

***PFH500F-xx-xxx-R***

***IEC 61000-4-xx Immunity Test Report***

## Contents

1. GENERAL INFORMATION .....	3
2. SUMMARY OF TEST RESULTS.....	3
3. ELECTROSTATIC DISCHARGE (ESD) IMMUNITY TEST (IEC61000-4-2).....	4
4. RADIATED RADIO FREQUENCY, ELECTROMAGNETIC FIELD IMMUNITY TEST (IEC61000-4-3).....	8
5. ELECTRICAL FAST TRANSIENT/BURST IMMUNITY TEST (IEC61000-4-4).....	11
6. SURGE IMMUNITY TEST (IEC61000-4-5) .....	16
7. CONDUCTED DISTURBANCES INDUCED BY RADIO-FREQUENCY FIELD IMMUNITY TEST (IEC61000-4-6).....	20
8. POWER FREQUENCY MAGNETIC FIELD IMMUNITY TEST (IEC61000-4-8) .....	24
9. VOLTAGE DIPS, SHORT INTERRUPTIONS IMMUNITY TEST (IEC61000-4-11) .....	28
10. Ring Wave TEST (IEC61000-4-12) .....	31
11. VOLTAGE FLUCTUATION IMMUNITY TEST (IEC61000-4-14) .....	35

## 1. GENERAL INFORMATION

### 1.1 Product Description

Model Number	PFH500F-xx-xxx-R <b>xx</b> – can be 12, 28 or 48V output <b>xxx</b> - can be any alphanumeric character or blank representing non-safety critical options such as pin length, mounting style, control function, etc....
Product Description	500W AC-DC Power Module Single Output with 12V Auxiliary Supply Universal Input 90V -264 VAC

## 2. SUMMARY OF TEST RESULTS

STANDARD	TEST ITEM	TEST RESULT	REMARKS
IEC61000-4-2	Electrostatic Discharge (ESD)	PASS	Contact Discharge up to: ±4kV Air Discharge up to: ±8kV Performance Criteria A
IEC61000-4-3	Radiated Radio Frequency (RF), Electromagnetic Field Immunity	PASS	80-1000MHz 1kHz sinewave, 80%, 10V/m Performance Criteria A
IEC61000-4-4	Electrical Fast Transient/ Burst	PASS	±2kV, 5kHz, Input and Output Ports Performance Criteria A
IEC61000-4-5	Surge	PASS	Level 3: Performance Criteria B Level 4: Performance Criteria B
IEC61000-4-6	Conducted Disturbance Induced by RF Field	PASS	0.15 to 80MH, 10V/m, 80% 1kHz AM Performance Criteria A
IEC61000-4-8	Power Frequency Magnetic Field	PASS	30A/m; 50Hz/60Hz; X,Y,Z, 5 min Performance Criteria A
IEC61000-4-11	Voltage Dip and Interruption	PASS	0%: Performance Criteria B 40%: Performance Criteria B 70%: Performance Criteria B 80%: Performance Criteria B
IEC61000-4-12	Ring Wave	PASS	Level 3: Performance Criteria B Level 4: Performance Criteria B
IEC61000-4-14	Voltage Fluctuation	PASS	Class 3 – 12% of Input Voltage Performance Criteria A

**3. ELECTROSTATIC DISCHARGE (ESD) IMMUNITY TEST (IEC61000-4-2)**

**3.1 Equipment Used**

Asset #	Device	Manufacturer	Model	Calibration Date	Calibration Due Date
NTS - 1077179	ESD Gun	TESEQ	NSG 438	9/21/2016	9/21/2017
TDK - IT0144	Multimeter	Fluke Corp	87 III	No Cal Required	No Cal Required
TDK - IT0247	True RMS Clamp Meter	Fluke Corp	337	No Cal Required	No Cal Required

**3.2 Device Under Test (DUT)**

Model Series: PFH500F-28 and PFH500F-12  
Quantity: 1 Unit each

**3.3 Test Conditions**

Input Voltage: 120Vac @ 60Hz, 230Vac @ 50Hz  
Output Current: 92% Resistive Load  
Discharge Rep. Rate:  $\geq 1$  Per Second  
Number of Discharges:  $\geq 10$  Per Location  
Polarity: +/-  
Required Performance Criteria: A

