ELECTRICAL ISOLATION VERIFICATION (DC)

Practice:

Direct current (DC) electrical isolation verification tests are made as part of the EMC test of hardware prior to final spacecraft assembly. Flight acceptance isolation retest is required after any hardware rework of subsystems with electrical interfaces that utilize system wiring.

Benefit:

Inadvertent grounds of isolated circuits and ground loops are detected directly by this test. In some cases, such grounds may pass other tests with no apparent degradation. Failure may not occur until the vehicle is subjected to high level electromagnetic radiation.

Since this test requires minimal test equipment and can be performed in a short time, its benefits are achieved at low cost.

Programs That Certified Usage:

Voyager, Magellan, Galileo, and Ocean Topographic Experiment (TOPEX/POSEIDON)

Center to Contact for Information:

Jet Propulsion Laboratory (JPL)

Implementation Method:

Electrical isolation verification is a direct current resistance measurement of all circuits that are required to have electrical isolation from subsystem circuit common or subsystem chassis. The resistance must be at least 1 megohm between each isolated circuit and circuit common or chassis when measured with a suitable multimeter. A multimeter must be selected that will not overstress sensitive components.

There are five types of isolation circuits which are tested in slightly different ways. Differences between the five types are shown in Figures 1 through 5 and in Table 1 below:

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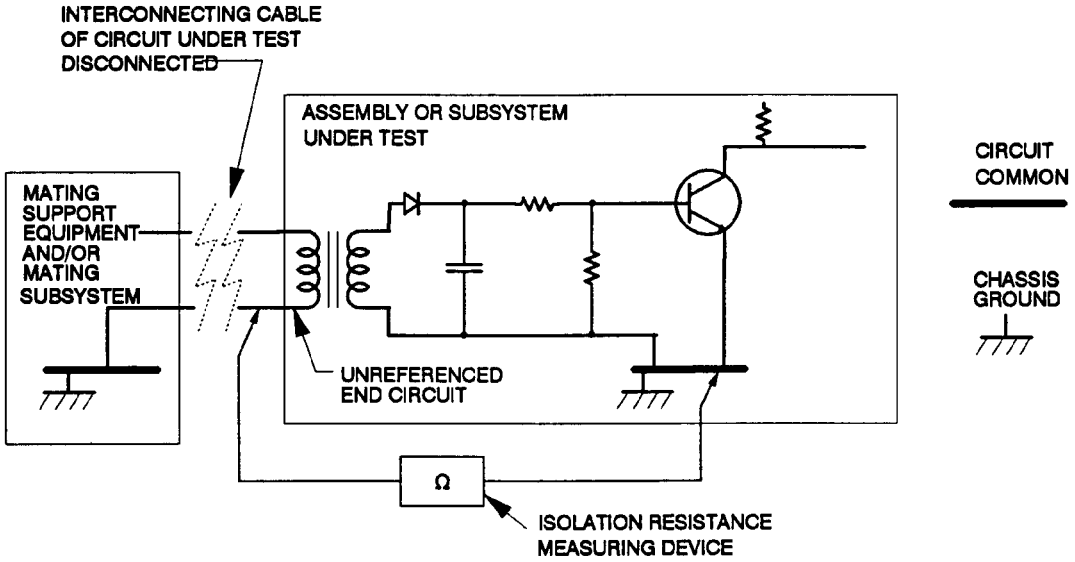

