An Explanation of Fail Verification

Fail Verification Overview

Fail Verification is a system used to confirm that an electrical safety tester is functioning properly and will detect failures in the Device Under Test (DUT). There may be more familiarity with the "external verification box," which has been available on the market for many years. While these verification boxes have served their intended purpose, they do represent an extra piece of equipment that must be hooked up to the safety tester to perform the test. Mechanical in nature, these verification boxes were needed because many of the available safety testers on the market were of the older analog style design.

Today's safety testers contain microprocessor-controlled technology and software-driven-circuits that allow for verification to be built-in to the instrument itself. These not only eliminate an extra piece of mechanical equipment and save cost, but the tests themselves are easier and safer to perform since there is nothing external to hook up. The internal verification system determines whether or not the safety tester will detect a failure condition in a DUT. Associated Research's VERI-CHEK® system is an example of an internal verification system. Various safety agencies have required manufacturers to perform this test, ensuring that unsafe products are not shipped because the test instrument itself is malfunctioning. While it is always possible for a component failure to cause the instrument to malfunction, there are other conditions that can cause inaccurate results in electrical safety testing.

1. If the High Voltage or the Return leads are open then it is possible the instrument will not detect failure because of this open circuit condition. Newer instruments with modern technology like "Low Limit Settings" and "DC Charge" detection help eliminate this problem. Verification can help to ensure that these parameters are set correctly.

2. Many safety tests are done through various types of fixturing that also might have open contact conditions that prevent the high voltage from actually reaching the DUT. This also creates an open circuit condition that can be detected with Low Limits and DC Charge-LO settings.

3. Although newer instruments are more tamper proof it is always possible that someone with access to setup menus may have changed or disabled the parameters of the fail detection systems. Verification can help to test all modes of the required electrical safety tests.

4. In the case where the operator has to make manual connections to the DUT it is possible that connection errors could be avoided by regularly verifying the tests.

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Safety Agency requirements

Some safety agencies that require verification of the electrical safety testing process include Underwriters Laboratories (UL), International Electrotechnical Commission (IEC), TÜV, and British Electrotechnical Approvals Board (BEAB). Most safety agency guidelines allow any personnel who have been properly educated in the use of safety-testing instruments to perform fail verification tests. How frequently these verification tests must be performed varies by safety agency. Some agencies may require this test to be performed several times a day. It is also very common to see fail verification required at the beginning of each shift change. However, other agencies only require fail verification at the beginning or end of each day. Of course the manufacturer has to first meet the guidelines of their respective safety agency.

Associated Research recommends that verification be performed at each shift change, as it is usually a convenient time to perform the test and it ties the verification process to a new operator. This way, an accountability link can be established for each individual and their safety tester. Although most safety agencies establish some guidelines for the frequency that verification should be performed, none make any recommendations for exactly how the test should be performed. This has resulted in some confusion and several different methods being recommended by manufacturers of electrical safety testing instruments.

Common Verification Test Methods

External Resistor method – Fixed resistors can be used to verify instrument failure. Many manufacturers provide boxes with several common resistor values built into them. The operator needs to select the correct resistor and connect the test leads across the resistive load. The resistor selected needs to be a value that will allow enough current flow at a selected test voltage to exceed the setting of the instrument's failure detection circuitry. The test voltage can either be brought up instantly or gradually ramped up to the selected level. If the failure detection circuitry is functioning correctly the instrument should indicate a failure before the full test voltage is reached. One drawback to this method is that it does not allow for leakage variances from one product to another so it becomes necessary to select and use several different resistor values or select one that will generate enough current to simulate failure on all DUT's.

