



Section 5.

Appendices.

“Information contained within this section shall be read in conjunction with all sections of this Installation Supply Connection Tests & Procedures manual”


5.1 Contents

Section 5	Appendices	Pages	Issue
5.1	Contents	1	2- Mar 2009
5.2	Neutral & Supply Tester - Faults chart	7	1- July 2004
5.3	Unavailable Independent Earth – Multiple Occupancy Installation	1	2- Mar 2009
5.4	Alternate Supplies	1	1-Jun 2006

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5.2 NEUTRAL & SUPPLY TESTER – FAULT INVESTIGATION GUIDE

Purpose This fault investigation guide is to assist in rectification of faults discovered during the performance of connection testing procedures. Depending upon methods of testing and other distribution factors the Neutral & Supply Tester does not always identify all neutral faults. Therefore this guide is not designed for, nor should be used for circumstances where a fault has been reported to the Distribution Business.

General Information Given the variables in different connection procedures and supply arrangements, this guide is in the format of flow charts with Handy Hints indicated by the symbol  and number to be referenced at the bottom of each chart.

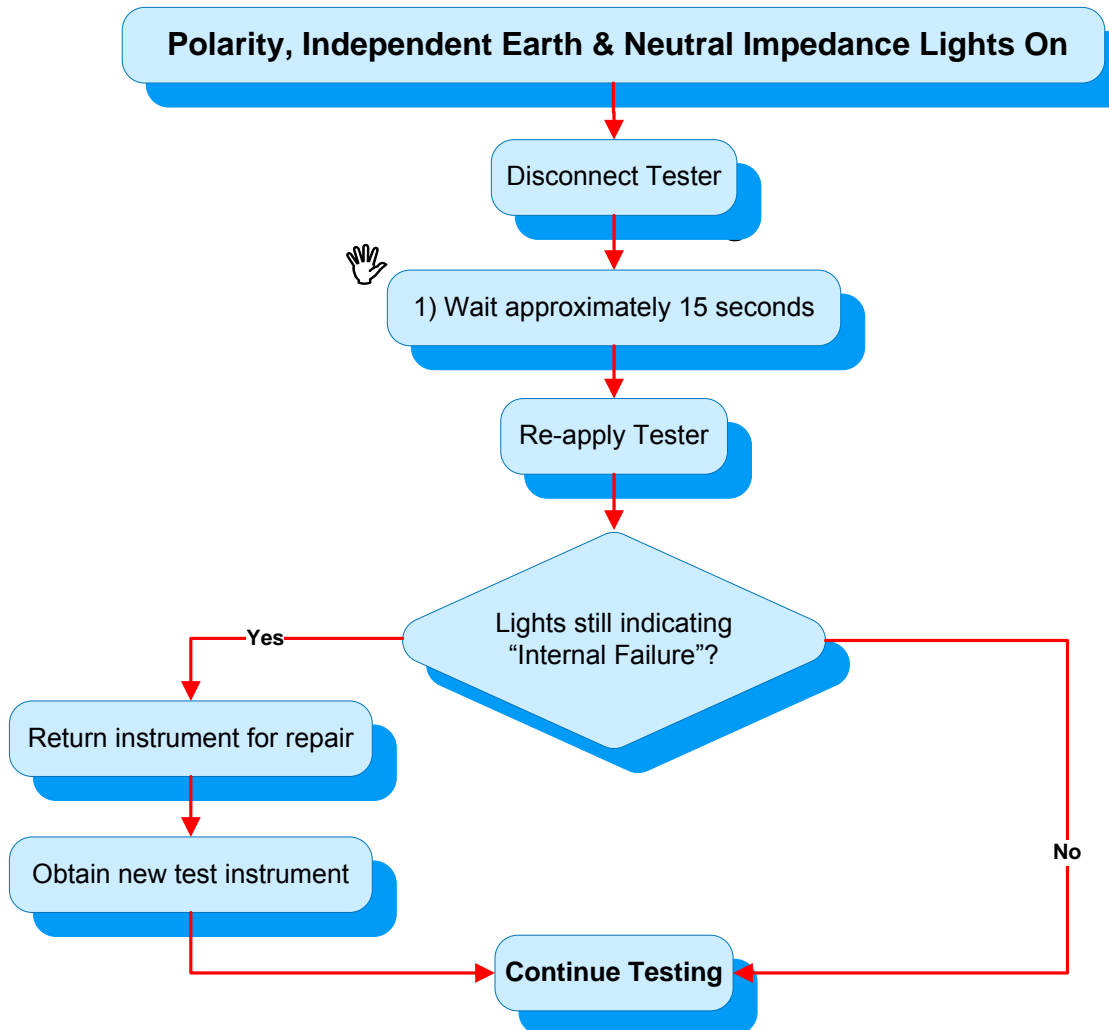
Test Step	Test Function	Power Green	Ready/ Pass (Green)	Ind. Earth (Red)	Polarity (Red)	Neutral Imp (Red).	ALARM	COMMENT
