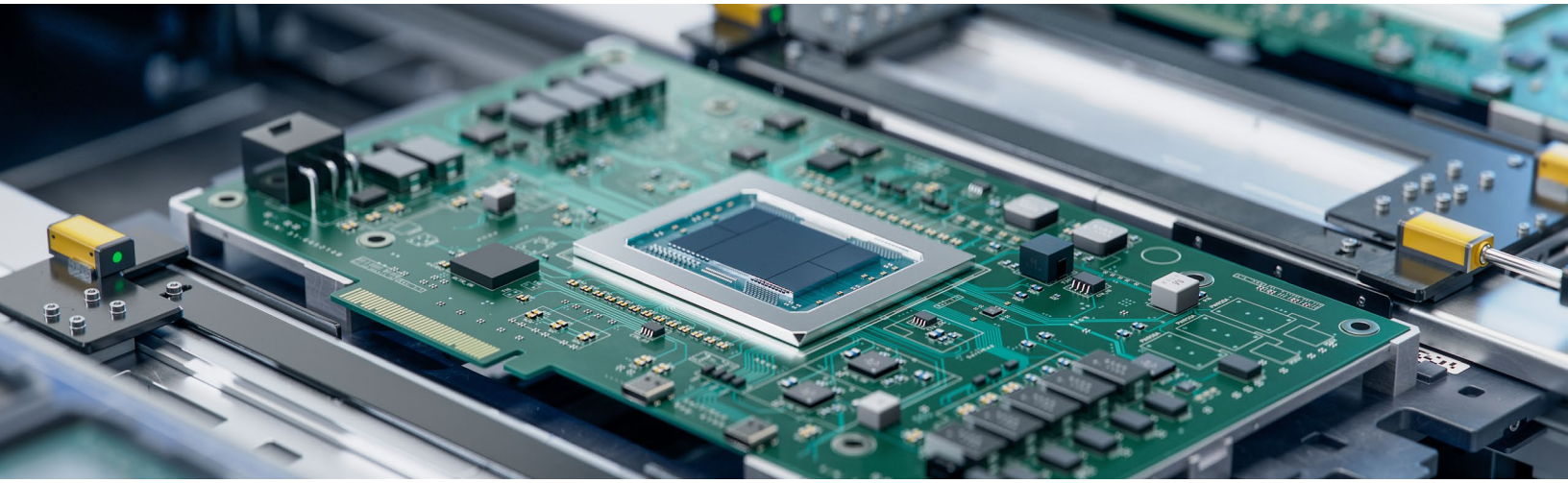
PACIFIC POWER SOURCE



SEMI-F47 Pre-Written Test Sequences

What is SEMI F47 Standard?

SEMI F47 is an industry standard, specifically SEMI F47-0706, that defines voltage sag immunity requirements for semiconductor manufacturing equipment. It ensures that equipment can withstand voltage dips or sags on the power line without causing process interruptions or shutdowns. This standard is crucial for maintaining high uptime and reliability in semiconductor fabs to prevent costly downtime and ensure tool reliability.

This standard was first released in 2000 and updated in 2006 (SEMI F47-0706). Power supplies that meet this standard are designed to function reliably even during short-term voltage fluctuations.

Why is SEMI F47 Important for Compliance Testing?

Ensuring compliance with industry standards is critical for power supply manufacturers serving the semiconductor equipment market. The SEMI F47-0706 standard, published by SEMI (Semiconductor Equipment and Materials International), establishes voltage sag immunity requirements for equipment used in semiconductor fabrication facilities.

These facilities demand high equipment uptime and reliability, and even short-duration voltage sags can lead to costly disruptions in production.

SEMI F47-0706 specifies the required voltage sag immunity for semiconductor processing, metrology, and automated test equipment.

Required voltage sag tolerance levels:

- 50% remaining voltage (50% missing voltage) for 200 milliseconds.
- 70% remaining voltage (30% missing voltage) for 500 milliseconds.
- 80% remaining voltage (20% missing voltage) for 1 second.

In addition to these requirements, SEMI F47-0706 also recommends (but does not mandate) that tools tolerate:

- 0% remaining voltage (100% missing voltage) for 1 cycle.
- 80% remaining voltage (20% missing voltage) for 10 seconds.
- Continuous sags of 90%.

