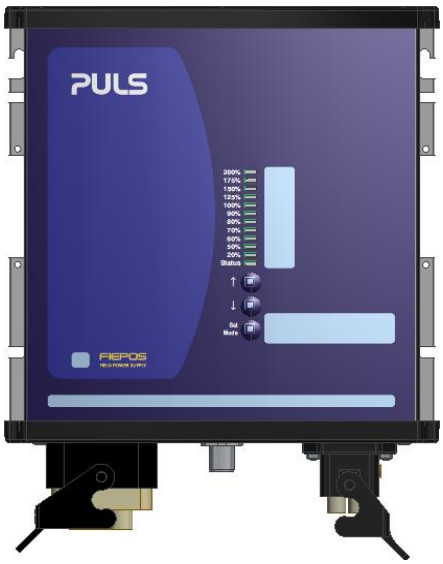
SEMI F47
Voltage Sag Immunity Test Report
for
Power Supply FPH500.24b-ccc-ddd



Other devices covered by this report:

FPH500.24b-ccc-ddd Single-phase highline input, 500 W output

b:	1	Standard version, single output, output voltage adjustable
	2	Standard version, single output, output voltage not adjustable
	5	Version with up to 4 adjustable outputs, individually current limited
	6	Version with up to 4 adjustable “NEC CLASS 2” limited power source outputs
	7	Version with up to 4 combined regular and “NEC CLASS 2” limited power source outputs, adjustable output voltage
ccc:	001-999	Defines the connection terminal module
ddd:	101-999	Defines product variant (consecutive number)

SEMI F47 Test Report

Document number	FPH500.24x Semi F47 Rev1
PCTM number	-
Standards	**SEMI F47-0706** (July 2006) SPECIFICATION FOR SEMICONDUCTOR PROCESSING EQUIPMENT - Voltage Sag Immunity Compliance Tests **IEC 61000-4-11** 2004 +A1:2017 Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current up to 16 A per phase
Applicant	PULS GmbH Elektrastraße 6 81925 Munich, Germany
Test Laboratory	PULS Vario GmbH Kranichberggasse 6 1120 Vienna, Austria
Test Engineer	Thomas Ramel
Test Date	15.05.2025, 19.05.2025
Description of Test Device:	Stand-alone power supply
Devices under Evaluation:	FPH500.241-002-101 Input: AC 100-240V, DC 200-300V, Output: DC 24-28V, 500W
S/N of Devices:	FPH500.241-002-101: S/N: 27 899 161
Application Details:	Input voltage: 1-Phase AC 208V Input frequency: 50 or 60Hz Output load: 500W

PASS/FAIL Criterions:	In accordance with paragraph 7.8.2 a) of SEMI F47-0706 The output voltage is not allowed to deviated more than 5% of the initial value. DC OK contact is not allowed to trigger during and after the test.
Test Result:	**PASS** The test device passed all essential SEMI F47-0706 tests according to the defined application details without any limitations and is qualified to bear the following approval mark:  Since DC power supplies, as covered in this test report, are only components of a semiconductor processing equipment, the tests of the SEMI F47 standard were conducted with selected rated characteristics of the DC power supply. The system integrator of the final semiconductor processing equipment needs to judge if the results of this test report are compatible with the SEMI F47 requirements of his system or if test data under other operating conditions are additionally required. The system integrator also needs to judge if the results of the inrush current peaks are compatible with the selected external fuses for input protection. The system integrator also needs to be aware about aging effects. It is expected that the ride through time can be reduced by 15% at end of the specified lifetime expectancy. A SEMI F47 certificate is not intended for this type of component, however the product fulfils the general requirements and can be marked with the symbol above.
Approved	Harald Etlinger Head of Product Compliance PULS Vario GmbH, Vienna
Date of Approval	**18.06.2025**

Copy of marking plate

List of Test Equipment

Type	Model	Inventory number
Test generator	Chroma 6560	10007
Load	Hewlett Packard 6051A	10034
Oscilloscope	Siglent SDS3034X HD	10566
Diffential probe	pico TA041	10519
Current Probe	LeCroy CP150	10290

The test equipment complies with the requirements of IEC 61000-4-11.

The peak current capability of the test generator was evaluated according Annex A of IEC 61000-4-11 and is able to deliver minimum 134A.