Figure 1. Single Unreferenced End-Circuit General Isolation Test Configuration

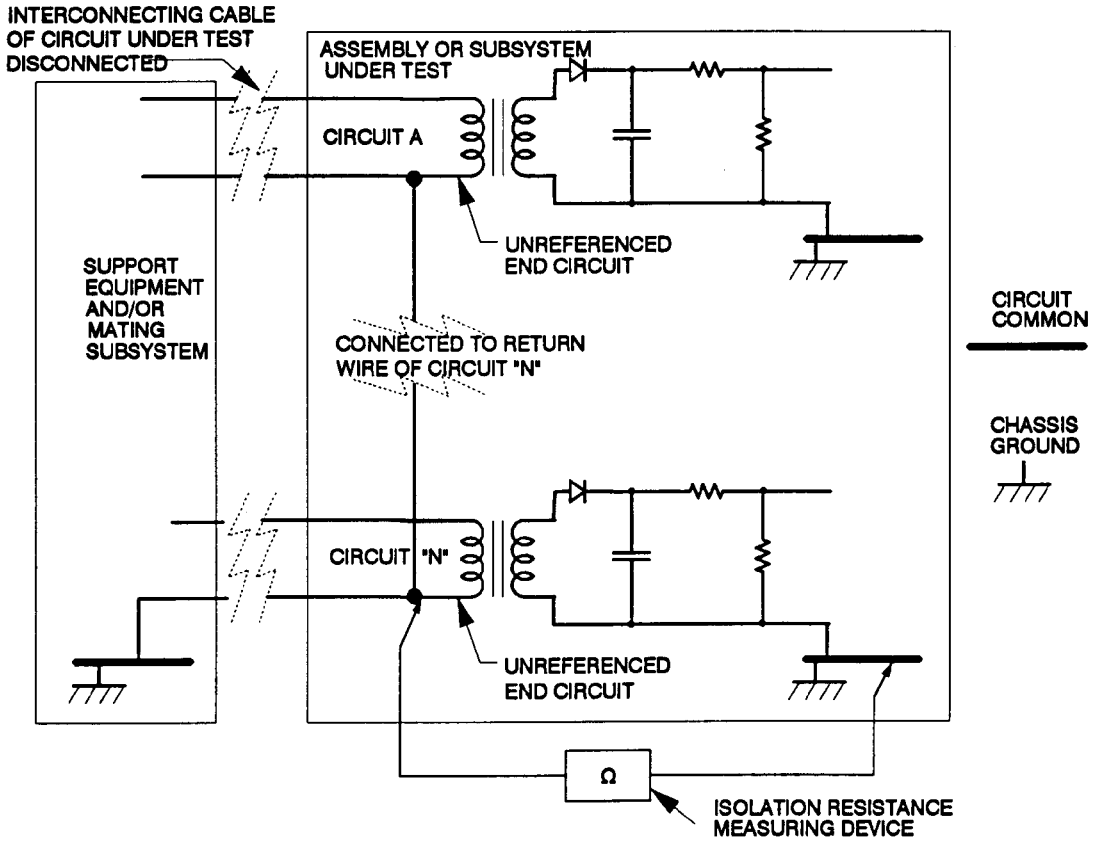

Figure 2. Multiple Unreferenced End-Circuits, Single Return
General Isolation Test Configuration

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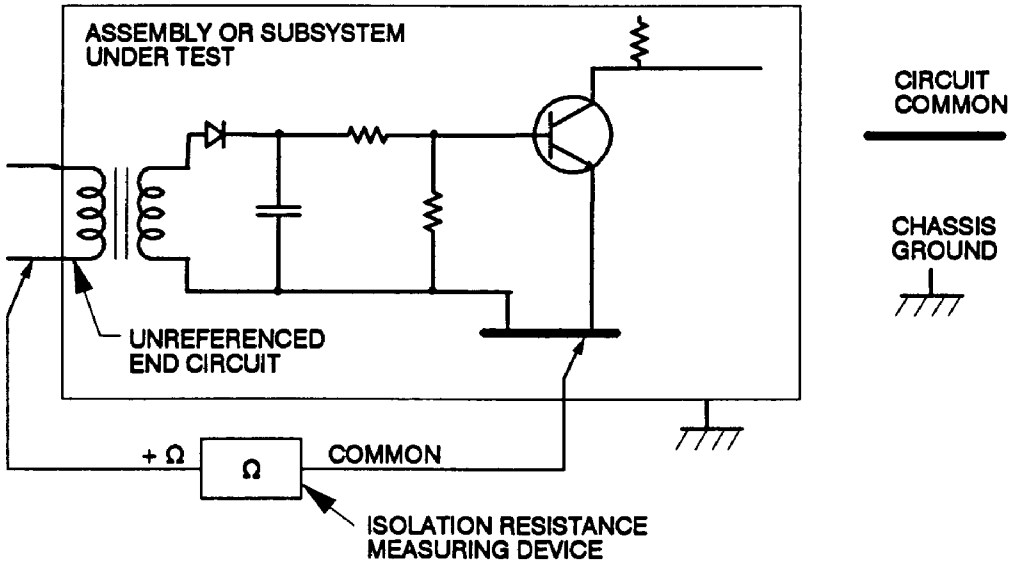