It is important to note that equipment must continue to operate without interruption during conditions identified above the defined line in the voltage-to-time curve. The standard references IEC standard (IEC 61000-4-34) for test protocol information.

AC Power Source Criteria

When selecting or configuring a programmable AC power source for SEMI F47-0706 compliance testing, it is essential that the source meets several specific technical and functional requirements to accurately simulate voltage sag events under controlled and repeatable conditions. Below are the key requirements and specifications to consider:

1. Voltage Sag Programming Capability

- Essential Requirement: Must allow precise programming of voltage sags (amplitude and duration).
- Duration Control: Must be capable of simulating sags as short as one cycle (16.67 ms at 60 Hz) and up to 200 ms or longer, depending on test conditions.

2. Fast Transient Response and Control

- Must support fast and precise transitions between voltage levels to simulate abrupt sags.
- Transition times between voltage levels should be less than 100 µs to accurately emulate real-world disturbances.

3. Programmable Waveform Parameters

- Voltage Range: Must cover common semiconductor facility voltages (e.g., 100 V to 240 V line-to-neutral).
- Frequency Range: Must support 50 Hz and 60 Hz, including small deviations.
- Phase Configuration: Should support single-phase and three-phase operation, depending on the equipment under test.

4. Output Stability and Regulation

- Maintain stable output during non-sag periods with <0.5% voltage regulation to avoid introducing unintended variations.

5. Output Power Capacity

- Must be capable of supplying sufficient power (VA) to the Device Under Test (DUT), even during sags, to ensure realistic test conditions.
- For high inrush loads, current delivery must not be limited during voltage dips.

6. Harmonic Performance

- Output voltage should be a low-distortion sine wave (<1% THD) during normal operation and voltage sag periods.

8. User Interface and Automation Support

- Availability of standard specific test sequence library of F47 tests ready to run to eliminate the need for developing test sequences.
- An easy to use graphical user interface to allow custom test profile creation via software GUI as needed.

Summary of Key AC Power Source Specifications

Feature	Specification
Voltage Sag Levels	70%, 80%, 90% of nominal voltage
Sag Duration	1 cycle to 200+ ms
Frequency Range	45 Hz to 65 Hz
Voltage Range	0 to at least 350 Vrms (L-N), phase configurable
Output Power	Sized appropriately for DUT (e.g., 6kVA to 250kVA typical)
Voltage Transition Time	<100 µs
THD	<0.5% (non-sag conditions)
Remote Interface	LAN, USB, GPIB, RS232 with SCPI support
Protection Features	OVP, OCP, OTP

Choosing a power source that meets these criteria ensures accurate, repeatable, and standards-compliant SEMI F47 testing, helping manufacturers validate immunity performance of power supplies for semiconductor equipment.