### 3.4 Test Method and Device Test Points

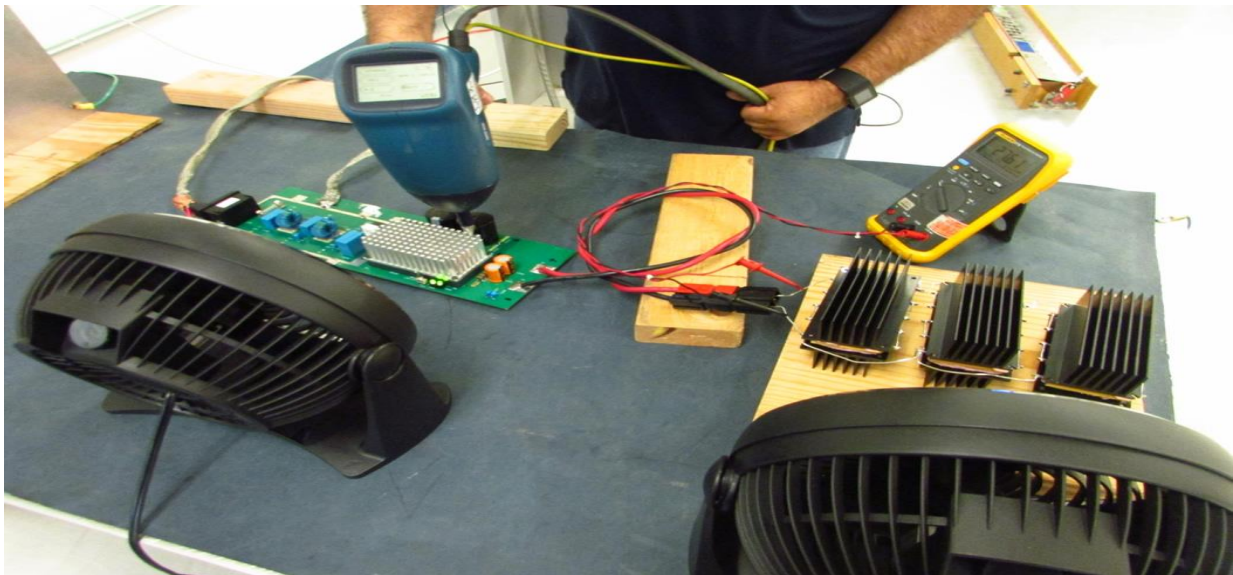
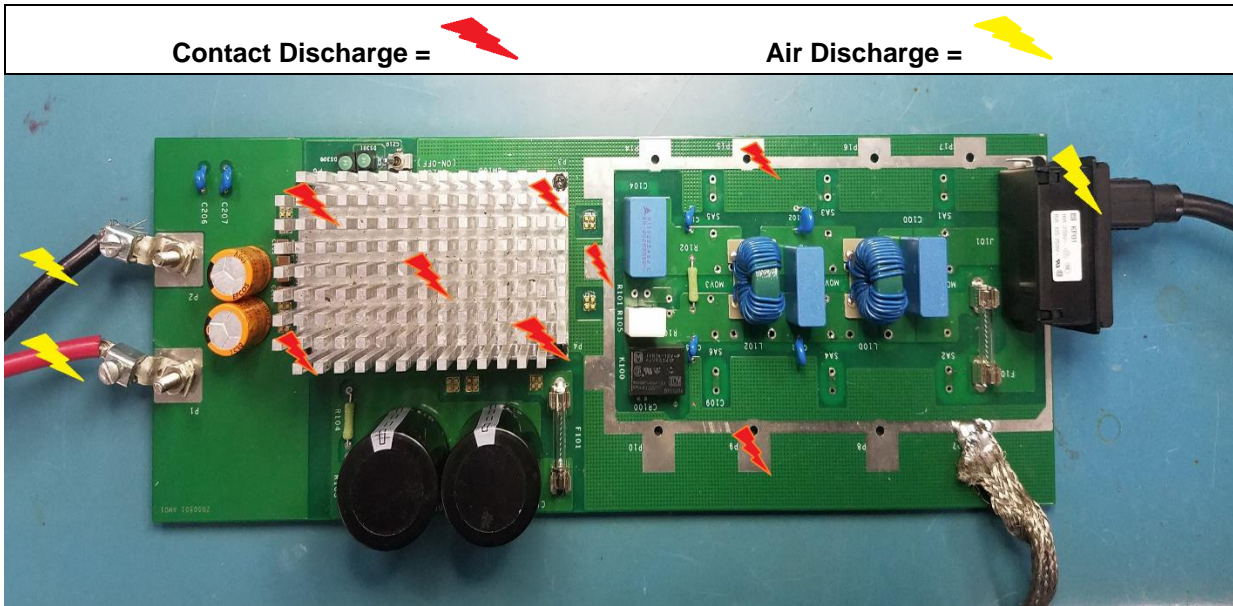
According to IEC61000-4-2.

Contact Discharge:

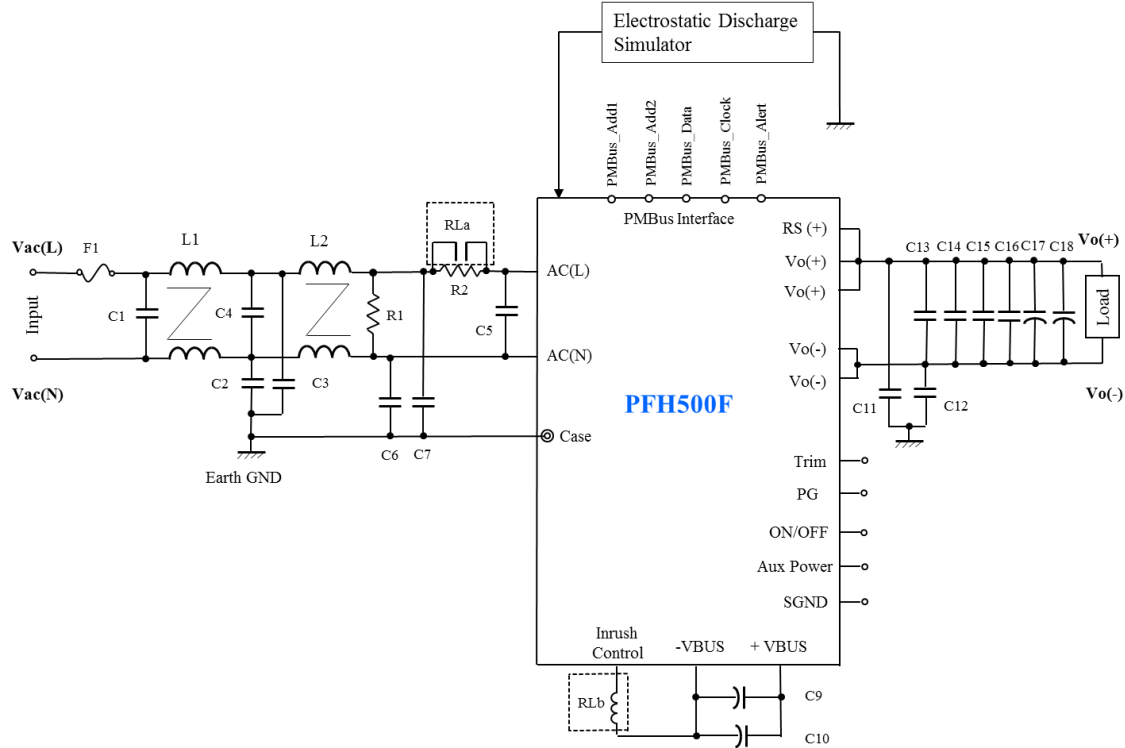
Air Discharge:

FG Terminal

Input and Output Terminals



### 3.5 Test Circuit



Circuit Code	Description	Circuit Code	Description
C1, C4	1 $\mu$ F Film Capacitor	C5	2.2 $\mu$ F Film Capacitor
C2, C3	3300pF Ceramic Capacitor	C6, C7	1000pF Ceramic Capacitor
L1, L2	6.3mH	R2	22 Ohms
R1	470kOhms	C13, C14, C15, C16	10 $\mu$ F Ceramic Capacitor
C17, C18	220 $\mu$ F Electrolytic Capacitor	C9, C10	470 $\mu$ F Electrolytic Capacitor
C11, C12	470pF Ceramic Capacitor	F1	10A, 250V, Fast Blow
RLa, RLb	1 Form A relay with 10A, 277VAC, power rating: 12VDC, 16.7mA, 200mW, High Sensitivity		

### 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	06-16-2017		
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**PASS** with Performance Criteria A

Contact Discharge	
Voltage (± kV)	<input checked="" 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	
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 (IEC61000-4-3)**

**4.1 Equipment Used**

Asset #	Device	Manufacturer	Model	Calibration Date	Calibration Due Date
TIW	Generator - Signal	Agilent	N5173B	7/5/2017	7/5/2020
SOY	Meter - Power	Amplifier Research	PM2003	6/2/2017	6/2/2018
SRJ	Power Sensor	Amplifier Research	PH2004	6/2/2017	6/2/2018
IER	Monitor - Field	Amplifier Research	FL7218	7/14/2017	7/14/2019
ALO	Antenna - Log Periodic	ETS Lindgren	3144	NCR	NCR
TTP	Amplifier - RF	Amplifier Research	500W1000B	NCR	NCR
RHB	Directional Coupler	Amplifier Research	DC6180A	NCR	NCR
SRK	Power Sensor	Amplifier Research	PH2004	8/21/2017	8/21/2018

**4.2 Device Under Test (DUT)**

Model Series: PFH500F-28  
Quantity: 1 unit

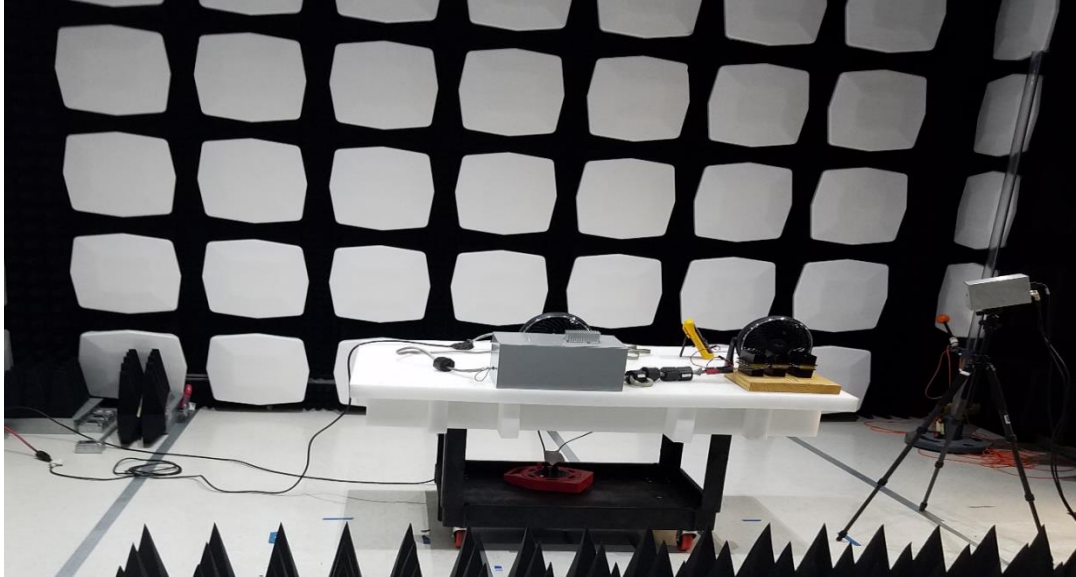
**4.3 Test Conditions**

Input Voltage:	220Vac@60Hz
Output Current:	92% Resistive Load
Electromagnetic Frequency:	80MHz – 1000MHz
Distance of Antenna – D.U.T:	3m
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%, 1KHz

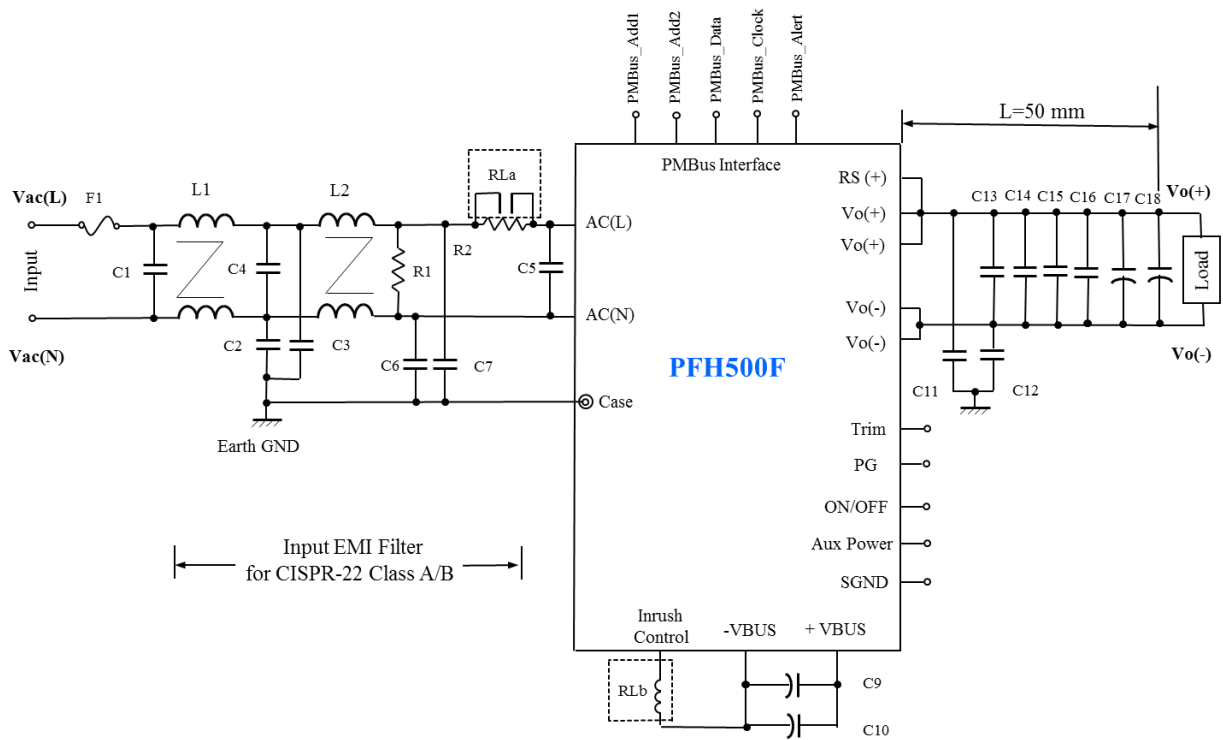


#### 4.4 Test Method

According to IEC61000-4-3.



