

## **The Misconceptions of EN 50191, Electrical Safety Testing Standard for the Erection and Operation of Electrical Test Equipment.**

The scope of this standard, The Erection and Operation of Electrical Test Equipment EN 50191: 2001, is to provide guidelines in the set-up and operation of the electrical test installation on the production line in the manufacturing environment, as well as in the test laboratories and repair facilities. This standard addresses not only the test station but also the operation of the equipment, and training of the personnel involved in the testing of the products to protect against dangerous shock hazards.

EN 50191 has no formal legal relationship with any of the Directives or the CE Marking or any other manufacturing product standard. The standard was implemented March 1, 2001 and the introduction requires any conflicting national standard be withdrawn by October 1, 2002. This European Standard was approved by CENELEC and CENELEC members are bound to comply with the conditions of this national standard without any alteration.

### **Compliance**

Compliance with this standard is not necessary if contact with live parts presents no danger. This is the case when one of the following conditions is satisfied at live exposed points.

- a) The voltage at frequencies above 500 Hz does not exceed 25 V AC or 60 V DC and complies with the requirements for SELV or for PELV in accordance with HD 384.4.41.
- b) In case of voltages at frequencies up to 500 Hz exceeding 25 V AC or 60 V DC the resultant current through a non-inductive resistance of 2 k ohms does not exceed 3 mA AC (RMS) or 12 mA DC.

*Many companies are interpreting this statement to mean that the equipment to do the testing must have a limited output current which is less than 3 mA AC in order to comply with the safety requirements of this standard. This is not the case if fact some EN safety standard require the use of equipment which have 100 mA full load capabilities. The design of the product being tested is the main factor in determining the size of the instrument required to perform the electrical safety test. If your test instrument has an output current level greater than 3 mA then you must follow the requirements of EN50191 and guard the live parts and set up the work station accordingly either with positive protection against direct contact or without positive protection and set up the test area with barriers and warning lights. If the equipment has a limited output current less than 3 mA then EN 50191 doe not apply.*

- c) At frequencies above 500 Hz no hazardous body currents or contact voltages occur. In these cases the national determination current and voltage values should be applied. If there are no national requirements, determined reference values for permissible body currents and contact voltages can be taken from Table A.1 in Annex A of the standard.
- d) The discharge energy does not exceed 350 mJ.

*When performing a DC test the capacitance of the DUT must also be considered in the available amount of discharge energy, many times the capacitance of the DUT stores larger discharge energy than the filter capacitor within the test equipment.*

Even though compliance with this standard is not necessary if one of the above-mentioned conditions is satisfied, other potential risks shall be considered and appropriate measures put into place to obviate the risk.

Test environments vary depending upon the product being manufactured or tested; EN50191 differentiates between test stations with positive protection against direct contact and those without, test laboratories and experimental stations as well as temporary test stations and test stations without test personnel in permanent attendance. The level of protection for each of these environments also varies as well as the degree of training for the test operators.

#### **Protection against electric shock.**

The test installation should be set-up employing the following safety measures to guard against an electrical shock.

- The test assemblies and work station should be arranged that protection against direct contact is secured by insulation of live parts, using covers, enclosures, barriers to insure a safe distance.
- Safe distance is insured when a person carrying out the tests cannot reach the Prohibition Zone with his or her body or tools. The prohibition zone is determined by the test voltage.
- Barriers are to be used to separate the work areas and passageways and should be designed to prevent access to the test area other than the test persons, and prevent people from reaching the prohibition zone.
- Indicator lights and signs to indicate the operational status.
- Emergency shut down switch, shall be provided to cut off electrical energy which could result in danger.
- Prevent unauthorized and unintentional switching-on.
- Prevent automatic energizing of test circuits in case of loss of mains power and recovery after a power failure.
- Protection against other hazards where additional dangers exist, due to arcs, noise, explosions, radiation, flying parts, fire.

#### **Test Stations with automatic protection against direct contact.**

The test assembly shall be so arranged and designed that the protection against direct contact is secured by insulation of live parts, covers, enclosures. It shall not be possible to switch on the test voltages until the means of protection are fully operational and functioning correctly. Opening the means of protection must disconnect the test voltage automatically. Residual voltages shall be automatically reduced to a non-hazardous level before live parts can be touched.

**Test Stations without automatic protection against direct contact.**

Test stations without automatic protection against direct contact shall only be installed if the erection of the test stations without automatic protection is not practical;

- due to frequently changing test duties;
- in case of varying types of test objects;
- in case of serious difficulties in performing the work;
- when test duties occur only occasionally.

The test area must be separated from work areas and passageways using barriers to prevent access to the test area by persons other than the test persons, the barriers must prevent persons from reaching the prohibition zone. The barriers must also prevent persons from outside the barrier reaching the operations devices of the test installation which are located inside the barrier. The barriers must be designed that visual contact with the operator can be maintained from outside at all times.

At least one emergency switching device shall be installed outside the test areas.

An adequate number of red signal lamps, indicating operational status shall be installed.

