



- The Leakage Current Test
- Testing requirements
- What is measured?
- How is it different?

Meet Our Team



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Please contact Amanda Boothe– on the chat line or email amanda.boothe@ikonixusa.com if you have any connection issues.



Introduction

Leakage Current

- What is leakage current?
- Types of insulation barriers
- What is measured

Touch Current

- What is Touch Current?
- Touch current types
- How it is measured

How is it different

- Video demonstrations
- By the standards

Effects of Electrical Current on the Human Body

Effects of the electrical current on the human body

Current	Reaction**
0.5 to 1 milliamp	Perception
5 milliamps	Slight shock felt, startled reaction
6 to 30 milliamps	Painful shock and inability to let go
30 to 150 milliamps	Extremely painful, respiratory arrest, ventricular fibrillation, death possible
10 amps	Cardiac arrest, severe burns

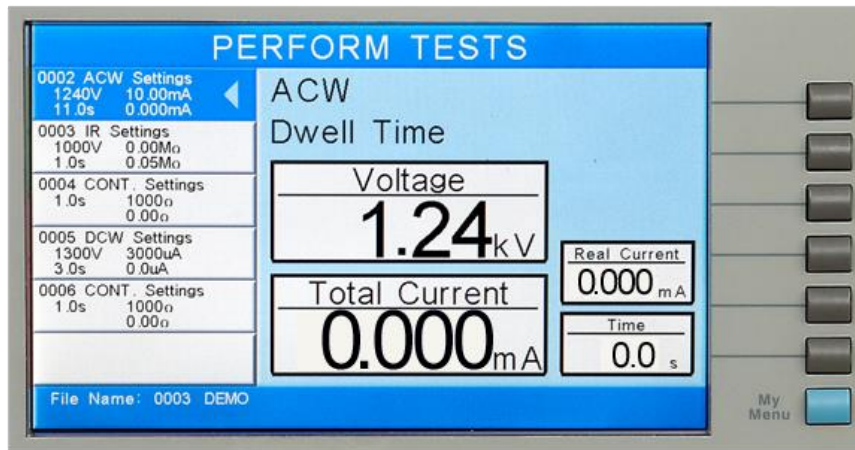
**These effects are for voltages less than 600 volts. Many electrical safety testers can output voltages in excess of 5000 volts which can cause more severe reactions at lower current levels.

¹OSHA 29 CFR part 1910.332 Subpart S defines the training requirements for anyone exposed to voltages in excess of 50 volts.

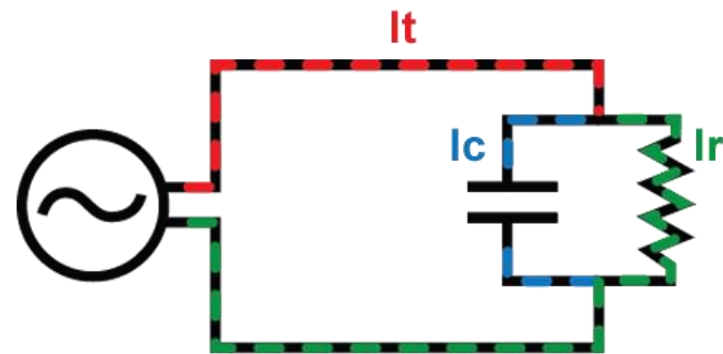
These limits can vary between people and different environments.

For example, women have a slightly different threshold than men for perception and pain as the result of exposure to electric current.

Leakage Current

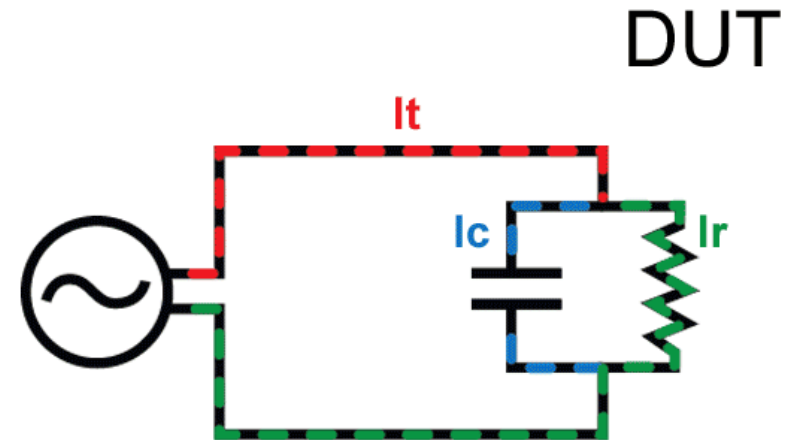
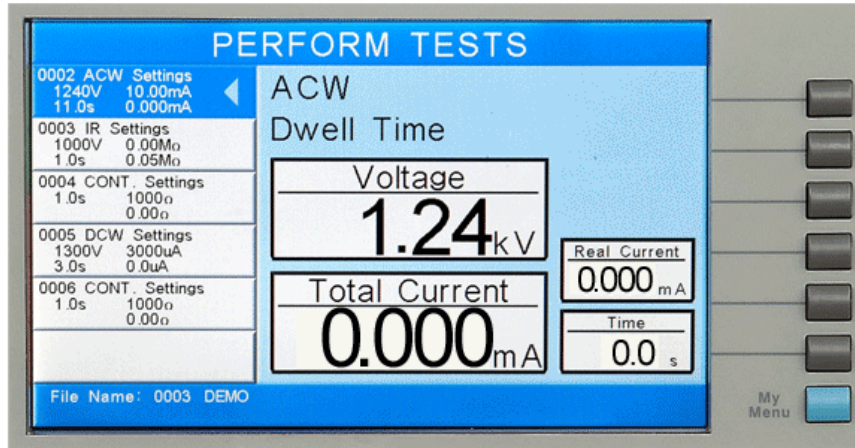


DUT



$$I_t = I_c + I_r$$

Leakage Current



$$I_t = I_c + I_r$$

Leakage current is the stray current that actually flows on the surface of and through the insulation. It is undesired current that we want to quantify to better understand the quality of an insulation barrier.