External Switch box method – Another very easy method to accomplish verification of the safety tester is simply by connecting the test leads together to create a short circuit. If the safety-testing instrument is functioning correctly it should sense excessive current flow and indicate a fault condition. If the instrument indicates failure during this condition then the Hipot fault detection system was verified. This same procedure can be used for performing IR fail verification. Shorting the leads will cause a very low resistance, which should be picked up as a failure by the instrument. Performing Continuity and Ground Bond fail verification is similar to this except that now a

shorted condition is considered good. Remember that these tests are looking for continuity so an open condition now represents failure. To simulate Continuity or Ground Bond failure the test leads should be left open while a test is run to simulate an open DUT ground connection. If the instrument indicates failure during this condition then the Ground Bond or Continuity fault detection system was verified. Some electrical safety testing instrument manufacturers offer external boxes that are basically a system of connectors and switches that toggle from one position to another to create these basic fault simulations. Although this system will work it involves additional costs for this equipment and it requires the operator to keep track of this external device to perform the verification test.

New Technology – VeriCHEK®

Confusing connections is a common weakness of these two systems mentioned above. This may require operators to refer to printed instructions to perform verification tests. New technology developed by Associated Research now provides for fail verification tests to be performed without the need for external resistors, verification boxes or the need for printed instructions.

Our newest electrical safety testers now include an enhanced graphic display. A graphic display and software provides the flexibility to add detailed messages and user prompts. VERI-CHEK is now included as a standard feature on all new Hypot III and HYAMP III mid-range models and on the OMNIA Series of fully automated multi-function instruments.

The VERI-CHEK system can be enacted each time the instrument is powered up. The instrument then begins to display a series of user-friendly prompts. The display is used to prompt the operator through all the steps needed to perform a verification test. The instrument prompts the user as to which leads need to be connected or disconnected (see figure 1). After the test the display gives a visual confirmation that the verification tests have been performed satisfactorily (see figure 2). In the event that the verification tests fail, another message is displayed (see figure 3). Functions that can be verified include AC Hipot, DC Hipot, Ground Continuity, Ground Bond and Insulation Resistance.

Best of all, the new VERI-CHEK system allows manufacturers to satisfy safety agency requirements for verification without the inconvenience and price of additional external test boxes. Verification becomes one more test that can be performed more safely, more conveniently and less expensively than ever before.

Figure 1 **Figure 2**

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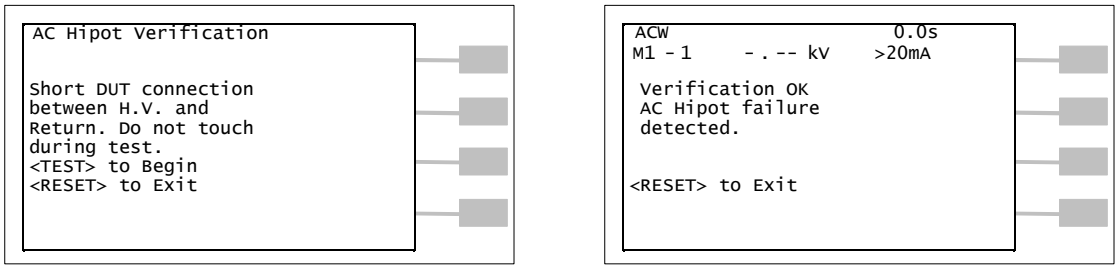
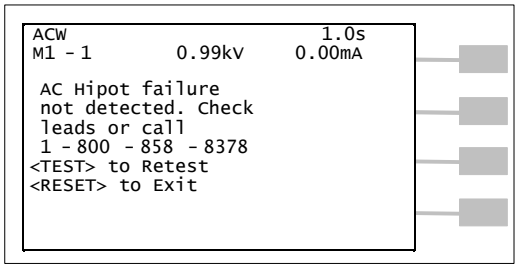

AC Hipot Verification
Short DUT connection
between H.V. and
Return. Do not touch
during test.
<TEST> to Begin
<RESET> to Exit
ACW 0.0s
M1 - 1 - . -- kV >20mA
Verification OK
AC Hipot failure
detected.
<RESET> to Exit

Figure 3


ACW 1.0s
M1 - 1 0.99kV 0.00mA
AC Hipot failure
not detected. Check
leads or call
1 - 800 - 858 - 8378
<TEST> to Retest
<RESET> to Exit