If test circuits are electrically connected to the general power supply system (*not isolated*) additional protection shall be provided by means of a RCD (*GFI Ground Fault Interrupter*) with a rated difference current  $\leq 30$  mA. If the residual current includes D.C. components, an appropriate RCD shall be used.

*The Smart GFI circuit built into the Associated Research hipots will shut down the high voltage output of the instrument when the leakage current to ground exceeds 0.5 mA.*

Test workbench tops shall be made of insulating materials.

Electrical equipment with protective insulation or supplied by means of an isolating transformer shall preferably be used.

*(Instruments employing a Ground Fault Interrupter in the output of the instrument are also acceptable). The Smart GFI circuit built into the Associated Research testers will shut down the instrument when the leakage current to ground exceeds 0.5 mA which is well below the 3 mA AC maximum leakage specified from the high side of the line to earth.*

The working area of the test stations shall be such that movement of test personnel is not impeded. National regulations shall be taken into considerations.

When safety test probes are used with voltages exceeding 1 kV, the high voltage side of the test apparatus shall be electrically isolated from the supply mains and insulated from earth, the same applies to test probes and their leads.

The R.M.S. value of the leakage current on the high voltage side of the test apparatus shall not exceed 3 mA. This value shall not be exceeded even when a highly resistive connection is made between the high voltage side and earth.

### **Test laboratories and experimental stations.**

These test stations must incorporate barriers using solid walls or grids at least 1800 mm high. Entrances shall be provided with warning sign “No unauthorized persons beyond this point”. When there are separate test areas within the laboratory the operation status of each of the areas shall be indicated by signal lights. Emergency escape doors and gates shall be opened from inside the test area. Provisions for earthing (grounding) shall be available. National regulations on escape routes and emergency exits shall be taken into account. Measures are required to prevent unauthorized entry but shall not prevent persons from leaving. When these safety measures are not appropriate for the type of construction, the protection of personnel required in the test area must be secured by equally effective means. One such measure is continuous supervision of access.

### **Temporary test stations.**

Unauthorized persons shall be prevented from access to the temporary test area by means of walls, grids, ropes, chains, bars or similar barriers. Entrances shall be provided with warning signs “No unauthorized persons beyond this point”

Escape facilities shall be provided.

When safety probes are used with voltages exceeding 1 kV, the high voltage side of the test apparatus shall be electrically isolated from the mains and insulated from earth, the same applying to test probes and their leads. The test object shall also be isolated from earth where practical.

*Note: If the test item is not isolated from earth then the test item and test instrument are now referenced to earth ground. In this case in order to comply with the 3 mA maximum leakage current to ground the instrument must have a limited output current of less than 3 mA. If the output of the test instrument is less than 3 mA then according to the scope of the standard you are not required to comply with the standard.*

### **Test stations without test personnel in permanent attendance.**

If a test station is intended to be operated without permanent presence of test personnel it shall be constructed following the requirements for test stations with automatic protection against direct contact or it must follow the requirements for a test laboratory. Emergency Stop equipment and automatic cutoff must be used to prevent access to the DUT.

### **Operation of the test installations.**

Test installations may only be operated under the control and supervision of a skilled person. This does not apply to test stations that have automatic protection against direct contact. The test installation shall be provided with operating instructions and these shall contain information for safe operation. The installations shall be inspected for externally visible damage or defects before each use and shall not be operated if there are any signs of damage or defects that could result in a dangerous condition. Only skilled persons shall be employed to maintain the test installation, and the proper operation and condition of the safety devices must be inspected on a regular basis and the inspections shall be recorded.



### **Personnel**

Only skilled or instructed personnel may work with test installations that do not employ automatic protection against direct contact. All personnel involved shall be instructed in safety requirements, safety rules and company instructions applicable for their work. The personnel are required to comply with the requirements and rules. The complexity of the work shall be evaluated and the appropriate choice of a skilled or instructed person is made for carrying out the activity. A written record of the training shall be kept. Personnel using safety test probes shall receive additional training regarding the special risk involved. Personnel working in test laboratories, experimental stations and temporary stations may work only under the overall supervision of a nominated person in control of the work.

### **Test procedures**

Assembly work and tests shall not be performed simultaneously as this could result in danger. In the event of a fault during the testing parts of the test object and test installation may become live which are not live during normal operation. It is therefore extremely important not to contact the DUT while the test is in process. Some test conditions require you as part of test to interrupt the protective ground conductor to facilitate the test because the enclosure has to be isolated from earth, the DUT shall be supplied from an isolation transformer in accordance with EN 61558. Before touching the DUT ensure that there are no dangerous voltages present on the accessible parts by grounding the DUT.

### **Conclusion**

This standard applies to organizations within the European Community (EC) performing electrical test on electronic or electrical products, and is not applicable to organizations in the United States, yet it provides the most comprehensive guide on how to set up a safe electrical testing workstation to protect against electric shock. In the United States the Standards pertaining to Electrical Safety in the workplace are covered under NFPA 70E or OSHA 29 CFR Part 1910 Subpart S Electrical Safety related work practices and are not focused on the electrical testing workstation. This standard covers the whole testing environment from operator training to the test installation.

### ***About the Author***

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