

Contents

1. GENERAL INFORMATION	3
2. SUMMARY OF TEST RESULTS.....	3
3. ELECTROSTATIC DISCHARGE (ESD) IMMUNITY TEST (IEC 61000-4-2:2008).....	4
4. RADIATED RADIO FREQUENCY, ELECTROMAGNETIC FIELD IMMUNITY TEST (IEC 61000-4-3).....	9
5. ELECTRICAL FAST TRANSIENT/BURST IMMUNITY TEST (IEC 61000-4-4).....	12
6. SURGE IMMUNITY TEST (IEC 61000-4-5)	17
7. CONDUCTED DISTURBANCES INDUCED BY RADIO-FREQUENCY FIELD IMMUNITY TEST (IEC 61000-4-6)	20
8. POWER FREQUENCY MAGNETIC FIELD IMMUNITY TEST (IEC 61000-4-8)	24
9. VOLTAGE DIPS AND SHORT INTERRUPTIONS IMMUNITY TEST (IEC 61000-4-11).....	28
10. RING WAVE TEST (IEC 61000-4-12)	31
11. VOLTAGE FLUCTUATION IMMUNITY TEST (IEC 61000-4-14)	35

1. GENERAL INFORMATION

1.1 Product Description

Model Number	PFE1500FB-xx-xxx-R xx – can be 28, 48 or 60V output xxx - can be any alphanumeric character or blank representing non-safety critical options such as pin length, mounting style, control function, etc....
Product Description	1500W AC-DC Power Module Single Output with 12V Auxiliary Supply Input Range 85-305 Vac

2. SUMMARY OF TEST RESULTS

STANDARD	TEST ITEM	TEST RESULT	REMARKS
IEC 61000-4-2	Electrostatic Discharge (ESD)	PASS	Contact Discharge up to: ±4kV Air Discharge up to: ±8kV Performance Criteria A
IEC 61000-4-3	Radiated Radio Frequency (RF), Electromagnetic Field Immunity	PASS	80-1000MHz 1kHz sinewave, 80%, 10V/m Performance Criteria A
IEC 61000-4-4	Electrical Fast Transient/ Burst	PASS	±2kV, 5kHz, Input Ports Performance Criteria B ±4kV, 5kHz, Input Ports Performance Criteria A
IEC 61000-4-5	Surge	PASS	Level 3: Performance Criteria A Level 4: Performance Criteria A
IEC 61000-4-6	Conducted Disturbance Induced by RF Field	PASS	0.15 to 80 MHz, 10V/m, 80% 1kHz AM Performance Criteria A
IEC 61000-4-8	Power Frequency Magnetic Field	PASS	30A/m; 50Hz; X, Y, Z, 5 min, Level 4 Performance Criteria A
IEC 61000-4-11	Voltage Dip and Interruption	PASS	0%: Performance Criteria B 40%: Performance Criteria B 70%: Performance Criteria B 80%: Performance Criteria B
IEC 61000-4-12	Ring Wave	PASS	Level 3: Performance Criteria B Level 4: Performance Criteria B
IEC 61000-4-14	Voltage Fluctuation and Flicker	PASS	Class 3 – 12% of Input Voltage Performance Criteria A

3. ELECTROSTATIC DISCHARGE (ESD) IMMUNITY TEST (IEC 61000-4-2:2008)

3.1 Equipment Used

Asset #	Device	Manufacturer	Model	Calibration Date	Calibration Due Date
NTS - 1077179	ESD Gun	TESEQ	NSG 437 Auto	12/07/2024	12/01/2025
DUV	Thermometer	Omega Engineering Inc	iTHx-SD-5	09/04/2024	09/04/2025
DUVA	Probe-Temperature/Humidity	Omega Engineering Inc	iTHP-5-DB9	09/04/2024	09/04/2025
TDK - IT0144	Multimeter	Fluke Corp	87 III	NCR*	NCR
TDK - IT0247	True RMS Clamp Meter	Fluke Corp	337	NCR	NCR

* No Calibration Required

3.2 Device Under Test (DUT)

Model Series: PFE1500FB-48
Quantity: 1 Unit

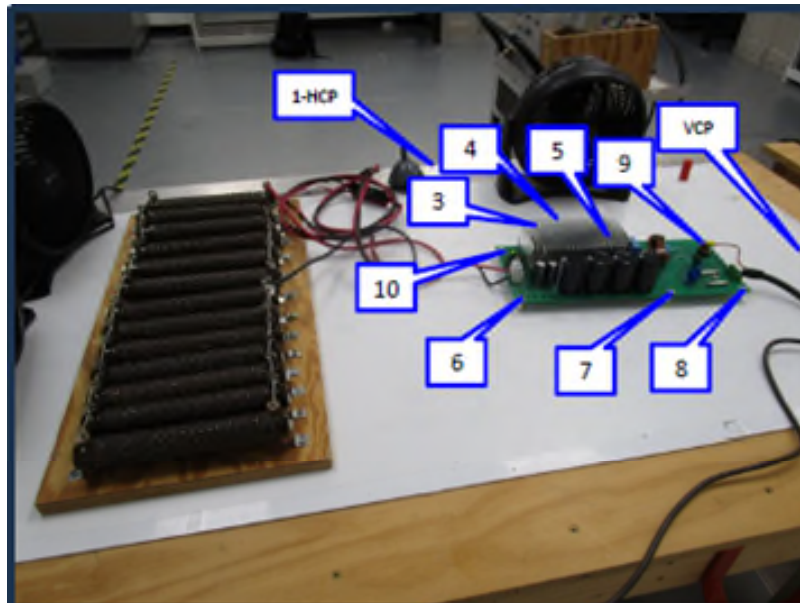
3.3 Test Conditions

Input Voltage:	230Vac @ 50Hz
Output Current:	90% Resistive Load
Discharge Rep. Rate:	≥ 1 Per Second
Number of Discharges:	≥ 10 Per Location
Polarity:	+/-
Required Performance Criteria:	A

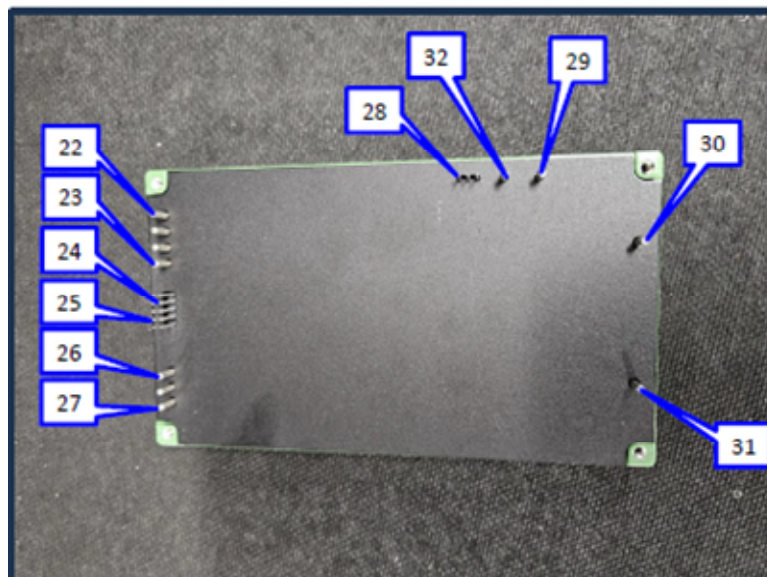
3.4 Test Method and Device Test Points

According to IEC 61000-4-2.
Contact Discharge:
Air Discharge:

FG Terminal
Input and Output Terminals

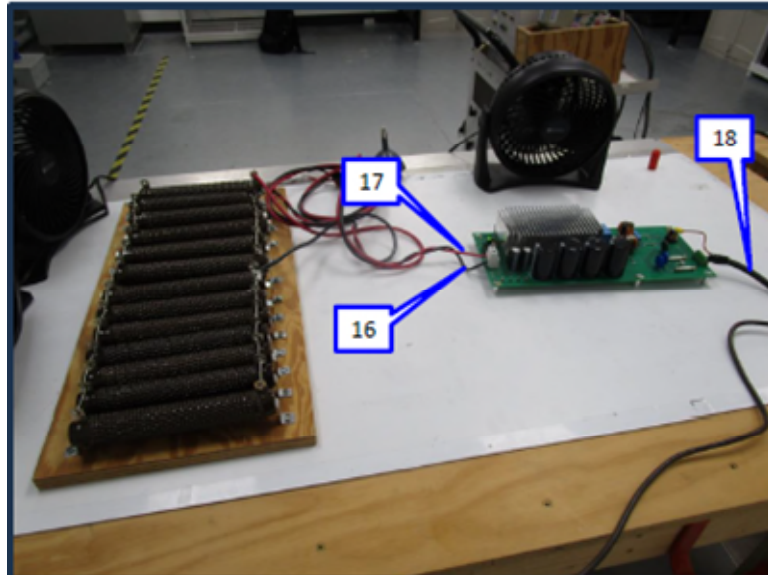


Test Setup for IEC 61000-4-2 (ESD Immunity).

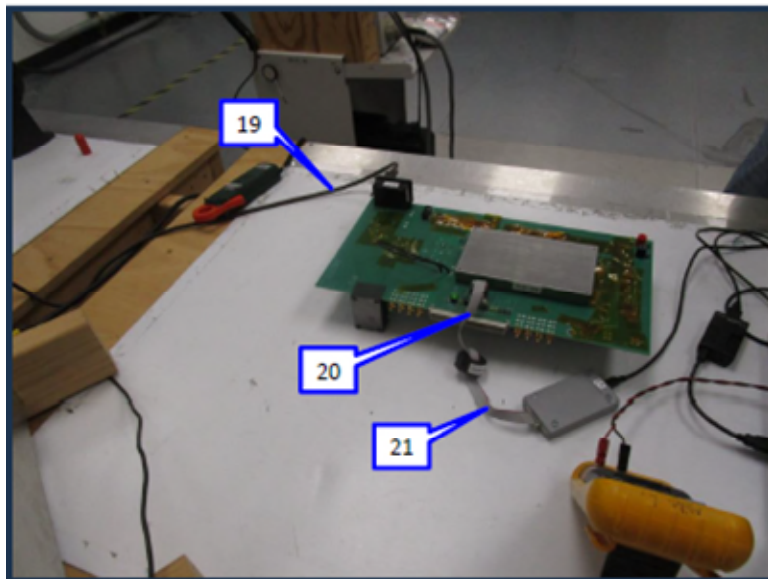


Test Setup for IEC 61000-4-2 (ESD Immunity).