Test Specification for SEMI F47 compliance

Voltage Sag Immunity according to the following table:

Sag depth#1	Duration	Duration at 50 Hz	Duration at 60 Hz
50%	200ms	10 cycles	12 cycles
70%	500ms	25 cycles	30 cycles
80%	1000ms	50 cycles	60 cycles

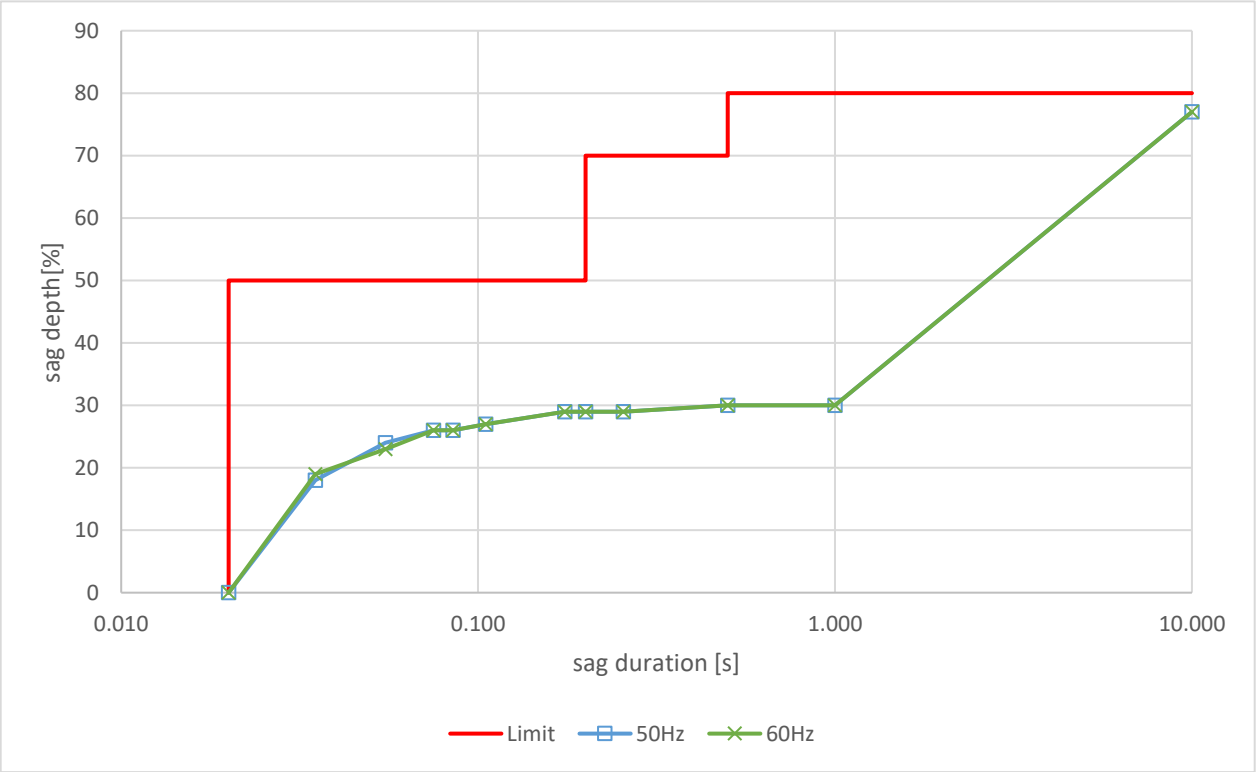
#1 Sag depth is expressed in percent of remaining nominal voltage. For example, during a 70% voltage sag on a 200 volt nominal system, the voltage is reduced during the sag to 140 volts and not 60 volts.

Test Setup

The unit under test in normal operating condition is mounted in a climate chamber.
The input is connected to an AC Source. The input voltage is measured with a 100:1 differential probe and the input current is measured with a current probe. These probes are connected to oscilloscope.

The output is connected to an active load. The output voltage is connected directly to the oscilloscope.
"DC-OK" signal is monitored with a logicanalyzer.

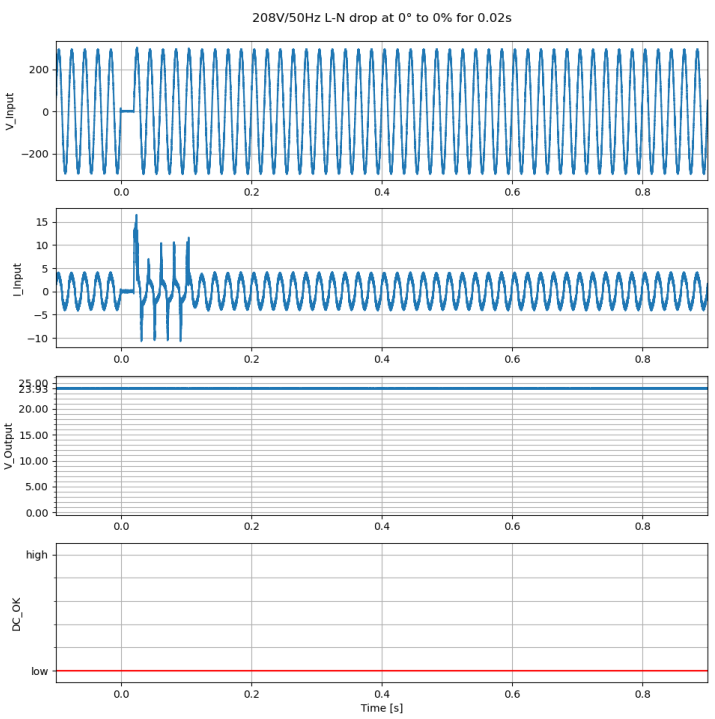
Voltage Sag Results L-N @ 208VAC; 24VDC/20.83A



