

# GW INSTEK Test & Measurement Seminar – 2017



## GW Instek Seminar

- EMC Test
- True waveforms by Signal Sources
- Accurate Measurements by DSO
- Electrical Safety Testing
- Power Supply Test Solutions

# What is Safety Test

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(Brief Introduction)

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**GW INSTEK**

Simply Reliable

GOOD WILL INSTRUMENT CO., LTD.

# Safety Test

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To test the product to its limitations to make sure that it can withstand the conditions it will be subjected to on the job - not just the specifications it is built to but also the environment in which it is potentially used.

To provide the **Safest Product Possible**



# Electrical Safety Test

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The application of Voltage/Current (AC or DC) for beyond what the DUT will encounter in normal use, with the expressed purpose of stressing insulating materials beyond their normal operating ratings.

To prevent **Harm** such **electric shock**

# Common Testing Items

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- Impulse test
- AC / DC Withstanding Voltage test
- Insulation Resistance test
- Ground Bond (Ground Continuity) test
- Leakage Current test

Note: Items required by standard

# Test should be performing

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## TYPE TEST

Test of one or more samples of equipment ( or parts of equipment ) made to a particular design, to show that the design and construction meet one or more requirements of this standard  
(Most performing in certificated / verification laboratory)

## ROUTINE TEST

Conformity test made on each individual item during or after manufacture

# AC/DC Withstanding Voltage test

- **AC/DC withstanding voltage Test :**
  - The test is intended to electrically stress a product's insulation beyond what it might encounter in normal use.
  - The end goal being assurance that the product will function as designed and not cause any harm to the product's user.

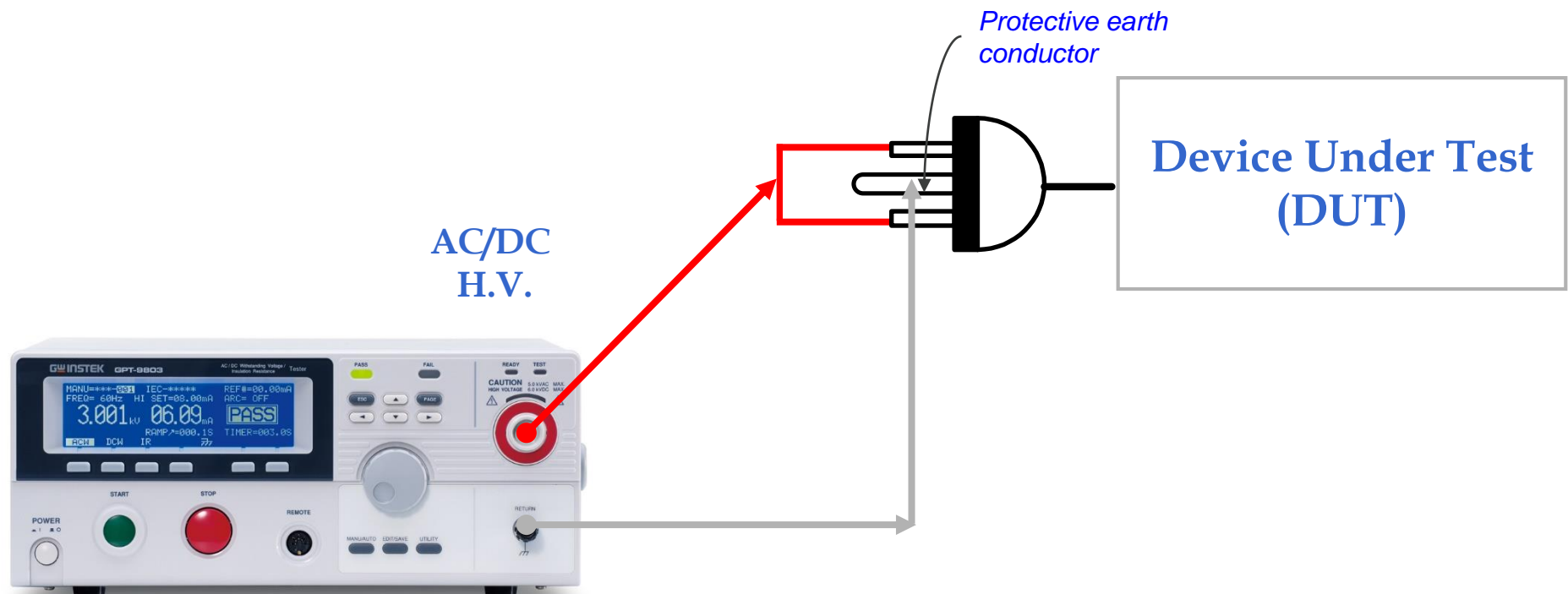
**Table 5 – Test voltages for solid insulation in MAINS CIRCUITS  
of OVERVOLTAGE CATEGORY II up to 300 V**

Voltage line-to-neutral a.c. r.m.s. or d.c.	1 min a.c. test voltage		1 min d.c. test voltage	
	BASIC INSULATION and SUPPLEMENTARY INSULATION	REINFORCED INSULATION	BASIC INSULATION and SUPPLEMENTARY INSULATION	REINFORCED INSULATION
V	V	V	V	V
≤ 150	1 350	2 700	1 900	3 800
>150 ≤ 300	1 500	3 000	2 100	4 200

IEC 61010-1

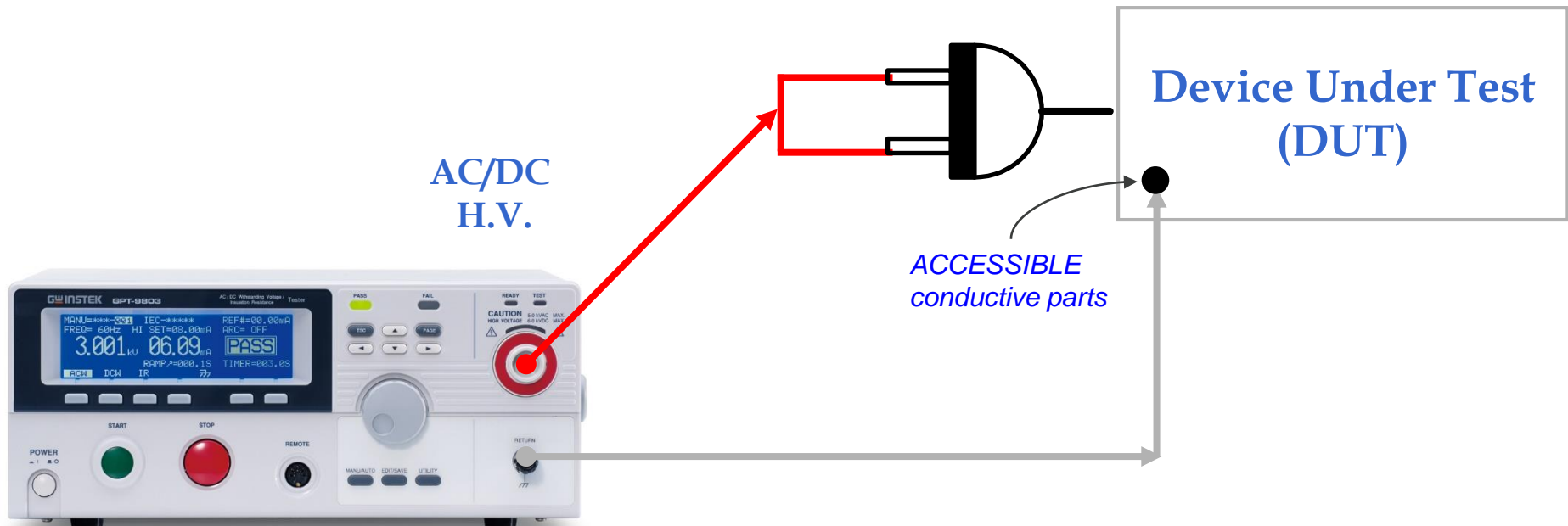
# AC/DC Withstanding Voltage test

For equipment with a protective earth conductor, the test is made between the *protective earth conductor* and the *line and neutral conductors joined together*, with the test voltage (IEC 61010-1)



