

## HIGH VOLTAGE INSULATION METERS

### WHY AND WHERE TO USE THEM?

#### What is an H.V. Insulation Meter ?

This is an instrument which displays the Insulation Resistance.

Rugged and Reliable H.V. Insulation Meters can display up to 500 Giga-ohms (500.000 M ) or even more and generate up to 10kVdc.

The display can be **Analog** or **Digital**.

The Measurement is done by generating the selected DC voltage across the insulation under test.

**Digital** H.V. Insulation Meters measure the applied voltage and the current going through the insulation, then calculate the Insulation resistance.

Most of those Digital H.V. Insulation Meters are Auto-Ranging.

(6210IN, 6211IN, 6212IN, 2803IN and 2804IN)

**Analog** H.V. Insulation Meters measure the current going through the insulation (ohm-meter principle).

The Large Analog Taut Band Panel Meter is graduated with the Insulation resistance. They have only two resistance ranges.

The Autoranging selection is displayed by Color coded L.E.D.s .

(6200IN and 6201IN)

#### Domestic or Industrial ?

Domestic Insulation Meters generates lower voltage : 250Vdc, 500Vdc, 1000Vdc and only measure up to 2 or 3G (digital models).

Generally, Analog Domestic Insulation Meters can only measure up to 400M .

They are used for domestic applications and do not have a guard facility to eliminate surface current during testing.

***Our High Voltage Insulation Meters are classified as Industrial Meters.***

Industrial H.V. Insulation Meters are rugged and generate from 500Vdc to 10000Vdc.

They are designed for longer battery life.

The Test Leads are Customized for High Voltage Measurement. (AL-30, AL-50, AL-53)

#### Is Digital Better than Analog ?

Digital H.V. Meters are rugged while Analog are fragile and subject to mechanical failure when mishandled.

Analog Panel Meters require mechanical adjustment. Their reading is subject to viewing angle and personal judgement.

Reading of the correct scale is subject to auto-ranging information given by Leds and proper interpretation by the field Engineer.

Digital High Voltage Insulation Meters can display multiple information and results on the display.

For example the voltage output indication can be given on a bargraph, Insulation Test Time and Insulation Results are available on the same display.

Hold facility is also provided as well as visual discharge of the circuit under Test.

Generally, Digital High Voltage Insulation Meters have a better Output Voltage Vs Current curve than their Analog counterpart.

Digital High Voltage Insulation Meters maintain their Voltage Constant with more current.

#### Why do High Voltage Insulation Meters need a Voltage Warning ?

Should the Circuit Under Test still being supplied with AC voltage, the Field Test Engineer will then be prompted to stop attempting to test immediately, so that he can open the supply circuit going to the Circuit or Device under Test.

Or, he may just be testing at the wrong place.

Capacitive and Inductive circuits may still be charged with dangerous voltages and high level of energy. Those circuits must be discharged before and after testing.

***Circuit or Device under Test must be free of any Potential Before and After Testing with High Voltage Insulation Meters***

## Why use H.V. Insulation Meters ?

### 1- Safety of personnel

- Calculate the Leakage Current.  
The sum of all the Leakage Current should give you the standing Earth Leakage Current of a electrical system.
- Check that no Insulation Breakdown occurs ( specially at higher voltage ).
- Compare with previous results.
- Keep a log-book with results.
- Analyse results for **Preventive Safety** and maintenance.

## Why not use a Domestic Insulation Meter for Preventive Maintenance?

Domestic Insulation meters can't measure high enough to be able to analyse trend and changes in most of the insulation materials. Industrial Insulation Meters can measure, at least, about 20 time higher insulation resistance than domestic insulation meters. For example, with a test voltage of only 1000Vdc , our Digital High Voltage Meters can measure up to 50G . This High Insulation Resistance measurement can help the field engineer to diagnose if an equipment need maintenance or not. A

## DANGERS OF ELECTRICITY TO HUMAN BEINGS

In modern countries, in workshop, office or classroom, it is forbidden to work alone when working with equipment, especially if it utilises the mains supply. In the event of an accident, should you receive an electric shock or burns, then there will be no-one nearby who can help you. High voltage such as domestic a.c. mains voltage or even high H.T. ( High Tension ) or E.H.T. ( Extra High Tension ) voltage can rise to particular hazards.

