

HOW TO SET UP A PRODUCT SAFETY TESTING WORKSTATION THAT IS SAFE FOR THE OPERATOR

As an industry leader in electrical safety testing instruments, Associated Research is often called upon as a consultant to interpret various product safety standards and advise manufacturers how to comply with these standards. Most questions are usually directed toward specific applications or tests that must be performed to meet the requirements of agency standards as specified in UL, CSA, EN or other standards. We provide detailed information on product safety testing in our application guide called [A Basic Guide to Electrical Product Safety Testing](#) and our booklet of [Frequently Asked Questions](#). Other questions that are sometimes asked pertain to the set-up of a safe workstation for Electrical Safety Testing. In our opinion, addressing operator safety during a test is just as important as ensuring the safety of the end product user.

The first challenge a manufacturer faces is finding where to go to find guidelines on how test stations should be set-up. It is also common to find that the individual responsible for setting up the test station may not have a basic understanding of electricity or the hazards involved. The lack of awareness of the potential hazards involved in performing these product safety tests makes it very difficult to build in the necessary safeguards to protect the operator against potential shock hazards. Most often the focus is on setting up the test area for maximum productivity. Assembly operations may also be performed at the same workstation to balance the production line. This makes it even more critical to set up a safe workstation. Assemblers not involved with the electrical aspects of manufacturing the product could inadvertently be exposed to electrical safety hazards. So, where does a manufacturer look to find proper guidelines on how workstations should be set up?

If you are a manufacturer located in the U.S.A., the first place you may look for guidance is to the Occupational Safety and Health Act (OSHA) 29 CFR Part 1910, subpart S, [Electrical Safety Related Work Practices](#). This standard used the National Fire Protection Association (NFPA 70E) [Electrical Safety Requirements for Employee Workplaces](#) as its source document in the development of the final standard. Both standards provide you with background information on “Electrical Shock Hazards”, “Nature of Electrical Accidents”, and some “Protective Measures”. They stipulate general requirements for employee training, and advise that the personnel performing these tests must be qualified, thoroughly trained and be familiar with the safety related work practices required by OSHA 29 CFR 1910.

OSHA 29 CFR 1910 goes on to say that qualified personnel must have the skills and techniques necessary to distinguish exposed live parts from other parts of electrical equipment and the hazards involved. Exposed live parts are considered to be parts of the product which are energized and that the operator may come into contact with during the test. The individual(s) responsible for setting up the workstation must be aware of the proper clearance distances for corresponding voltage levels. The operator should be

trained in safety related work practices and procedures, and in emergency procedures required to release victims from contact with exposed live parts or circuits. A person setting up test stations must be able to determine the degree and extent of the hazard and the personal protective equipment and job planning necessary to perform the task safely. For example, the OSHA standards specifically call out that conductive materials and jewelry should not be worn by anyone working on or near energized equipment, yet it is commonplace to see personnel working at electrical testing workstations wearing anti-static clothing and jewelry. A test station cannot be considered safe without the proper training of any individuals involved in or exposed to the testing. In addition, the product safety testing station needs to be configured to provide the operator with every possible protection against exposure to hazardous voltages.

The standard does provide you with some necessary background information but it unfortunately, is not specifically written to give you guidelines regarding the proper set up of an electrical testing workstation. There is another standard that manufacturers can refer to that does provide more details on the set-up of a safe workstation.

This standard is the proposed European Norm Standard prEN 50191 Erection and Operation of Electrical Test Equipment and is an excellent source document that calls out guidelines for the set-up of an electrical testing workstation. This standard is scheduled to be accepted and published as a European Standard (EN 50191) later this year, and published as an identical British National Standard in the year 2000. This safety standard specifies the requirements for the set-up and operation of electrical test equipment to minimize the risks during the performance of various product safety tests. Please note this is not a standard in the U.S.A., but the guidelines for the set-up and operation of an electrical testing workstation are much easier to understand as they specifically address the set-up and operation of electrical test equipment.

EN 50191 differentiates between test stations with “positive protection” against direct contact and test stations without “positive protection” against direct contact. A test station with positive protection against direct contact is a station in which the device under test (DUT) and all live parts of the test apparatus have positive and full protection against direct contact while the equipment is in an energized condition. An example of full protection would be a test hood that covers the entire product and the test instrument making it impossible for the operator to contact either during a test without de-activating the high voltage. A test station without positive protection is not fully protected against direct contact. Test stations without positive protection against direct contact should only be installed if it is not practicable to install test stations with positive protection. Some common reasons for setting up test stations without positive protection may be due to the physical size of the DUT or requirements to manually test multiple points which could prohibit the use of an enclosure. However, testing of multiple points does not necessarily mean that positive protection cannot be utilized. Several new safety-testing instruments are available with scanning matrixes that can automatically apply voltage to multiple points of a DUT without operator intervention.

How can positive protection against direct contact be achieved?