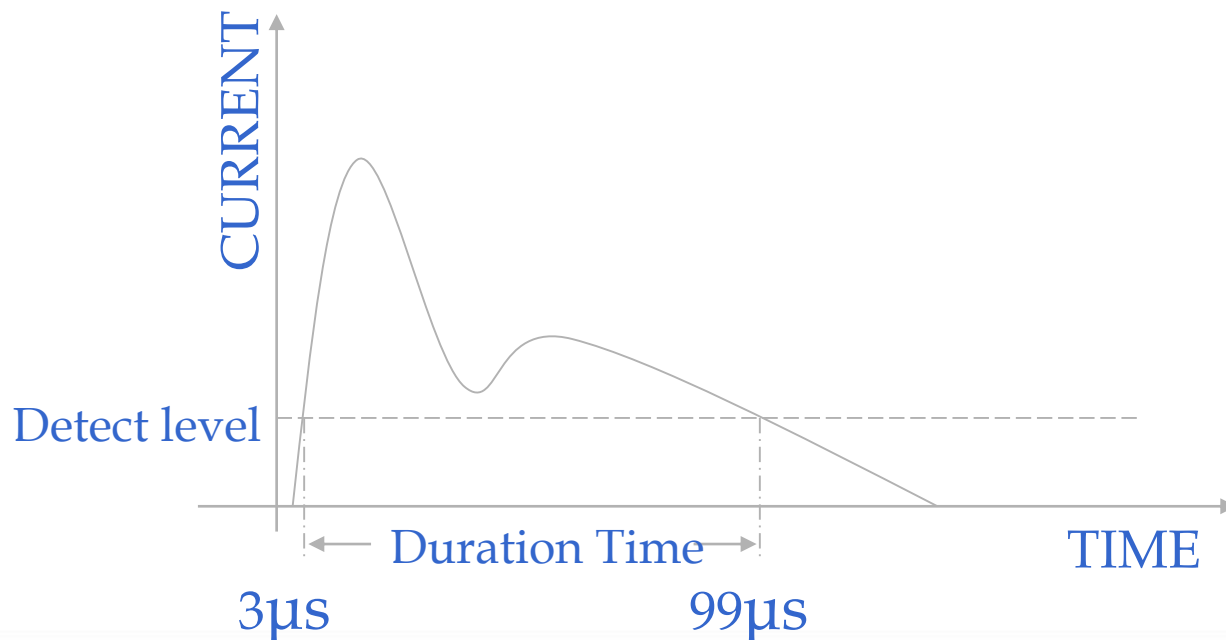
# AC/DC Withstanding Voltage test

For equipment without a protective earth conductor, the test is made between **ACCESSIBLE conductive parts** of the equipment and the **line and neutral conductors joined together**, with the test voltage (IEC61010-1)



# Current Waveform for ARC Detection

- **ARC Detection :**
  - The spark current during AC/DC Hi-Pot test.
  - The duration time is from 3 microseconds to 99 microseconds.



# Insulation Resistance test

*Find two points between which there is insulation, make connection with an insulation tester (sometimes called megohmmeter) and make a measurement.*

**Table 10.1 – Minimum insulation resistance**

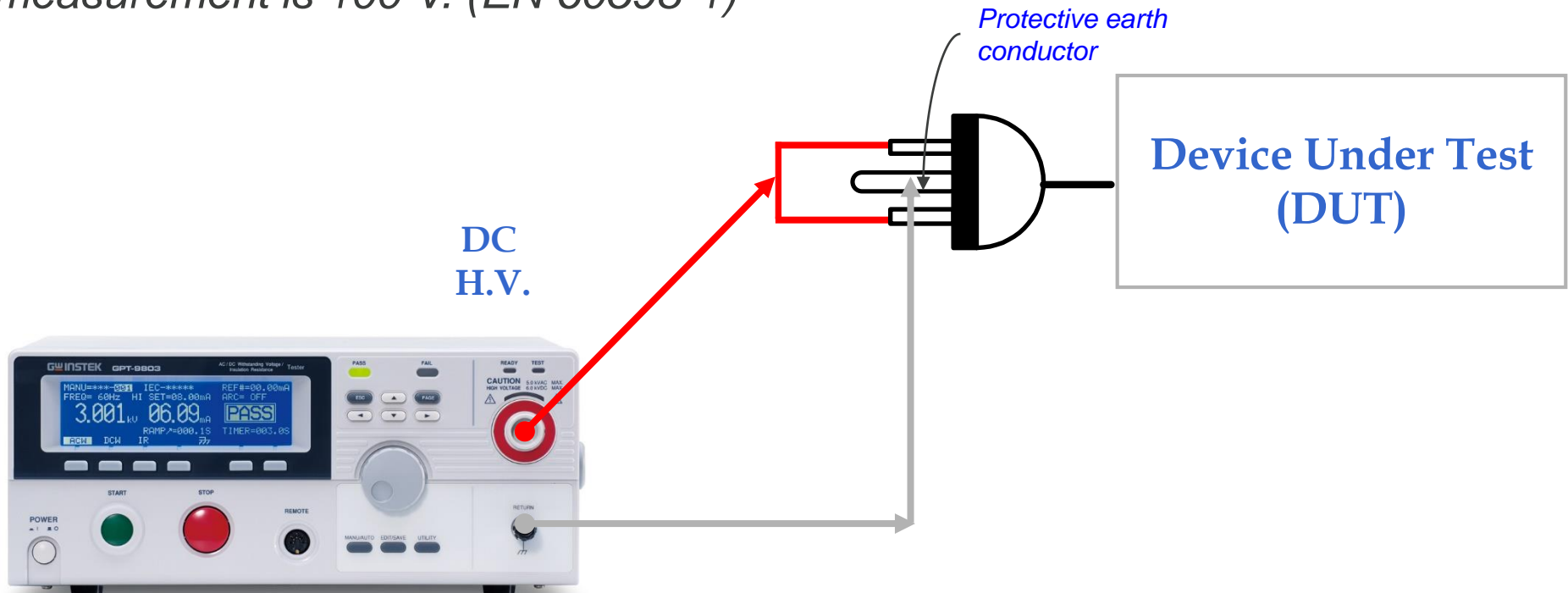
<i>Insulation of parts</i>	<i>Minimum insulation resistance Mohm</i>		
	<i>Class I luminaires</i>	<i>Class II luminaires</i>	<i>Class III luminaires</i>
<i>SELV:</i>			
<i>Between current-carrying parts of different polarity</i>	<i>a</i>	<i>a</i>	<i>a</i>
<i>Between current-carrying parts and the mounting surface *</i>	<i>a</i>	<i>a</i>	<i>a</i>
<i>Between current-carrying parts and metal parts of the luminaire</i>	<i>a</i>	<i>a</i>	<i>a</i>
<i>Other than SELV:</i>			
<i>Between live parts of different polarity</i>	<i>b</i>	<i>b</i>	–
<i>Between live parts and the mounting surface *</i>	<i>b</i>	<i>b and c, or d</i>	–
<i>Between live parts and metal parts of the luminaire</i>	<i>b</i>	<i>b and c, or d</i>	–
<i>Between live parts which can become of different polarity through action of a switch</i>	<i>b</i>	<i>b and c, or d</i>	–
<i>Basic insulation for voltages of SELV (a)</i>	<i>1</i>		
<i>Basic insulation for voltages other than SELV (b)</i>	<i>2</i>		
<i>Supplementary insulation (c)</i>	<i>2</i>		
<i>Double or reinforced insulation (d)</i>	<i>4</i>		