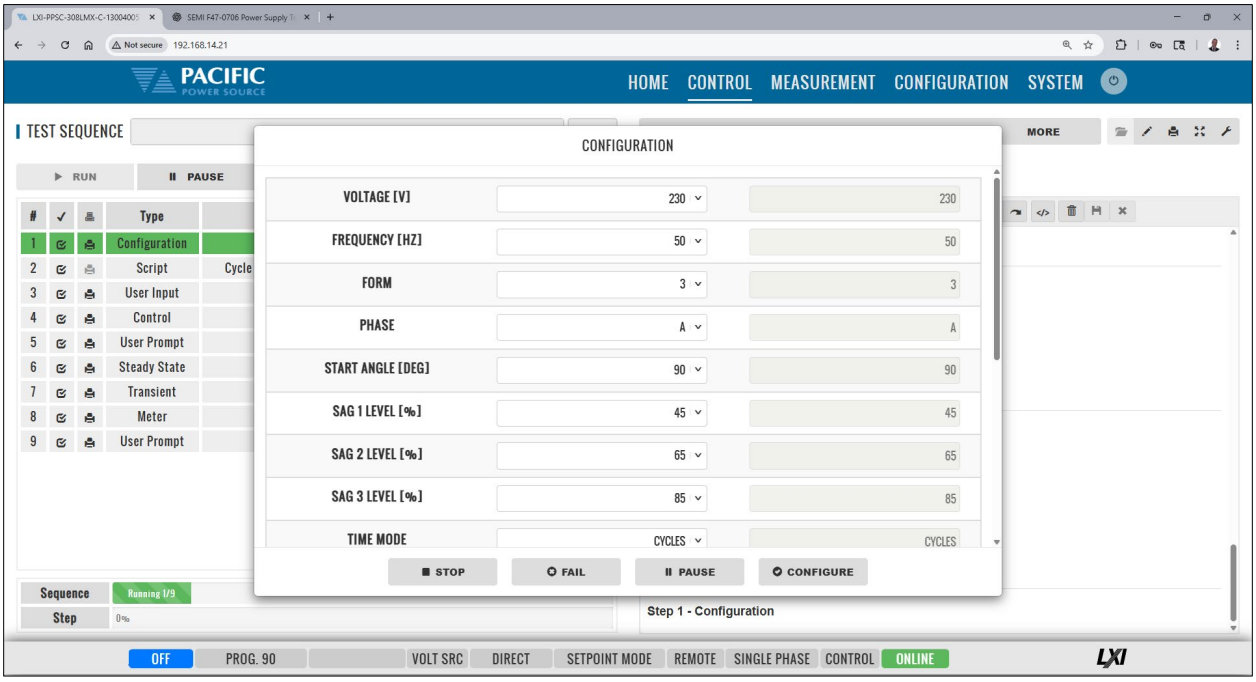
Web Browser based Semi-F47-0706 Test Sequence Option

This optional test sequence provides the user with a ready to run test sequences that are fully parameterized for user selectable voltage and frequency settings to run Semi-F47 tests using any of Pacific Power Sources AC power sources or grid simulators.

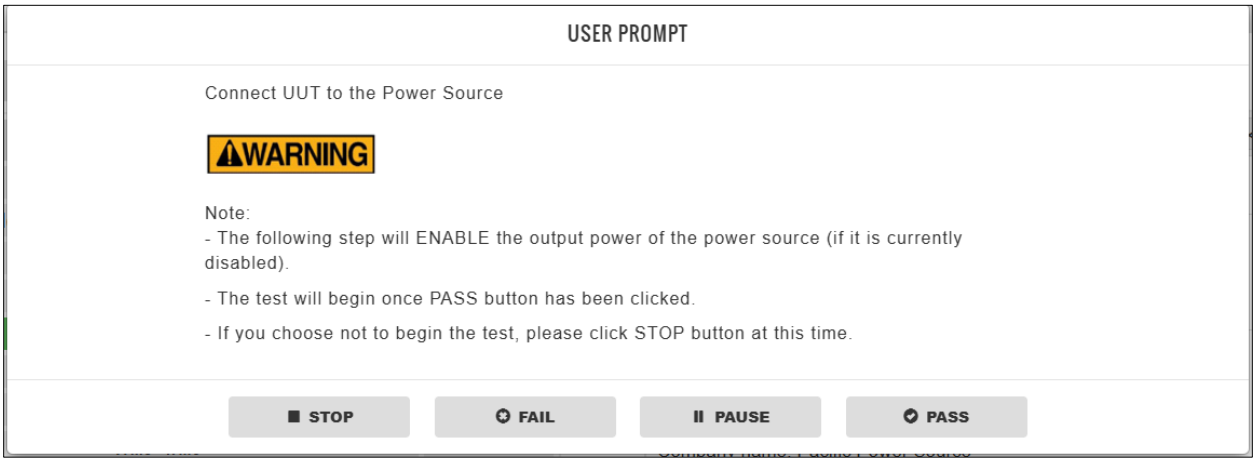
These test sequences can be installed and executed on the AC power source controller and are operated via a LAN or USB connection using any web browser. This allows either PC's, Laptops, tablets or smart phones to be used as the operator control panel. It also eliminates the need for specific PC operating systems or programming environments like LabView™ or LabWindows™ or other proprietary test platforms.

