# Earth Leakage tester

# Instruction Leaflet & Test Log


**We recommend testing your boat's electrical system for earth leakage on a monthly basis**

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# Galvanic Isolator
## ELT-16

The ELT-16 Earth Leakage tester is a tool that detects earth leakage by monitoring the current flowing in the earth conductor in the electrical cable that connects a boat to it's shore based electricity supply. Two indicator LED's indicate fault conditions when illuminated..

**What is Earth Leakage?**

Earth Leakage is NOT the same as Galvanic Current. If your boat is fitted with a Galvanic Isolator, it will not prevent earth leakage. Earth Leakage is a different phenomenon.

In these instructions, Earth leakage is defined as any electrical current that unintentionally flows along the earth conductor of the boat's mains connecting cable. Ideally, there should be NO current flowing in this conductor. However, in practice, small currents CAN flow. These currents are usually very small indeed - just a few milliamps. (One milliamp is a thousandth of an Amp).

**There are three main types of Earth Leakage.**

**AC Leakage.** AC Leakage is potentially life threatening, as the voltage of the AC system on boats is high - around 230 Volts. This is enough to give a person a nasty shock, or even kill. It's often caused by faulty appliances, or water getting into electrical systems. It usually gets worse over time, and can cause tripping of your RCD (Earth leakage circuitbreaker). It can also prevent your galvanic isolator from working properly.

If the AC leakage gets too high, the RCD on the boat, or the RCD on the supply post will trip. Whilst this protects you from electric shocks, it could be very inconvenient. The Earth Leakage tester can detect leakage that's too small to trip an RCD, so you can deal with it before the problem gets worse.

**DC Leakage.** DC Leakage can cause rapid corrosion to your boat's anodes, metal hull and underwater metal fittings. Usually, the first you would know about it is when your anodes are gone, or your hull corrodes. This kind of leakage can cause very rapid corrosion - MUCH faster than galvanic corrosion. That's because the voltage is much higher. Galvanic voltages are typically around 1 Volt. But DC leakage can be as high as 14 Volts (or double that on a 24 Volt system).

So, as you can imagine, the rate of corrosion is proportionally faster. Fortunately, DC leakage is quite rare - but it DOES happen, and should be dealt with urgently.

**Imprinted Leakage.** Imprinted Leakage is becoming more and more common. It's caused by the "tech" on our boats. When the internal voltages equipment's power supplies "leaks" into the boat's earthing system. This can happen in a number of ways. Through direct electrical conduction into the earth wiring, through capacitive or inductive coupling, and through radiation. Don't worry if you don't understand all that.

What you need to know is that typical causes of Imprinted Leakage are Battery Chargers & Inverters, TV's, Computer & phone power supplies, navigation equipment etc. Imprinted Leakage can render your galvanic isolation ineffective. It can also be a cause of rapid corrosion in it's own right.

**Testing:** During the test, al the boat's electrical equipment should be switched ON.

**The tester must only be connected during the testing process. It must be removed immediately testing is complete.**

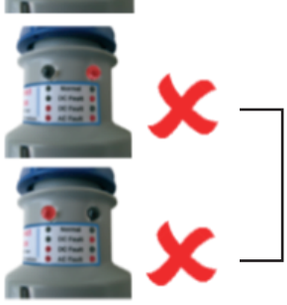
The tester can be connected at either the boat end or the supply end. If it is connected at the boat end, it will test only the boat electrics. If it is connected at the supply end, it will also test the connecting cable. We recommend testing the boat electrics first, then move the tester to the supply end to test the connecting cable.

If you have a plug in Galvanic Isolator, it is advisable, but not essential, to remove this prior to testing.

Before connecting the tester, please check that the RCD's on the boat, and the supply post are working. If not, please rectify the problem before proceeding with the test. After the test, please check again that the RCD's are working normally.

When plugged in, NO LIGHTS SHOULD SHOW. If no lights show, no further action is required. If any lights show, please refer to the following diagram and instructions.

