

Chroma Systems Solutions, Inc.

Using a Load Box to Verify a Hipot Tester is Working Properly

190xx Products

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Title:

Using a Load Box to Verify a Hipot Tester is Working Properly

Product Family: **190xx Products**

Abstract

How do you know if your hipot tester is functioning properly? Are you getting false failures or worse, false pass results? Use a load box to verify that the hipot tester is performing measurements correctly. The S14-01 is a custom configurable load box used to ensure the hipot tester is measuring properly, and that all test leads are in working condition. The S14-01 consists of high voltage resistors with the resistor values based upon the test specifications that the hipot tester is configured for. The customer specifies the resistor values when he purchases the load box. The S14-01 Load Box is then built to that customer's test configuration. The S14-03 Custom Pass/Fail Load Box verifies both the hipot and ground bond functions of an electrical safety tester.

Solutions

S14-01 Load Box Example

An appliance manufacturer has his Sentry 19073 Hipot Tester configured for a 1200V hipot test. The high limit is programmed for 10mA. The resistor from Ground to Pass would need to be greater than 120kohm. Say, the manufacturer chooses to use a 140kOhm resistor. The user would expect to have his hipot tester measure 8.5mA, which would be considered a PASS given the set 10mA high limit. The Fail resistor would need to be less than 120kOhm. The manufacturer chooses a 100kohm resistor. The 100kohm load with 1200V produces 12mA of current, resulting in a FAIL.



Figure 1: S14-01 Load Box

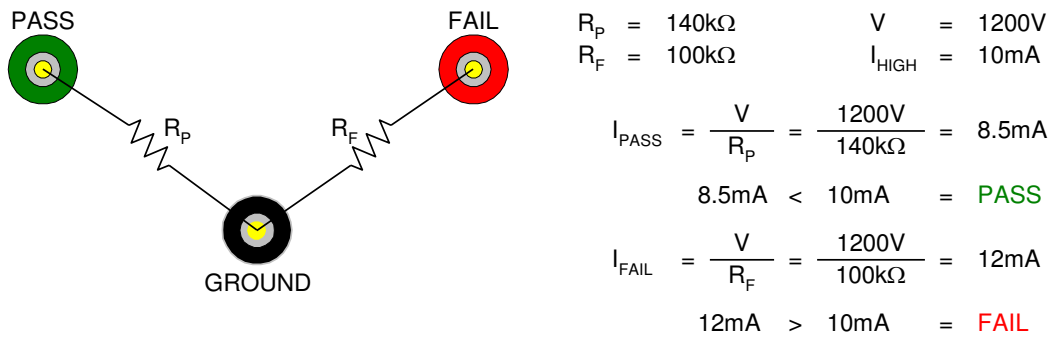


Figure 2: Internal S14-01 Configuration

Figure 2 illustrates how to calculate the PASS and FAIL current values based on the manufacturer's specifications of a 1200V hipot test with a 10mA high limit.

Hipot Verification

Connection of S14-01 Load Box to Hipot Tester

Figure 3 illustrates the connection of an S14-01 Pass/Fail Load Box to a Sentry 19073 AC/DC/IR Hipot Tester. The S14-01 Load Box is compatible with the 19071, Sentry 19073 and Guardian Series instruments. In the S14-01 example, the Sentry 19073 is programmed for 1200V AC and the high limit is set at 10mA.

To verify the hipot measurement, connect the white banana plug between the HV OUTPUT on the Sentry 19073 and PASS binding post on the S14-01 load box. Connect the black banana plug between RTN/LOW on the Sentry 19073 and the GROUND binding post on the S14-01 load box. Press [START]. The Sentry should read approximately 8.5mA and "PASS". Now check the fail function by switching the white banana plug so that it is connected between the HV OUTPUT on the Sentry 19073 and the FAIL binding post. Leave the black banana plug connected between RTN/LOW and GROUND. Press [START]. The Sentry should read approximately 12.0mA and "FAIL".