Test Parameter Selections

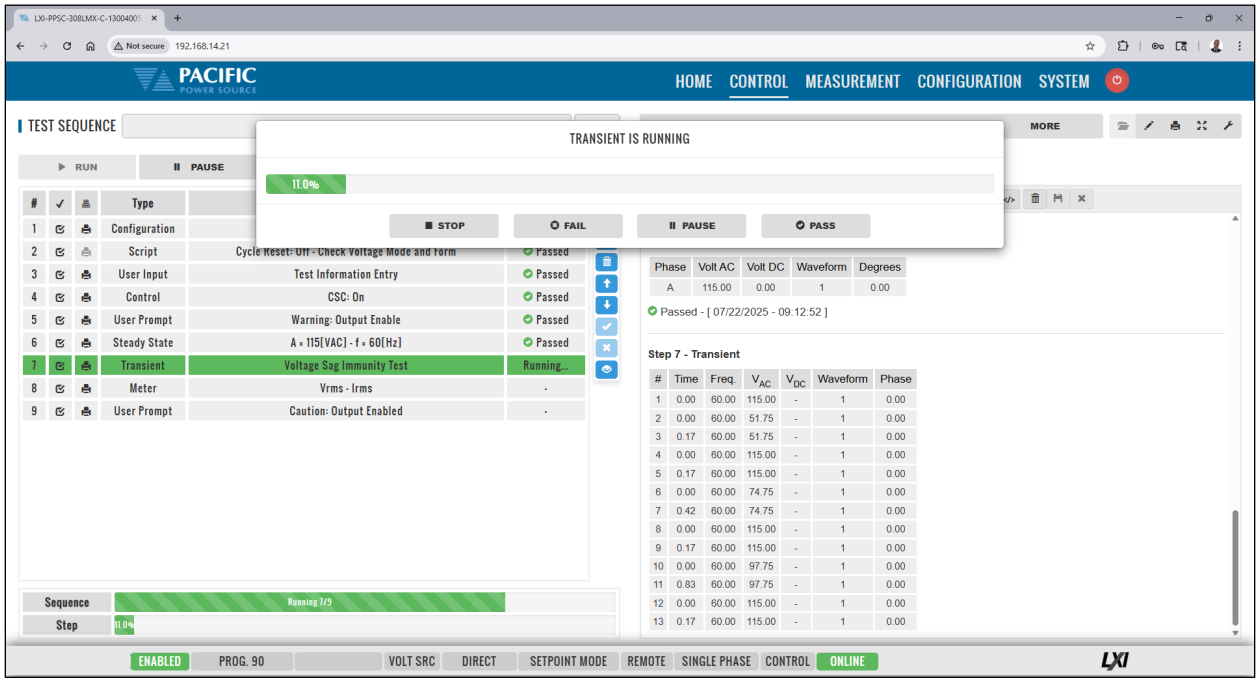
The operator is guided through the test execution by a series of User Prompts. The screen below shows the relevant AC voltage settings and voltage sag start phase angle as well as sag levels to be applied. Once set, the test runs till completion.



