc. Maximum resistance shall be low enough to permit the passage of current necessary to operate the circuit protective device in the required time (refer Table 8.2 of AS/NZS 3000).

Note: For ranges/stoves earth continuity tests shall be to the stove general frame as well as individual earth continuity tests to each hot plate and element.

- Reconnect any earth bonds that were disconnected.

Note: If insulation resistance tests are carried out before continuity tests a defective continuity test may require a further insulation resistance test of the circuit affected.

Insulation resistance

- Test insulation resistance between the main earthing conductor at the switchboard and each conductor of the consumers mains including the disconnected neutral conductor.
- Disconnect the MEN link and test insulation resistance between the main earth link at the switchboard and the neutral link, and terminals of the main switch(es).

Note: Minimum insulation resistance for the general installation is 1 M Ω and for appliances incorporating metal sheathed heating elements it is 10,000 Ω .

Note: Surge protective devices or electronic equipment shall be disconnected or switched off before carrying out the insulation resistance test or the test voltage may be reduced to 250 V.

Note: Where equipment, such as an RCD with a Functional Earth (FE) connection, is likely to influence the test then the FE connection shall be disconnected before carrying out the insulation resistance test.

Note: Where circuits with low insulation resistance incorporate appliances, the appliances are to be disconnected where practical and the test repeated on the circuit to establish whether the equipment or the circuit has the low insulation resistance.

- Test insulation resistance between any conductive parts of low pitched roofs or roofs associated with cathedral ceilings and the main neutral link and the terminals of the main switch(es). Minimum insulation resistance 1 M Ω .

Polarity testing of mains

- Turn OFF the main switch(es) and any circuit breakers or remove all fuse carriers. Confirm that bonding conductor to a service support is not connected and that main neutral is still disconnected from link.
- Reconnect supply.
- Test between the main neutral conductor and the line terminal(s) of the main switch(es) and on a multiphase installation, between phases. The test lamps should light, proving that the test lamps are in order and that the required supply is available.
- Test between the main neutral conductor and an independent earth electrode. The test lamps should not light.
- Test between an independent earth electrode and the line terminal(s) of main switch(es). The test lamps should light.

Note: Failure of the test lamps to light during this test indicates that the resistance between the independent electrode and the general mass of earth is too high. The last two tests must be repeated using an approved instrument (voltmeter) in lieu of test lamps.

- Test between the main neutral conductor and both line and load side of all circuit protective devices. The test lamps should not light, proving there is no supply at the circuit protective devices with the main switch(es) in the "OFF" position.
- Reinstall the main neutral conductor and main earthing conductor into the neutral link, and any service bonding conductor that was removed.

Note: Replacement of the main earth and neutral into the neutral link at this time minimises the possibility of a potential rise on the earthing system during tests. A rise in potential may cause others on site to receive a shock should they come in contact with exposed earthed parts.

Note: A similar polarity test sequence is required for sub-mains.

- Turn the main switch ON.

Correct circuit connections

- Test between the main neutral conductor and the line side of all circuit protective devices (CPDs). (Proves supply at CPDs).
- Energise one CPD at a time and test between the main neutral conductor and the load side of all circuit breakers. Test lamps should only light for the energised CPD proving there is no interconnection of active conductors.
- Energise one CPD at a time and test between the load side of the CPD and all neutrals on the load side of all CPD/RCD's. Test lamps should only light for the neutral on the energised CPD/RCD proving there is no interconnection of the neutral conductors.

Earth fault-loop impedance testing

- Carry out earth fault-loop impedance testing of each socket-outlet circuit not protected by an RCD. Testing shall be carried out at the socket-outlet which is the most distant point on the circuit and the results shall not exceed the values given in AS/NZS 3000 Clause 8.3.9 utilising either of the test methods documented.

Testing and checking of circuits (including RCD testing)

Water heater

- Energise circuit.
- Check that the control switch, over temperature cut-out and thermostat are connected in the active conductor.
- Check that the neutral conductor corresponds with the active conductor and that there is no interconnection with other circuits.
- Check access is available for component replacement and maintenance.
- Check circuit loading and that the current carrying capacities of the cable, control switch and protection device has not been exceeded and the switchboard is correctly marked. For water heaters with off peak and booster elements that have a common neutral, a double pole control switch or double pole circuit breaker is required.

Range / cooking appliance

- Ensure that any isolating switch and all range element control switches are in the "OFF" position.
- Note kW rating of range, and check that the current carrying capacity of all cables and equipment forming part of the final sub-circuit for the range has not been exceeded.
- Connect supply and prove that any isolating switch is connected in the active conductor and effectively isolates supply. If fuses are incorporated in the range prove they are connected in the active conductor.
- Check that the neutral conductor corresponds with the active and that there is no interconnection with other circuits.

Power circuits

- Energise and test one circuit at a time, checking each outlet individually for continuity, polarisation and polarity.

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- Energise the RCD(s) and test for accuracy with an RCD test instrument. The RCD(s) should trip between 50% and 100% of rated value (test trip time at both 0° and 180°).
- Energise all applicable circuits and press each RCD test button to ensure it is operational.
- Check cable rating, RCD current and trip rating, fuse element or circuit breaker size and switchboard marking.

Lighting circuits

- Energise each lighting circuit separately. Check that each light works.
- Test light switches for correct polarity.
- Energise any RCD(s) and test for accuracy with an RCD test instrument. The RCD(s) should trip between 50% and 100% of rated value (test trip time at both 0° and 180°).
- Energise all applicable circuits and press each RCD test button to ensure it is operational.
- Check cable rating, fuse element or circuit breaker size and switchboard marking.

Permanently connected appliances or equipment

- Energise each circuit separately.
- Energise any RCD(s) that may be associated with permanently connected appliances (eg. pool equipment) and test for accuracy with an RCD test instrument. The RCD(s) should trip between 50% and 100% of rated value (test trip time at both 0° and 180°).
- Energise all applicable circuits and press each RCD test button to ensure it is operational.
- Check cable rating, fuse element or circuit breaker size and switchboard marking.

General

- Using total loading obtained from previous tests, calculate the maximum demand and check that the rating of the consumers mains and main switch(es) are suitable.
- Measure voltage at the extremity of any power circuit to ensure it is satisfactory and is greater than 215 V. If voltage is less than this figure recommend to the client that they request the electricity Distribution Entity to conduct a voltage check at their terminals.
- Check marking and rating of main switch(es) is correct and refit neutral link cover where required.
- Test with the whole of the installation energised, including lighting points switched **ON**, that any exposed conductive parts are not live.

Before leaving the site check that the switchboard is in the same condition as it was found. Ensure any fridge, freezer or hot water system is energised and stove elements and oven are off.

Note: Recheck the M.E.N Connections.

For new connections of electrical supply, mark the date of initial energising of the electrical installation on the inside of the main switchboard.

Referenced practices:

- BEMSPRAC003 Before Use Inspection of Electrical Test Equipment
- BEMSPRAC007 Risk Assessment Testing and Fault Finding
- BEMSPRAC009 Visual Electrical Safety Inspections
- BEMSPRAC013 Safety Precautions when Extracting-Reinstating Service Fuses