Leakage Current Types

Touch Current

- Electric current through a human body when it touches one or more accessible parts of an installation or of equipment.¹
- Also called Enclosure Leakage Current.

Protective Conductor Current

- Current which flows in a protective conductor¹
- Also called Enclosure Leakage Current.

1 – IEC 60990 2nd edition: Methods of Measurement of Touch Current and Protective Conductor Current

How is this Different?

Touch Current

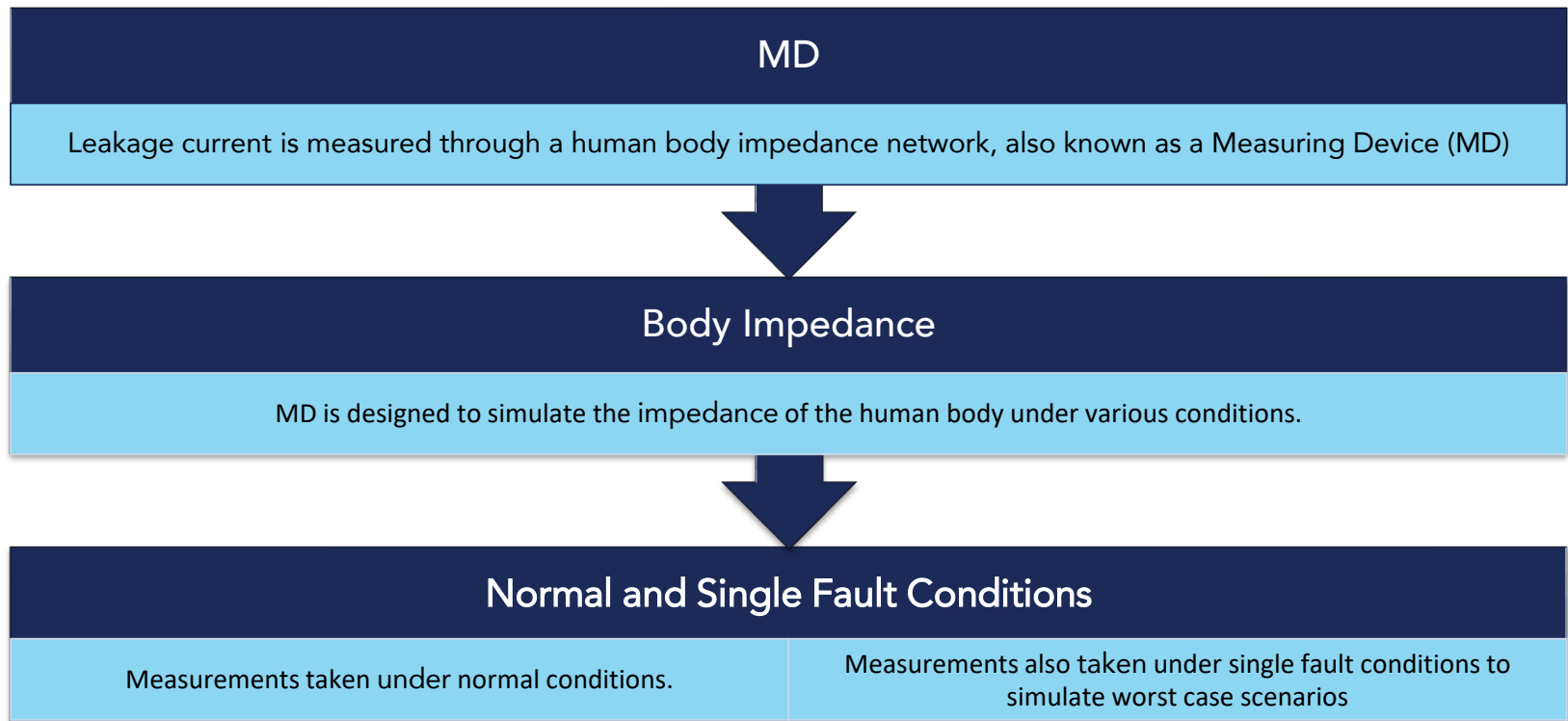
- Measured when the device is powered up during various operation states.

Hipot Leakage Current

- Insulation stressed with high voltage and leakage current measured.