Self Check 1	Supply volts > 150V	OFF	OFF	OFF	OFF	OFF	OFF	No supply or instrument failure
		DIM	OFF	OFF	OFF	OFF	OFF	Voltage < 150V
		ON	OFF	OFF	OFF	OFF	OFF	Acceptable result, next test
Self Check 2	Instrument internal operation check	ON	OFF	Flashing	Flashing	Flashing	YES	Internal failure of tester
			OFF	OFF	OFF	OFF	NO	Acceptable result, next test
Live Test 1	Active to neutral voltage is within acceptable tester operation range of 205v – 264v (+ - 5%)	ON	Dim & flashing quickly	OFF	OFF	OFF	NO	Neutral connection made to isolated length of conductor – e.g. Floating neutral
			OFF	OFF	ON	OFF	YES	Voltage outside acceptable range
			OFF	OFF	OFF	OFF	NO	Acceptable result, next test
Live Test 2	Neutral to earth volts < Active to earth volts	ON	OFF	Flashing	Flashing	OFF	YES	Neutral to earth > Active to earth Probable reverse polarity
			OFF	OFF	OFF	OFF	NO	Acceptable result, next test
Live Test 3	Neutral to earth volts < 5v (+- 5%)	ON	OFF	ON	OFF	OFF	YES	Voltage of test neutral > than 5V
			OFF	OFF	OFF	OFF	NO	Acceptable result, next test
Live Test 4	Neutral to Earth Impedance < 10 kΩ	ON	OFF	ON	OFF	OFF	YES	Independent earth impedance > 10kΩ
			OFF	OFF	OFF	OFF	NO	Acceptable result, next test
Safe to Proceed	All the above tests pass	ON	Flashing	OFF	OFF	OFF	NO	Acceptable result, next test
Touch Pad (where fitted)	Active to Neutral Supply Impedance < 1Ω	ON	OFF	OFF	OFF	ON	YES	Active to Neutral impedance is > 1Ω
			ON	OFF	OFF	OFF	NO	Acceptable result – NST Pass