EN 50191 recommends the use of safeguards in the design of the test station to guard against electrical shock hazards. Some examples of these safeguards and a brief explanation of what they mean are as follows:

- *The use of barriers or walls-* This requirement is called out to separate the test area from assembly areas. The distance between the barriers and any parts that could become live are specified in the standard in relation to the maximum test voltage being used. The barriers should be designed to prevent people who are standing outside the test area from reaching in to the DUT or the controls of the test instrument.
- *The use of insulated enclosures or covers to prevent access to the DUT, these covers should be interlocked with the test instrument-* The use of failsafe interlocks would prevent test equipment from being energized unless the enclosure or cover is closed. Interlocks should also be installed at the entrances to the test area. The equipment must not be able to be switched on again until all doors have been closed. Automatic re-energizing of the test circuits must be prevented upon the recovery of the input power should a power failure occur. If the size of the equipment is so large that an interlocked insulated enclosure or cover is not practical a “light curtain” around the perimeter of the DUT may be an alternative solution to prevent access to the DUT.
- *Indicator lamps and warning signs-* These would provide visual indications that could be incorporated in the test area to indicate the operating status of the equipment within view of all operators.
- *Positive protection to guard against residual voltage must be incorporated-* This basically means that output shorting devices should be used to discharge any energy which may be stored in the DUT.

What must be done to protect operators at test stations that do not incorporate “positive protection” against direct contact? Here are some suggestions on how the test area could be set up when positive protection is not possible.

- *The test station should be separated from work areas-* The use of walls and barriers should be constructed to protect the people standing outside the test area. The barriers should be constructed so visual contact with the test operator can be maintained from outside the test area. The test station should be clearly identified and the appropriate warning signs and red signal lamps must be used to indicate the operating condition.
- *The test apparatus must be guarded against unauthorized use, or unintentional operation-* A lockout device should be incorporated into the design of the test station and a protective collar should completely surround the test switch or the device should require two deliberate actions to activate the test such as dual palm switches.
- *Emergency switching equipment-* This emergency switching provides operators with a quick way to cut off all voltages that could result in danger. At least one of the devices should be located outside the danger area. It should not be possible to re-energize the equipment until the emergency switching device has been reset.

However, the resetting of the emergency switch should not cause the test equipment to re-energize.

- *The test bench should be made of non-conductive material-* This is required to isolate the DUT during the test.
- *The use of two-hand controls-* If an insulated enclosure cannot be incorporated in the design of your workstation the use of two-handed controls may be an alternative. This will require the operator to use both hands to activate a test.
- *The use of two safety probes-* The operator can either apply voltage to the probes by manual operation or release the live probes which must at a minimum safely insulate the user from the test voltage if it remains active. Some probes may include an automatic switching circuit which would de-activate high voltage when the probe is released. Two safety probes are specified which require the operator to use both hands to test the DUT. This prevents the operator from contacting the device under test while the test is in progress.

What are some of the requirements for the operation of the test equipment? Are there different skill levels required for personnel working at these test stations?

- *Operating instructions shall be provided for the test equipment.* The instructions should also include instructions for safe operation of the equipment at the specific test station. These instructions may vary from one test station to another. Operators should have access to these instructions. This may seem like an obvious comment but it is common to find instructions kept in an engineering file rather than at the test station.
- *The test equipment and any fixtures should be checked for any signs of damage or defects before each use.* Functional tests can be performed on the test equipment utilizing test loads or simulation boxes to verify proper operation. Functional tests should also be performed on any safety devices before starting any work. These tests should be performed at a minimum at the start of each shift. Any defects must be repaired immediately by a qualified person or reported to responsible supervisor.
- *The training requirements of operators at test stations that do not incorporate positive protection is much higher.* Only skilled personnel may work with test equipment at these test stations. A skilled person is a person who has an electrical or electronics background and experience to enable them to avoid danger. They should also receive safety training at least once per year and the instructions should be recorded. Operators who use safety test probes should receive additional training regarding the specific dangers involved in manual testing. Test stations that incorporate positive protection against direct contact do not require operators with an electrical or electronics background.
- *Assembly work and testing must not be performed simultaneously.* This could result in a dangerous shock hazard. Some product safety tests require that the ground circuit of the DUT be opened during the test. If a fault should occur during a test it is possible that an exposed part of the DUT could be subject to dangerous voltages. This could present an electrical hazard to anyone that might be in contact with the DUT at the time it fails.

Summary

Most manufacturers of electrical or electronic products do everything possible to ensure that the products produced are electrically safe by following guidelines of the product safety standards. Manufacturers also have an obligation to provide an equal level of safety protection to the operators who perform these electrical safety tests. Even though there are no clear standards for operator safety, there are resources available that manufacturers can turn to for information. Additional safety information is available at the Associated Research website at www.asresearch.com. By using these resources and common safety practices the manufacturer can provide operators with a safe work environment.

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Technical Services Manager at Associated Research, Inc. Mr. Davis holds an Electronics degree from DeVry Technical Institute. For over 30 years Dwayne has been instrumental in the design, development and manufacture of many of Associated Research's high voltage products including transformers, high voltage supplies and safety testing instruments. In addition, Dwayne has extensive field experience having done customer seminars throughout the world as well as presentations at industry gatherings. He is a recognized expert in the field of High Voltage Safety Testing and its application. Today, Dwayne heads up the Technical Services group at Associated Research, Inc.