**No lights – all is well – no further action required**



**One, (either) light illuminated – DC Leakage**

**Both lights illuminated – AC or Imprinted Leakage**

**AC Leakage - Both lights lit**


AC Leakage occurs when an appliance, cable or connection has poor insulation resistance, and some of the circuit's current "leaks" away to earth. If there is sufficient leakage, the earth leakage circuit breaker, also known as the RCD, will trip, disconnecting the supply.

At lower levels of leakage, the RCD may not trip, but the lights on your Earth Leakage Tester may still glow, alerting you to the likelihood of earth leakage. Usually, an earth leakage fault will only get worse, so you should always take this seriously and investigate.

No two electrical systems are the same, so it's only possible to give broad suggestions of how to locate any problem.


1) Switch off the main RCD on the boat.
In most cases, this will result in the lights going out. If not, there is probably something connected to the mains supply BEFORE the RCD.

2) Assuming the lights go out when the RCD is switched off, switch off ALL the circuit breakers, then switch the RCD back on. In most cases, the isolator's lights will stay off. **

**Rarely, even though all the circuit breakers (except the RCD) are switched off, the isolator lights will remain on. In this case you will need to disconnect all appliances, either by pulling out the plugs, or disconnecting any wired in appliances. Do this one at a time, taking care to ensure that you don't forget anything. As you disconnect items, check the isolator lights. The last item you disconnect is the one causing problems.

3) Switch the circuit breakers back on one at a time until the isolators lights come back on. The last circuit breaker you switched on has the faulty circuit, or appliance connected to it.

4) When you have traced the fault to a single appliance or circuit, it must then be checked for earth leakage by a competent person.

**DC Leakage - One light lit** (either light)


DC Leakage happens when part of the DC voltage of your boat leaks into the earthing system of the vessel. This is most often caused by incorrect wiring, loose earth connections, or faulty equipment. Moisture ingress can also cause DC leakage problems.

1) Check that the boat's AC earth is properly bonded to the boat's hull. In our experience this is one of the most common causes of DC Leakage.


2) Ensure that all earth/negative connections are sound - not just at the battery connection, but also where the connection is made to the hull/engine block/earth bussbar etc. Connections must be clean and tight.
The above two items will resolve the vast majority of DC Leakage problems

3) If your boat has a battery charging system, switch it off. If the fault clears, suspect the battery charger.

4) Check for water ingress into alternators and other equipment. Check for faulty cabling in areas where cables are likely to be damaged.

5) If your boat is connected to a shore based TV or Internet connections, disconnect them one at a time, whilst checking the tester's lights.

If after following the above instructions, you still have DC leakage problems, it is recommended that further investigations are carried out by a qualified marine electrician,

**Imprinted Earth Leakage - Both lights lit.** Sometimes one more brightly


Imprinted Leakage typically occurs when equipment using a Switched Mode Power Supply Unit, (SMPSU), is connected to your system. Imprinted Leakage can prevent galvanic isolators from working properly, or even cause severe corrosion in it's own right. The list below covers just some of the equipment that will use an SMPSU. The list is not exhaustive.

**• Battery Chargers • Battery Management Systems • Nav Equipment • Computers • TV's • Phone Chargers • Computers • Laptop & Pad Power Supplies • Domestic Appliances etc., etc.**

1) Ensure that permanently installed equipment such as battery chargers are properly earthed. Equipment is often installed without adequate earth bonding. Please consult the equipment's installation manual, or contact the manufacturers for more information


In our experience, battery chargers are often the cause of imprinted leakage. CE regulations require that equipment should not create this kind of interference, but not all equipment is as "clean" as it should be.

2) Switch off or disconnect all equipment that is likely to contain a SMPSU. The tester's lights should go out. Then switch on the items one by one.