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Power Light On – Ready Pass Light Flashing Dim and Quickly

Indication that the neutral under test is not connected to a point of different potential e.g. (floating).

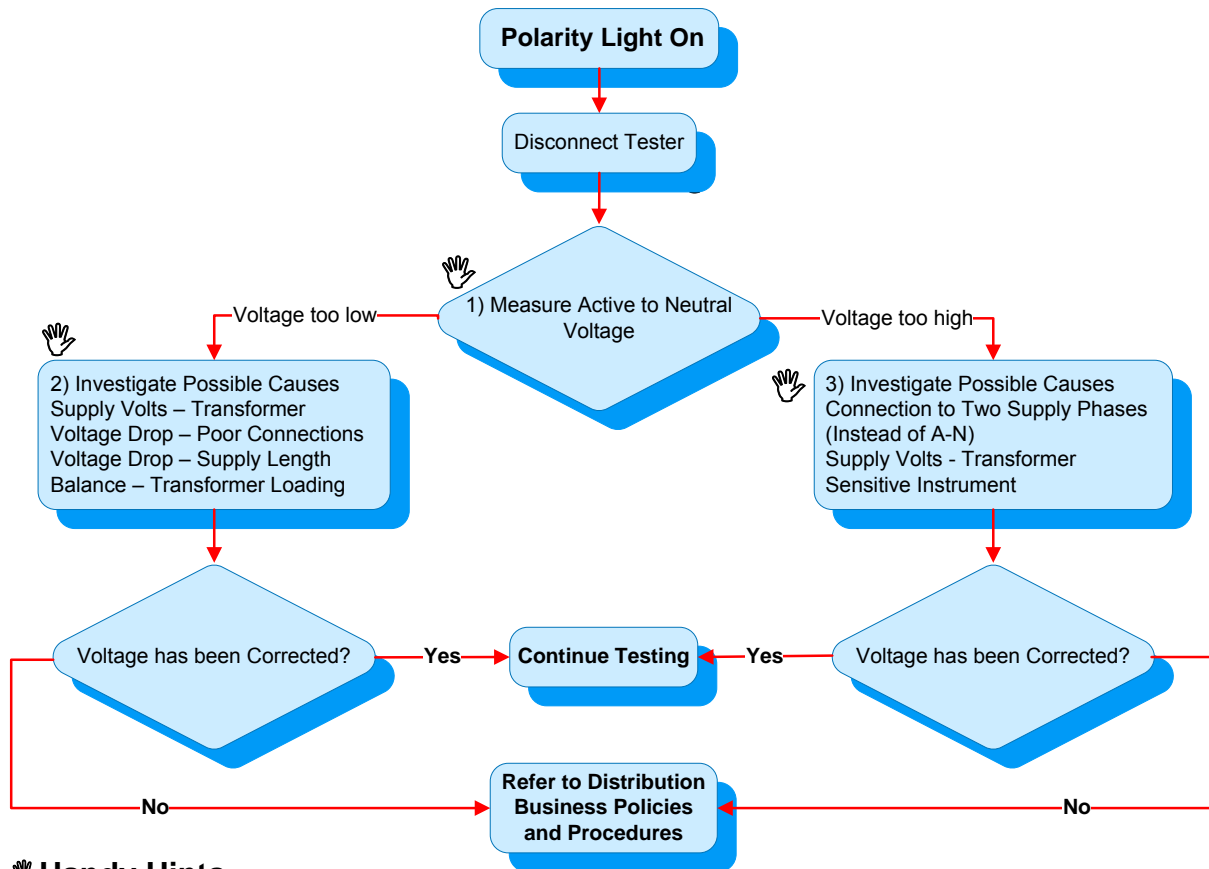
Note: Dependant upon other circuit factors this light may not activate in all circumstances, although the fault will be indicated through the activation of the polarity light (active to neutral supply voltage outside the acceptable test range), or other fault indication.



Handy Hints -

- 1) An intermittent contact made with the active test probe during the testing may disturb the instruments test sequence resulting in the indication of an internal failure on some testers. The re-application of the tester after waiting approximately 15 seconds may reset the tester for correct operation.

Should the tester still indicate an internal failure return the instrument for repair.



Handy Hints -

- 1) Utilising a voltmeter, gain an accurate measurement of the voltage of the supply phase under test.
- 2) In some circumstances correct voltage may be obtained by balancing load across phases. If this is not achievable, increasing the secondary voltage of the supply transformer may be an option, although the resultant increase in voltage to customers upstream towards the supply transformer must also be considered in these circumstances.