Numbers on photo indicate the test locations



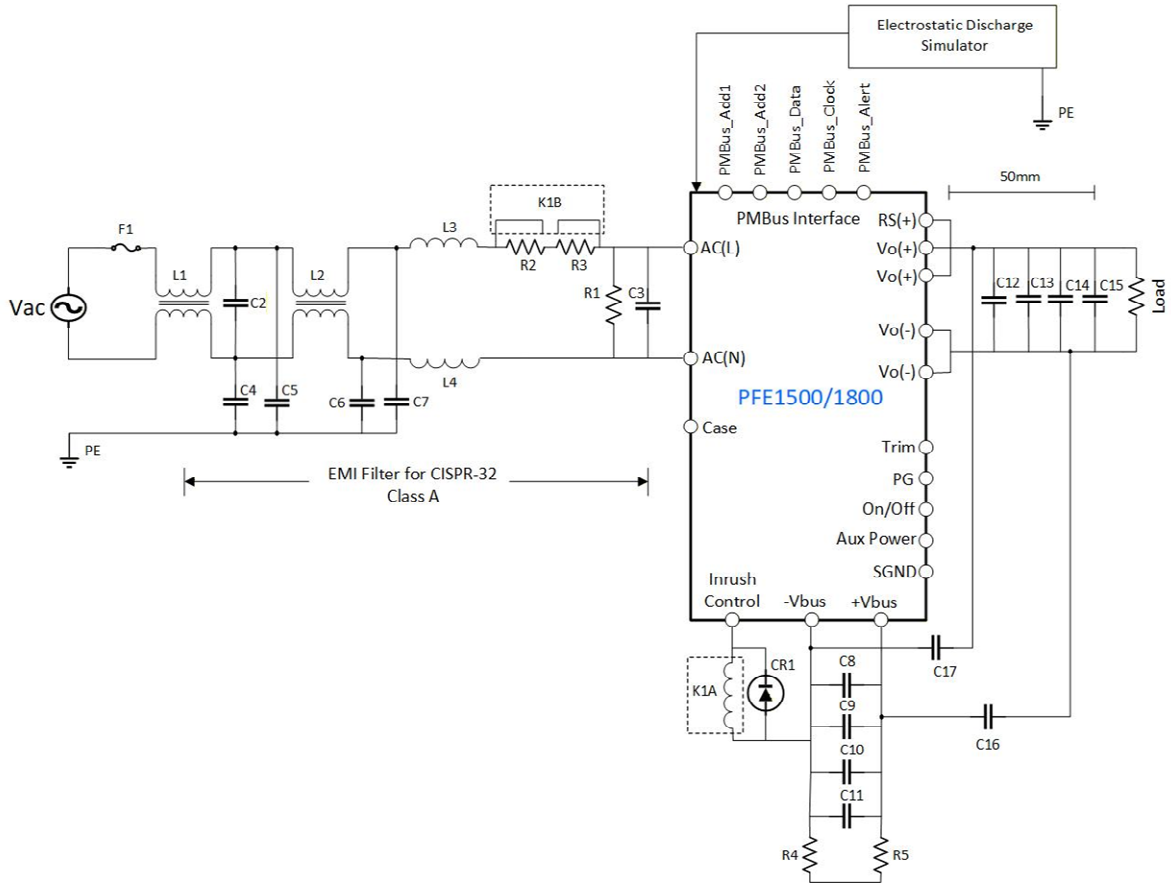
Test Setup for IEC 61000-4-2 (ESD Immunity).



Test Setup for IEC 61000-4-2 (ESD Immunity).

Numbers on photo indicate the test locations

3.5 Test Circuit



Reference Designator	Description	Reference Designator	Description
C2	0.47 μ F Film Capacitor	C3	2x2.2 μ F Film Capacitor
C4, C5, C6, C7	4700pF Ceramic Capacitor	C15	0.1 μ F ceramic capacitor
C16, C17	7500pF ceramic capacitor	CR1	CRH01, 200V, 1A Diode
L1	1mH	R2, R3	10 Ω 5W
L2	1.3mH	C12, C13	560 μ F electrolytic capacitor
L3, L4	27 μ H	C14	8x4.7 μ F Ceramic Capacitor
R1, R4, R5	470 k Ω , 2 W	C8, C9, C10, C11	470 μ F Electrolytic Capacitor
K1	1 Form A relay with 16A, 277VAC, power rating: 12VDC, 16.7mA, 200mW, High Sensitivity	F1	20A, 280V, Fast Blow

3.6 Acceptance Criteria

3.6.1 Performance Criteria A: DUT must operate within specification limits during and after test.

3.7 Test Results

Date of Test	09-25-2024		
--------------	------------	--	--

PASS with Performance Criteria A

Contact Discharge: Points 3-15 and 22-32	
Voltage (± kV)	<input type="checkbox"/> 2 <input checked="" type="checkbox"/> 4 <input type="checkbox"/> 6 <input type="checkbox"/> 8 <input type="checkbox"/> Other _____
Location:	
Horizontal Coupling Plane	No Susceptibility Noted
Contact Locations	No Susceptibility Noted
Air Discharge: Points 16-21	
Voltage (± kV)	<input checked="" type="checkbox"/> 2 <input checked="" type="checkbox"/> 4 <input checked="" type="checkbox"/> 8 <input type="checkbox"/> 15 <input type="checkbox"/> Other _____
Location:	
Air Location	No Susceptibility
"Spark" Event(s)	No spark events noted

4. RADIATED RADIO FREQUENCY, ELECTROMAGNETIC FIELD IMMUNITY TEST (IEC 61000-4-3)

4.1 Equipment Used

Asset #	Device	Manufacturer	Model	Calibration Date	Calibration Due Date
TEW	Generator - Signal	Keysight	N5171B-506	05-14-2024	05-14-2027
SOY	Meter - Power	Amplifier Research	PM2003	02-15-2024	02-15-2025
SRJ	Power Sensor	Amplifier Research	PH2004	02-15-2024	02-15-2025
IER	Monitor - Field	Amplifier Research	FL7218	07-14-2024	07-14-2025
AJH	Antenna – Double Ridge	EMCO	3115	NCR	NCR
TSH	Amplifier - RF	Amplifier Research	250S1G6	NCR	NCR
RHB	Directional Coupler	Amplifier Research	DC6180A	NCR	NCR
RHC	Directional Coupler	Amplifier Research	DC7200	NCR	NCR
ALO	Antenna –Log Periodic	ETS Lindgren	3144	NCR	NCR
SRK	Power Sensor	Amplifier Research	PH2004	02-15-2024	02-15-2025
TTP	Amplifier - RF	Amplifier Research	500W1000B	NCR	NCR

4.2 Device Under Test (DUT)

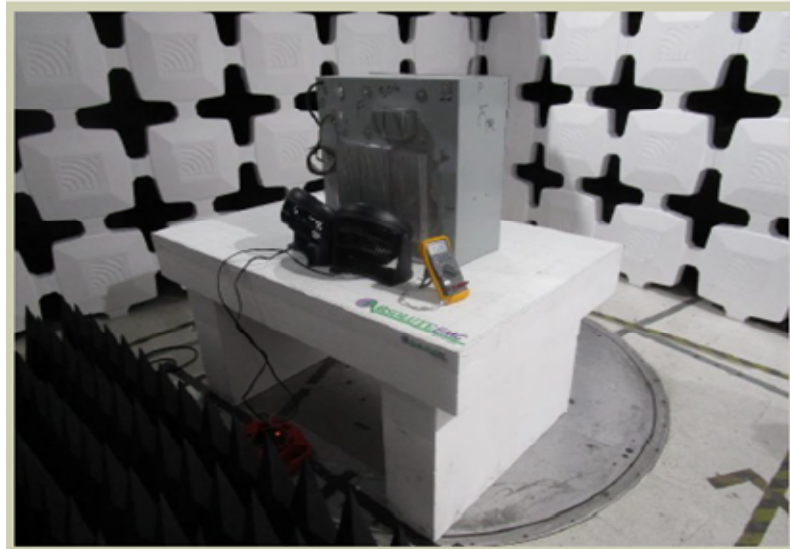
Model Series: PFE1500FB-48
Quantity: 1 unit

4.3 Test Conditions

Input Voltage:	220Vac@60Hz
Output Current:	90% Resistive Load
Electromagnetic Frequency:	80MHz – 1000MHz
Distance of Antenna – DUT:	3 m
Sweep Conditions:	1.0% Step Up, 1 second hold
Sides Tested:	Front, Back, Left, Right
Polarities Tested:	Horizontal, Vertical
Test level:	≥ 10V/m
Amplitude Modulated:	80%, 1 KHz

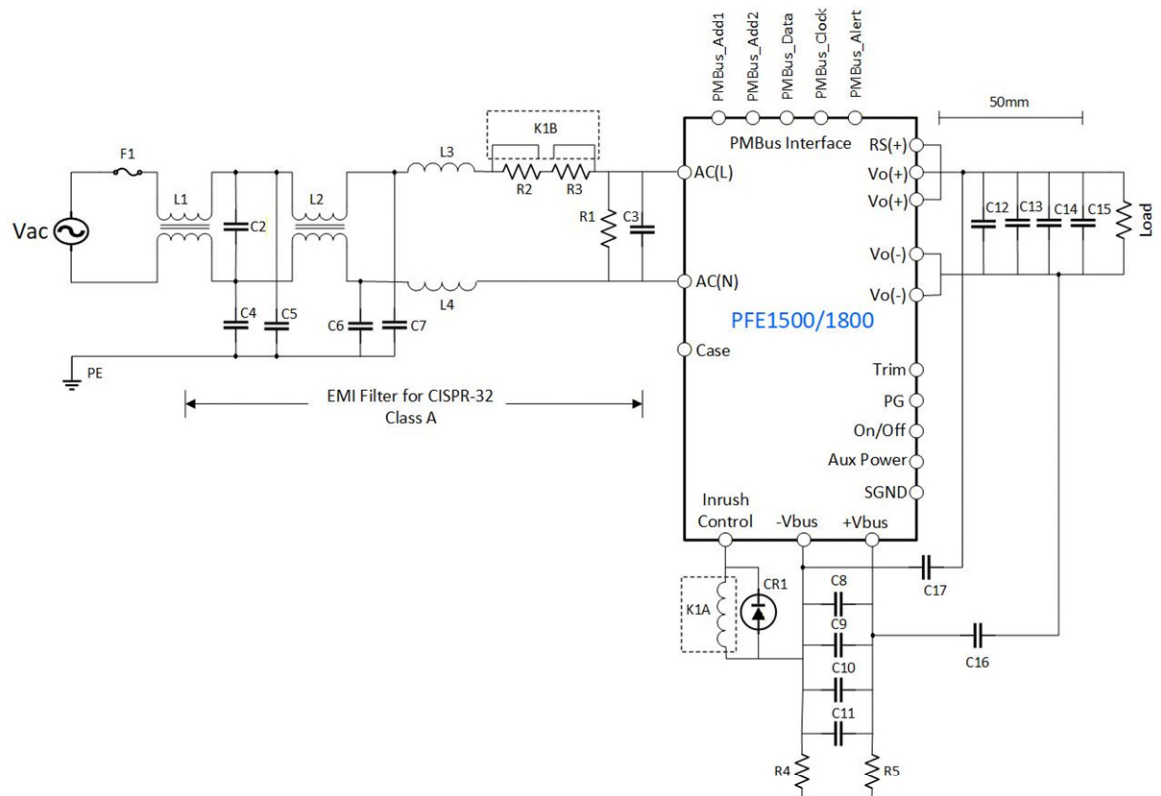
4.4 Test Method

According to IEC 61000-4-3.



Test Setup for IEC 61000-4-3 (Electromagnetic Field Immunity).