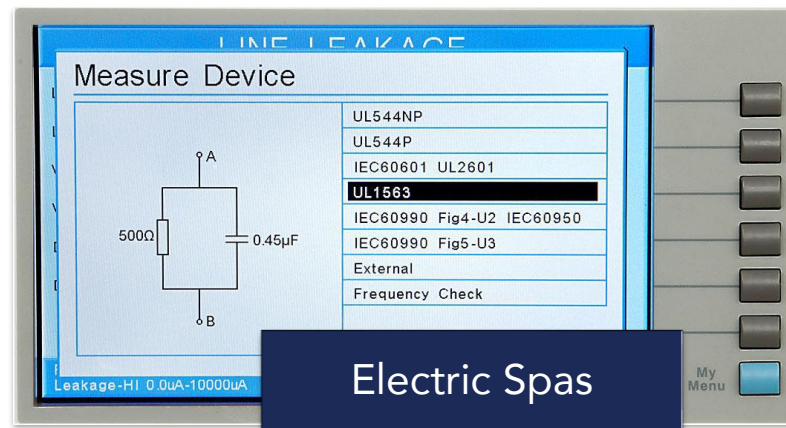
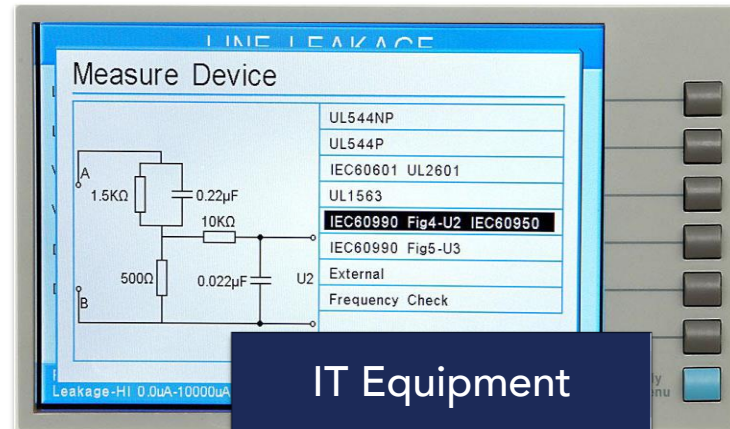
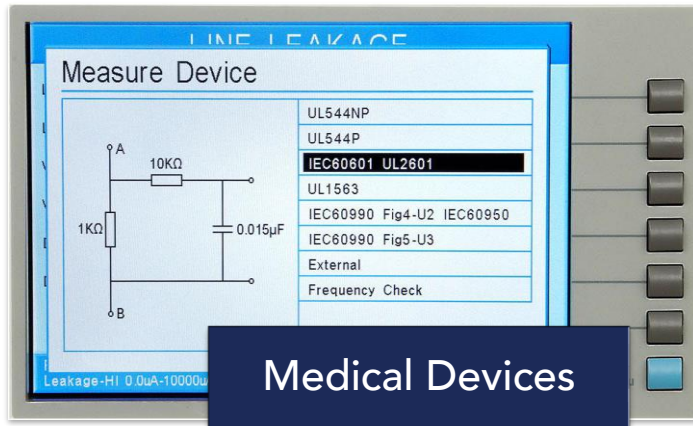
A hipot test measures leakage through product insulation while the device is powered off. Insulation is stressed by high voltage and the resulting leakage current is measured.

How is it Measured?



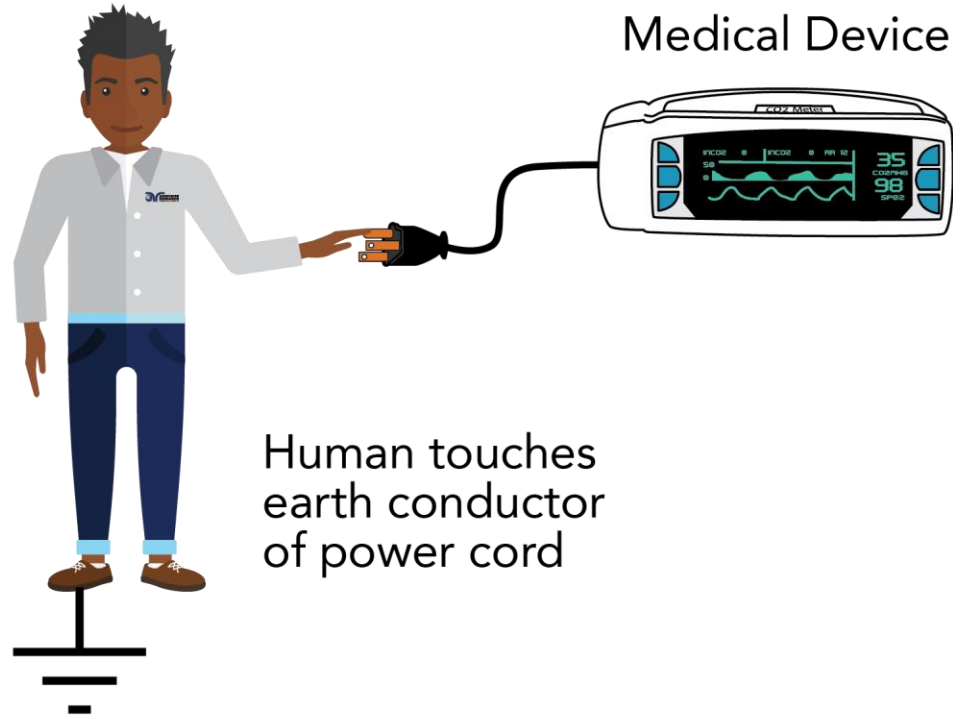
Leakage current is measured by an MD under normal and single fault conditions. The main question to ask: What is the severity of electric current someone would be exposed to if they were to touch the DUT under such conditions?

How is it Measured?



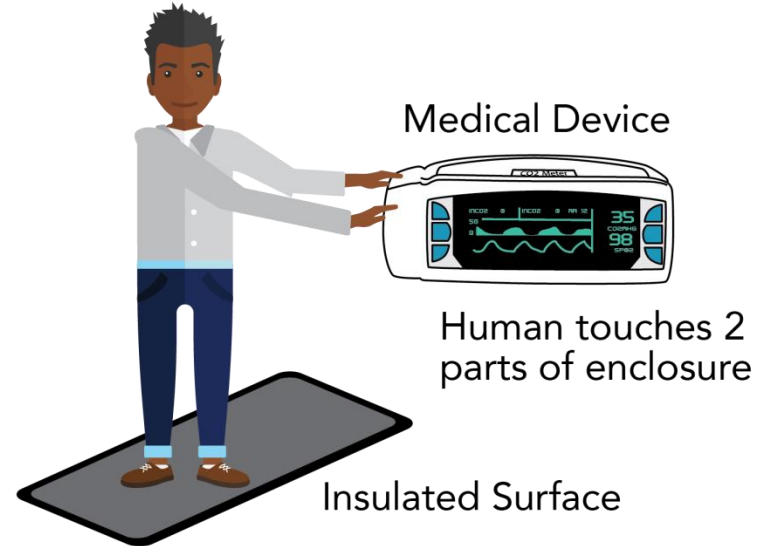
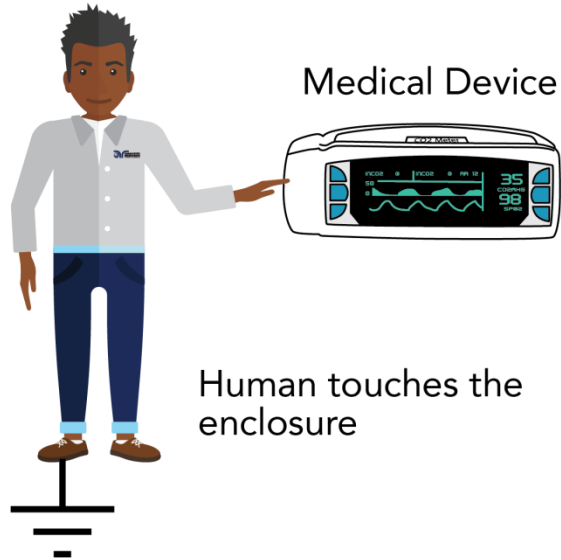
MD will vary by product standard.
Most MDs are derived from IEC 60990-1.