#### 4.5 Test Circuit



Circuit Code	Description	Circuit Code	Description
C1, C4	1μF Film Capacitor	C5	2.2μF Film Capacitor
C2, C3	3300pF Ceramic Capacitor	C6, C7	1000pF Ceramic Capacitor
L1, L2	6.3mH	R2	22 Ohms
R1	470kOhms	C13, C14, C15, C16	10μF Ceramic Capacitor
C17, C18	220μF Electrolytic Capacitor	C9, C10	470μF Electrolytic Capacitor
C11, C12	470pF Ceramic Capacitor	F1	10A, 250V, Fast Blow
RLa, RLb	1 Form A relay with 10A, 277VAC, power rating: 12VDC, 16.7mA, 200mW, High Sensitivity		

#### 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	08-23-2017		
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**PASS** with Performance Criteria A

**5. ELECTRICAL FAST TRANSIENT/BURST IMMUNITY TEST (IEC61000-4-4)**

**5.1 Equipment Used**

Asset #	Device	Manufacturer	Model	Calibration Date	Calibration Due Date
Element --TIQA	Transformer	TESEQ	INA6502-CIB	5/16/2018	3/16/2019
Element --TIQ	Transient Generator	TESEQ	NSG3040	5/16/2018	3/16/2019
Element --ICJ	Clamp-EFT	Amplifier Research	EFT Clamp	5/16/2018	3/16/2019
TDK – IT0144	Multimeter	Fluke Corp	87 III	No Cal Required	No Cal Required

**5.2 Device Under Test (DUT)**

Model Series: PFH500F-28  
 Quantity: 1 unit

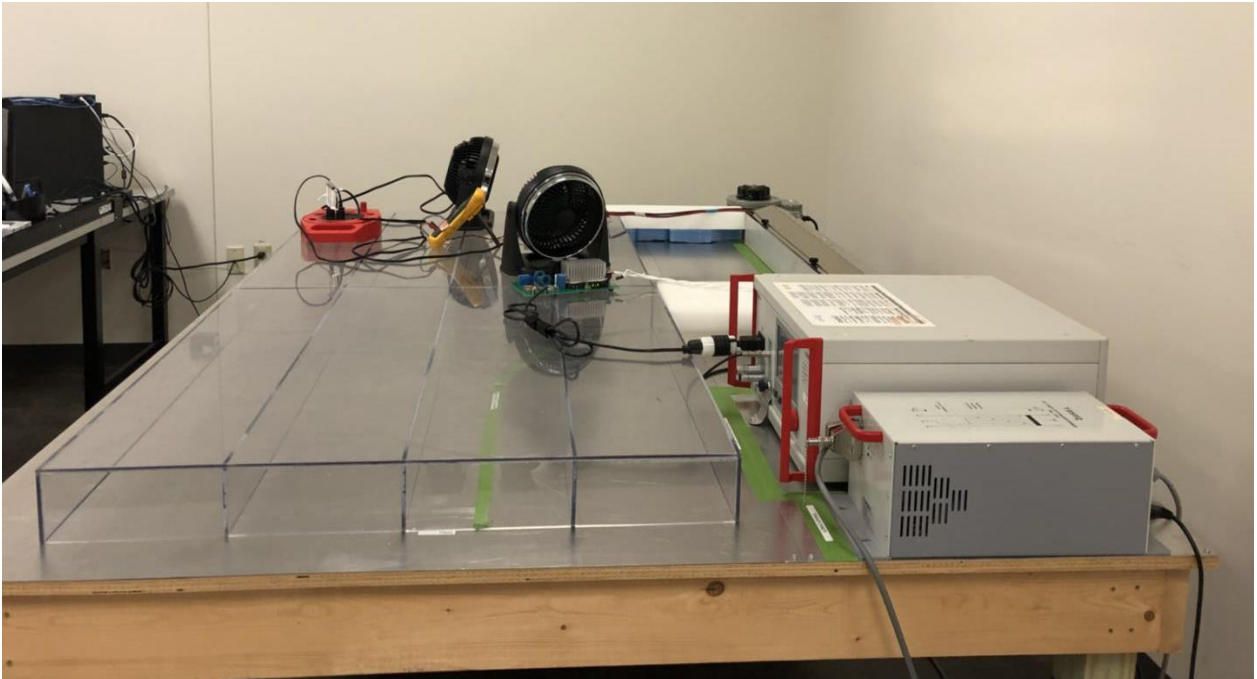
**5.3 Test Conditions**

Input Voltage:	230Vac @ 50Hz
Output Current:	80% Resistive Load
Power Port:	AC Mains
Highest Power Port Test Level:	2.0KV
Highest Signal Port Test Level:	2.0KV
Test Duration:	61 Seconds
Burst:	5 kHz