Conducted Tests at 208V 50Hz

Input voltage	208Vac
Input Frequency	50Hz
Output voltage	24V
Output current	20.83A
Ambient temperature	25°C

Sag duration [s]	Voltage remaining [%]	Peak current [A]
0.020	0	16.52
0.200	50	13.74
0.500	70	11.01
1	80	5.84
10	80	5.69



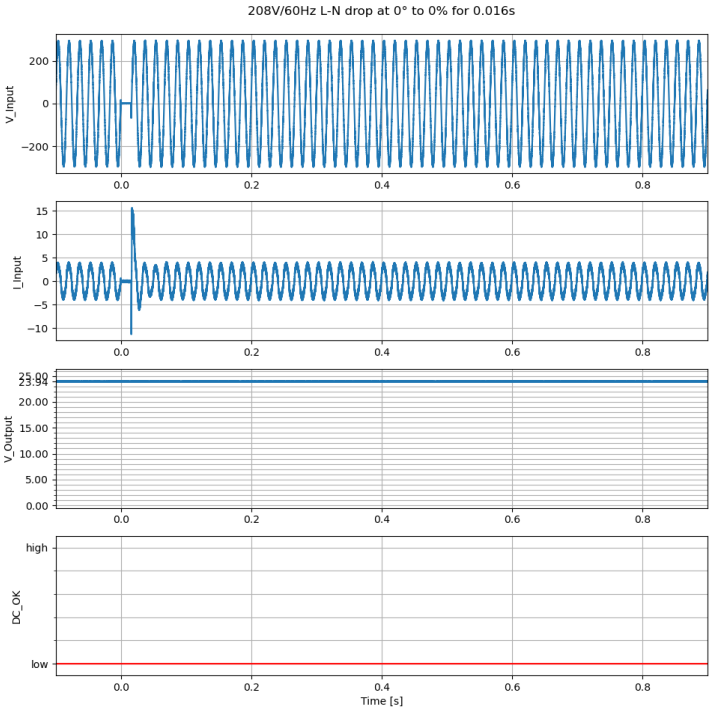
Informational measurements:

Sag duration [s]	Voltage remaining [%]	Peak current [A]
0.020	0	16.80
0.035	18	63.72
0.055	24	53.88
0.075	26	51.34
0.085	26	57.55
0.105	27	55.11
0.175	29	45.27
0.200	29	14.59
0.255	29	54.16
0.500	30	15.25
1	30	14.96
10	77	6.21

Conducted Tests at 208V 60Hz

Input voltage	208Vac
Input Frequency	60Hz
Output voltage	24V
Output current	20.83A
Ambient temperature	25°C

Sag duration [s]	Voltage remaining [%]	Peak current [A]
0.016	0	15.72
0.200	50	13.84
0.500	70	11.20
1	80	5.84
10	80	5.84



Informational measurements:

Sag duration [s]	Voltage remaining [%]	Peak current [A]
0.016	0	15.62
0.035	19	26.64
0.055	23	41.32
0.075	26	16.80
0.085	26	26.73
0.105	27	38.59
0.175	29	16.00
0.200	29	16.24
0.255	29	38.26
0.500	30	15.58
1	30	15.95
10	77	6.21

Inrush current measurements according 61000-4-11 at 208V 50Hz

Input voltage	208Vac
Input Frequency	50Hz
Output voltage	24V
Output current	20.83A
Ambient temperature	25°C

Peak input current measurements on unit under test:

First two measurements turn off input power for EUT for 5 minutes and then

Measure peak input current when AC turned on at 90°: 12.8 A

Measure peak input current when AC turned on at 270°: 12.8 A

Next two measurements turn on the input power for EUT for at least 1 minute then turn off input power for 5s and on again.