*\*SELV : safety extra-low voltage*

*EN 60598-1*

# Insulation Resistance test

The insulation resistance shall be measured with a **d.c. voltage** of approximately 500 V, **1 min** after the application of the voltage.  
For the insulation of SELV parts of luminaires, the d.c. voltage to be used for measurement is 100 V. (EN 60598-1)



# Ground Bond (Earth Continuity) test

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*The tests verify the integrity of the ground connection between exposed metal and the ground of the power cord under high current conditions.*

*The impedance between the PROTECTIVE CONDUCTOR TERMINAL and each ACCESSIBLE part for which PROTECTIVE BONDING is specified shall not exceed 0,1  $\Omega$ . (IEC 61010-1)*

*This verifies that the grounds in the device can handle high current until a circuit breaker trips or fuse blows.*

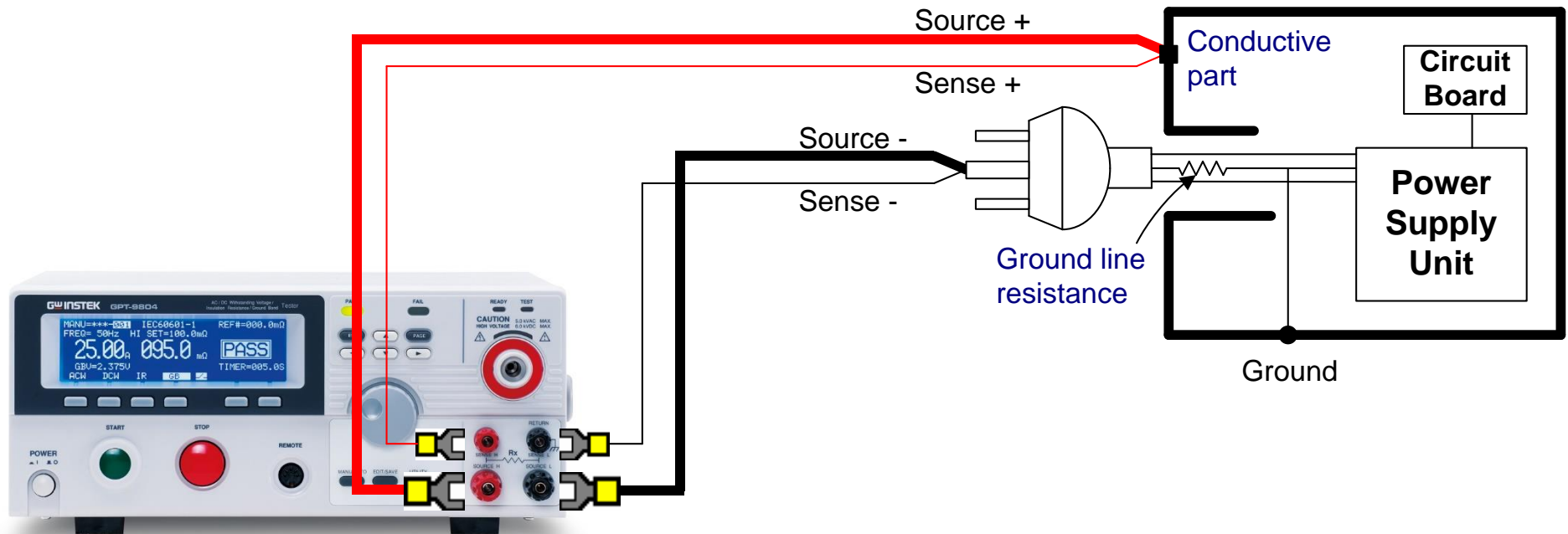
# Ground Bond (Ground Continuity) test

Conformity is checked by applying a test current for **1 min** and then calculating impedance. (IEC 61010-1)

The test current is the greater of

a) **25 A a.c.** r.m.s. at RATED MAINS frequency or d.c.,

b) a current equal to twice the RATED current of the equipment.

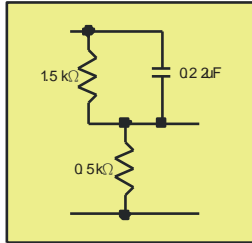


# Leakage Current test

Leakage current (or Touch current) is measured in such a way as to simulate a human body coming in contact with different parts of the product and then measuring the leakage current flowing through a simulated human body device or network.

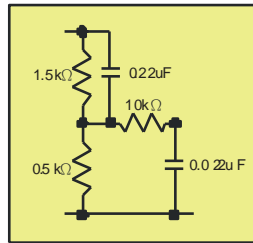
MD-A

For: IEC60990/60995



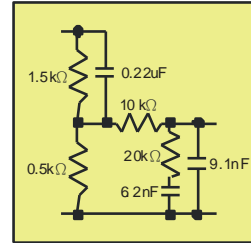
MD-B

For: IEC60990/60950



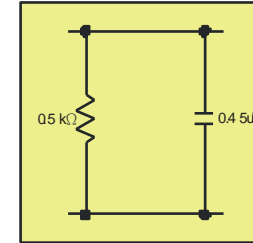
MD-C

For: IEC60990/60598



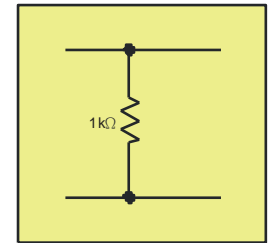
MD-D

For: IEC 60335-1/UL1563



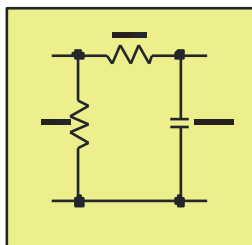
MD-E

For: JIS B 56 1/UL2601-1



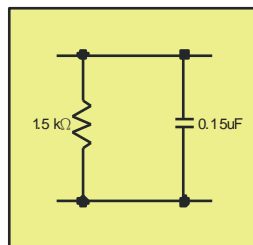
MD-F

For: IEC60601-1/UL2601-1



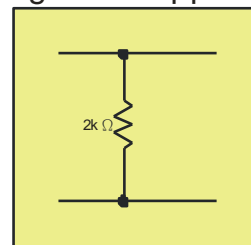
MD-G

For: UL554NP/1310



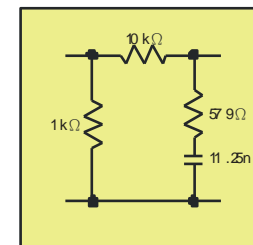
MD-H

For: general application



MD-I

For: JIS B 56 1/UL554NP



# Leakage Current test

*Measurement is made to simulate the flow route (or path) of the leakage current under different conditions.*