Earth Leakage



MD will vary by product standard.
Most MDs are derived from IEC 60990-1.

Enclosure Leakage

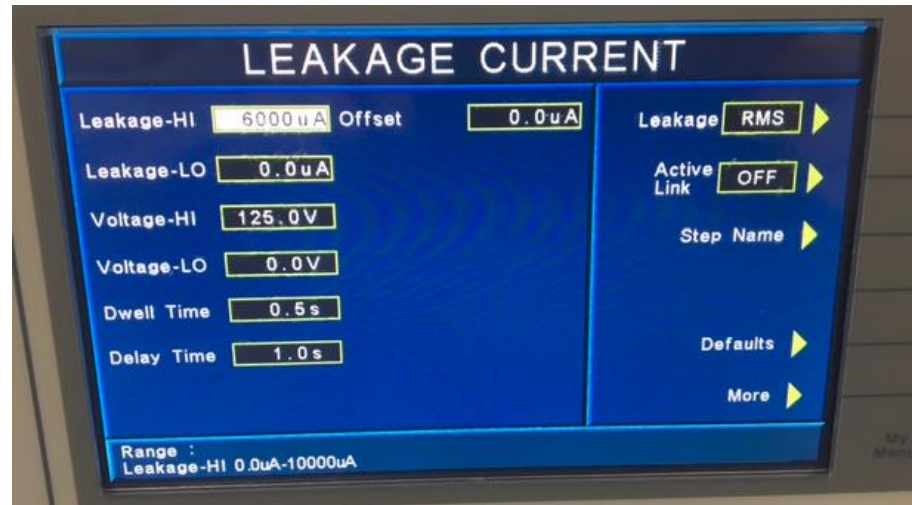
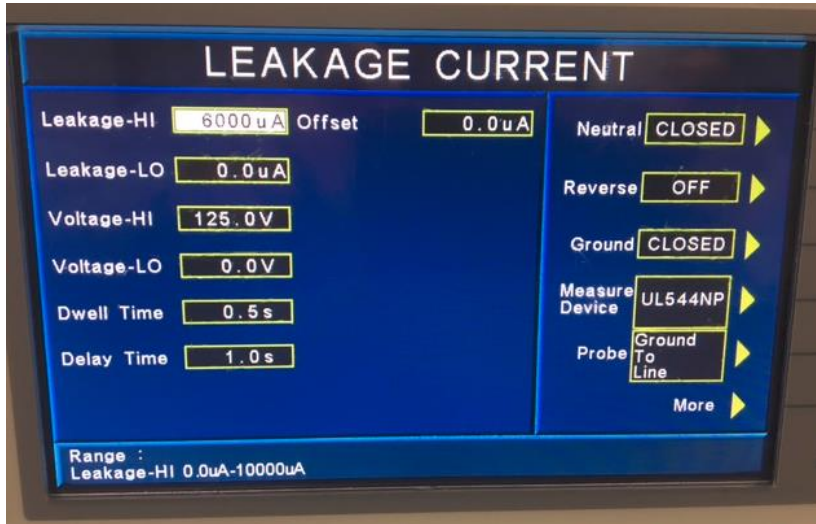


MD will vary by product standard.
Most MDs are derived from IEC 60990-1.

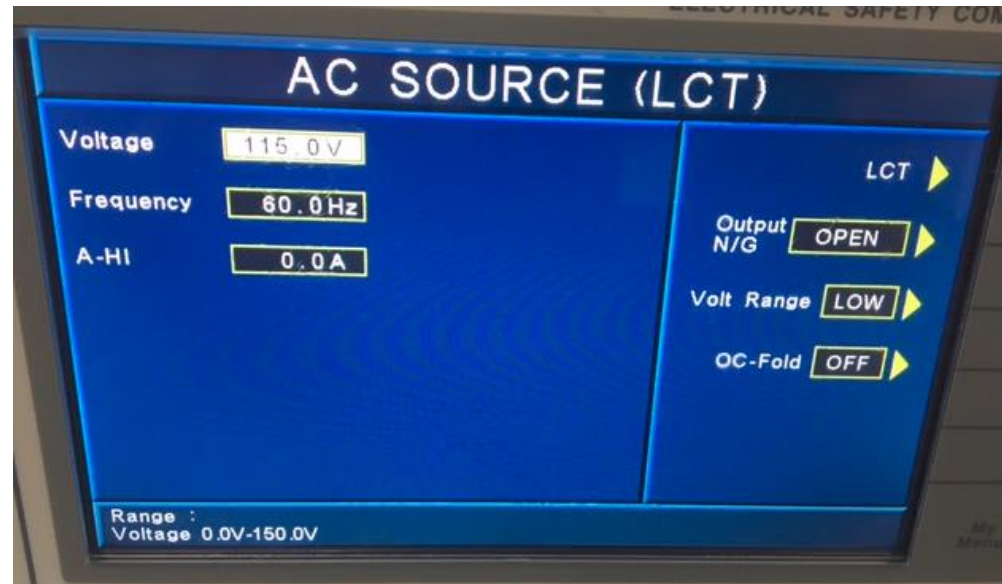
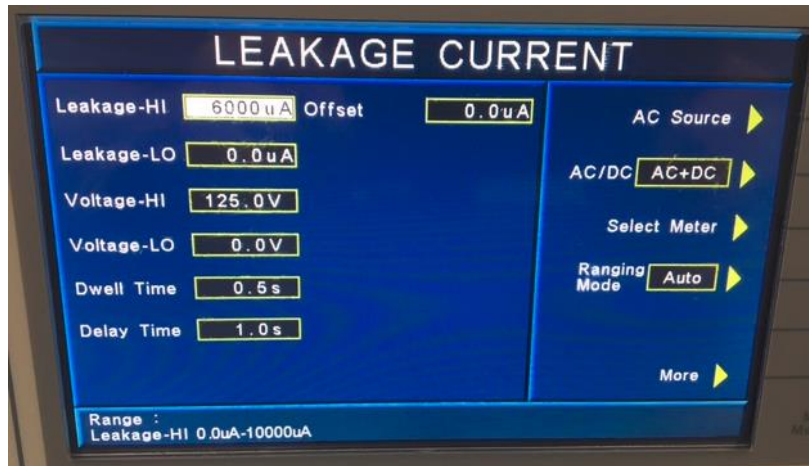
Poll Question