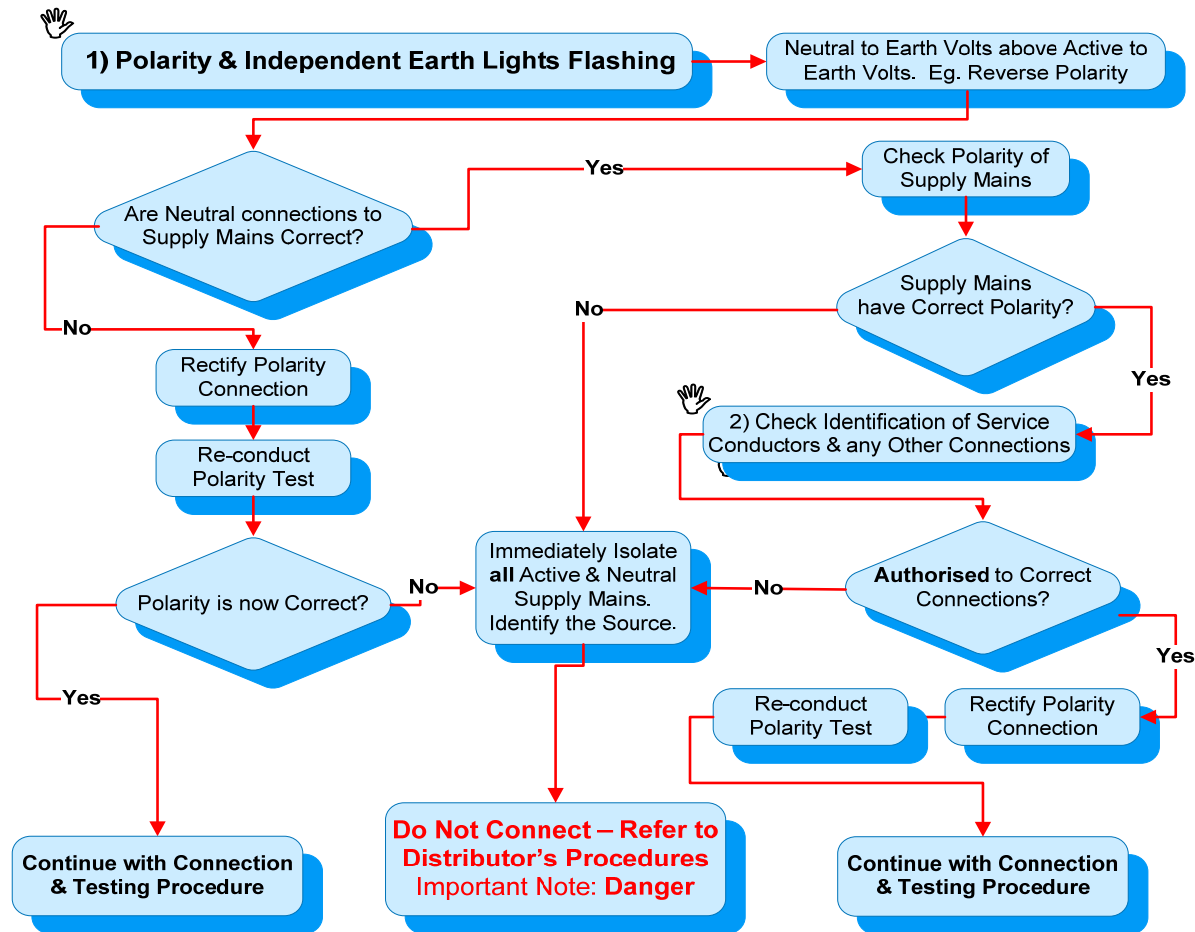
Where poor connections are suspected, testing across the connection with a voltmeter is a valuable method of identifying abnormalities.

If the supply volts are low as a result of insufficient cable size or excessive supply length and cannot be rectified, refer to the Distribution Business policies and procedures.

- 3) Some Neutral and Supply Testers may indicate a fault with voltages that are within the acceptable supply range e.g. 252. The application of another, less sensitive Neutral & Supply Tester may result in the correct testing results being obtained.

Where the supply voltage is high consider decreasing the secondary voltage on the supply transformer. Consideration must be given to the resultant effects on voltage to customers downstream in the supply system when exercising this option.

The **Power Light** activating immediately upon the neutral test lead being connected to the neutral under test, indicates the neutral under test is alive. **⚡ Danger -** The active test lead will immediately be alive in these circumstances.