*Earth leakage current*

*Enclosure to earth leakage current*

*Enclosure to enclosure leakage current*

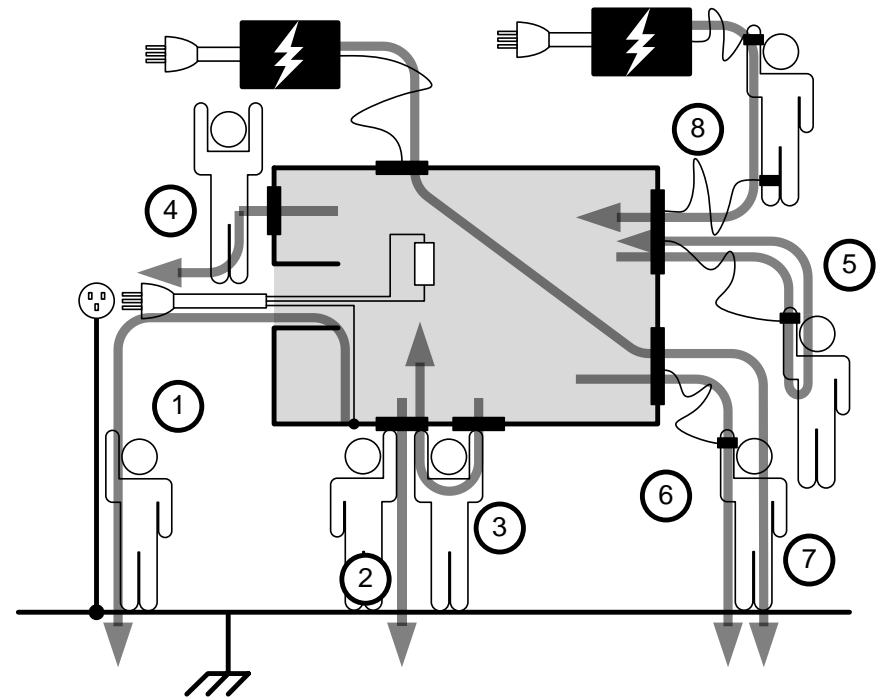
*Enclosure to line leakage current*

*Patient auxiliary current*

*Patient leakage current I*

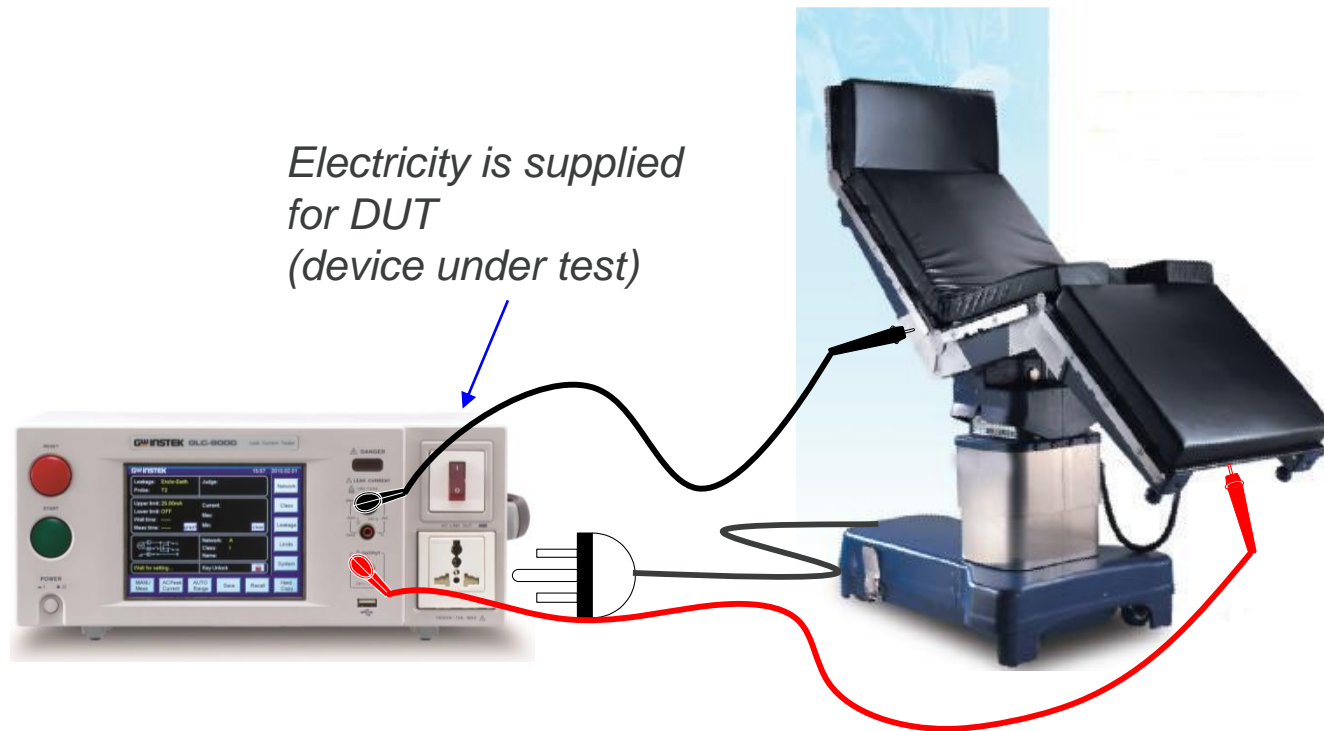
*Patient leakage current II*

*Patient leakage current III*



# Leakage Current test

Unlike other electrical safety test (such as AC/DC withstanding voltage test), the leakage current test is *an on-line testing*, it means the DUT (device under test) is *tested under a working condition*; other electrical safety test tests the DUT with a off-line condition.



# Regulations

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# Regulation of Product (I)

Regulations	Title of regulation	Applied DUT
IEC 60950-1 UL 1950 EN 950	Information Technology Equipment – Safety – Part1: General Requirements	Computers and peripherals, keyboard, wireless mouse, digital cameras, mobile phones, PC screen, General Instrument, indoor projectors, routers, game consoles (Xbox,Wii), filter.
IEC 60335-1	Household and similar electrical Appliances – Safety – Part1: General Requirements	Household refrigerators, washing machines, vacuum cleaners, air conditioners, air cleaners, sweeping machines, rice cookers, induction cooker, microwave ovens, electric water heaters, range hoods, ovens, bread maker, electric waxing machines, electric ice machine.
IEC 60065	Audio, Video and similar Electronic apparatus – Safety Requirements	LCD TV, high-power projection equipment, high power audio equipment, DVD player, telegraph equipment, civilian bandwidth equipment.
EN 60601-1 IEC 60601-1	Medical Electrical Equipment – Part1: General Requirements for Basic safety and essential Performance	ECG Monitor (ECG), the electronic sphygmomanometer, blood dialysis machine, ultrasound diagnostic equipment, blood machines, CT (computed tomography), respirator.

# Regulation of Product (II)

Regulations	Title of regulation	Applied DUT
IEC 61010 -1 EN 61010 -1	Safety Requirements for electrical equipment for Measurement , control and Laboratory use	Electric testing, measuring or recording electrical test or measurement equipment of one or more quantity of electricity or non-quantity of electricity, such as: signal generators, measurement standards, power supplies, sensors.
EN 60598 -1	Luminaires - Part1: General Requirements and tests	Lighting products: including chandeliers, table lamps, floor lamps, stage lighting, outdoor lighting. (Use only 250VAC or less)
EN 60204 -1	Safety of Machinery – Electrical equipment of machines - Part1: General requirements	Conveyor system, automatic plug-in machines, various types of processing machines using electricity (molding, packaging, cutting, washing, cooling ....).
UL 1446 IEC60085	Systems of Insulating Materials – General	Fiber, resin, quartz, high voltage capacitors, Breaker, resistors, Relay, ceramics, glass, silica, mica, varnish, casing.