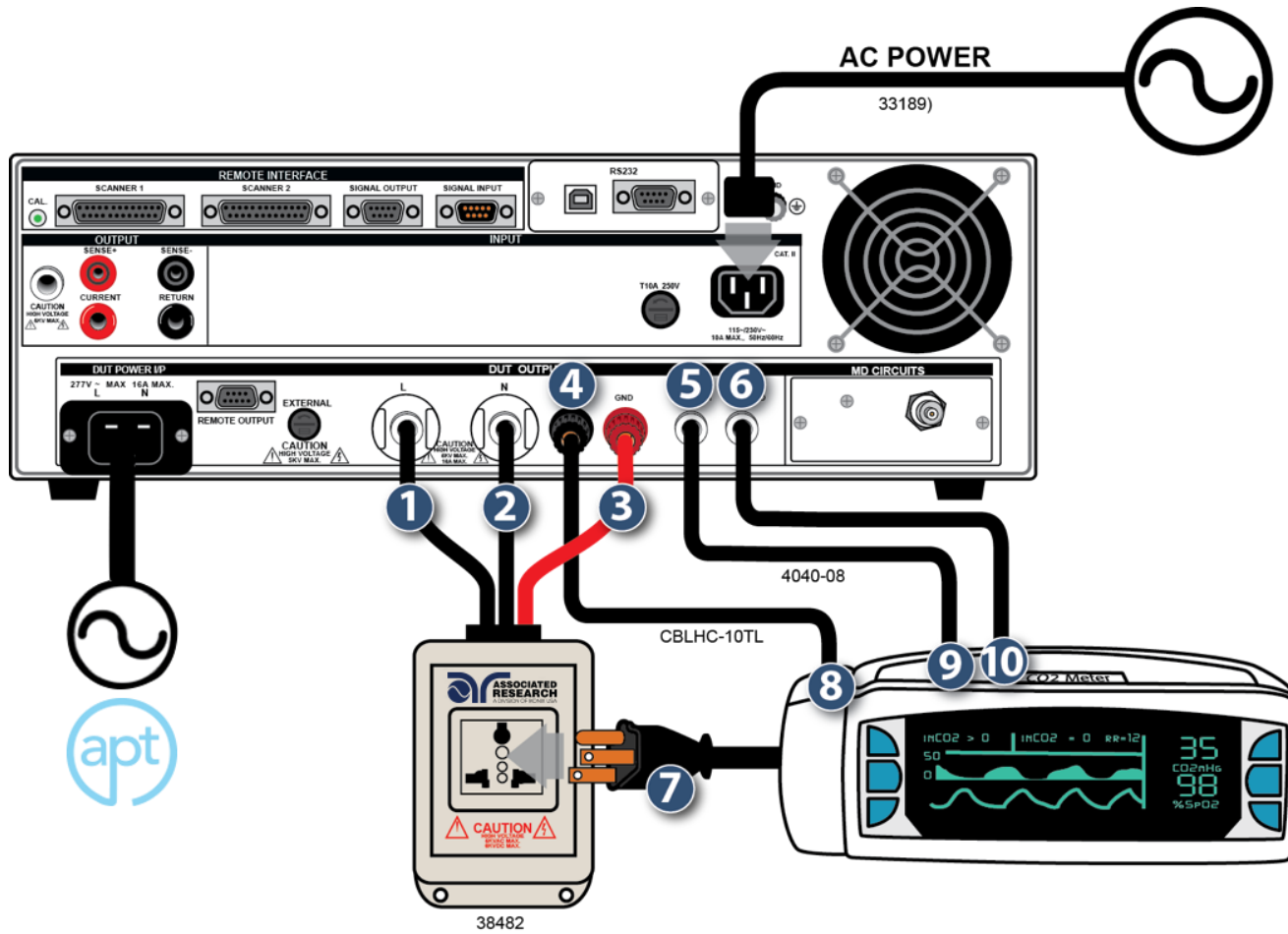
How is the leakage current measured during a Leakage Current Test different from the leakage current measured during the Hipot test?