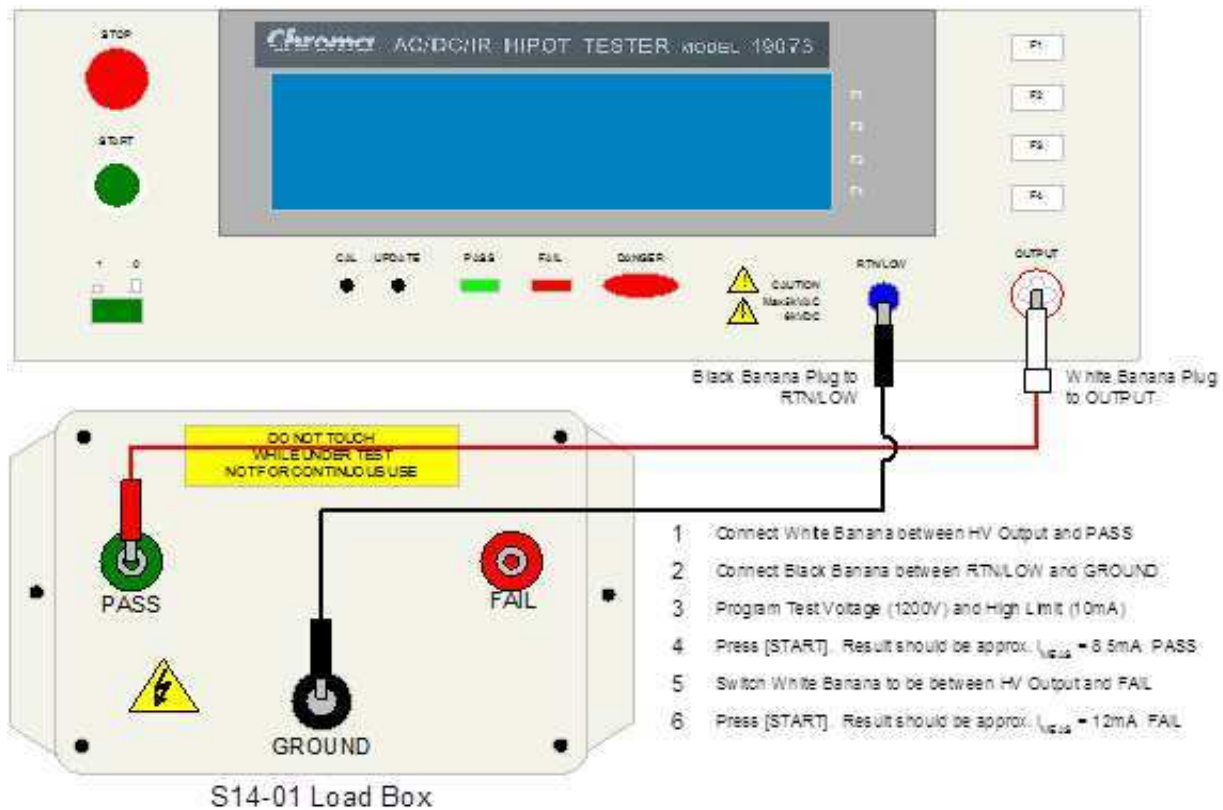


Figure 3: Connection of S14-01 Load Box to Sentry 19073 Hipot Tester

S14-03 Custom Pass/Fail Load Box

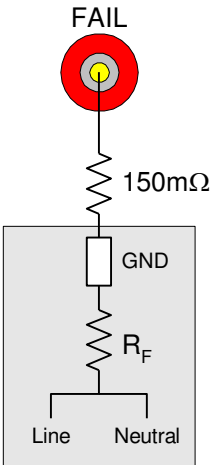
The S14-03 Custom Pass/Fail load box is used to verify that both the Hipot and and Ground Bond functions of the tester are functioning properly. To verify the Ground Bond portion, high current resistor values of 50m Ω and 150m Ω are used. Ground Bond (GB) verification is performed from the ground blade of the power entry adapter to the binding post. Typically, the maximum limit for Ground Bond is 100m Ω . Connecting to the red binding post and to the FAIL power entry module, will result in a failure in the GB test, because the actual value of resistance (150m Ω) is greater than the set limit of 100m Ω . The pass circuit has the 50m Ω resistor, so in connecting between the green binding post and the PASS power entry module, the GB test will pass.



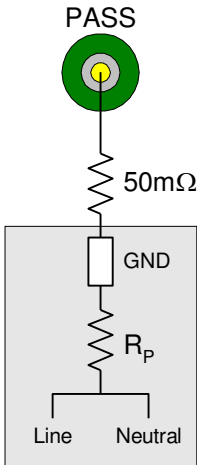
Figure 4: S14-03 P/F Load Box

For Hipot verification, custom resistors are installed between the LINE and NEUTRAL of the power entry adapter to the Ground Blade. These resistors are determined based on the specifications of the hipot test. Figure 5 uses the same hipot specifications as described for the S14-01 example.