Handy Hints –

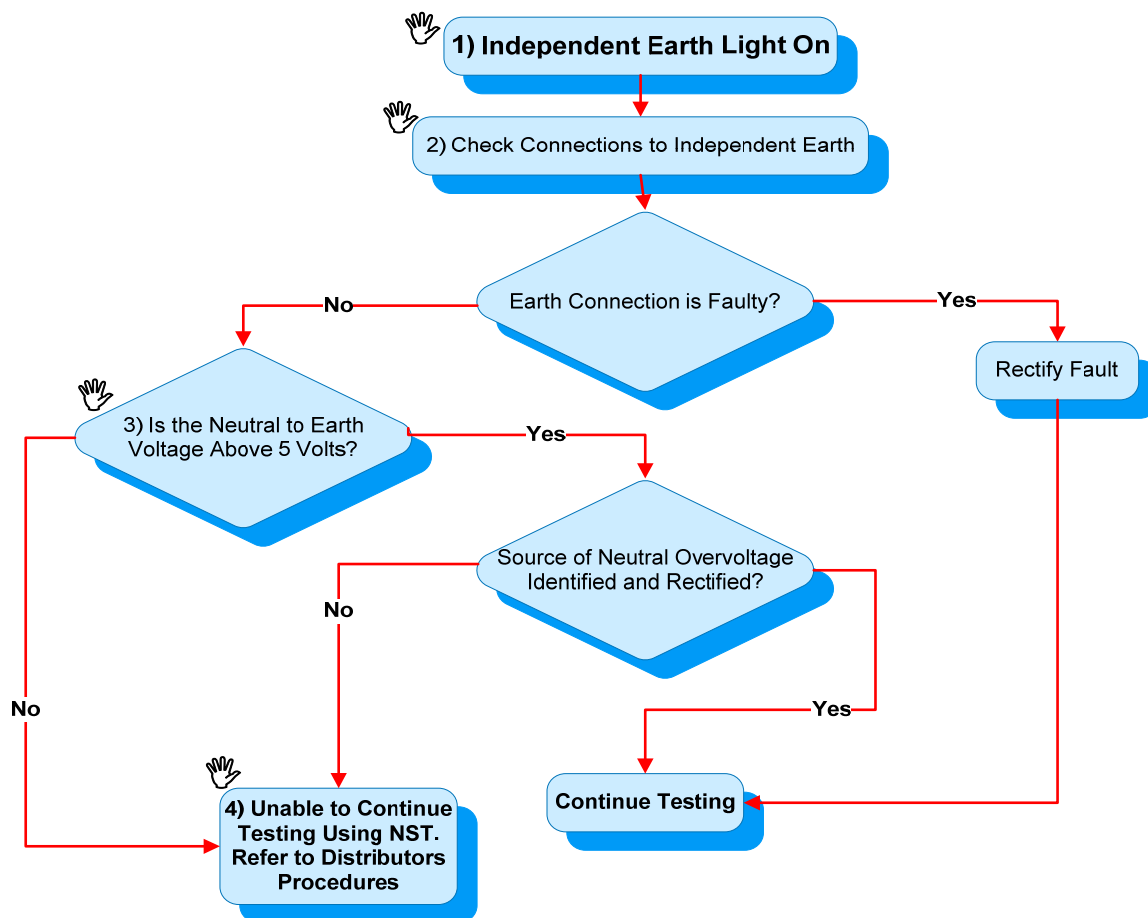
- 1) The **Power Light** activating immediately upon the neutral test lead being connected to the neutral under test, indicates the neutral under test is alive. **⚡ Danger** - The active test lead will immediately be alive in these circumstances.
- 2) Sources of incorrect polarity may include incorrect identification of conductors by persons not directly involved in the connection process e.g. Licensed Electrical Contractor. If the source of the reverse is unable to be identified, or the connector is not authorised to correct the source of reverse, isolate all active and neutral service conductors from the supply mains and refer to the Distribution Business policies and procedures.

Note: Work shall only be conducted by persons **authorised** to perform such work in accordance with Clause 11, Code of Practice on Electrical Safety (*Green Book*).