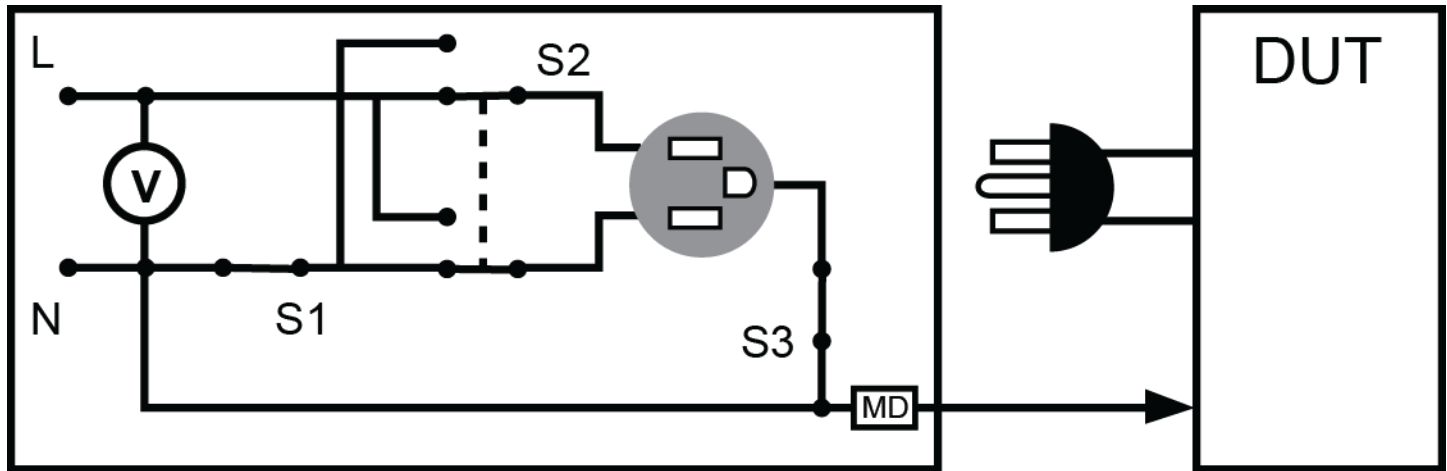
- A. Line leakage always leaks from line to ground
- B. Line leakage is always purely resistive
- C. Line leakage is measured with device under test (DUT) powered OFF
- D. Line leakage is measured using a Measuring Device (MD)