The Human Heart is simply a muscle, and happens to be the most susceptible to stimulation at an applied frequency of about 50Hz ( which perversely also to be a.c. mains frequency ).

The effects of electric shock are a combination of the voltage level applied and also the current which flows trough the body, not to mention the time period of the shock itself.

Assuming that an unfortunate person pick up or touch a "live"electric device, typical effects on the helpless victim are as follows :

<u>Current</u>	<u>Effect on Human Being</u>
1 mA	Tingling.
9 mA	Probably able to release the device.
16mA	Borderline on ability to drop the faulty device.
25mA	Probably unable to release the device to escape further electric shock.
16 to 50 mA	Pain, Possible unconsciousness. Heart and respiration functions probably continue !
>100mA	Ventricular fibrillation ( Heart tremor ). Respiration paralysis ( asphyxia, suffocation ) Severe shock and burns . <b>POSSIBLE DEATH .</b>

### 2- Safety of Buildings

- Better Insulation = Fire and Hazard Risk Reduction.
- Monthly Checks = Keeps Records
- Analyse Results = Lower Costs

### 3- Safety of Machinery and other Assets.

- Better Insulation = Better Maintained
- Better Insulation = Longer Life.
- Better Insulation = Better and Safer Working Conditions.

Domestic Insulation Meter could not do that. In Industrial Environment, equipment and circuitry are submitted to higher transient voltage than in normal domestic use. The Test voltage of domestic Insulation testers is too low. We need to know what will happen in the worst scenario, **when High Voltage Transient occurs, will the Insulation of the Equipment or Circuitry survive long enough to protect the Lives and Assets at stake or will Insulation Breakdown !**

HELPING YOU MAKING OUR WORLD  
SAFER, EVERYDAY, DAY AFTER DAY.  
TOGETHER,  
WE CAN MAKE THE DIFFERENCE

### Periodic measurements - WHY ?

*periodic measurement are made in order to ensure that:*

- Personnel is safe with electricity in the workplace.(keep probable leakage current below the maximum safe allowed).
- Buildings are safe.  
(wiring and circuit breaker insulation are still good - Fire will not start)
- Equipment is safe to use by personnel. (leakage will be lower than the allowed one for the machinery).
- Equipment is safe for itself. (Insulation Material has not deteriorated too much)
- Trend of insulation resistance can be kept and therefore preventive maintenance can be performed before breakdown occurs.
- Downtime and Repairs can be planned, production does not suffer.

### What happen in case of a bad Insulation ?

#### • *In the Best Case :*

When Insulation breakdown, a current path to the earth is created.  
Provided you have a good and healthy earthing system, the Earth Leakage Circuit Breaker will detect the imbalance between Line and Neutral and will trip the Circuit breaker. The Earth Leakage Circuit Breaker will detect the rise in earth current (sensitivity) and will trip quickly (time to disconnect), so, hopefully, the personnel, which could have touched the earthing system, will not be chocked because of the good earthing system and the equipment will maybe not too badly damaged because of the fast response of the Earth Leakage Circuit Breaker.

#### • *In a not so good case :*

For example if the earthing is bad (high earth resistance) and the leakage current can't trip the E.L.C.B., then the personnel is at risk, the machinery could also start burning.

#### • *In a very bad case :*

Imagine a case of very Bad Insulation and the E.L.C.B. does not trip because it was bypassed during the day to keep production running (a fault was tripping the breaker, but production was getting late and the production manager decided to "fix" the problem).

The live conductor touching (very bad insulation) the casing of a large and expensive piece of equipment, the casing of that machinery is not properly earthed, the Night Watchman touching the casing of the machine, therefore creating a path for that fault, the insulation start carbonising and the fault get worse, the night watchman can't let go and die, a fire is started inside the machine, nothing trips, nobody else is there. The rest is for the fire brigade and specialised investigators.

Should preventive maintenance had been performed, the insulation change could have been picked up long before a real fault occurred, the machinery could had been maintained on schedule, and the protections could have been active. Nobody would have died and the assets would be intact.

### The next time, we will discuss : how your business can make money with High Voltage Insulation Resistance Measurement.

#### 1- Preventive Maintenance.

Monthly checks.

#### 2- Higher Productivity.

No unscheduled downtime.

#### 3- Lower Insurance Costs.

Renegotiate better rates for lower risk.