Figure 3. DC Isolation Resistance for Subsystem or Assemblies Isolated from Chassis Ground

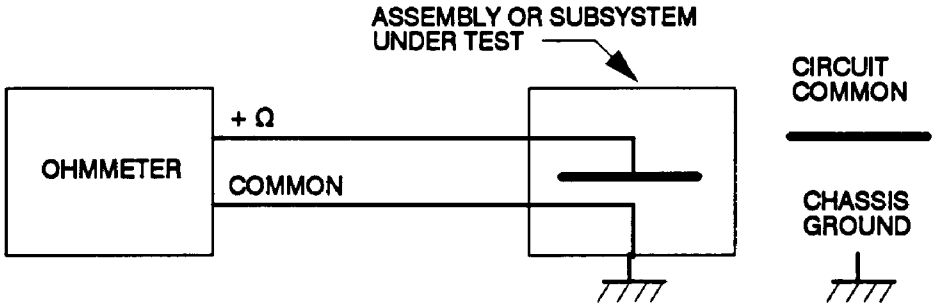

Figure 4. DC Isolation, Circuit Common to Chassis Ground

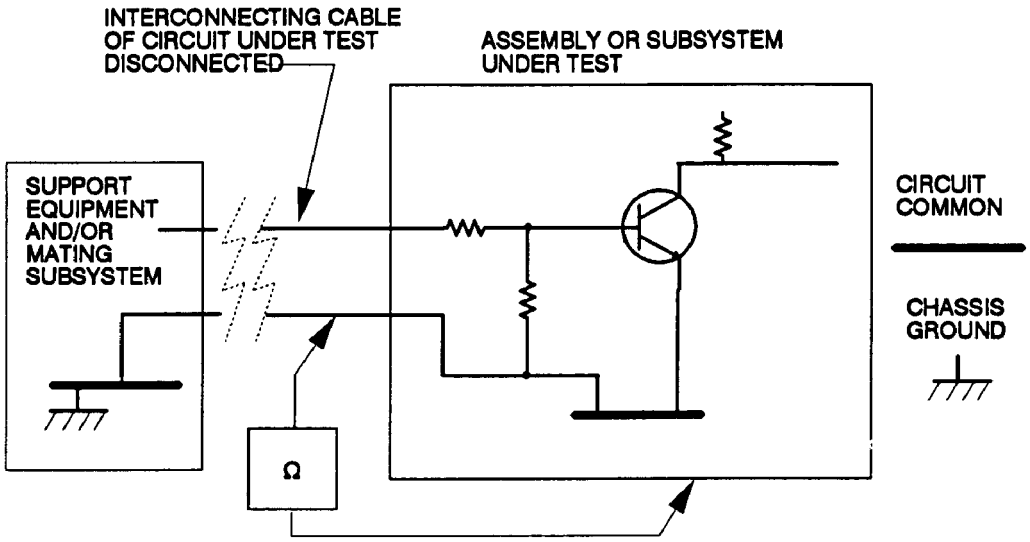

Figure 5. Isolated Circuit Common Configuration

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CONDITIONS				
Figure	Isolation Test	Signal	Chassis	Common
1.	Signal to Common	isolated	ground	ground
2.	Signal to Common	multiple/ isolation	ground	ground
3.	Signal to Common	isolated	ground	isolated
4.	Common to Ground	--	ground	isolated
5.	Common to Chassis	--	isolated	isolated

Table 1. Testing of Five Types of Isolation Circuits

When more than one end circuit shares a common return, as in Figure 2, the minimum allowable resistance is divided by the number of end circuits.

Each measurement is made with the subsystem or assembly unpowered and disconnected from support equipment. The measurements are made in both polarities of the multimeter because semiconductors have polarity dependent resistance. No attempt is made to record the actual resistance; the only requirement is that it exceed 1 megohm per circuit (0.5 megohm for two circuits, etc.).

Technical Rationale:

This is a relatively simple measurement which can be made with minimum impact on other activities during spacecraft assembly. A number of problems, such as inadvertent grounds have been detected by this test which may have passed the normal checkout test operations.

Impact of Non-practice:

Erratic or uncontrolled performance may occur which could compromise or abort the mission.