4.5 Test Circuit



Reference Designator	Description	Reference Designator	Description
C2	0.47μF Film Capacitor	C3	2x2.2μF Film Capacitor
C4, C5, C6, C7	4700pF Ceramic Capacitor	C15	0.1μF ceramic capacitor
C16, C17	7500pF ceramic capacitor	CR1	CRH01, 200V, 1A Diode
L1	1mH	R2, R3	10Ω 5W
L2	1.3mH	C12, C13	560μF electrolytic capacitor
L3, L4	27 μH	C14	8x4.7μF Ceramic Capacitor
R1, R4, R5	470 kΩ, 2 W	C8, C9, C10, C11	470μF Electrolytic Capacitor
K1	1 Form A relay with 16A, 277VAC, power rating: 12VDC, 16.7mA, 200mW, High Sensitivity	F1	20A, 280V, Fast Blow

4.6 Acceptable Criteria

4.6.1 Performance Criteria A: DUT must operate within specification limits during and after test.

4.7 Test Results

Date of Test	09-11-2024		
--------------	------------	--	--

PASS with Performance Criteria A

5. ELECTRICAL FAST TRANSIENT/BURST IMMUNITY TEST (IEC 61000-4-4)

5.1 Equipment Used

Asset #	Device	Manufacturer	Model	Calibration Date	Calibration Due Date
Element --TIQA	Transformer	TESEQ	INA 6502	07-26-2024	01-26-2025
Element --TIQ	Transient Generator	TESEQ	NSG 3040	07-26-2024	01-26-2025
TDK – IT0144	Multimeter	Fluke Corp	87 III	No Cal Required	No Cal Required
TDK-NSG 3060A-Full	Multifunction Generator	TESEQ	NSG-3060A-Full	No Cal Required	No Cal Required

5.2 Device Under Test (DUT)

Model Series: PFE1500FB-48
Quantity: 1 unit

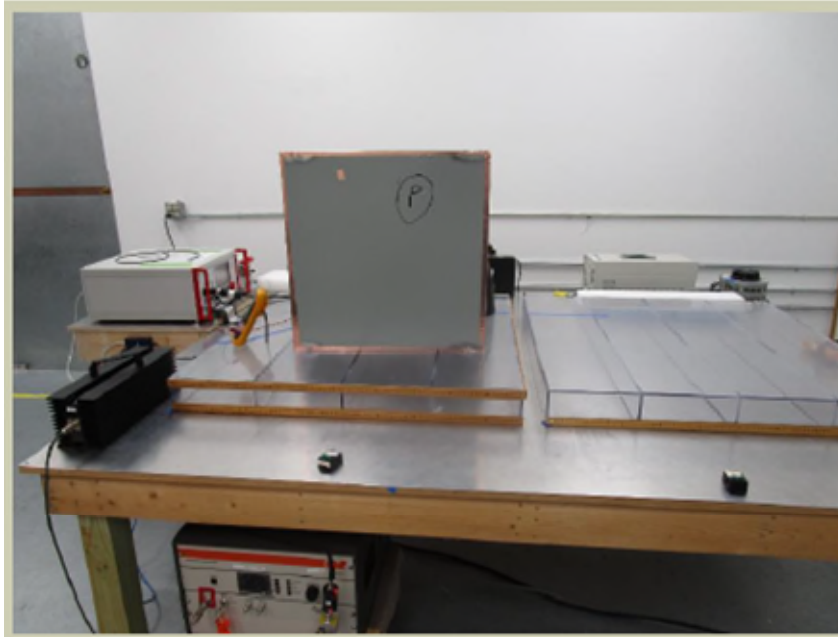
5.3 Test Conditions

Input Voltage: 230 Vac @ 50 Hz, 125 Vac @ 60 Hz, 225 Vac @ 60 Hz.
Output Current: 91% Resistive Load
Power Port: AC Mains
Highest Power Port Test Level: 2.0 kV, 4 kV
Test Duration: 60 Seconds
Burst: 5 kHz, 100 kHz

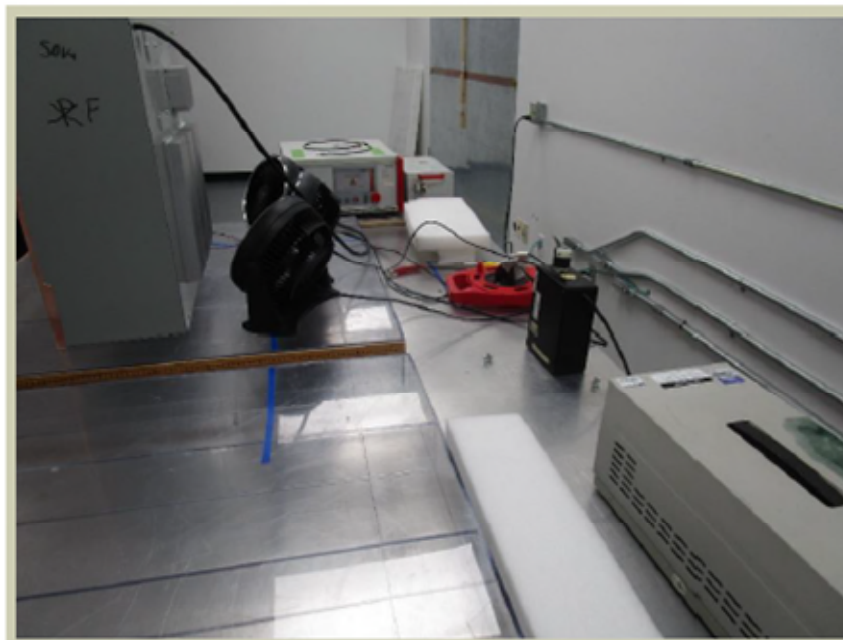
5.4 Test Method and Device Test Points

According to IEC 61000-4-4.

A) Input Port: Apply 2kV, 5kHz transient to N, L and FG all at the same time.



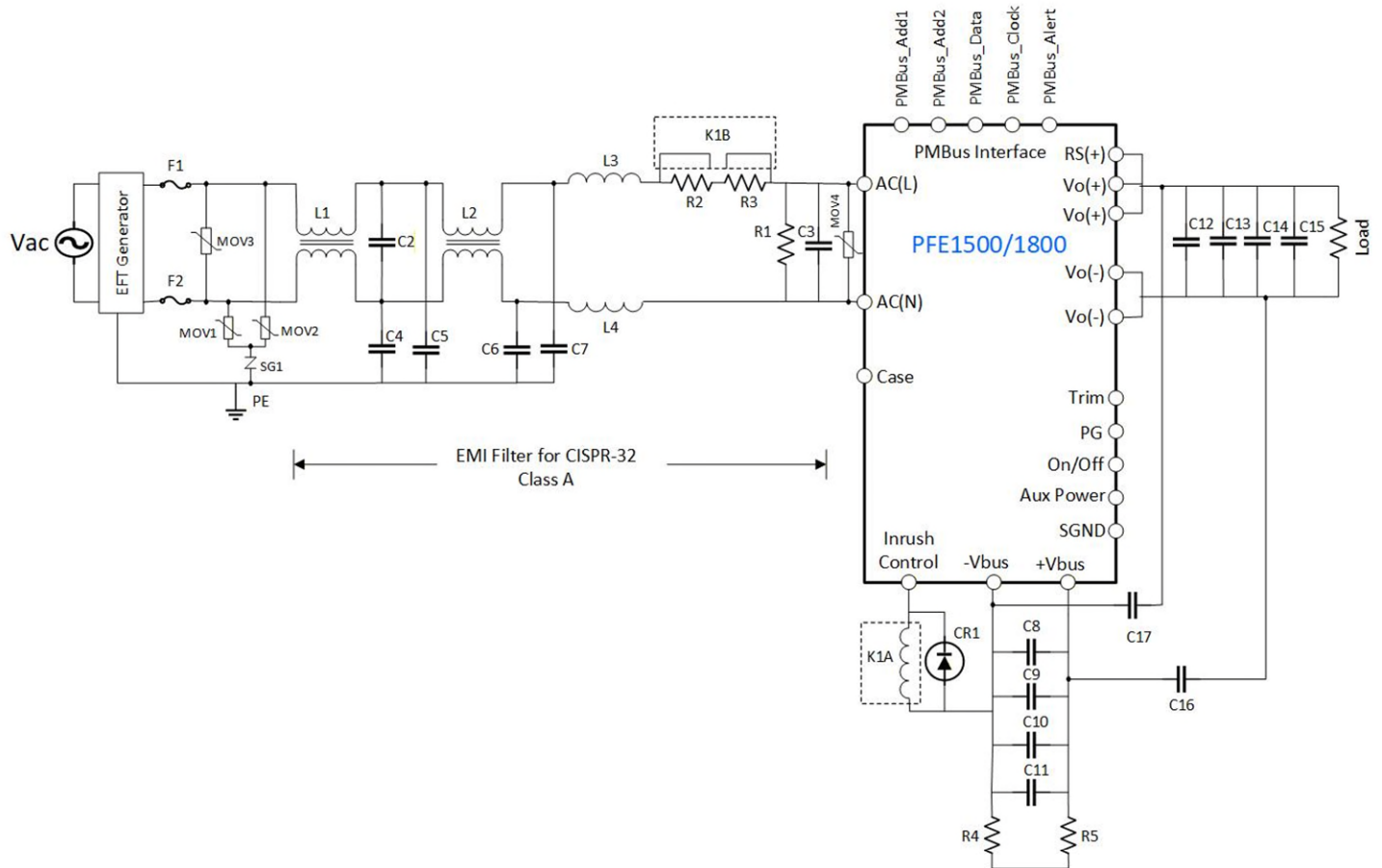
Test Setup for IEC 61000-4-4 (Electrical Fast Transients Immunity).



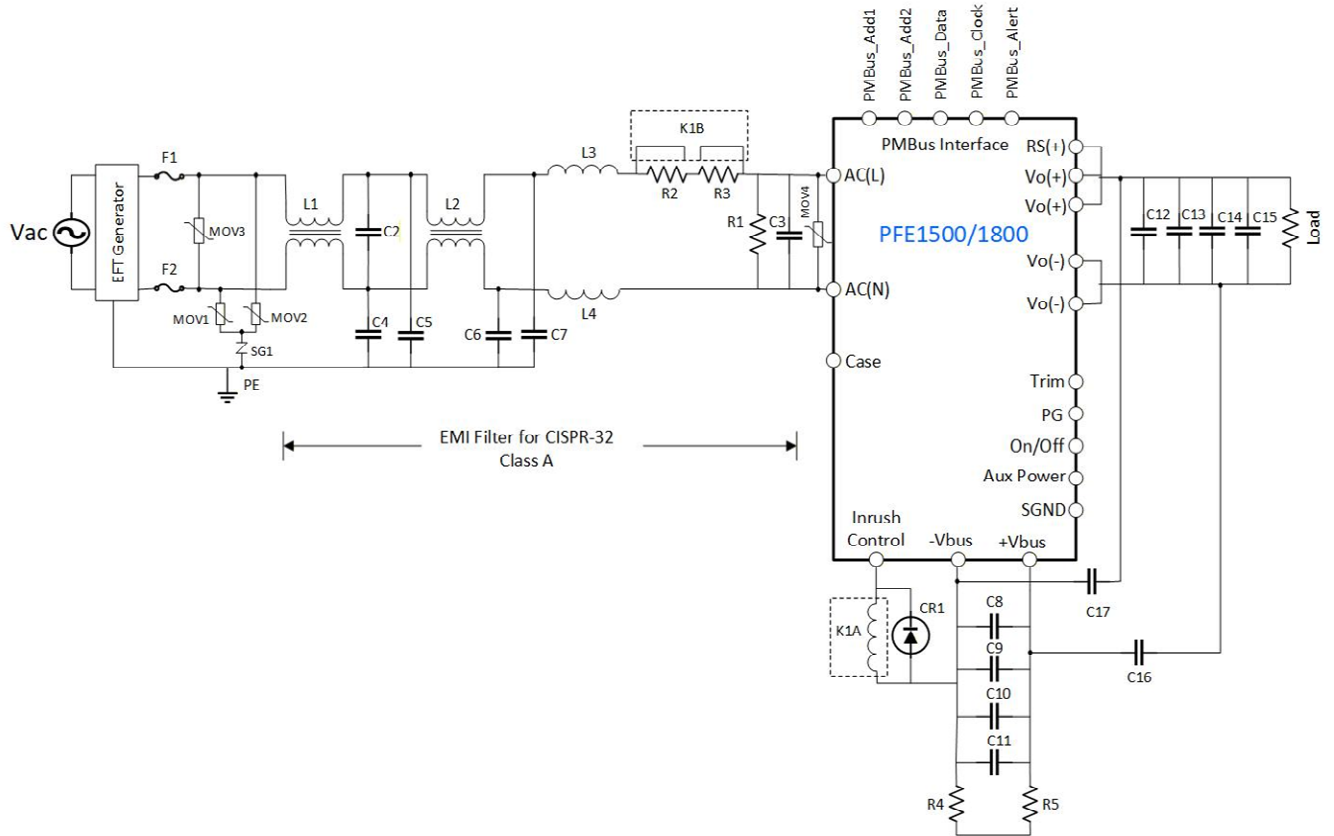
Test Setup for IEC 61000-4-4 (Electrical Fast Transients Immunity).