#### 5.4 Test Method and Device Test Points

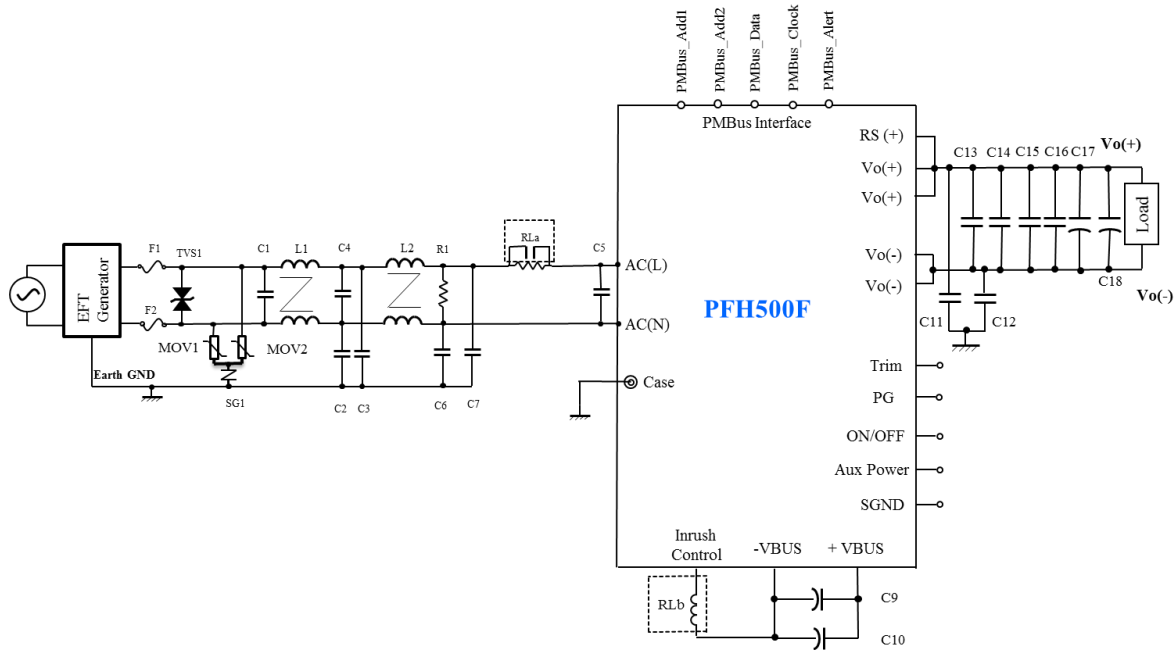
According to IEC61000-4-4.

- A) Input Port: Apply 2kV, 5kHz transient to N, L and FG all at the same time
- B) Output Port: Apply 2kV, 5kHz transient to +Vo and -Vo all at the same time

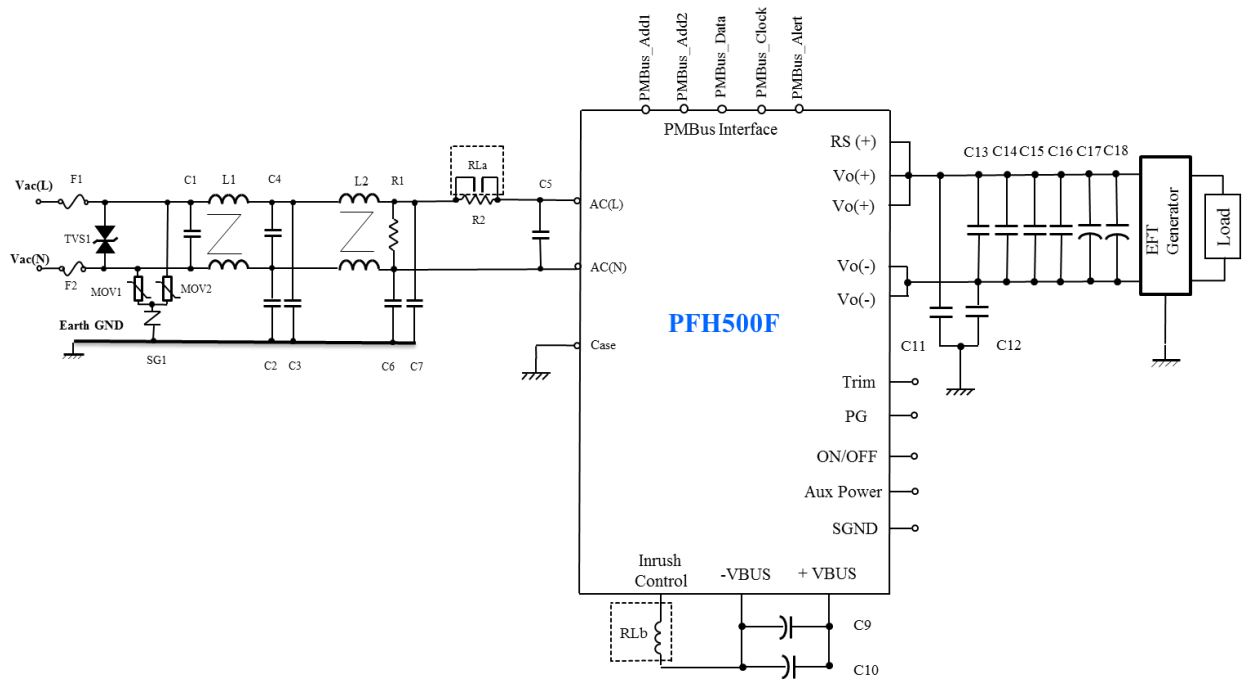


### 5.5 Test Circuit

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



B) Output Port: Apply 2kV, 5kHz transient to +Vo and -Vo all at the same time



Circuit Code	Description	Circuit Code	Description
C1, C4	1 $\mu$ F Film Capacitor	C2, C3	3300pF Ceramic Capacitor
C5	2.2 $\mu$ F Film Capacitor	C6, C7	1000pF Ceramic Capacitor
L1, L2	6.3mH	R2	22 Ohms
R1	470kOhms	C13, C14, C15, C16	10 $\mu$ F Ceramic Capacitor
C17, C18	220 $\mu$ F Electrolytic Capacitor	C9, C10	470 $\mu$ F Electrolytic Capacitor
C11, C12	470pF Ceramic Capacitor	F1, F2	10A, 250V, Fast Blow
MOV1, MOV2	B72220P3251K101	SG1	CG32.5L
RLa, RLb	1 Form A relay with 10A, 277VAC, power rating: 12VDC, 16.7mA, 200mW, High Sensitivity	TVS1	PTVS1-380C-TH

Table of Component Values apply to both Test Circuits.