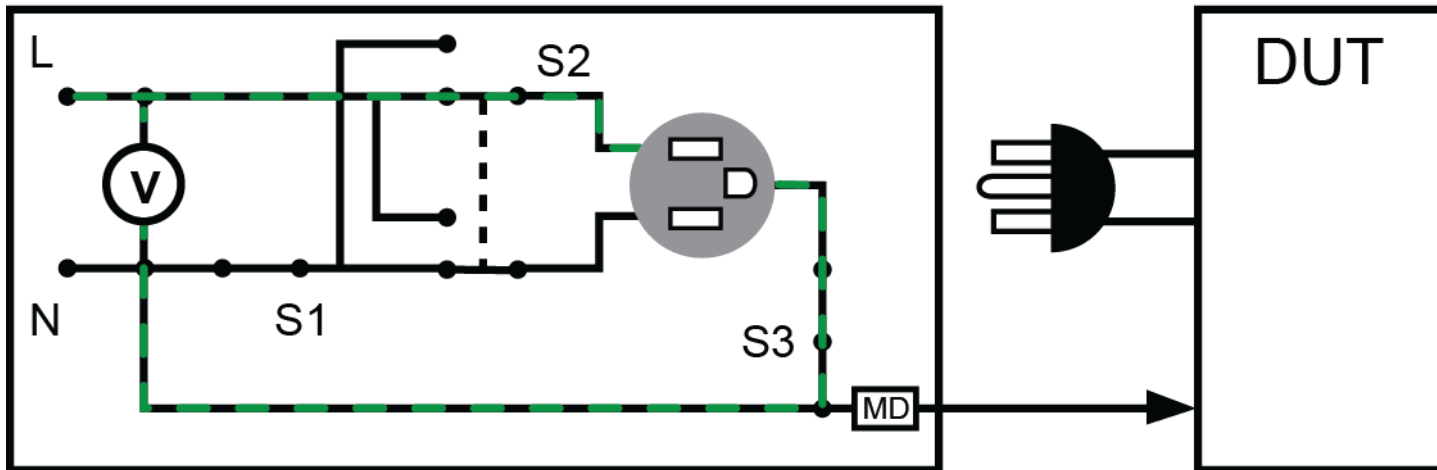
Common Methods for Testing-Recap



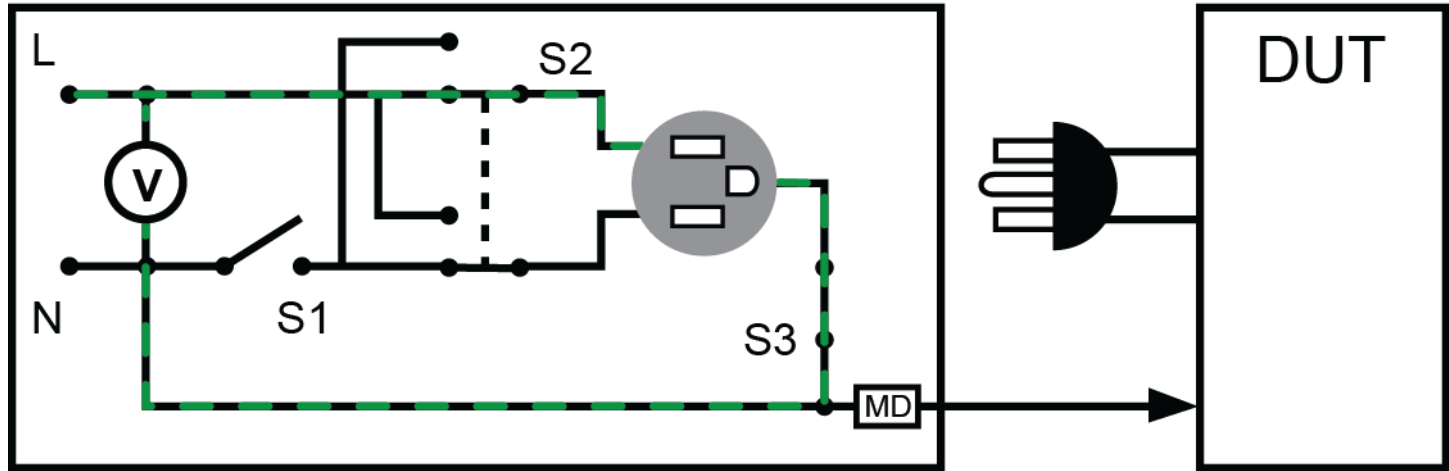




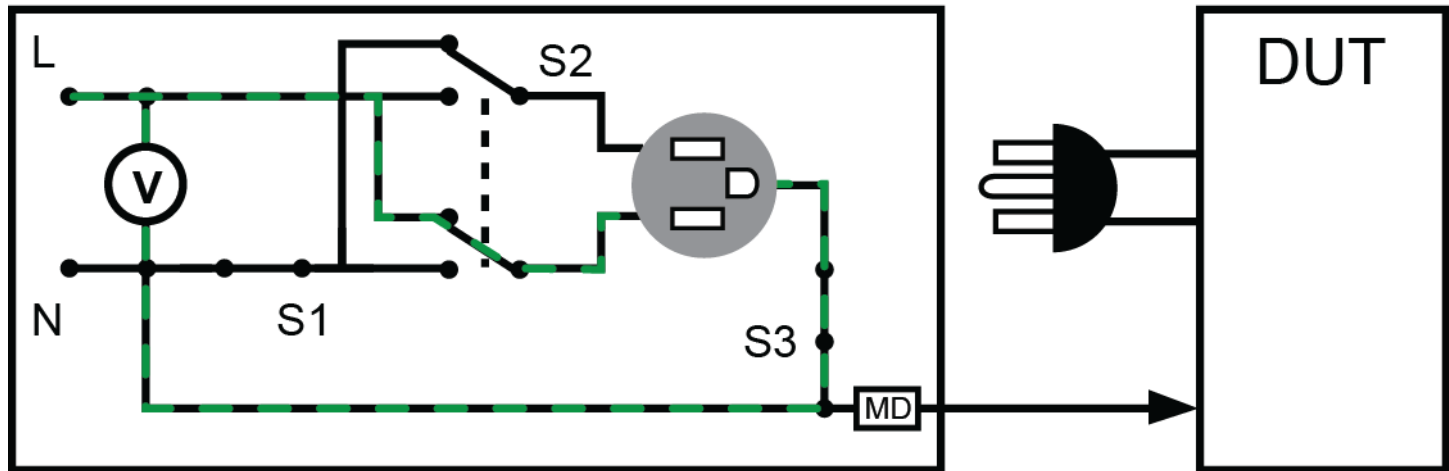
Normal Conditions



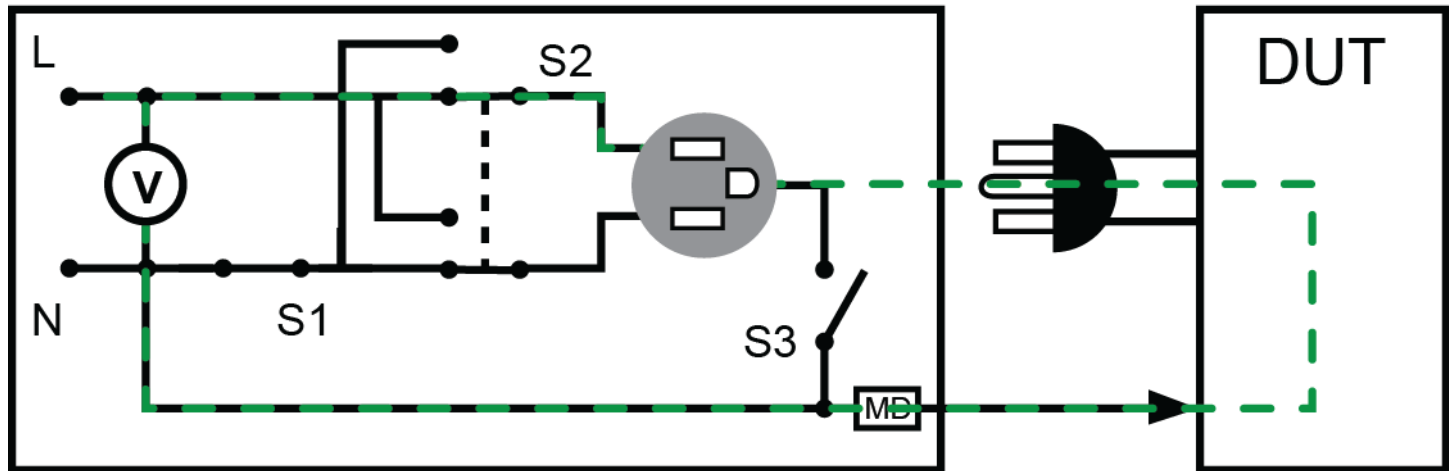
Open Neutral



Reverse Polarity



Open Ground



By the Standards – IEC 60601-1 Medical Equipment

8.7 Leakage Current and Patient Auxiliary Current* (The Leakage Current Test)

OMNIA® II 8206, 8207

LINECHECK® 620L



REQUIREMENT:

Tested in Normal Conditions (NC) & Single Fault Conditions (SFC)

Tested with supply at 110% highest rated mains voltage

Tested at highest rated supply frequency

PASS CRITERIA:

Earth Leakage Current ≤ 5 mA (NC) or 10 mA (SFC)

Touch Current ≤ 100 μ A (NC) or 500 μ A (SFC)

Patient Leakage Current - Refer to Tables 3 and 4

*Section 8.7 consists of a number of various leakage tests. Further details are given in the below diagram

8.7.4 Leakage Current Measurements

OMNIA® II 8206, 8207

LINECHECK® 620L

OPTIONAL APT POWER SOURCE SC6540



Earth Leakage Current: Figure 13, Section 8.7.4.5

Touch Current (Enclosure Leakage): Figure 14, Section 8.7.4.6

Patient Leakage General: Section 8.7.4.7

Patient Auxiliary (Patient Lead to Lead): Fig. 19, Section 8.7.4.8

Patient Lead to Earth: Fig. 15, Section 8.7.4.7a

Mains on Applied Part (for F-Type Patient Leads): Fig. 16, Section 8.7.4.7b

Mains on Signal I/O Ports: Fig. 17, Section 8.7.4.7c

Mains on Non-Protectively Earthed Chassis Point: Fig. 18, Section 8.7.4.7d

By the Standards – IEC 61010-1 Laboratory Equipment

5.6.3 Limit Values for Accessible Parts (The Leakage Current Tests)



LINECHEK® 620L

REQUIREMENT:

Tested in Normal Conditions (NC) and Single Fault Conditions (SFC)

NOTE: AR Instruments contain leakage network A.1.
Other networks must be manually built into our External MD.