5.5 Test Circuit

A) Input Port: Apply 2kV, 5kHz transient to N, L and FG all at the same time.



B) Input Port: Apply $\pm 4\text{kV}$, 5kHz and 100kHz transient to L, N and PE individually and all at the same time.



Reference Designator	Description	Reference Designator	Description
C2	0.47 μF Film Capacitor	C6	2x2.2 μF Film Capacitor
C4, C5, C6, C7,	4700pF Ceramic Capacitor	C14	8x4.7 μF Ceramic Capacitor
L1	1mH	R2, R3	10 Ω 5W
L2	1.3mH	C12, C13	560 μF electrolytic capacitor
L3, L4	27 μH	C16, C17	7500pF ceramic capacitor
MOV1, MOV2	B72220P3251K101	SG1	CG32.5L
R1, R4, R5	470 k Ω , 2 W	C8, C9, C10, C11	470 μF Electrolytic Capacitor
RLa,RLb	1 Form A relay with 16A, 277VAC, power rating: 12VDC, 16.7mA, 200mW, High Sensitivity	F1, F2	20A, 280V, Fast Blow
MOV3, MOV4	TND20V-511K	C15	0.1 μF ceramic capacitor

Table of Component Values applies to both Test Circuits.

5.6 Acceptance Criteria

- 5.6.1 Test A, Performance Criteria B: DUT exhibits a change in performance when operating as intended. The DUT self-recovered.
- 5.6.2 Test B, Performance Criteria A: The DUT exhibited no change in performance when operating as intended.

5.7 Test Results

Date of Test A	09-09-2024	Date of Test B	09-09-2024
----------------	------------	----------------	------------

TEST A PASSED with Performance Criteria B

TEST B PASSED with Performance Criteria A

125V 25.6A load					
		L	N	PE	L+N+PE
4000V	5KHz	A	A	A	A
	100KHz	A	A	A	A
-4000V	5KHz	A	A	A	A
	100KHz	A	A	A	A
225V 25.6A load					
		L	N	PE	L+N+PE
4000V	5KHz	A	A	A	A
	100KHz	A	A	A	A
-4000V	5KHz	A	A	A	A
	100KHz	A	A	A	A

6. SURGE IMMUNITY TEST (IEC 61000-4-5)

6.1 Equipment Used

Asset #	Device	Manufacturer	Model	Calibration Date	Calibration Due Date
Element – TIQ	Transient Generator	TESEQ	NSG 3040	07-26-2024	01-26-2025
Element -- TIQA	Transformer	TESEQ	INA 6502	07-26-2024	07-26-2025
TDK – IT0144	Multimeter	Fluke Corp	87 III	No Cal Required	No Cal Required

6.2 Device Under Test (DUT)

Model Series: PFE1500FB-48

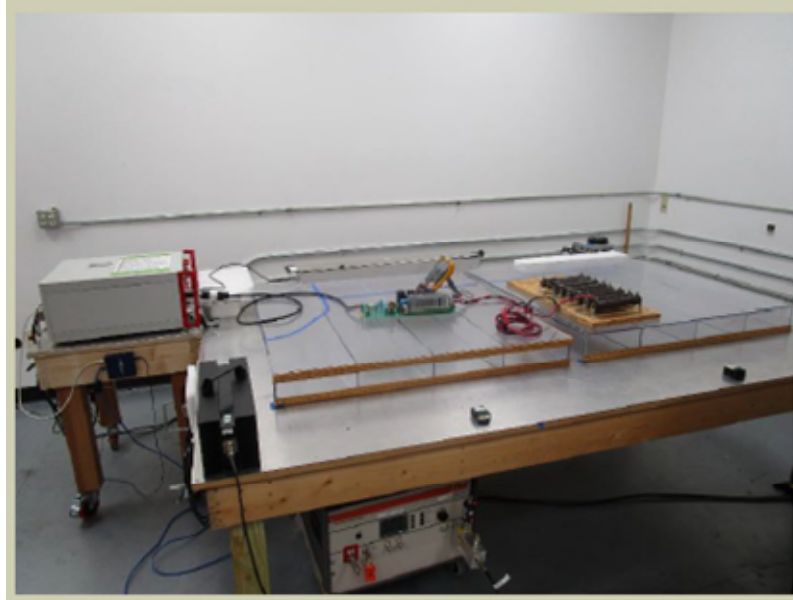
Quantity: 1 Unit

6.3 Test Conditions

	Test Condition
Input Voltage	230Vac / 50Hz
Power Port	AC Mains
Highest Power Port Test Level Line - Line	1.0kV, 2.0kV
Highest Power Port Test Level Line – Ground	2.0kV, 4.0kV
Highest Signal Port Test Level	None
Rest Duration Between Strikes	20 Seconds
Repetitions	5 each polarity
Polarity	Negative and Positive
Strike Angles on Power Frequency Phase	0°, 90°, 180°, 270°
Waveform Generator Type	Combination
Performance Criteria	A
DUT Mode	90% Resistive Load

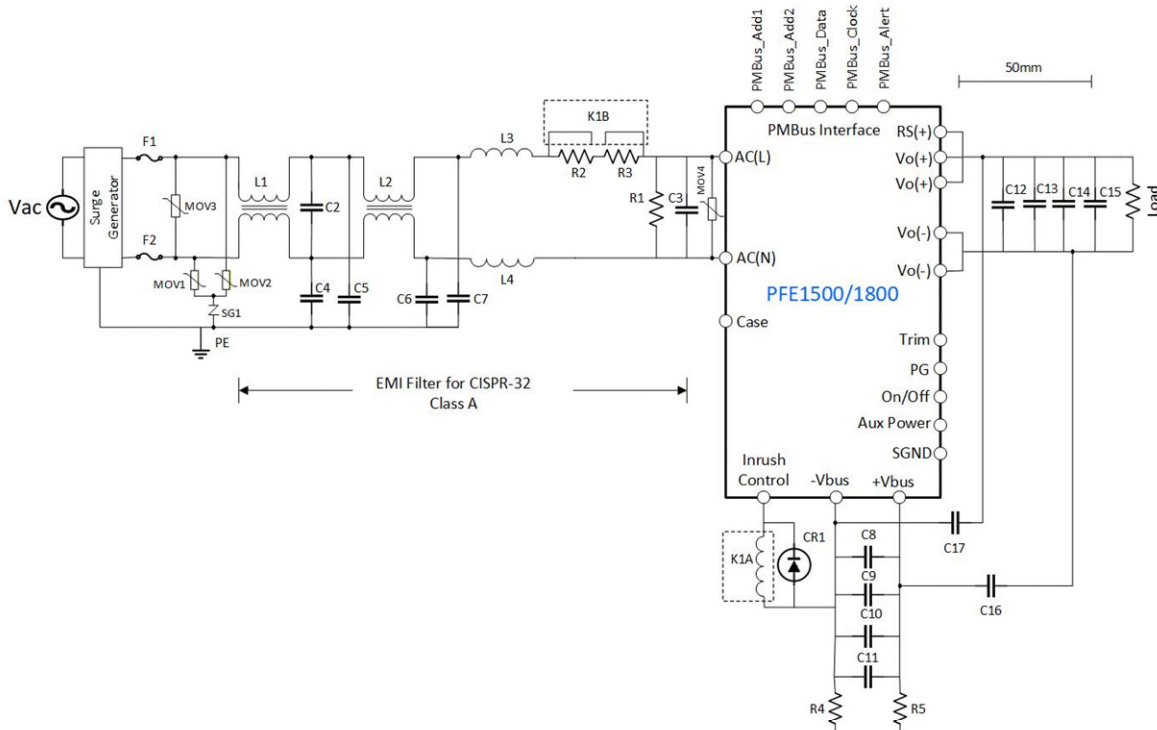
6.4 Test Method

According to IEC 61000-4-5



Test Setup for IEC 61000-4-5 (Surge Immunity).

6.5 Test Circuit



Reference Designator	Description	Reference Designator	Description
C2	0.47μF Film Capacitor	C6	2x2.2μF Film Capacitor
C4, C5, C6, C7,	4700pF Ceramic Capacitor	C14	8x4.7μF Ceramic Capacitor
L1	1mH	R2, R3	10Ω 5W
L2	1.3mH	C12, C13	560μF electrolytic capacitor
L3, L4	27 μH	C16, C17	7500pF ceramic capacitor
MOV1, MOV2	B72220P3251K101	SG1	CG32.5L
R1, R4, R5	470 kΩ, 2 W	C8, C9, C10, C11	470μF Electrolytic Capacitor
RLa,RLb	1 Form A relay with 16A, 277VAC, power rating: 12VDC, 16.7mA, 200mW, High Sensitivity	F1, F2	20A, 280V, Fast Blow
MOV3, MOV4	TND20V-511K	C15	0.1μF ceramic capacitor

6.6 Acceptance Criteria

6.6.1 Performance Criteria A: The DUT exhibited no change in performance when operating as intended.

6.7 Test Results

Date of Test	09-09-2024		
--------------	------------	--	--

PASSED with Performance Criteria A

Tested Strikes

	Level 3				Level 4			
	CM		DM		CM		DM	
	2.0kV		1.0 kV		4.0 kV		2.0 kV	
	+	-	+	-	+	-	+	-
N – GND	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
L1 – GND	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
N – L1	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
					Additional Comments			
Performance Criteria A			<input checked="" type="checkbox"/>		No Susceptibility Noted			
Performance Criteria B			<input type="checkbox"/>					

7. CONDUCTED DISTURBANCES INDUCED BY RADIO-FREQUENCY FIELD IMMUNITY TEST (IEC 61000-4-6)

7.1 Equipment Used

Asset #	Device	Manufacturer	Model	Calibration Date	Calibration Due Date
TDK – IT0144	Multimeter	Fluke Corp	87 III	No Cal Required	No Cal Required
Element – TGE	Signal Generator	Agilent	N5171B	10-24-2023	10-24-2026
Element - TTO	Amplifier - RF	Amplifier Research	200A400	No Cal Required	No Cal Required
Element – SOX	Meter - Power	Amplifier Research	PM2003	07-02-2024	07-02-2025
Element - RHA	Directional Coupler	Amplifier Research	DC3400A	No Cal Required	No Cal Required
Element - UAM	Attenuator	Fairview Microwave	SA3N500-03	No Cal Required	No Cal Required
Element - SRI	Power Sensor	Amplifier Research	PH2000A	07-02-2024	07-02-2025
Element - IIQ	Probe - Current	Teseq	CIP 9136A	No Cal Required	No Cal Required
Element - TNP	Terminator	Fairview Microwave	ST3B-C	03-15-2024	03-15-2025