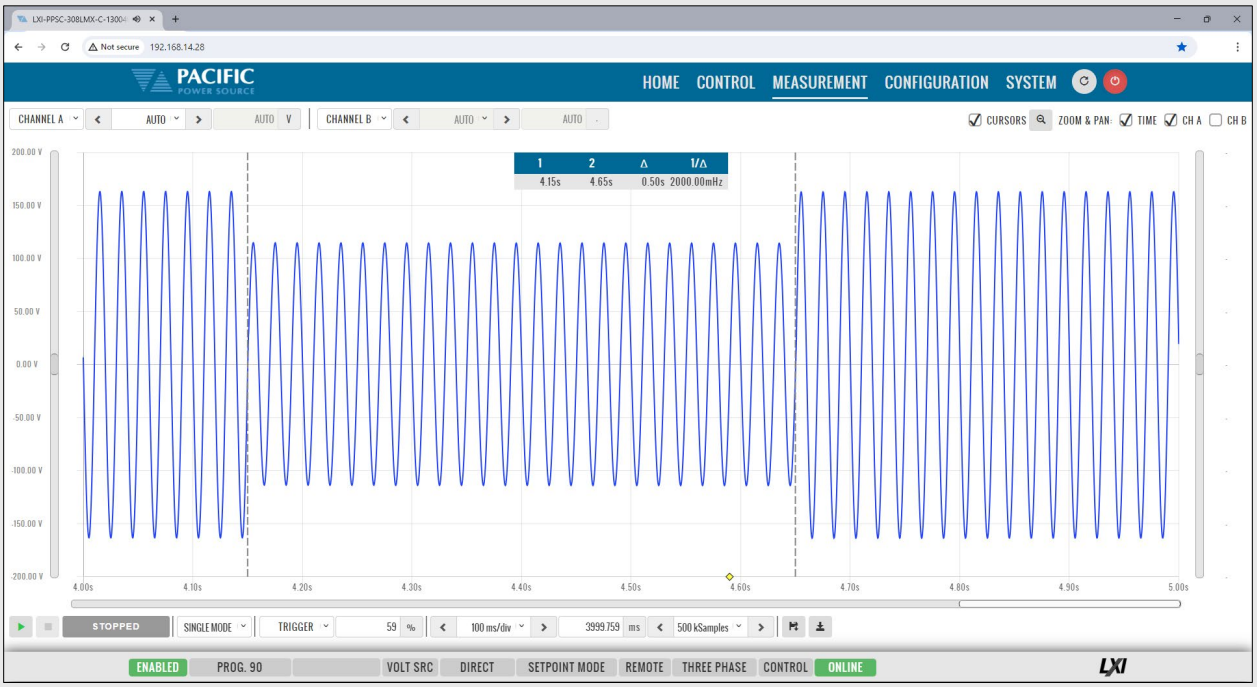
Once configured, the operator is notified of the start of the test



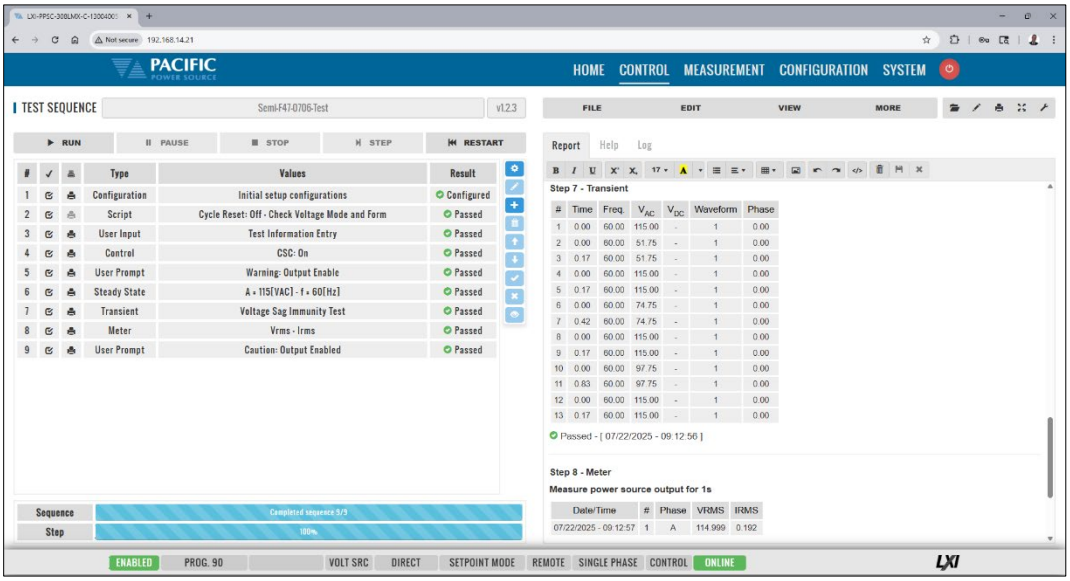
The test progress is communicated to the operator in real time and allows for pausing or aborting at any time if desired.



The internal digital scope function of the Pacific Power Source may be used to capture the voltage sags being applied to the unit under test. Being internal to the AC source makes it easy to trigger at the start of the Voltage sag as the same time base is used for waveform generation and acquisition. The scope on-screen cursors may be used to verify duration of each voltage sag as shown in the image below.