## 5.6 Acceptance Criteria

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

**5.7 Test Results**

Date of Test	09-14-2018		
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**PASS** with Performance Criteria A

<b>Input Port</b>				
<b>Test Level</b>	<b>L1</b>	<b>L2</b>	<b>PE</b>	<b>Comments</b>
± 2.0kV	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	No Susceptibility Noted
± 2.0kV	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	No Susceptibility Noted
± 2.0kV	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No Susceptibility Noted
± 2.0kV	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	No Susceptibility Noted
± 2.0kV	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	No Susceptibility Noted

<b>Output Port</b>		
<b>Test Level</b>	<b>Cable Description (Clamp Injection)</b>	<b>Comments</b>
± 1.0kV	Vdc Output Cables	No Susceptibility Noted
± 2.0kV	Vdc Output Cables	No Susceptibility Noted
Compliant	<input checked="" type="checkbox"/>	No Susceptibility Noted
Non-Compliant	<input type="checkbox"/>	

**6. SURGE IMMUNITY TEST (IEC61000-4-5)**

**6.1 Equipment Used**

Asset #	Device	Manufacturer	Model	Calibration Date	Calibration Due Date
Element – TIQ	Transient Test System	TESEQ	NSG3040	5/16/2018	3/16/2019
Element -- TIQA	Transformer	TESEQ	INA6502	5/16/2018	3/16/2019
TDK – IT0144	Multimeter	Fluke Corp	87 III	No Cal Required	No Cal Required

**6.2 Device Under Test (DUT)**

Model Series: PFH500F-28, PFH500F-12 and PFH500F-48  
 Quantity: 1 Unit each

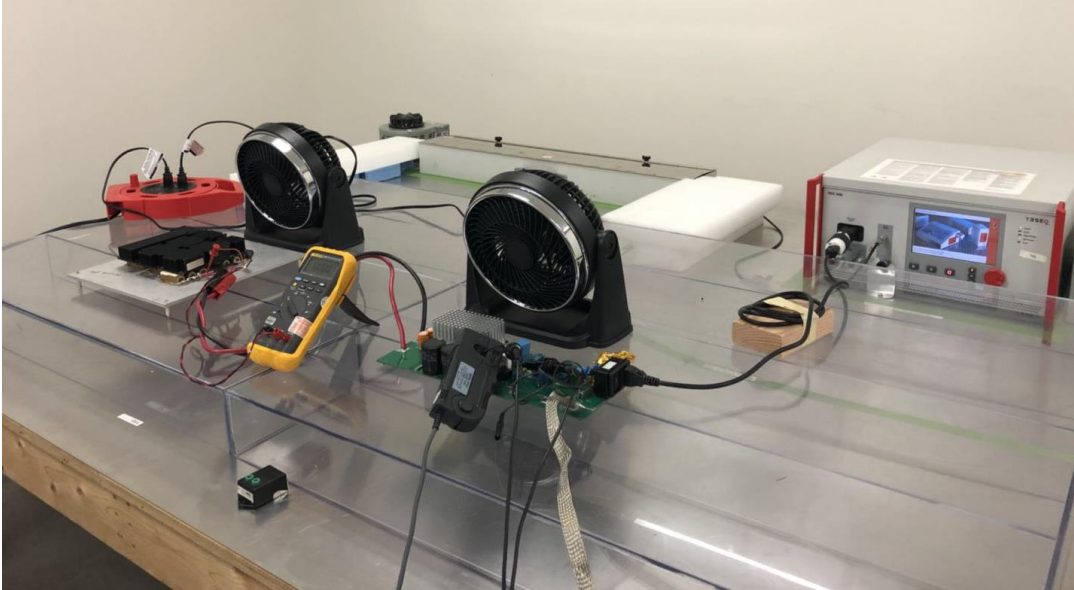
**6.3 Test Conditions**

	Test Condition A
Input Voltage	110Vac / 60Hz, 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	61 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
EUT Mode	80% Resistive Load