Important Note: ⚡ Danger

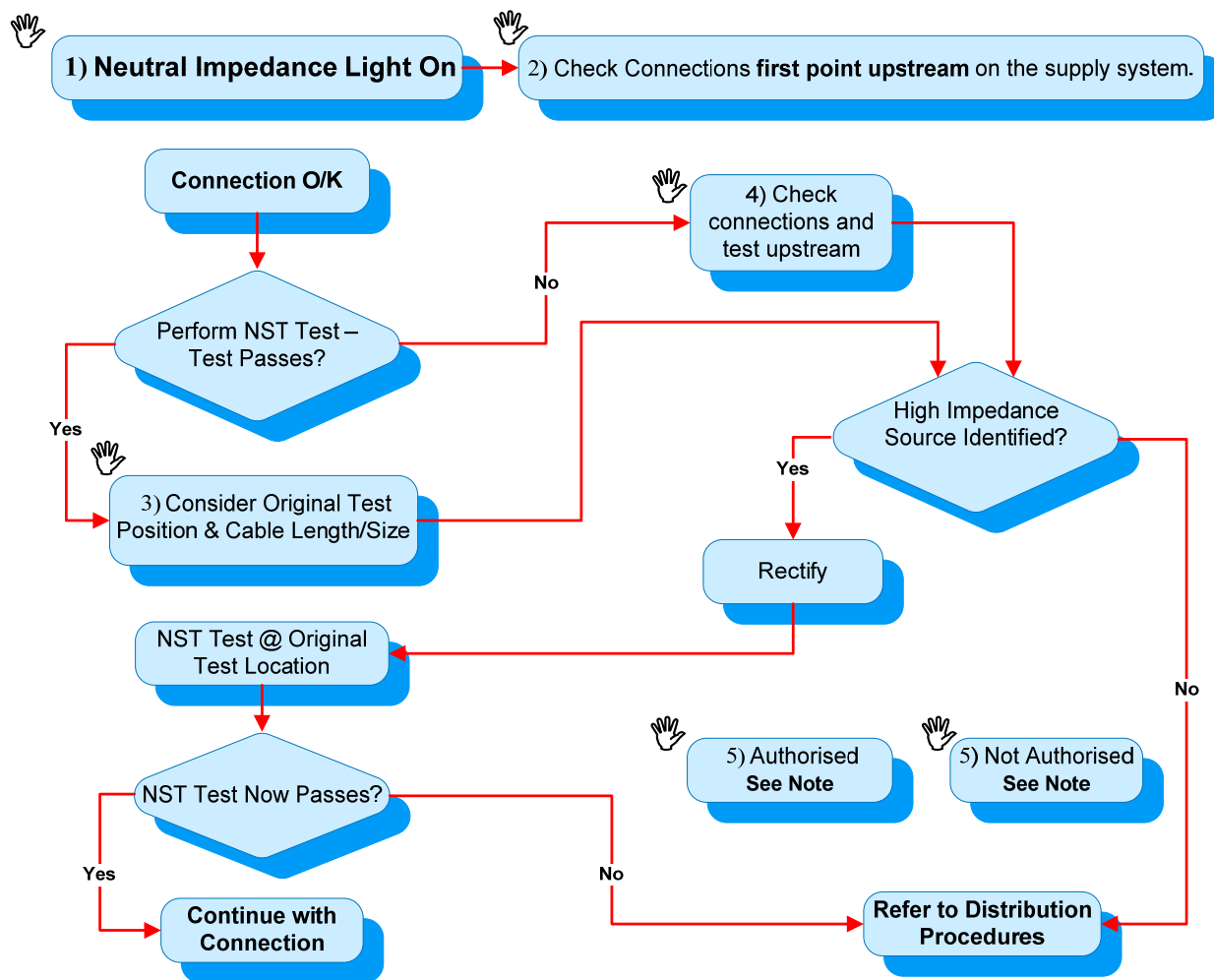
A reverse polarity will result in the earthing system of an electrical installation becoming alive.

In circumstances where the polarity of supply mains is reversed it is essential that the source is immediately identified. In addition to this, all installations connected to the supply network downstream of the source, shall have all active and neutral conductors isolated from the network and each installation prepared for polarity testing prior to the polarity of the supply mains being corrected. Upon re-energisation each installation shall be tested individually to ensure correct polarity and neutral impedance is obtained to all installations.



Handy Hints -

- 1) The activation of this light may indicate one of two testing faults being either, the connection of the independent earth is above 10kΩ to earth, or the voltage of the supply neutral is greater than 5 Volts.
- 2) The connection of the test instrument to earth is the most common cause of this fault. Check the continuity of the testing circuit to earth and that the independent earth is in a good body of soil and that the reel and connections are in good condition
- 3) Where voltage on the neutral conductor is suspected gain an accurate indication of voltage testing with a voltmeter to an independent earth.
Although not without weaknesses, greater than five volts on the supply neutral may often be the result of an existing high impedance neutral under load from other customers within the sub circuit. This may be due to insufficient cable size, excessive supply length or poor conductor connections. Where conductor connections are suspected, testing across either side of neutral connections with a voltmeter is a valuable method of identifying abnormalities.
In addition to this, the balance of load within the system will also have effects upon the neutral voltage although should not be looked at as the primary source unless the supply neutral conductor and connections are considered suitable.
- 4) In some installations voltage may be found on the neutral conductor through the harmonic effects of the electrical apparatus on the circuit. This is particularly common in large installations e.g. shopping centres and may not be capable of being rectified by the connector. In such circumstances refer to Distributors policies and procedures for guidance.