To Verify Ground Bond Test



To Verify Hipot Test



$$\begin{aligned}
 R_P &= 140k\Omega & V &= 1200V \\
 R_F &= 100k\Omega & I_{HIGH} &= 10mA \\
 I_{PASS} &= \frac{V}{R_P} = \frac{1200V}{140k\Omega} = 8.5mA \\
 8.5mA &< 10mA & &= \text{PASS} \\
 I_{FAIL} &= \frac{V}{R_F} = \frac{1200V}{100k\Omega} = 12mA \\
 12mA &> 10mA & &= \text{FAIL}
 \end{aligned}$$

Figure 5: Internal Configuration of S14-03 Load Box

Ground Bond Verification

Connection of S14-03 Load Box to Electrical Safety Analyzer

To verify the Ground Bond function of the Guardian 19032, connect the S14-03 load box as shown in Figure 6. Use the G14 Power Entry Adapter to connect to the PASS module and the red G15 GC test lead to connect to the green binding post. Program a Ground Bond test with a high limit of 100mΩ. Press [START]. The 19032 should read approximately 50mΩ and “PASS”. Check the fail function now by connecting the G14 Power Entry Adapter to the FAIL module and the G15 test lead to the red binding post. Press [START]. The 19032 should read approximately 150mΩ and “FAIL”. The hipot verification uses the same connections and can be programmed at the same time as the Ground Bond by programming a 2-step test.

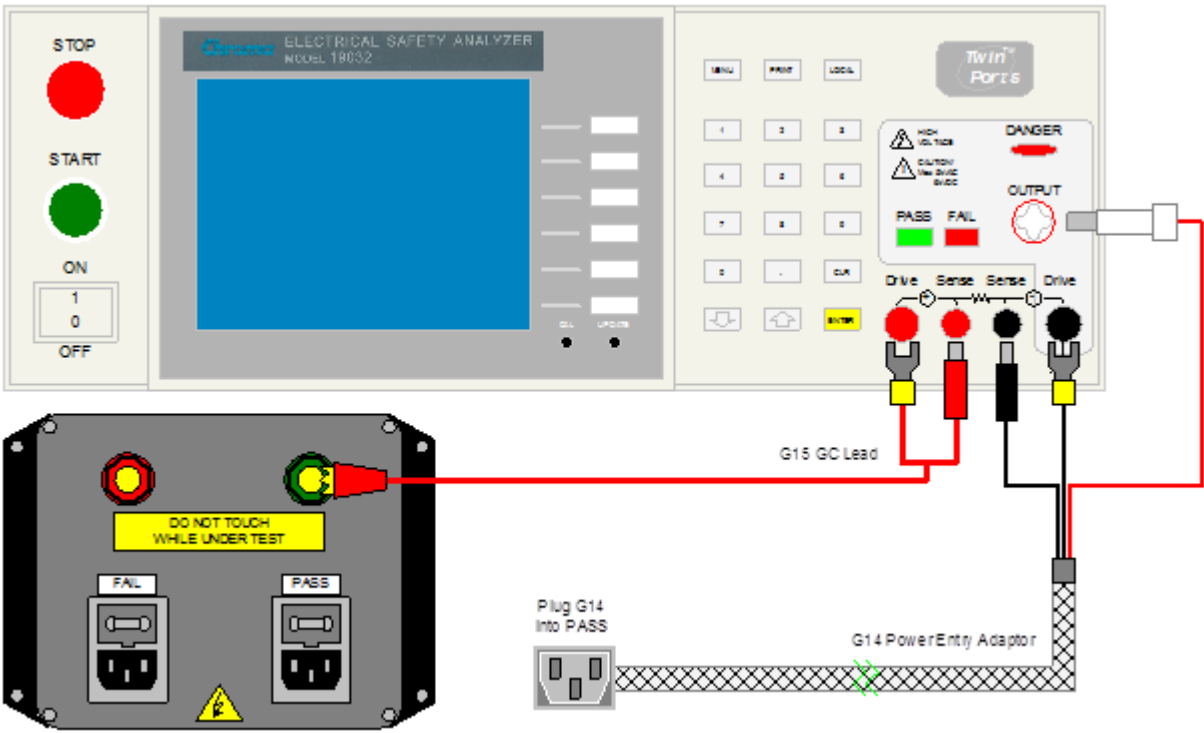


Figure 6: Connection of S14-03 Load Box to Guardian 19032 Safety Analyzer

Conclusion:

In conclusion the use of a load box, will ensure that the Safety tester is performing properly, it is measuring and outputting the correct voltage (if the voltage is incorrect the measured current will be incorrect). It also confirms the test leads being used are good condition and there are no opens or shorts.