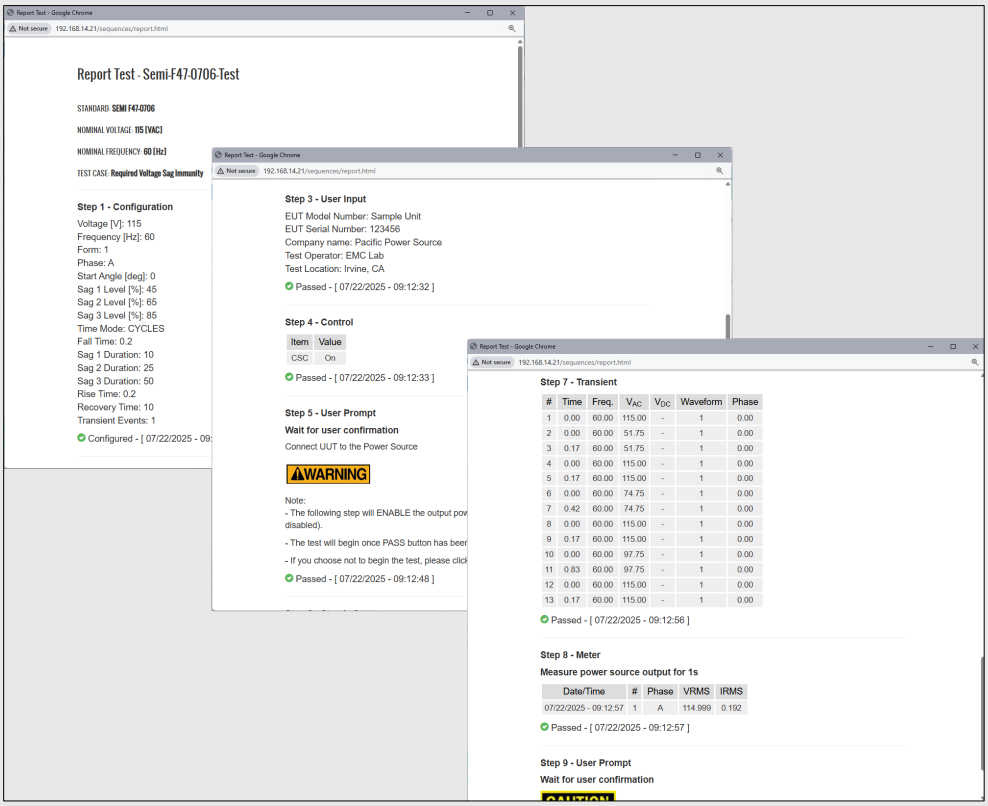


Once the immunity test run is completed, the operator can determine the condition of the unit under test to determine if any issues resulted from the applied voltage sags.



Reporting and Documentation

Being able to document the tests applied to the EUT and the results of these immunity tests is key to obtaining and proving compliance to relevant product immunity standards. The Semi-F74 test sequence generates a report in PDF or HTML format. The operator can view the report, export it or print a hard copy as needed. Sample report pages are shown in the image below.



Product Information

Web Browser based test sequences run on the power source controller and are operated through a web browser via the standard LAN or USB interface of the power source. Execution, Single Step, Control and Editing of test steps is supported as is printing test reports via common web browser functions.

Delivered test sequence compressed files can be loaded to the power source's memory. Once loaded, they are accessible using most web browsers - Chrome, Edge, Firefox, etc.

Ordering Information

Required options needed to support the following tests:

Test Standard	Test Sequence Part Number	Notes
Semi-F47-0706-WB	149311	Includes IEEE 1547.1-2020 Test Sequences

Example Order:

Semi-F47-0706-WB, P/N 149311
Provides Test Sequences based Semi-F47-0706 Voltage Sag Immunity Test Profiles. Web-browser based via SmartSource Suite.

Supported AC Source Model Series

Test	Modes	AGX, AZX, GSZ, LMX, LSX , RGS	ECTS2
Semi-F47-0706	AC	√	√

Contact Us

These prewritten test sequences are available as an option compatible with all Pacific Power Source AC power sources. For additional information, please contact sales@pacificpower.com.

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