7.2 Device Under Test (DUT)

Model Series: PFE1500FB-48
Quantity: 1 Unit

7.3 Test Conditions

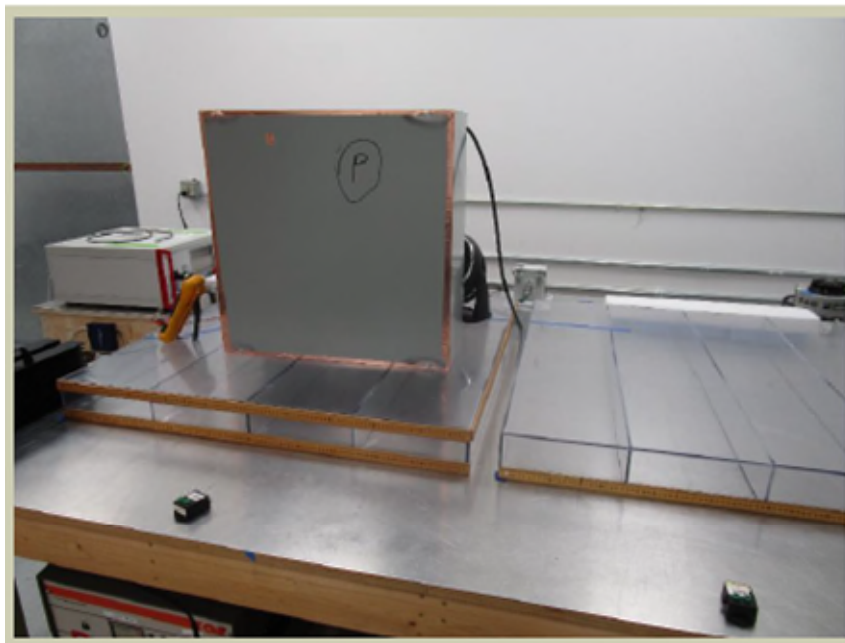
Input Voltage: 230Vac @ 50Hz
Output Current: 90% Resistive Load
Test Level: 10 V/m
Modulation: 80% Depth, 1KHz AM Modulation
Frequency Range: 0.15 to 80 MHz
Step Size: 1%
Dwell Time: 1 Second
Performance Criteria: A
Injection Point: AC Mains
Injection Method: CDN

7.4 Test Method

According to IEC 61000-4-6

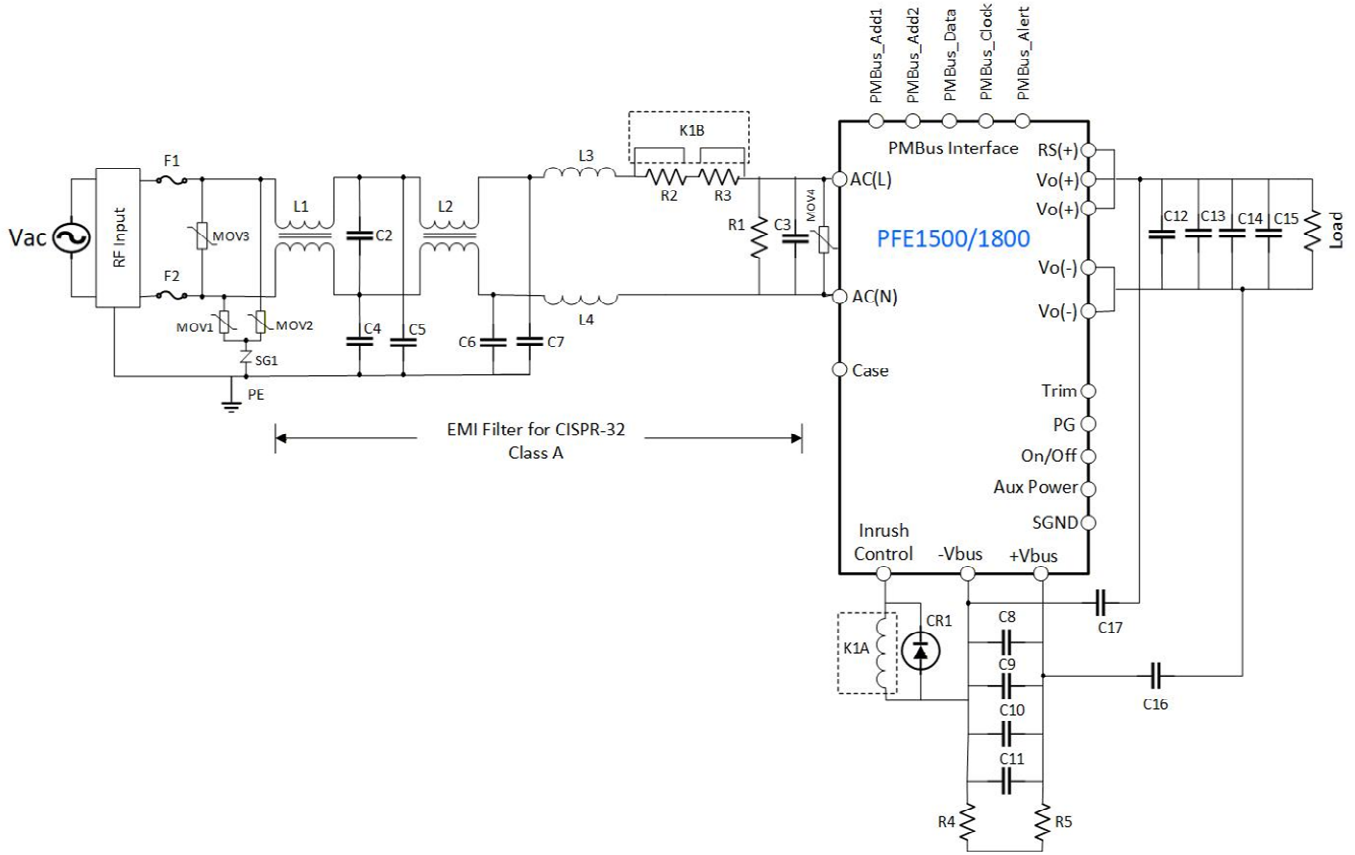


Test Setup for IEC 61000-4-6 (Conducted Disturbances).



Test Setup for IEC 61000-4-6 (Conducted Disturbances).

7.5 Test Circuit



Reference Designator	Description	Reference Designator	Description
C2	0.47 μ F Film Capacitor	C6	2x2.2 μ F Film Capacitor
C4, C5, C6, C7,	4700pF Ceramic Capacitor	C14	8x4.7 μ F Ceramic Capacitor
L1	1mH	R2, R3	10 Ω 5W
L2	1.3mH	C12, C13	560 μ F electrolytic capacitor
L3, L4	27 μ H	C16, C17	7500pF ceramic capacitor
MOV1, MOV2	B72220P3251K101	SG1	CG32.5L
R1, R4, R5	470 k Ω , 2 W	C8, C9, C10, C11	470 μ F Electrolytic Capacitor
RLa,RLb	1 Form A relay with 16A, 277VAC, power rating: 12VDC, 16.7mA, 200mW, High Sensitivity	F1, F2	20A, 280V, Fast Blow
MOV3, MOV4	TND20V-511K	C15	0.1 μ F ceramic capacitor

7.6 Acceptance Criteria

7.6.1 Performance Criteria A: DUT must operate within specification limits during and after test.

7.7 Test Results

Date of Test	09-09-2024		
--------------	------------	--	--

PASSED with Performance Criteria A.

Injection Point	AC Mains		
Injection Method	<input type="checkbox"/> Clamp	<input checked="" type="checkbox"/> CDN	
	Additional Comments		
Performance Criteria A	<input checked="" type="checkbox"/>	No Susceptibility Noted	
Performance Criteria B	<input type="checkbox"/>		

8. POWER FREQUENCY MAGNETIC FIELD IMMUNITY TEST (IEC 61000-4-8)

8.1 Equipment Used

Asset #	Device	Manufacturer	Model	Calibration Date	Calibration Due Date
Element -- IMO	Coil-Helmholtz	Northwest EMC	N/A	03-06-2024	03-06-2027
Element --THC	Power Source/Analyzer	Hewlett Packard	6841A	No Cal Required	No Cal Required
TDK – IT0144	Multimeter	Fluke Corp	87 III	No Cal Required	No Cal Required

8.2 Device Under Test (DUT)

Model Series: PFE1500FB-48
 Quantity: 1 unit

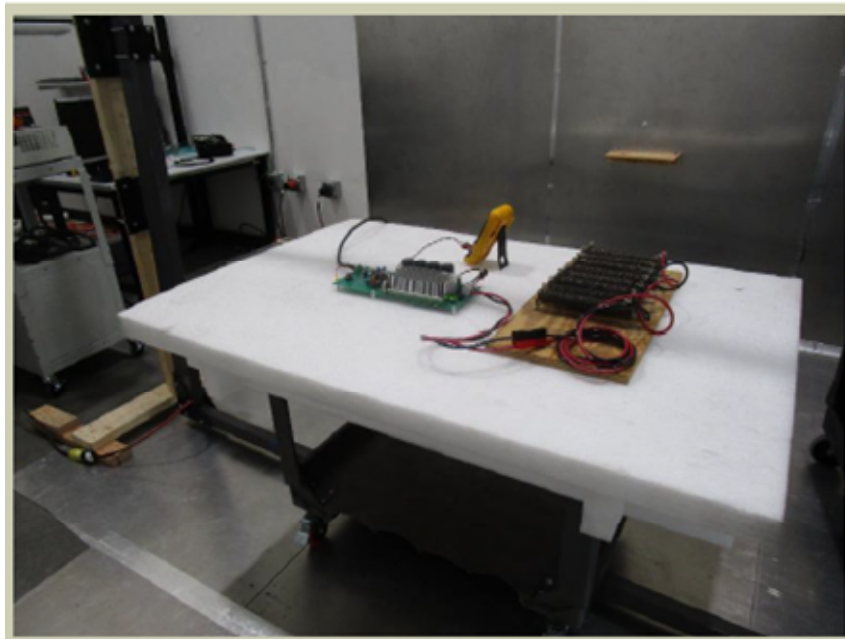
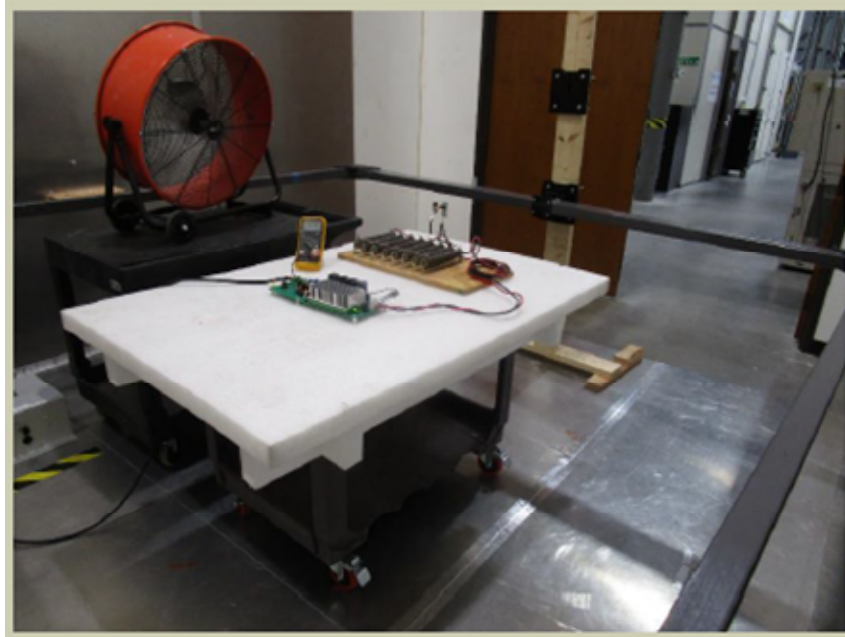
8.3 Test Conditions

Input Voltage: 230V @ 50Hz
 Output Current: 90% Resistive Loads
 Threat Level: 30 A /m
 Frequency: 50Hz
 Test Axis: X, Y, Z
 Duration Per Axis: 5 Minutes
 Performance Criteria: A