# Safety test requirements

Regulation	Capacity requirement	ACW	DCW	IR	GB
IEC60950-1	not specified	<p>1. The voltage applied to the insulation under test is gradually raised from zero to the prescribed voltage and held at that value for <b>60 s. (TYPE TEST)</b></p> <p>2. Based on grade of insulation <b>ACW : 1000~3000V</b></p> <p>3. <b>ROUTINE TESTS</b> are required to be conducted. It is permitted to <b>reduce the duration of the electric strength test to 1 s and to reduce the test voltage permitted by 10 %.</b></p>	<p>A d.c. test voltage equal to the peak voltage of the prescribed a.c. test voltage <b>ACW x 1.414</b></p> <p>For example, DCW can be applied if products have Y capacitance</p>	<p>500VDC &gt;2MΩ</p>	<p>1. For equipment powered from a MAINS SUPPLY, if the <b>protective current rating of the circuit</b> under test <b>is 16 A or less</b>, the test current <b>is 200 %</b> of the protective current rating applied for <b>120 s.</b></p> <p>2. The test current <b>can be either a.c. or d.c.</b> and the test voltage shall <b>not exceed 12 V.</b> <b>Resistance: &lt; 0.1 Ω.</b></p>

# Safety test requirements

Regulation	Capacity requirement	ACW	DCW	IR	GB
IEC60335-1	The high-voltage source used for the test is to be capable of supplying a <b>short circuit current</b> $I_s$ between the output terminals after the output voltage has been adjusted to the appropriate test voltage.	<p>The appliance insulation is subjected to a voltage having a frequency of 50 Hz or 60 Hz for <b>1 min</b>. <b>No breakdown shall occur during the test.</b></p> <p>ACW : 1000 ~ 3000V</p> <p>The insulation of the appliance is subjected to a voltage having a frequency of approx. 50 Hz or 60 Hz for <b>1 s</b>. <b>Breakdown is assumed the current exceeds 5 mA ~ 30 mA</b></p> <p>ACW: 800 ~ 2500V (ROUTINE TESTS)</p>	<p>Instead of being subjected to an a.c. voltage, the insulation may be subjected to a d.c. voltage of 1,5 times the a.c. voltage (ROUTINE TESTS)</p>	not specified	<p>A current derived from a source having a no-load voltage not exceeding 12 V (a.c. or d.c.) and equal to <b>1.5 times rated current</b> of the appliance or <b>25 A</b>, whichever is higher</p> <p>The resistance shall <b>not exceed 0.1 <math>\Omega</math></b>.</p> <p>A current of <b>at least 10 A</b>, derived from a source having a <b>no-load voltage not exceeding 12 V</b> (a.c. or d.c.)</p> <p>The resistance shall be <b>0.1 ~ 0.2 <math>\Omega</math> depending on supply cord.</b></p>

	Min. current (mA)	
Test voltage (V)	$I_s$	$I_r$
$\leq 4\,000$	<b>200</b>	100
$> 4\,000$ and $\leq 10\,000$	<b>80</b>	40
$> 10\,000$ and $\leq 20\,000$	<b>40</b>	20

# Safety test requirements

Regulation	Capacity requirement	ACW	DCW	IR	GB
IEC60065	The test voltages shall be obtained from a suitable source so designed that, <b>when the output terminals are short-circuited</b> after the test voltage has been adjusted to the appropriate level, <b>the output current is at least 200 mA.</b>	<p>Test time <b>1min</b> Voltage is required from <b>1410 ~ 4240Vpp</b> (<b>1000 ~ 3000V r.m.s</b>) depending on operation voltage and grade of insulation</p> <p>Test time <b>1~4s</b> Voltage is required from <b>1130 ~ 3540Vpp</b> (<b>800 ~ 2500V r.m.s</b>) depending on operation voltage and grade of insulation <b>(ROUTINE TESTS)</b></p>	Where corona, charge effects or the like may occur, d.c. test voltage is recommended	500V d.c. Insulation resistance from 2M $\Omega$ ~ 4M $\Omega$ depends on grade of insulation	<p>The test shall be carried out for <b>1 min</b> with a <b>test current of 25 A a.c. or d.c.</b> The test voltage shall not exceed 12 V.</p> <p>The test current applied for <b>1~ 4s</b> should be in the order of <b>10 A a.c.</b>, derived from a source having a <b>no-load voltage not exceeding 12 V.</b></p> <p>The resistance shall be <b>0.1 ~0.2 <math>\Omega</math></b> depending on supply cord.</p>

# Safety test requirements

Regulation	Capacity requirement	ACW	DCW	IR	GB
IEC60601-1	not specified	<p><i>Initially, not more than half the test voltage is applied, and then it is gradually raised over a period of 10 s to the full value, which is hold for 1 min, after which it is gradually lowered over a period of 10 s to less than half the full value.</i></p> <p><i>Depending on grade of insulation design and working voltage</i>  ACW: 1000V~4000V</p> <p><i>The test voltage for routine testing is to be the appropriate voltage as TYPE TESTS</i></p>	a d.c. test voltage equal to the peak value of the a.c. test voltage may be used.	comply with the requirements of IEC 60950-1 for Insulation coordination	<p><i>A current of 25 A or 1.5 times the highest RATED current of the relevant circuit, whichever is greater, from a source with a frequency of 50 Hz or 60 Hz and with a no-load voltage not exceeding 6 V, is passed for 5 ~ 10 s</i></p>

# Safety test requirements

Regulation	Capacity requirement	ACW	DCW	IR	GB
IEC61010-1	The generator shall be able to supply a power of at least 500 VA	<p>The test voltage is raised uniformly from 0 to the specified value within 5 s and held at that value for at least the specified time. ACW: 1350~3500V</p> <p>For the a.c. tests, the test voltage is raised to its specified value within 5 s, and hold for at least 2 s. (ROUTINE TESTS) ACW: 840 ~ 2000V</p>	<p>The d.c. voltage is raised uniformly from 0 to the specified value within 5 s and held at that value at least 1 min DCW: 1900~4200V</p> <p>For the d.c. tests, the test voltage is raised to its specified value within 5 s, and hold for at least 2 s. (ROUTINE TESTS) DCW: 1200~4700V</p>	not specified	<p>By applying a test current for 1 min. The test current is 25 A a.c. r.m.s. at RATED MAINS frequency or d.c. or equal to twice the rated current of the equipment which is the greater</p> <p>Same test points as TYPE TESTS, but No value is specified for the test current. (ROUTINE TESTS)</p>

# Safety test requirements

Regulation	Capacity requirement	ACW	DCW	IR	GB
EN60598-1	<p>the high-voltage transformer used for the test, when the output terminals are <b>short circuited</b> after the output voltage has been adjusted to the appropriate test voltage, the output current <b>shall be at least 200 mA</b>.</p> <p>The <b>overcurrent relay</b> shall <b>not trip</b> when the output current is <b>less than 100 mA</b></p>	<p>A voltage of substantially sine-wave form, having a frequency of <b>50 Hz or 60 Hz</b> and shall be applied for <b>1 min</b> across the grade of insulation.</p> <p><i>Basic: 2U+1000V</i>  <i>Double: 2U+1750V</i>  <i>Reinforced: 4U+2750V</i></p> <p>Measured by applying a minimum voltage of <b>1.5 kV a.c.</b> for a minimum of <b>1 s</b>  <i>Breakdown current: &lt; 5mA</i>  <i>(ROUTINE TESTS)</i></p>	<p><math>ACW \times \sqrt{2} = DCW</math></p> <p>Measured by <b>1.5 kV</b> x <math>\sqrt{2}</math> d.c. for a minimum of <b>1 s</b>  <i>Breakdown current: &lt; 5mA</i>  <i>(ROUTINE TESTS)</i></p>	<p>The insulation resistance shall be measured with a <b>d.c. voltage</b> of approximately <b>500 V, 1 min</b>  <i>Resistance: &gt; 2~4MΩ</i></p> <p>Measured by applying 500 V d.c. for 1 s  <i>Resistance: &gt;2MΩ</i>  <i>(ROUTINE TEST)</i></p>	<p>A current of at least <b>10 A</b>, derived from a source with a <b>no-load voltage not exceeding 12 V</b>, and the current shall be applied for a period of at least <b>1 min</b>  <i>Resistance: &lt;0.5Ω.</i></p> <p>Measured by passing a minimum current of <b>10 A</b> at between 6 and 12 V for at least <b>1 s</b>.  <i>Resistance &lt;0.5Ω.</i>  <i>(ROUTINE TESTS)</i></p>