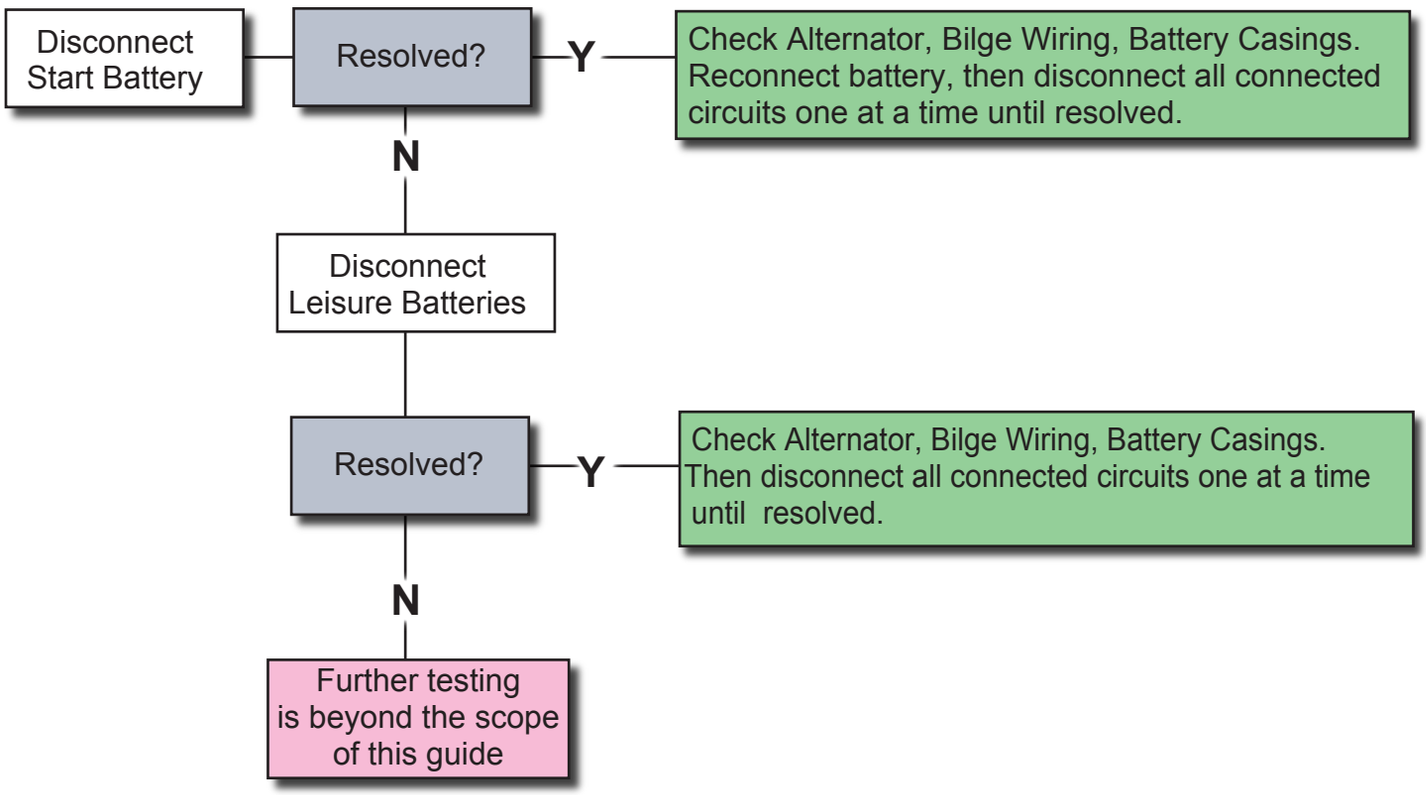
3) When the lights on the tester illuminate, the last item you switched on is a likely cause of the problem.

OFTEN there are two or more items contributing to Imprinted Leakage. If you identify an item that is causing leakage. Make a note of it, then switch it off, and continue to check all other items.