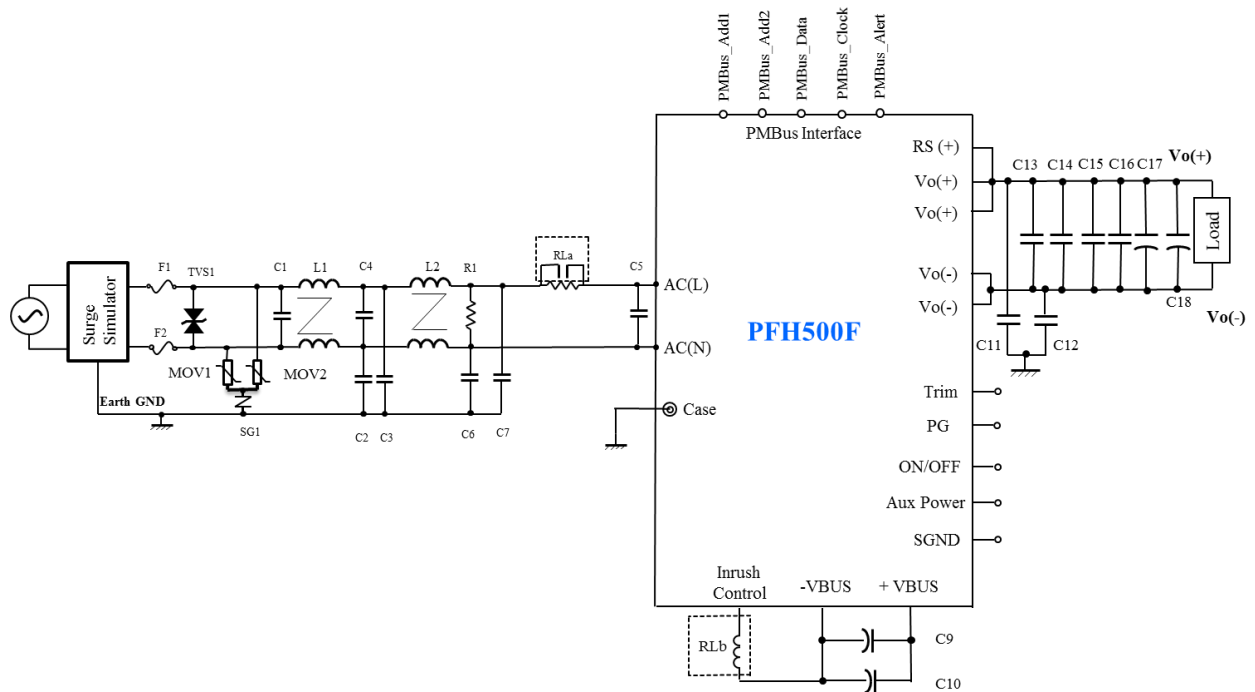
## 6.4 Test Method

According to IEC61000-4-5



## 6.5 Test Circuit

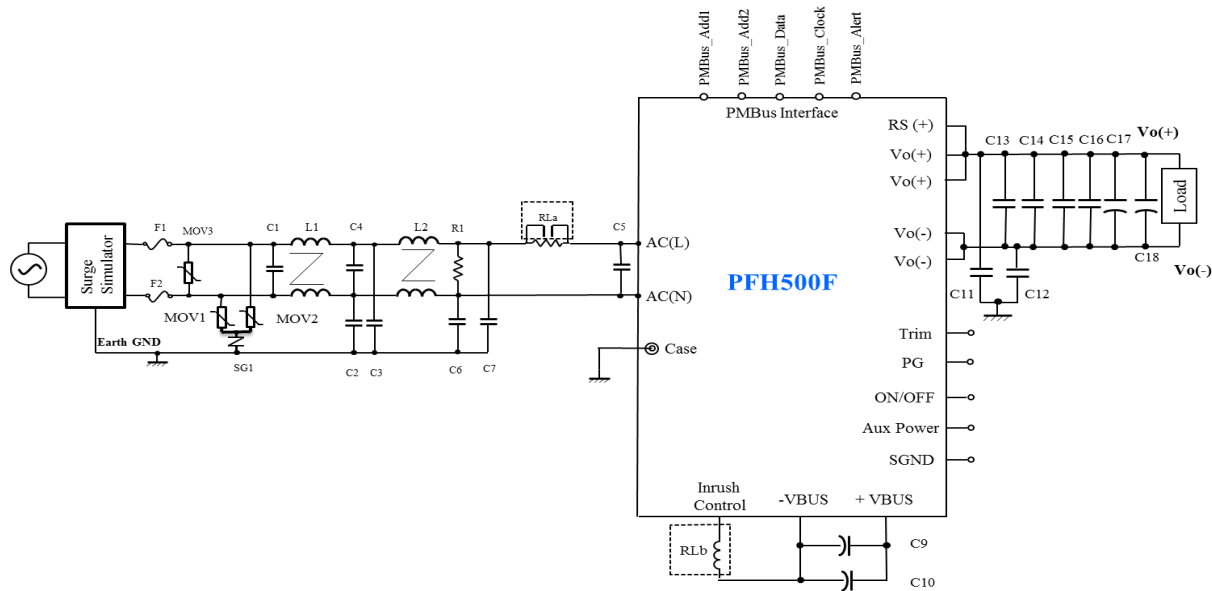
**Circuit A:**



For Circuit A

Circuit Code	Description	Circuit Code	Description
C1, C4	1 $\mu$ F Film Capacitor	C2, C3	3300pF Ceramic Capacitor
C5	2.2 $\mu$ F Film Capacitor	C6, C7	1000pF Ceramic Capacitor
R1	470kOhms	R2	22 Ohms
C17, C18	220 $\mu$ F Electrolytic Capacitor	C13, C14, C15, C16	10 $\mu$ F Ceramic Capacitor
C11, C12	470pF Ceramic Capacitor	C9, C10	470 $\mu$ F Electrolytic Capacitor
MOV1, MOV2	B72220P3251K101	SG1	CG32.5L
TVS1	PTVS1-380C-TH	F1, F2	10A, 250V, Fast Blow
RLa, RLb	1 Form A relay with 10A, 277VAC, power rating: 12VDC, 16.7mA, 200mW, High Sensitivity	L1, L2	6.3mH

**Circuit B:**



For Circuit B

Circuit Code	Description	Circuit Code	Description
C1, C4	1 $\mu$ F Film Capacitor	C2, C3	3300pF Ceramic Capacitor
C5	2.2 $\mu$ F Film Capacitor	C6, C7	1000pF Ceramic Capacitor
R1	470kOhms	R2	22 Ohms
C17, C18	220 $\mu$ F Electrolytic Capacitor	C13, C14, C15, C16	10 $\mu$ F Ceramic Capacitor
C11, C12	470pF Ceramic Capacitor	C9, C10	470 $\mu$ F Electrolytic Capacitor
SG1	CG32.5L	MOV1, MOV2	B72220P3251K101
MOV3	TND20SE471	F1, F2	10A, 250V, Fast Blow
RLa, RLb	1 Form A relay with 10A, 277VAC, power rating: 12VDC, 16.7mA, 200mW, High Sensitivity	L1, L2	6.3mH

**6.6 Acceptance Criteria**

6.6.1 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.

**6.7 Test Results**

Date of Test	07-27-2018		
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**PASS** with Performance Criteria B

**Circuit A:**

**Test Strikes Accomplished**

	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"/>
					<b>Additional Comments</b>			
Compliant			<input checked="" type="checkbox"/>		No Susceptibility Noted			
Non-Compliant			<input type="checkbox"/>					

**Circuit B:**

**Test Strikes Accomplished**

	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"/>
					<b>Additional Comments</b>			
Compliant			<input checked="" type="checkbox"/>		No Susceptibility Noted			
Non-Compliant			<input type="checkbox"/>					

**7. CONDUCTED DISTURBANCES INDUCED BY RADIO-FREQUENCY FIELD IMMUNITY TEST (IEC61000-4-6)**

**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
NTS – E1428P	Signal Generator	Rohde & Schwarz	5MY-01	3/27/17	03/27/18
NTS – E1131P	Amplifier	Instruments For Industry	PS5000/28/40	No Cal Required	No Cal Required
NTS – E1131P	AC Injection Signal		SMX100	No Cal Required	No Cal Required
NTS – E1223P	LISN	Solar Electronics Co.		9/14/16	9/14/17
NTS – E1348P	Dual Directional Coupler	Werlatone	C6145-10	No Cal Required	No Cal Required
NTS – E1547P	Spectrum Analyzer	Agilent	8595E	6/14/17	6/14/19