# Safety test requirements

Regulation	Capacity requirement	ACW	DCW	IR	GB
EN60204-1	500VA required. Specified in 2000 edition, but not specified in 2006 edition.	The test voltage shall be at a nominal frequency of <b>50 Hz or 60 Hz</b> ; and shall have a value of <b>twice the rated supply voltage</b> of the equipment or <b>1000 V</b> , whichever is the greater. <b>Test-time for 1s</b>	not specified	the insulation resistance measured at 500V d.c. between the power circuit conductors and the protective bonding circuit. Resistance:>1MΩ	The resistance shall be measured with a current between at least <b>0.2 ~10 A</b> and having a <b>maximum no-load</b> voltage of <b>24 V a.c. or d.c..</b>

# Safety test requirements

Regulation	Capacity requirement	ACW	DCW	IR	GB
UL1446	A test transformer having a capacity of at least <b>500 volt-amperes</b> is to be used.	<p>at a voltage of twice the rated voltage plus 1000 V</p> <p>The test voltage is to be applied for 10 minutes</p>			

# Organization

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- ANSI [www.ansi.org](http://www.ansi.org)
- IEEE [www.ieee.org](http://www.ieee.org)
- OSHA [www.osha.gov](http://www.osha.gov)
- UL [www.ul.com](http://www.ul.com)
- CSA [www.csa.ca](http://www.csa.ca)
- IEC [www.iec.ch](http://www.iec.ch)
- ISO [www.iso.ch](http://www.iso.ch)
- CENELEC [www.cenelec.org](http://www.cenelec.org)
- BSI [www.bsi.org.uk](http://www.bsi.org.uk)
- VDE [www.vde.de](http://www.vde.de)
- TUV [www.tuv.com](http://www.tuv.com)
- JSA [www.jsa.or.jp](http://www.jsa.or.jp)
- CCC [www.cccn.org.cn](http://www.cccn.org.cn)
- BSMI [www.bsmi.gov.tw](http://www.bsmi.gov.tw)

# Select a Safety Tester

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**GW INSTEK**

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# What should be major consideration?

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**TYPE**  
Analog vs Digital

**PRICE**  
inexpensive vs expensive

**Standards**

**SIZE**

# What should be major consideration?

## Output Capacity

The output capacity of safety tester is defined according to the **AC withstanding voltage multiply maximum current** (some called trip current) that can be measured. For example,

GPT-9900 : 5kV a.c. x 100mA = 500VA

GPT-9800 : 5kV a.c. x 40mA = 200VA

MODEL \ FUNCTION	AC	DC	IR	GB	SWEEP
GPT-9904	✓ ☆	✓	✓	✓	✓
GPT-9903	✓ ☆	✓	✓		✓
GPT-9903A	✓ ☆	✓	✓		✓
GPT-9902A	✓ ☆	✓			✓
GPT-9901A	✓ ☆				✓
GPT-9804	✓	✓	✓	✓	
GPT-9803	✓	✓	✓		
GPT-9802	✓	✓			
GPT-9801	✓				

☆ Short Current >200mA

# Safety test requirements

Regulation	Capacity requirement	ACW	DCW	IR	GB
IEC61010-1	The generator shall be able to supply a power of at least 500 VA	<p>The test voltage is raised uniformly from 0 to the specified value within 5 s and held at that value for at least the specified time. ACW: 1350~3500V</p> <p>For the a.c. tests, the test voltage is raised to its specified value within 5 s, and hold for at least 2 s. (ROUTINE TESTS) ACW: 840 ~ 2000V</p>	<p>The d.c. voltage is raised uniformly from 0 to the specified value within 5 s and held at that value at least 1 min DCW: 1900~4200V</p> <p>For the d.c. tests, the test voltage is raised to its specified value within 5 s, and hold for at least 2 s. (ROUTINE TESTS) DCW: 1200~4700V</p>	not specified	<p>By applying a test current for 1 min. The test current is 25 A a.c. r.m.s. at RATED MAINS frequency or d.c. or equal to twice the rated current of the equipment which is the greater</p> <p>Same test points as TYPE TESTS, but No value is specified for the test current. (ROUTINE TESTS)</p>

# Safety test requirements

Regulation	Capacity requirement	ACW	DCW	IR	GB
EN60598-1	<p>the high-voltage transformer used for the test, when the output terminals are <b>short circuited</b> after the output voltage has been adjusted to the appropriate test voltage, the output current <b>shall be at least 200 mA</b>.</p> <p>The <b>overcurrent relay</b> shall <b>not trip</b> when the output current is <b>less than 100 mA</b></p>	<p>A voltage of substantially sine-wave form, having a frequency of <b>50 Hz or 60 Hz</b> and shall be applied for <b>1 min</b> across the grade of insulation.</p> <p>Basic: <math>2U+1000V</math>            Double: <math>2U+1750V</math>            Reinforced: <math>4U+2750V</math></p> <p>Measured by applying a minimum voltage of <b>1.5 kV a.c.</b> for a minimum of <b>1 s</b>  <b>Breakdown current:</b> <b>&lt; 5mA</b>  <b>(ROUTINE TESTS)</b></p>	<p><math>ACW \times \sqrt{2} = DCW</math></p> <p>Measured by <b>1.5 kV</b> x <math>\sqrt{2}</math> d.c. for a minimum of <b>1 s</b>  <b>Breakdown current:</b> <b>&lt; 5mA</b>  <b>(ROUTINE TESTS)</b></p>	<p>The insulation resistance shall be measured with a <b>d.c. voltage</b> of approximately <b>500 V, 1 min</b>  <b>Resistance:</b> <b>&gt; 2~4MΩ</b></p> <p>Measured by applying <b>500 V d.c.</b> for <b>1 s</b>  <b>Resistance:</b> <b>&gt;2MΩ</b>  <b>(ROUTINE TEST)</b></p>	<p>A current of at least <b>10 A</b>, derived from a source with a <b>no-load voltage not exceeding 12 V</b>, and the current shall be applied for a period of at least <b>1 min</b>  <b>Resistance:</b> <b>&lt;0.5Ω</b>.</p> <p>Measured by passing a minimum current of <b>10 A</b> at between <b>6 and 12 V</b> for at least <b>1 s</b>.  <b>Resistance</b> <b>&lt;0.5Ω</b>.  <b>(ROUTIN TESTS)</b></p>

# Safety test requirements

Regulation	Capacity requirement	ACW	DCW	IR	GB
IEC60950-1	not specified	<p>1. The voltage applied to the insulation under test is gradually raised from zero to the prescribed voltage and held at that value for <b>60 s. (TYPE TEST)</b></p> <p>2. Based on grade of insulation <b>ACW : 1000~3000V</b></p> <p>3. <b>ROUTINE TESTS</b> are required to be conducted. It is permitted to <b>reduce the duration of the electric strength test to 1 s and to reduce the test voltage permitted by 10 %.</b></p>	<p>A d.c. test voltage equal to the peak voltage of the prescribed a.c. test voltage <b>ACW x 1.414</b></p> <p>For example, DCW can be applied if products have Y capacitance</p>	<p>500VDC &gt;2MΩ</p>	<p>1. For equipment powered from a MAINS SUPPLY, if the <b>protective current rating of the circuit</b> under test <b>is 16 A or less</b>, the test current <b>is 200 %</b> of the protective current rating applied for <b>120 s.</b></p> <p>2. The test current <b>can be either a.c. or d.c.</b> and the test voltage shall <b>not exceed 12 V.</b> <b>Resistance: &lt; 0.1 Ω.</b></p>

# What should be major consideration?

## Functionalities

- Enough functions for performing required test
- Programmable ramp & test time



# Digital vs Analog

There is no question that there are still many analog electrical safety testers being used in the field. However, the need for **standards**, **higher productivity**, **efficiency**, and the focus on better safety assurances are placing new demands on electrical safety instrument.