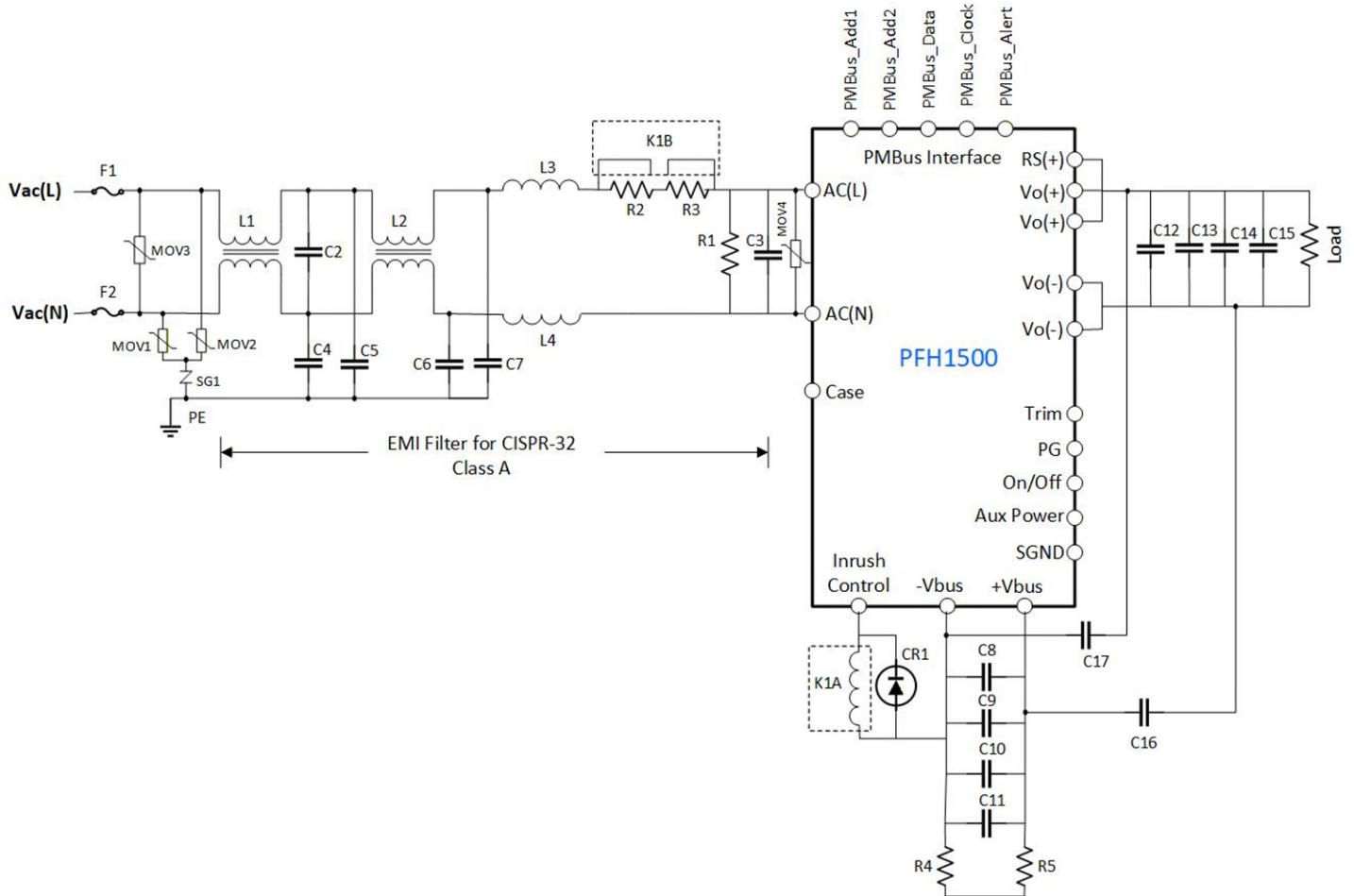
8.4 Test Method

According to IEC 61000-4-8 Level 4





8.5 Test Circuit



Reference Designator	Description	Reference Designator	Description
C2	0.47 μ F Film Capacitor	C6	2x2.2 μ F Film Capacitor
C4, C5, C6, C7,	4700pF Ceramic Capacitor	C14	8x4.7 μ F Ceramic Capacitor
L1	1mH	R2, R3	10 Ω 5W
L2	1.3mH	C12, C13	560 μ F electrolytic capacitor
L3, L4	27 μ H	C16, C17	7500pF ceramic capacitor
MOV1, MOV2	B72220P3251K101	SG1	CG32.5L
R1, R4, R5	470 k Ω , 2 W	C8, C9, C10, C11	470 μ F Electrolytic Capacitor
RLa,RLb	1 Form A relay with 16A, 277VAC, power rating: 12VDC, 16.7mA, 200mW, High Sensitivity	F1, F2	20A, 280V, Fast Blow
MOV3, MOV4	TND20V-511K	C15	0.1 μ F ceramic capacitor

8.6 Acceptance Criteria

8.6.1 Performance Criteria A: DUT must operate within specification limits during and after test

Test Results

Date of Test	09-09-2024		
--------------	------------	--	--

PASSED with Performance Criteria A.

Test Axis	Compliant		Comments
	Yes	No	
X	<input checked="" type="checkbox"/>	<input type="checkbox"/>	No Susceptibility Noted
Y	<input checked="" type="checkbox"/>	<input type="checkbox"/>	No Susceptibility Noted
Z	<input checked="" type="checkbox"/>	<input type="checkbox"/>	No Susceptibility Noted
			Additional Comments
Performance Criteria A	<input checked="" type="checkbox"/>	No Susceptibility Noted	
Performance Criteria B	<input type="checkbox"/>		

9. VOLTAGE DIPS AND SHORT INTERRUPTIONS IMMUNITY TEST (IEC 61000-4-11)

9.1 Equipment Used

Asset #	Device	Manufacturer	Model	Calibration Date	Calibration Due Date
Element --TIQA	Transformer	TESEQ	INA 6502	07-26-2024	01-26-2025
Element --TIQ	Transient Generator	TESEQ	NSG 3040	07-26-2024	01-26-2025
Element – CPA	Capacitor	Northwest EMC	30µF	01-19-2024	01-19-2025
TDK – IT0144	Multimeter	Fluke Corp	87 III	No Cal Required	No Cal Required

9.2 Device Under Test (DUT)

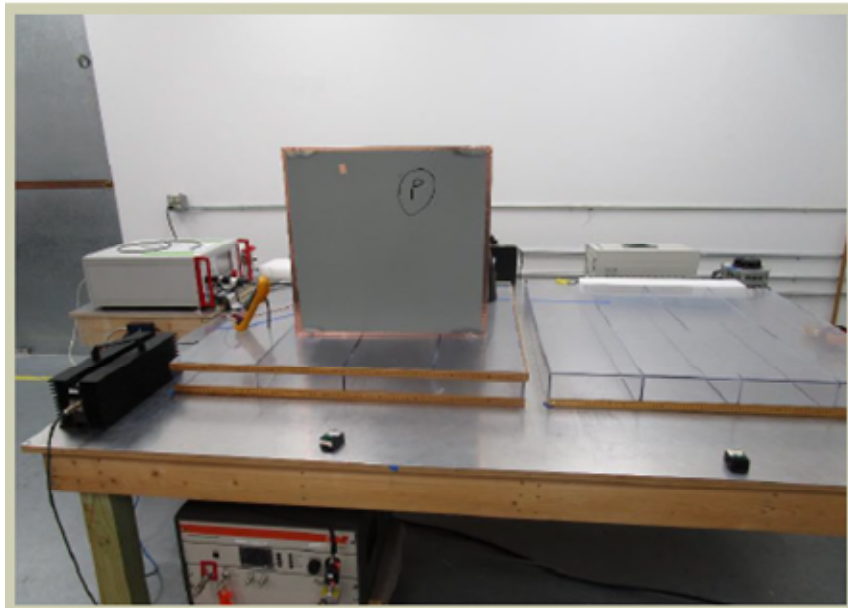
Model Series: PFE1500FB-48
Quantity: 1 Unit

9.3 Test Conditions

Input Voltage:	230Vac / 50Hz
Output Current:	90% Resistive Load
Performance Criteria:	Per Test Plan
Changes at Phase Angle:	0°, 45°, 90°, 135°, 180°, 215°, 270°, 315°.
Repetitions:	3 shots each condition.

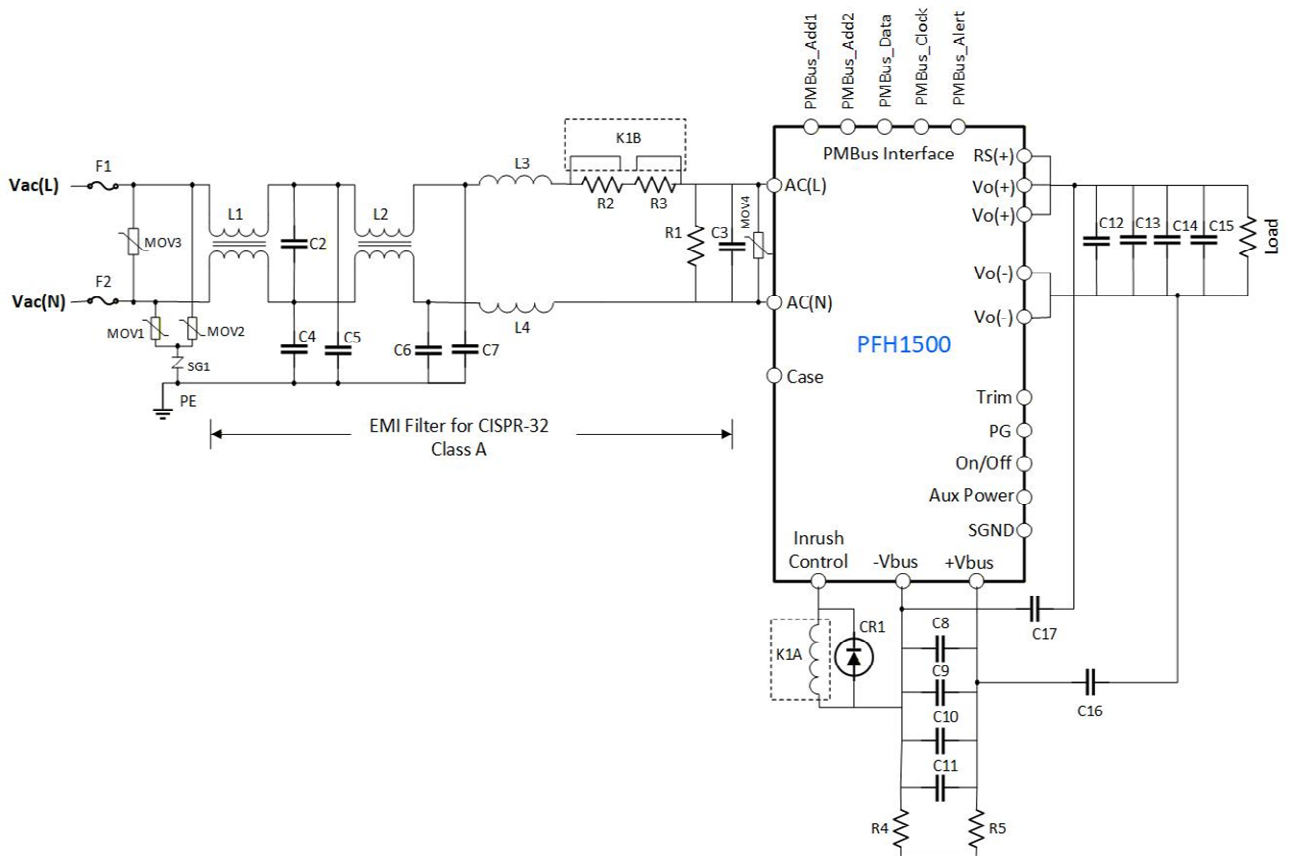
9.4 Test Method

According to IEC 61000-4-11



Test setup for IEC 61000-4-11 (Voltage Dips and Interruptions Immunity).