**From the above, you'll see that a structured approach, and some detective work may be called for to locate and resolve any problems that are found by the Earth Leakage tester. We are happy to advise on the use of the tester, but cannot assist with actual fault diagnosis, as no two electrical installations are the same. In case of difficulty, we suggest that you enlist the help of a competent marine electrician. Above all, DO NOT IGNORE THE FAULT.**

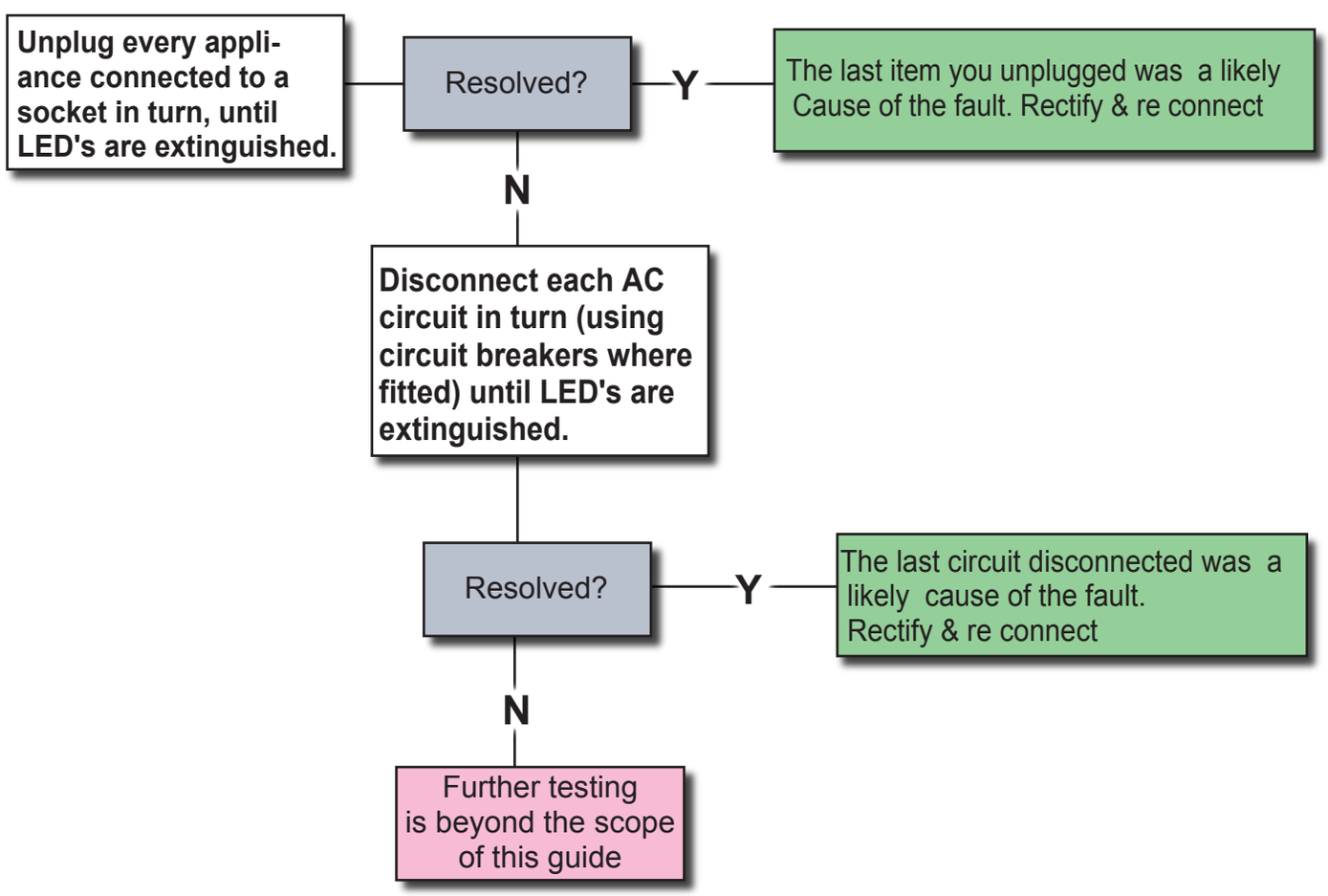
**Important: Disconnect the tester immediately after use.**

## ONE (either) LED glowing




## BOTH LEDs glowing

**This indicates a possibility of AC (mains voltage) leakage or Imprinted Leakage Proceed with great care Danger of electrical shock. If in doubt, please consult a qualified electrician.**



Galvanic Isolator

# Earth Leakage Tester Test Log

**Boat Name** .....

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