# Digital vs Analog

## Better viewing & resolution

Viewing measurement data on a digital display eliminates the guesswork prevalent on analog devices



# Digital vs Analog

## Better lockout security

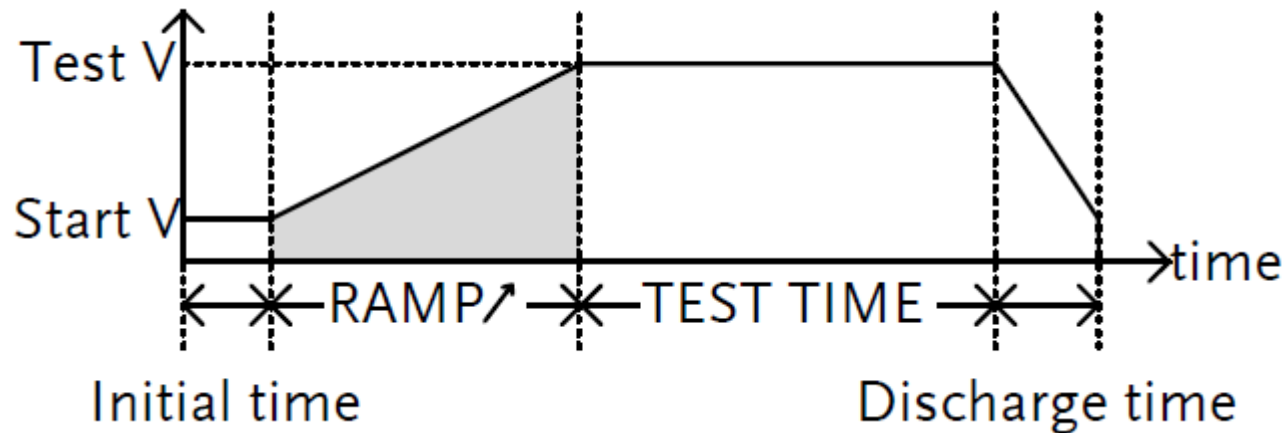
Digital devices offer keypad lockout eliminates the risk of unauthorized button pushing and improper or unsafe programming.



# Digital vs Analog

## Programmable ramp & test time

Programmable ramp and test time capability goes a long way in eliminating waste (due to improper potentials which can damage product) and complying with safety standards.



# Safety test requirements

Regulation	Capacity requirement	ACW	DCW	IR	GB
IEC60601-1	not specified	<p><i>Initially, not more than half the test voltage is applied, and then it is gradually raised over a period of 10 s to the full value, which is hold for 1 min, after which it is gradually lowered over a period of 10 s to less than half the full value.</i></p> <p><i>Depending on grade of insulation design and working voltage</i>  ACW: 1000V~4000V</p> <p><i>The test voltage for routine testing is to be the appropriate voltage as TYPE TESTS</i></p>	a d.c. test voltage equal to the peak value of the a.c. test voltage may be used.	comply with the requirements of IEC 60950-1 for Insulation coordination	<p><i>A current of 25 A or 1.5 times the highest RATED current of the relevant circuit, whichever is greater, from a source with a frequency of 50 Hz or 60 Hz and with a no-load voltage not exceeding 6 V, is passed for 5 ~ 10 s</i></p>

# Digital vs Analog

## Memory storage

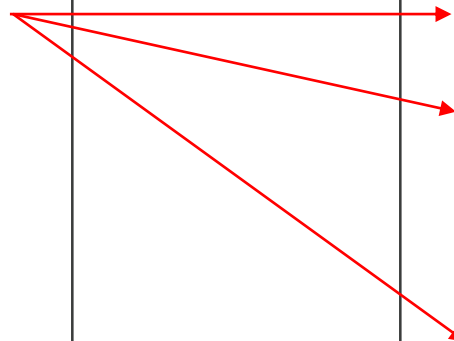
Digital devices offer test steps or sequences to be saved in memory for further used. It eliminates the risk of mistake of repeating change test parameters.

### AUTO MODE (100 sets)

AUTO=001-\*\*\*  
AUTO=002-\*\*\*  
.  
.  
.  
AUTO=099-\*\*\*  
AUTO=100-\*\*\*

### MANU MODE (100 sets)

MANU=\*\*\*-001  
MANU=\*\*\*-002  
.  
.  
.  
MANU=\*\*\*-099  
MANU=\*\*\*-100



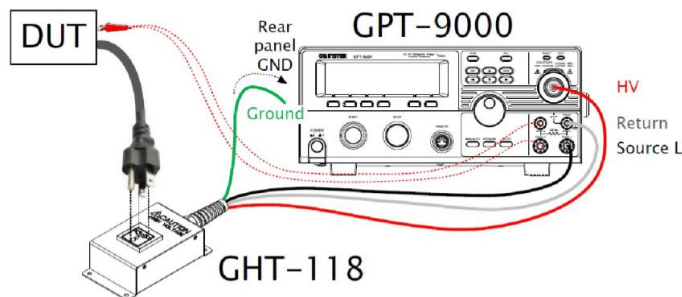
# Safety test requirements

Regulation	Capacity requirement	ACW	DCW	IR	GB
IEC60065	The test voltages shall be obtained from a suitable source so designed that, <b>when the output terminals are short-circuited</b> after the test voltage has been adjusted to the appropriate level, <b>the output current is at least 200 mA.</b>	<p>Test time <b>1min</b> Voltage is required from <b>1410 ~ 4240Vpp</b> (<b>1000 ~ 3000V r.m.s</b>) depending on operation voltage and grade of insulation</p> <p>Test time <b>1~4s</b> Voltage is required from <b>1130 ~ 3540Vpp</b> (<b>800 ~ 2500V r.m.s</b>) depending on operation voltage and grade of insulation <b>(ROUTINE TESTS)</b></p>	Where corona, charge effects or the like may occur, d.c. test voltage is recommended	500V d.c. Insulation resistance from $2M\Omega$ ~ $4M\Omega$ depends on grade of insulation	<p>The test shall be carried out for <b>1 min</b> with a <b>test current of 25 A a.c. or d.c.</b> The test voltage shall not exceed 12 V.</p> <p>The test current applied for <b>1~ 4s</b> should be in the order of <b>10 A a.c.</b>, derived from a source having a <b>no-load voltage not exceeding 12 V.</b></p> <p>The resistance shall be <b>0.1 ~0.2 <math>\Omega</math></b> depending on supply cord.</p>

# Digital vs Analog

# Test sequencing

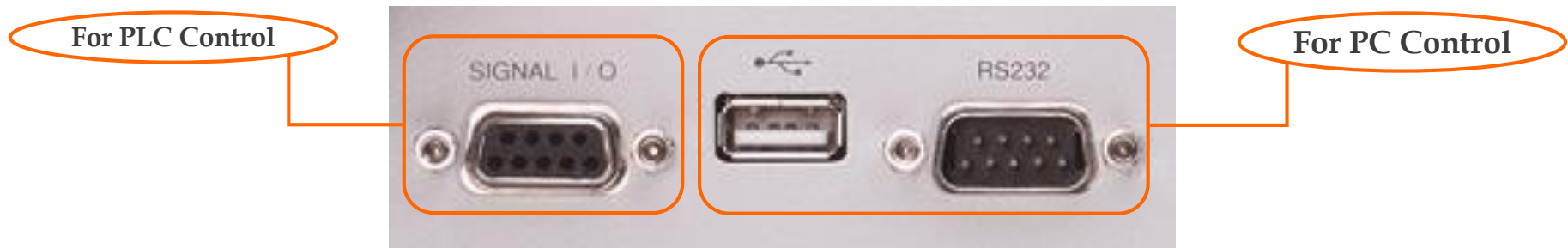
A test sequence is simply a series of electrical safety tests that run from one to the next automatically. It is plain to see the time saving, productivity, and organizational benefits of digital electrical safety testers



# Digital vs Analog

## Digital interface capability

IEEE-488.2, USB device, RS-232, and I/O type interfaces are available. The benefits are high productivity, speed, test and data archiving, statistical analysis, and the simplicity of automated testing. Although you may find an interface of one sort or another on an analog instrument.