9.5 Test Circuit



Reference Designator	Description	Reference Designator	Description
C2	0.47μF Film Capacitor	C6	2x2.2μF Film Capacitor
C4, C5, C6, C7,	4700pF Ceramic Capacitor	C14	8x4.7μF Ceramic Capacitor
L1	1mH	R2, R3	10Ω 5W
L2	1.3mH	C12, C13	560μF electrolytic capacitor
L3, L4	27 μH	C16, C17	7500pF ceramic capacitor
MOV1, MOV2	B72220P3251K101	SG1	CG32.5L
R1, R4, R5	470 kΩ, 2 W	C8, C9, C10, C11	470μF Electrolytic Capacitor
RLa,RLb	1 Form A relay with 16A, 277VAC, power rating: 12VDC, 16.7mA, 200mW, High Sensitivity	F1, F2	20A, 280V, Fast Blow
MOV3, MOV4	TND20V-511K	C15	0.1μF ceramic capacitor

9.6 Acceptance Criteria

9.6.1 Performance Criteria B: Temporary loss of function or performance degradation is possible during test but the DUT will self-recover to normal operation without any operator intervention

9.7 Test Results

Date of Test	09-09-2024		
--------------	------------	--	--

PASSED with Performance Criteria B.

Ref	Dip Level	Duration	Phase Angle	Result
A	100%	½ cycle	0°	Criteria B
B	30%	25 cycles	0°	Criteria B
C	100%	250 cycles	0°	Criteria B

10. RING WAVE TEST (IEC 61000-4-12)

10.1 Equipment Used

Asset #	Device	Manufacturer	Model	Calibration Date	Calibration Due Date
TDK—IT0362	Transient Generator	TESEQ	NSC 3060	No Cal Required	No Cal Required
TDK	Transformer	SIGNAL	DU-2	No Cal Required	No Cal Required
TDK – IT0144	Multimeter	Fluke Corp	87 III	No Cal Required	No Cal Required

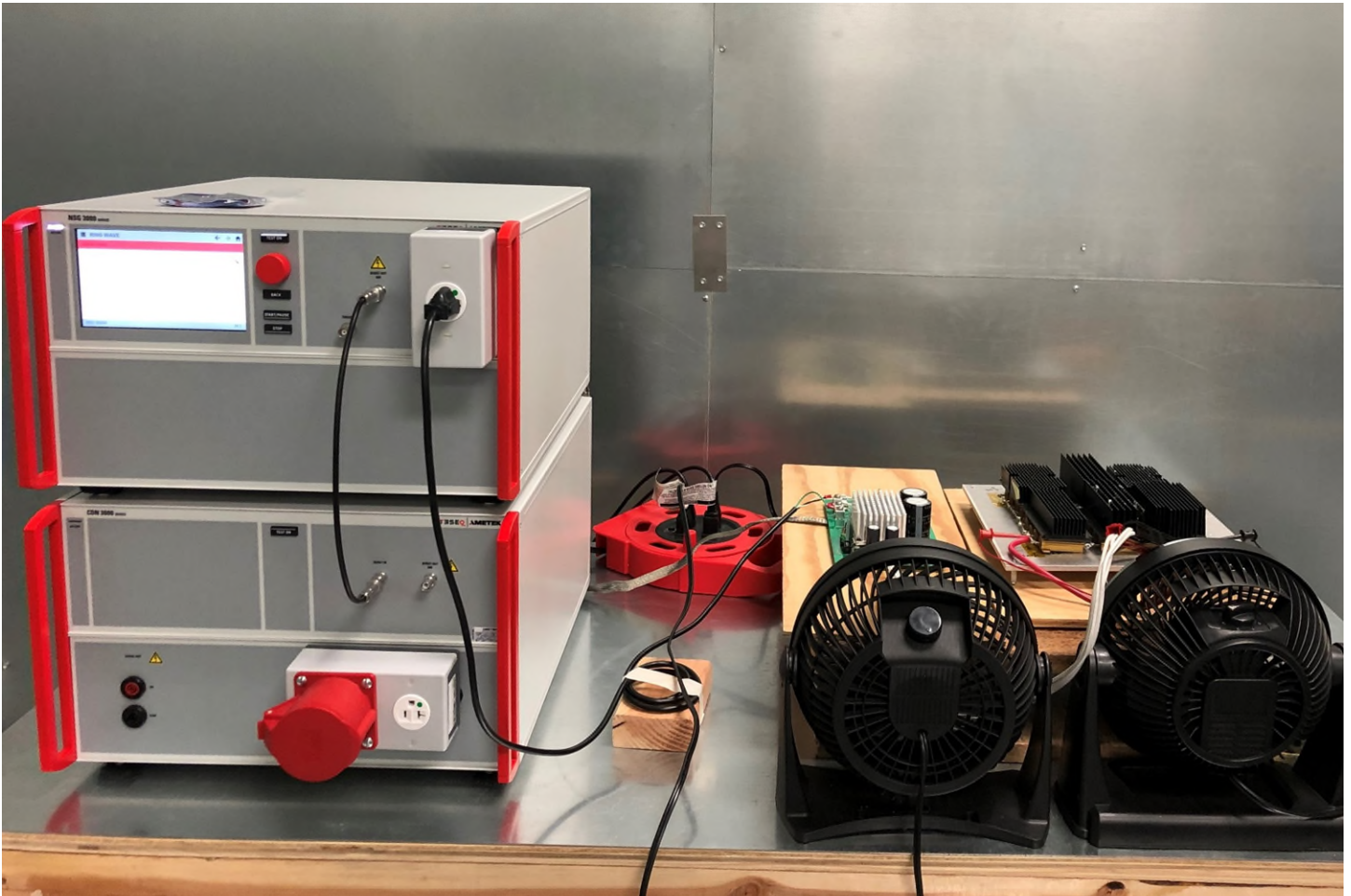
10.2 Device Under Test (DUT)

Model Series: PFE1500FB-48
Quantity: 1 Unit

10.3 Test Conditions

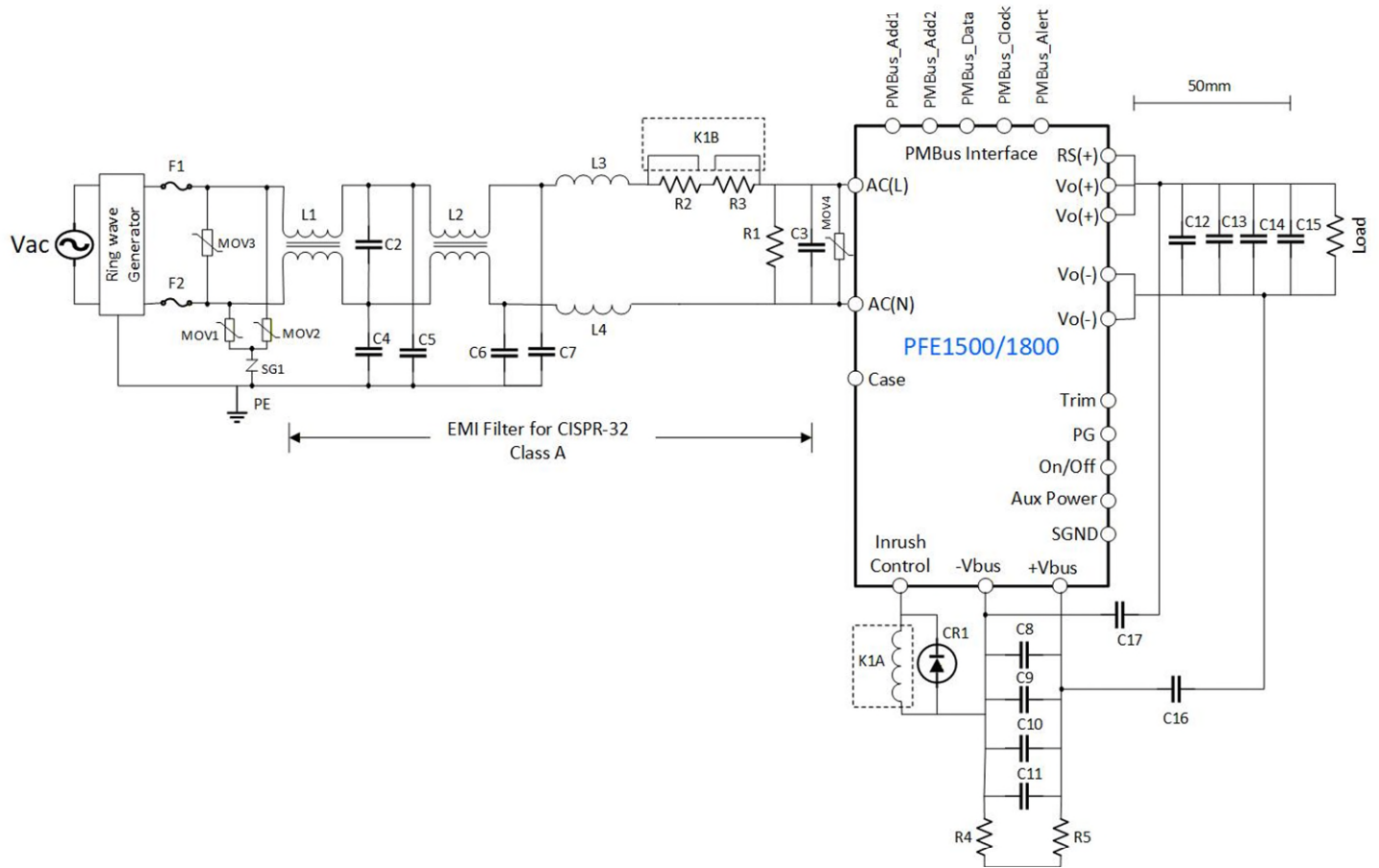
	Test Condition
Input Voltage	110Vac / 60Hz, 230Vac / 60Hz
Power Port	AC Mains
Highest Power Port Test Level Line - Line	1.0kV, 2.0kV
Highest Power Port Test Level Line – Ground	2.0kV, 4.0kV
Highest Signal Port Test Level	None
Rest Duration Between Strikes	45 Seconds
Repetitions	5 each polarity
Polarity	Negative and Positive
Strike Angles on Power Frequency Phase	0°, 90°, 180°, 270°
Waveform Generator Type	Combination
Performance Criteria	B
DUT Mode	92% load at 110Vac and 77% load at 230Vac (Resistive)

10.4 Test Method



Test setup for IEC 61000-4-12 (Ring Wave Test).

10.5 Test Circuit



Reference Designator	Description	Reference Designator	Description
C2	0.47 μ F Film Capacitor	C6	2x2.2 μ F Film Capacitor
C4, C5, C6, C7,	4700pF Ceramic Capacitor	C14	8x4.7 μ F Ceramic Capacitor
L1	1mH	R2, R3	10 Ω 5W
L2	1.3mH	C12, C13	560 μ F electrolytic capacitor
L3, L4	27 μ H	C16, C17	7500pF ceramic capacitor
MOV1, MOV2	B72220P3251K101	SG1	CG32.5L
R1, R4, R5	470 k Ω , 2 W	C8, C9, C10, C11	470 μ F Electrolytic Capacitor
RLa,RLb	1 Form A relay with 16A, 277VAC, power rating: 12VDC, 16.7mA, 200mW, High Sensitivity	F1, F2	20A, 280V, Fast Blow
MOV3, MOV4	TND20V-511K	C15	0.1 μ F ceramic capacitor

10.6 Acceptance Criteria

10.6.1 Performance Criteria B: Temporary loss of function or performance degradation is possible during test, but the DUT will self- recover to normal operation without any operator intervention.