PASS CRITERIA:

Leakage Current (NC) ≤ 0.5 mA R.M.S. OR ≤ 0.7 mA Peak
OR ≤ 2 mA DC

Leakage Current (SFC) ≤ 3.5 mA R.M.S. OR 5 mA Peak
OR 15 mA DC

By the Standards – IEC 60950 IT Equipment

5.1 Touch Current and Protective Conductor Current (The Leakage Current Test)



LINECHEK® 620L

REQUIREMENT:

- Tested at rated voltage
- Tested with open ground, open neutral and reverse polarity
- Tested for single phase equipment connected line-to-neutral
- Tested with measuring device D.1 (IEC 60990-1 Fig. 4 U2)

PASS CRITERIA:

- Maximum touch leakage current ~ 0.25 - 3.5 m A R.M.S
- Maximum earth leakage current $\leq 5\%$ input current
- Refer to Table 5A for details

NOTE: Associated Research Inc. equipment cannot perform leakage testing on balanced or 3 phase systems.

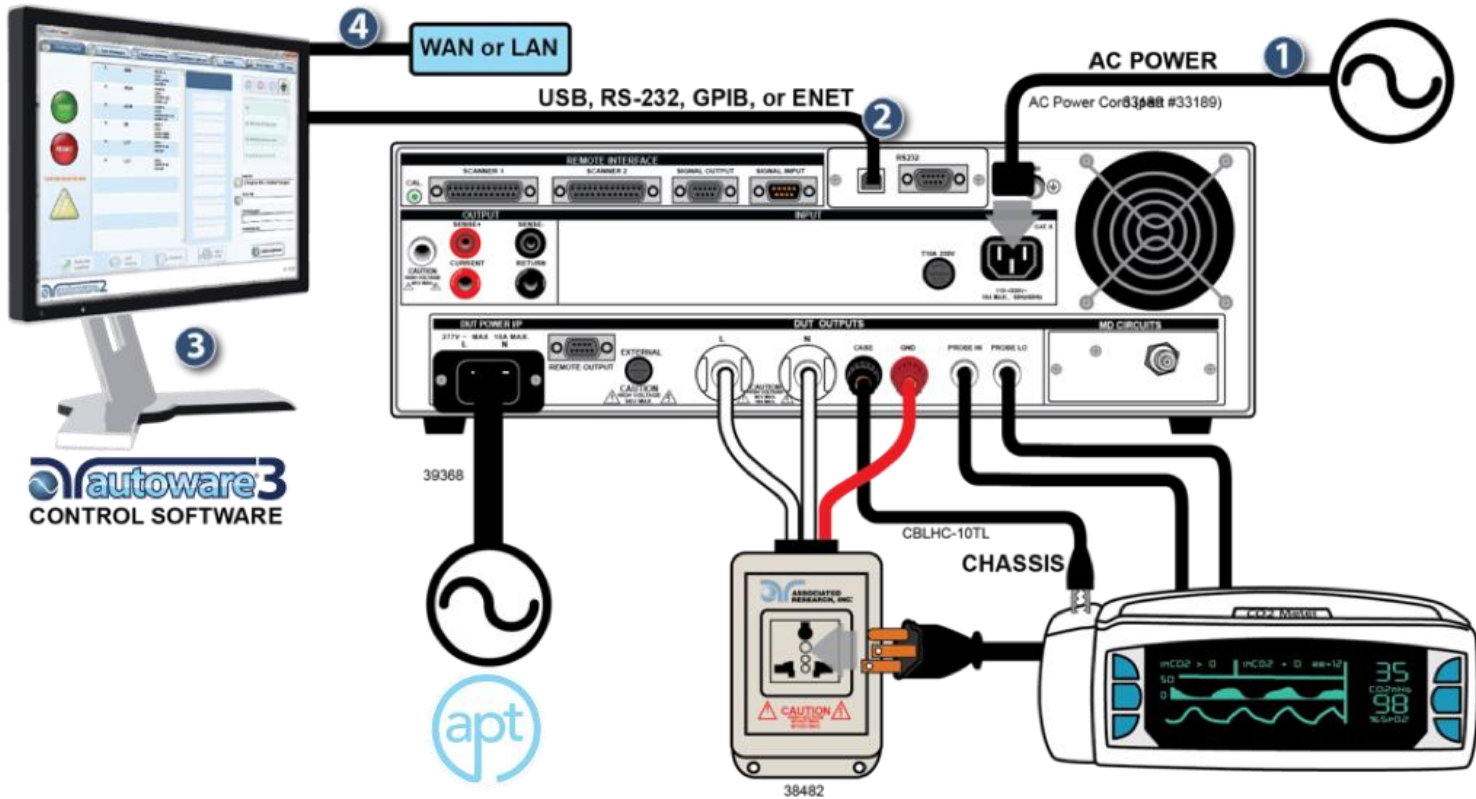
Video Demonstration



Poll Question

What are some of the difficulties you encounter when running a Leakage Current Test?

- A. Measurement uncertainty
- B. Verification of the test instrument
- C. Operator safety
- D. Making the test connections
- E. Other (please email us with your concerns)



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Our Next Webinar is

Leakage Current Testing 102

**Wednesday, November 7 at
10AM CST (GMT – 4:00)**

Click the link in chat box to learn more



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