Handy Hints -

- 1) Ensure that the connections of the test instrument to the apparatus under test are electrically sound, as unsatisfactory connections will effect the testing results.
- 2) *The neutral impedance light activates when the supply Active to neutral impedance is greater than 1Ω . Therefore the impedance may be within the supply active, the supply neutral or a collective combination of both.*
- 3) *Consider the original test position in relation to the cable length and size. An increase as low as $.1\Omega$ may result in a test failure when there is existing impedance of 1Ω upstream.*
- 4) Although not without weaknesses, neutral impedance located on supply mains of a LV circuit would most likely be indicated with the Independent Earth Light (Neutral greater than 5 volts) activating on the Neutral & Supply Tester as a result of load from other customers. As this neutral voltage will depend upon distribution loading this handy hint has weaknesses but should be considered when investigating such faults.
- 5) Sources of high impedance may include connections or conductors that are not the responsibility of persons involved in the connection process e.g. Licensed Electrical Contractors.
Note: Work shall only be conducted by persons authorised to perform such work in accordance with Clause 11 Code of Practice on Electrical Safety (Green Book)

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5.3 Unavailable Independent Earth - Multiple Occupancy Installation

Electrical Testing and Connection Testing Procedures within Multiple Occupancy Installations often pose a dilemma to the connection worker due to a lack of suitable independent earth positions. This has been particularly relevant within multi story buildings and shopping centers.

During the connection process of multiple occupancy installations it is imperative that Polarity Testing and NST Testing of the supply conductors to the main switchboard are conducted using an independent earthing system.

Where occupancies are to be connected downstream of the main switchboard or Metering Alterations/Additions are to be conducted at multiple occupancy installations, an installations earthing system may be used in substitution for the independent earth if;

- a suitable independent earth position is not available; and
- the occupancy switchboard earthing system is directly connected to the main switchboard earthing system by means of an earth conductor; and
- the supply conductors to the main switchboard had been Polarity and NST tested using an independent earth in accordance with established procedures upon connection.

Note: For an existing installation already on supply, it is considered that the appropriate installation test have been carried out at the time of connection.

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5.4 Alternate Supplies

Introduction

Alternative supplies at electrical installations may take the form of either approved or non approved supply sources, and have potential to pose a serious electrical hazard to workers performing connection tasks.

Alternative supplies may include:

- Break before Make Alternative Supplies; (typically back up or emergency generation) Grid Connected Energy Systems via Inverters; (typically, solar photo voltaic cells, mini hydro generators, wind generators, etc).
- Portable generators
- Portable invertors
- Supplies from neighbouring properties and other such sources.

Non Approved Sources of Supply

Where non approved alternative supplies are identified the connection workers shall:

- Where authorised ensure the electrical installation is in a safe condition by either isolating or arranging the immediate isolation of the non approved supply to the installation.
- Immediately notify the relevant Distribution Network Operator.
- Discontinue further connection works on the installation until notified by the Distribution Network Operator.

Approved Alternative Sources of Supply

Installations fitted with Break before Make alternative supplies shall have a prominent label fixed on the main switchboard, including information on the sections of the electrical installation they supply and their point of control.

Installations fitted with Grid Connected Energy Systems may be identified by the following:

- The switchboard must be clearly and permanently labelled as having an inverter energy system connected to it. The circuit breaker, fuse or switch must also be clearly labelled: and
- A label indicating that an alternative power supply system is connected to the electrical installation shall be fitted at the FOLCB for an overhead electricity supply or at the consumer terminals and service fuse for underground supply.

Upon identification of an approved alternative supply the connection worker shall ensure the following actions are taken.

- Where Break before Make alternative supplies are installed the worker shall ensure the isolation of the alternative supply from the Distribution System by visually checking the isolation point and where appropriate locking of devices.
- Where Grid Connected Energy Systems are installed the isolation switch connecting the alternative supply to the grid shall be turned to, and locked in, the open/off position: and
- All apparatus deemed to be de-energised shall be confirmed to be de-energised by test before the commencement of work on that apparatus.

Note: These instructions do not apply to connection works involving other forms of Grid Connected Alternative Supplies.

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