Measure peak input current when AC turned on at 90°: 13.8 A

Measure peak input current when AC turned on at 270°: 14.3 A

Inrush current measurements according 61000-4-11 at 208V 60Hz

Input voltage	208Vac
Input Frequency	60Hz
Output voltage	24V
Output current	20.83A
Ambient temperature	25°C

Peak input current measurements on unit under test:

First two measurements turn off input power for EUT for 5 minutes and then

Measure peak input current when AC turned on at 90°: 13.0 A

Measure peak input current when AC turned on at 270°: 15.5 A

Next two measurements turn on the input power for EUT for at least 1 minute then turn off input power for 5s and on again.

Measure peak input current when AC turned on at 90°: 16.2 A

Measure peak input current when AC turned on at 270°: 14.0 A

Operating conditions and their influence in test results:

a) Ambient temperature:
Control measurements show that the ambient temperature has only a minor influence in the ride-through time test results.
Depending on the used topology to reduce the input inrush current, the ambient temperature can have a major influence in the arising peak current after the sag test. Therefore, tests were performed at ambient temperatures of 25°C and +60°C.
It is assumed that semiconductor processing equipment is never used at lower temperatures than +25°C. Although the power supply itself is specified down to -25°C, a test at such low temperatures is not performed.

b) Mains frequency 50Hz vs. 60Hz:
Control measurements show that 50Hz testing is more critical than 60Hz testing.
Therefore, unless otherwise noted, all tests were performed with a mains frequency of 50Hz.

c) Output voltage 24V vs. 28V:
The ride-through time depends on the stored energy in the input capacitors and the amount of output power. The output voltage is not essential as long as the output power is constant.
The adjusted output voltage has no influence in input currents peaks after input voltage sags.
Therefore, unless otherwise noted, all tests were performed with an output voltage of 24Vdc.

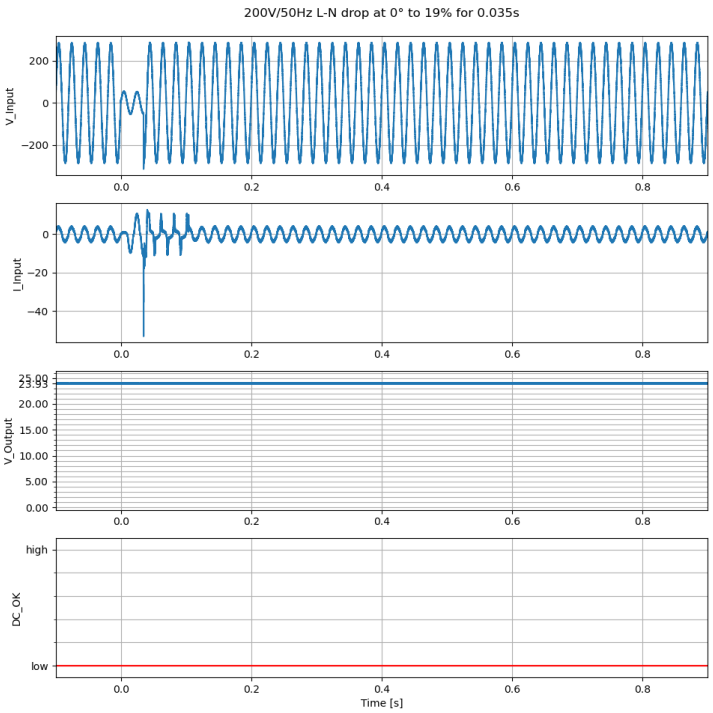
APPENDIX

Informational measurements at 200V

Input voltage	200Vac
Input Frequency	50Hz
Output voltage	24V
Output current	20.83A
Ambient temperature	25°C

Informational measurements:

Sag duration [s]	Voltage remaining [%]	Peak current [A]
0.020	0	16.33
0.035	19	53.08
0.055	25	44.66
0.075	27	40.75
0.085	28	37.74
0.105	28	46.16
0.175	30	37.84
0.200	30	16.71
0.255	30	44.14
0.500	31	14.82
1	31	15.48
10	80	6.12



Informational measurements at 230V

Input voltage	230Vac
Input Frequency	50Hz
Output voltage	24V
Output current	20.83A
Ambient temperature	25°C

Informational measurements:

Sag duration [s]	Voltage remaining [%]	Peak current [A]
0.020	0	16.99
0.035	16	86.96
0.055	21	82.73
0.075	23	78.59
0.085	24	75.81
0.105	25	73.60
0.175	26	73.27
0.200	26	15.86
0.255	27	59.25
0.500	27	15.53
1	27	14.87
10	69	10.12