#### 4- Lower Future Running Costs.

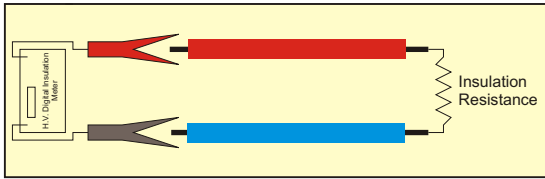
Buy safer, better and more efficient equipment for higher returns.



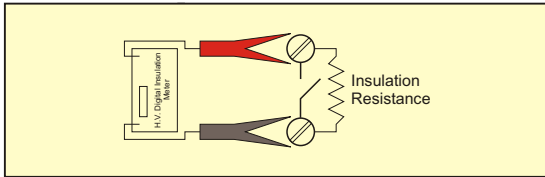
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## Some popular applications

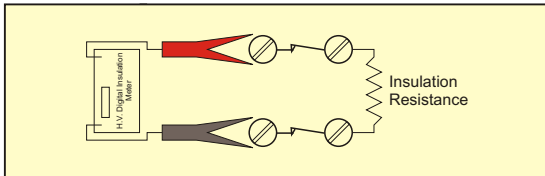
### • Measuring Insulation between Wires.



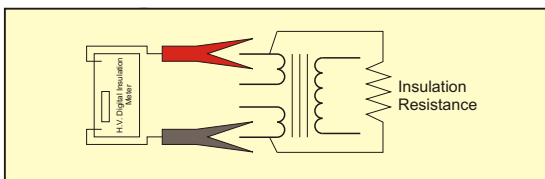
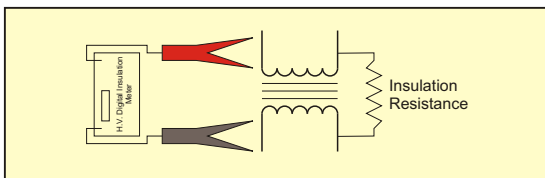
### • Measuring Insulation of Open Contacts of Circuit Breaker.



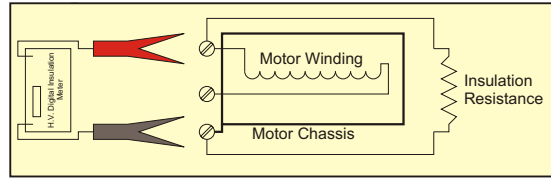
### • Measuring Insulation between contacts of Circuit Breaker.



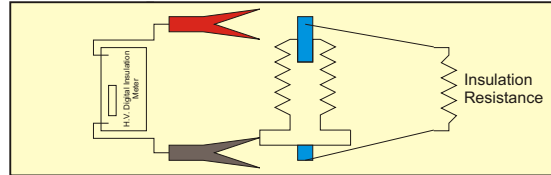
### • Measuring Insulation between Primary and Secondary of Transformer or between windings



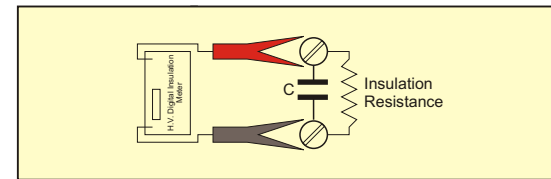
### • Motor



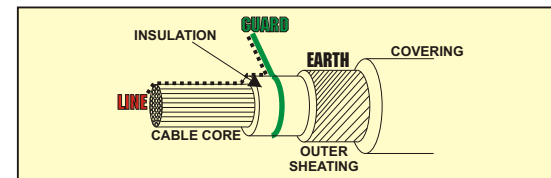
### • Insulator



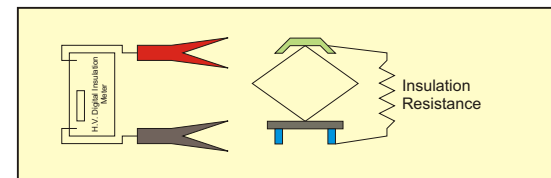
### • Capacitor



### • Cable



### • Insulator on Railway Coach



Please forward your comments, suggestions and complains to my E-mail address in South Africa: [JMBvion@iAFRICA.CO.ZA](mailto:JMBvion@iAFRICA.CO.ZA) or to the SEW factory at Taipei: [Jacques@SEW.COM.TW](mailto:Jacques@SEW.COM.TW)  
Your information and questions are important to us.

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Page 4

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