10.7 Test Results

Date of Test	08-16-2024		
--------------	------------	--	--

PASSED with Performance Criteria B

Test Strikes

	Level 3				Level 4			
	CM		DM		CM		DM	
	2.0kV		1.0 kV		4.0 kV		2.0 kV	
	+	-	+	-	+	-	+	-
N – GND	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
L1 – GND	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
N – L1	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
					Additional Comments			
Performance Criteria A			<input type="checkbox"/>		No Susceptibility Noted			
Performance Criteria B			<input checked="" type="checkbox"/>		Unit shuts down but recovers			

11. VOLTAGE FLUCTUATION IMMUNITY TEST (IEC 61000-4-14)

11.1 Equipment Used

Asset #	Device	Manufacturer	Model	Calibration Date	Calibration Due Date
N/A	Oscilloscope	LeCroy	HDO4104	03-07-2024	03-07-2025
N/A	AC Power Source	Ametek	AST12K3A1C-E151A2G	N/A	N/A
N/A	Multimeter	Fluke Corp	87 III	12-18-2023	12-18-2024

11.2 Device Under Test (DUT)

Model Series: PFE1500FB-48
Quantity: 1 Unit

11.3 Test Conditions

Nominal Input Voltage: 230 Vac / 50 Hz
EUT Mode: 90% Resistive Load
Performance Criteria: A
Falling Voltage Changes: Begin at 270°, Finish at 360°
Rising Voltage Changes: Begin at 180°, Finish at 270°
Test Level: Class 3 –12%
230V rising and falling 12%
207V rising 12%
253V falling 12%

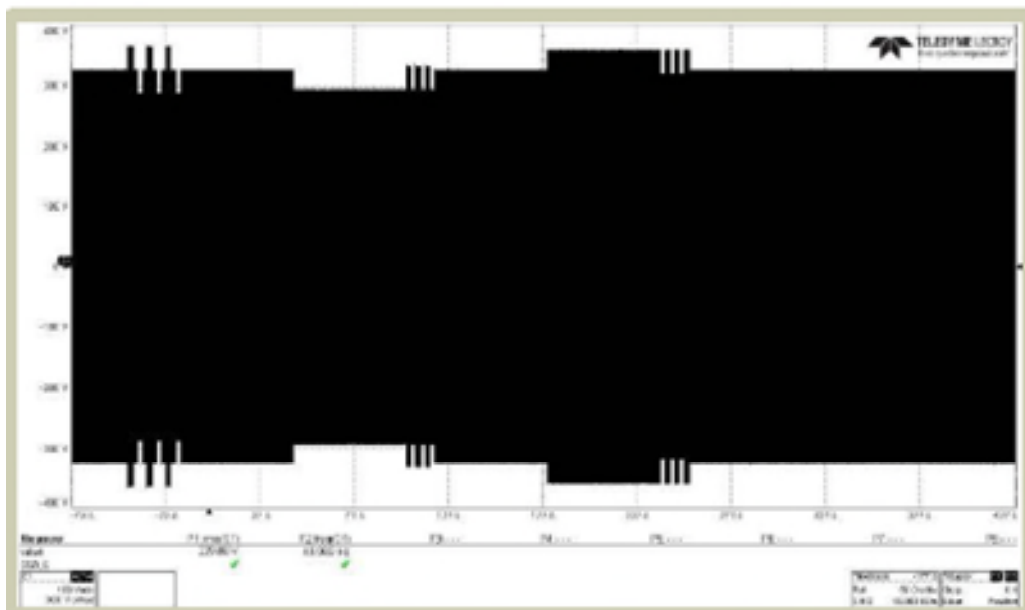
Repetitions: 6 times each test condition
Duration of the Voltage Fluctuations: 5 s

11.4 Test Method

Per IEC 61000-4-14

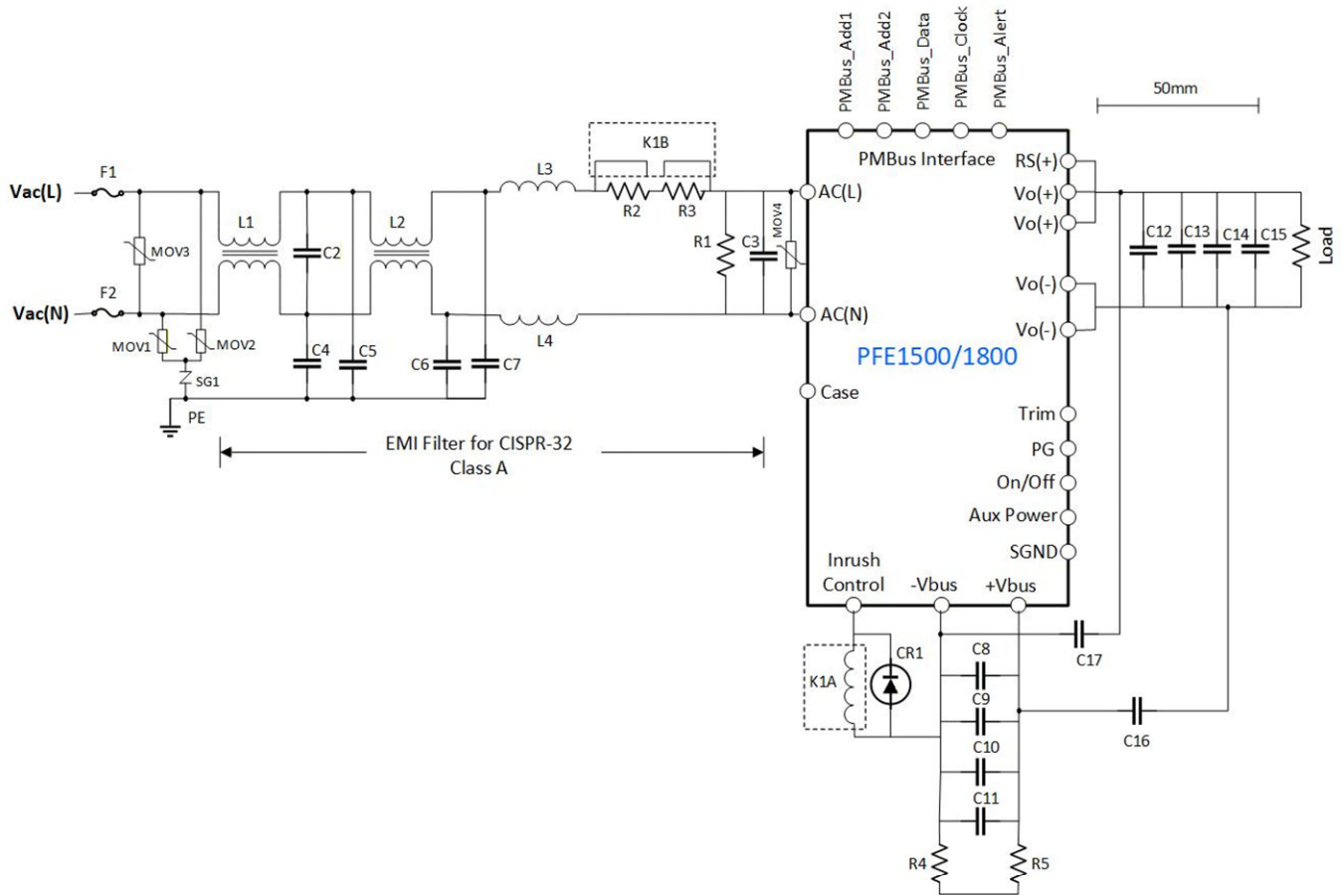


Test setup for Voltage Fluctuation Immunity.



PFE1500/1800 Input Voltage during IEC 61000-4-14.

11.5 Test Circuit



Reference Designator	Description	Reference Designator	Description
C2	0.47 μ F Film Capacitor	C6	2x2.2 μ F Film Capacitor
C4, C5, C6, C7,	4700pF Ceramic Capacitor	C14	8x4.7 μ F Ceramic Capacitor
L1	1mH	R2, R3	10 Ω 5W
L2	1.3mH	C12, C13	560 μ F electrolytic capacitor
L3, L4	27 μ H	C16, C17	7500pF ceramic capacitor
MOV1, MOV2	B72220P3251K101	SG1	CG32.5L
R1, R4, R5	470 k Ω , 2 W	C8, C9, C10, C11	470 μ F Electrolytic Capacitor
RLa,RLb	1 Form A relay with 16A, 277VAC, power rating: 12VDC, 16.7mA, 200mW, High Sensitivity	F1, F2	20A, 280V, Fast Blow
MOV3, MOV4	TND20V-511K	C15	0.1 μ F ceramic capacitor

11.6 Acceptance Criteria

11.6.1 Performance Criteria A: DUT must operate within specification limits during and after test.

11.7 Test Results

Date of Test	09-04-2024		
--------------	------------	--	--

PASSED with Performance Criteria A.

Voltage Fluctuation	Compliant Status
Falling 12% at 230V	<input checked="" type="checkbox"/> Compliant to Criteria A
Rising 12% at 230V	<input checked="" type="checkbox"/> Compliant to Criteria A
Falling 12% at 253V	<input checked="" type="checkbox"/> Compliant to Criteria A
Rising 12% at 207V	<input checked="" type="checkbox"/> Compliant to Criteria A
Performance Criteria A	<input checked="" type="checkbox"/> No Susceptibility Noted
Performance Criteria B	<input type="checkbox"/>

Information furnished by TDK-Lambda is believed to be accurate and reliable. However, TDK Lambda assumes no responsibility for its use, nor for any infringement of patents or other rights of third parties, which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of TDK Lambda. TDK components are not designed to be used in applications, such as life support systems, wherein failure or malfunction could result in injury or death. All sales are subject to TDK Lambda's Terms and Conditions of Sale, which are available upon request. Specifications are subject to change without notice.

Trusted • Innovative • Reliable

TDK-Lambda



TDK-Lambda France SAS

Tel: +33 1 60 12 71 65
tff.fr.powersolutions@tdk.com
www.emea.lambda.tdk.com/fr



Italy Sales Office

Tel: +39 02 61 29 38 63
tff.it.powersolutions@tdk.com
www.emea.lambda.tdk.com/it



Netherlands

tff.nl.powersolutions@tdk.com
www.emea.lambda.tdk.com/nl



TDK-Lambda Germany GmbH

Tel: +49 7841 666 0
tfg.powersolutions@tdk.com
www.emea.lambda.tdk.com/de



Austria Sales Office

Tel: +43 2256 655 84
tfg.at.powersolutions@tdk.com
www.emea.lambda.tdk.com/at



Switzerland Sales Office

Tel: +41 44 850 53 53
tfg.ch.powersolutions@tdk.com
www.emea.lambda.tdk.com/ch



Nordic Sales Office

Tel: +45 8853 8086
tfg.dk.powersolutions@tdk.com
www.emea.lambda.tdk.com/dk



TDK-Lambda UK Ltd.

Tel: +44 (0) 12 71 85 66 66
tiu.powersolutions@tdk.com
www.emea.lambda.tdk.com/uk



TDK-Lambda Ltd.

Tel: +9 723 902 4333
tli.powersolutions@tdk.com
www.emea.lambda.tdk.com/il-en



TDK-Lambda Americas

Tel: +1 800-LAMBDA-4 or 1-800-526-2324
tia.powersolutions@tdk.com
www.us.lambda.tdk.com



TDK Electronics do Brasil Ltda

Tel: +55 11 3289-9599
sales.br@tdk-electronics.tdk.com
www.tdk-electronics.tdk.com/en



TDK-Lambda Corporation

Tel: +81-3-6778-1113
www.jp.lambda.tdk.com



TDK-Lambda (China) Electronics Co. Ltd.

Tel: +86 21 6465-0777
tfc.powersolutions@tdk.com
www.lambda.tdk.com.cn



TDK-Lambda Singapore Pte Ltd.

Tel: +65 6251 7211
tts.marketing@tdk.com
www.sg.lambda.tdk.com



TDK India Private Limited, Power Supply Division

Tel: +91 80 4039-0660
mathew.philip@tdk.com
www.sg.lambda.tdk.com

For Additional Information, please visit
<https://product.tdk.com/en/power/>