# Tips of Performing Safety Tests

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When performing electrical safety tests, the issue of safety plays a major role. Everyone agrees that making the tests as **safe** and **efficient** as possible is very important.

## Tips1(Safe)

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# Dedicated

## Person & document

## The role of dedicated person

- An authorized person whose can change testing step or editing parameters.
- An authorized person whose can perform safety tests

### MORE IMPORTANT

It is person whose having well training or well knowledge for the safety tests.

# The role of dedicated document

- An specific instruction for necessary operation only

## Step1 : Power Up



- Equipment turns on with last operation before power off
- Equipment is in "READY" status

## Step2 : Select Test Function



- Press the key under LCD to select test function. Either single test function or Auto mode.

## Step3 : Editing



- Press EDIT key into edit status, and then press FIELD key in between parameter items
- Using wheel to change parameter and then press SAVE key to confirm setting

## Step4 : Setting Output Voltage



- Using wheel to the desired Output Voltage

## Step5 : Start Test



- Pressing START button, test is starting

## Tips2(Safe)

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# Protection

## Wear insulation items while operation

To prevent electric shock

- Insulation gloves
- Insulation shoes



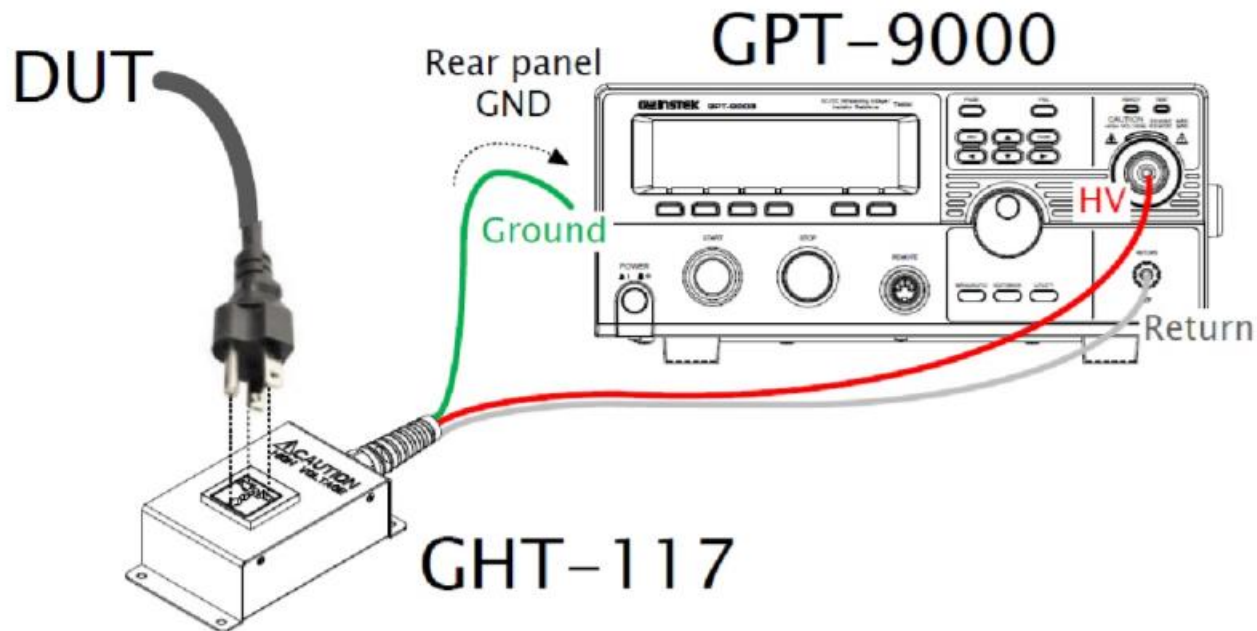
## Tips3(Efficient)

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Use proper Fixture

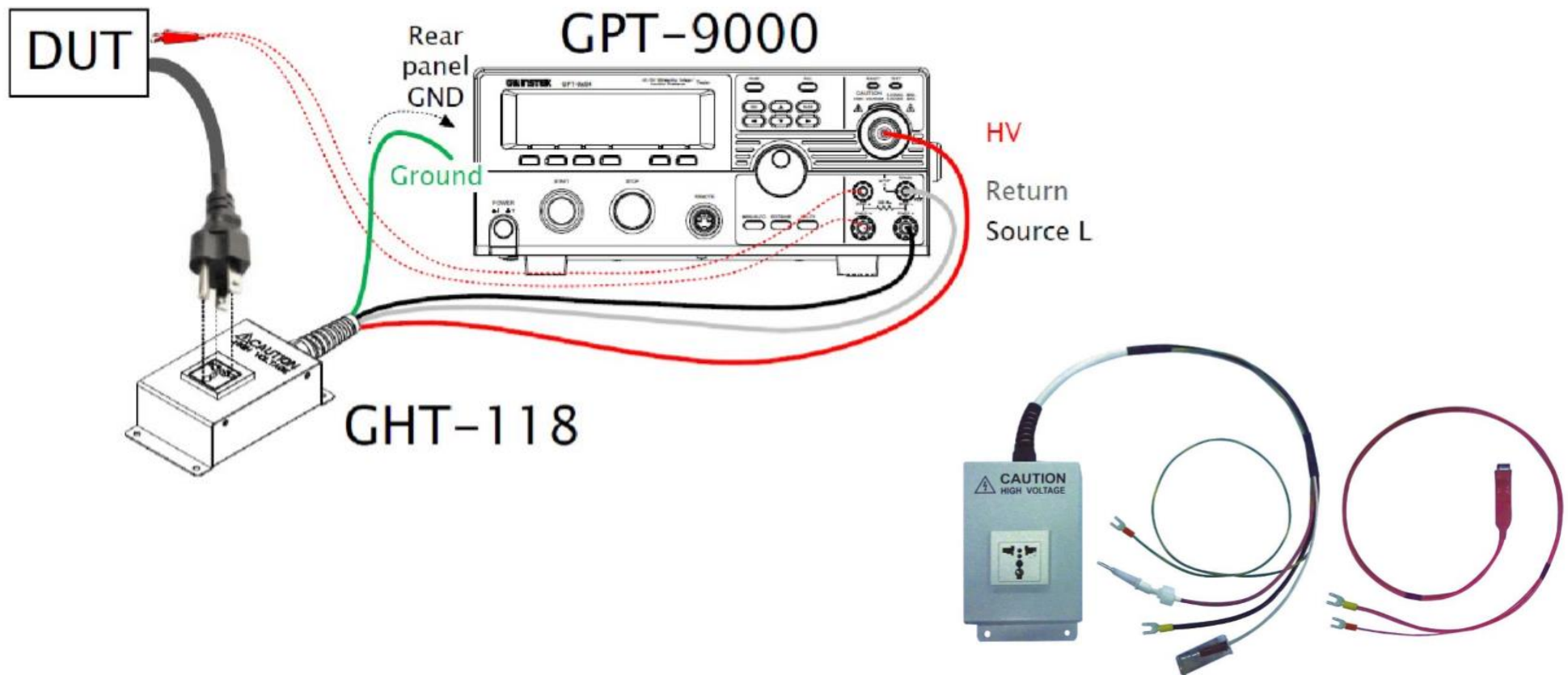
## Fixture 1: Adapter ~ GHT-117

- Single product for AC/DC withstanding voltage & IR tests



## Fixture2: Adapter ~ GHT-118

- Single product for AC/DC withstanding voltage, IR & GB tests



## Fixture3: Scanner box ~ GSB-01/02

- Single product with multiple test points