**7.2 Device Under Test (DUT)**

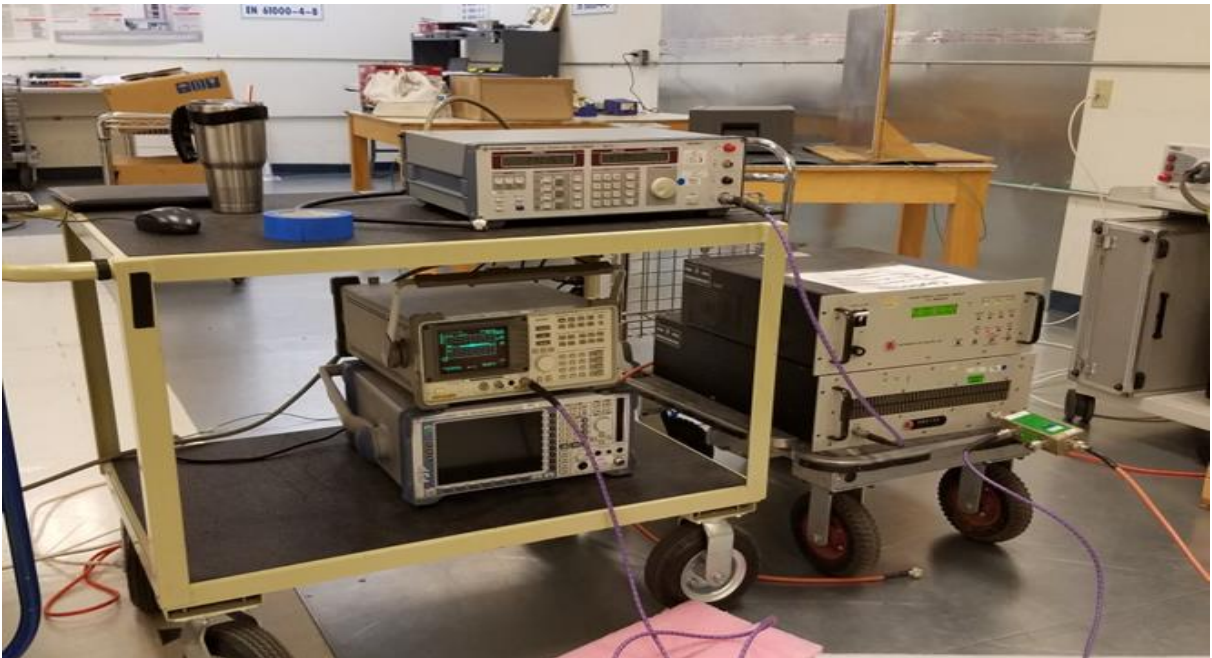
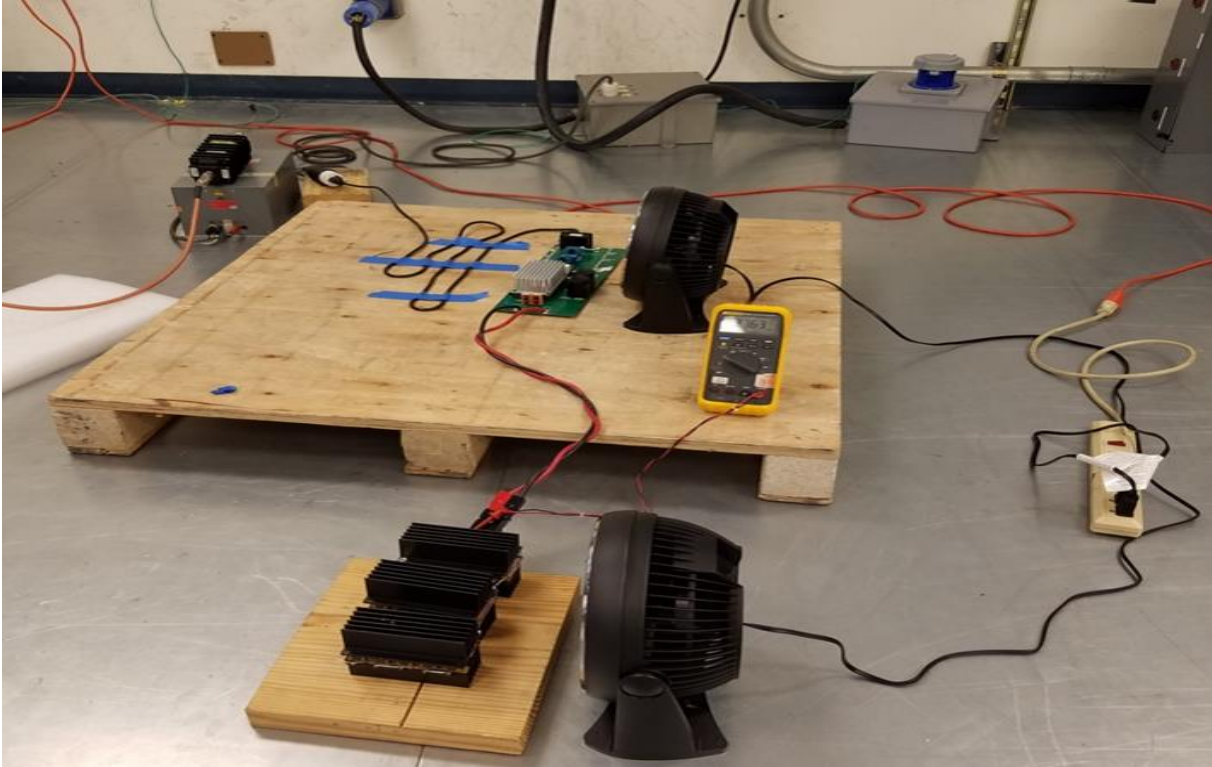
Model Series: PFH500F-28  
Quantity: 1 Unit

**7.3 Test Conditions**

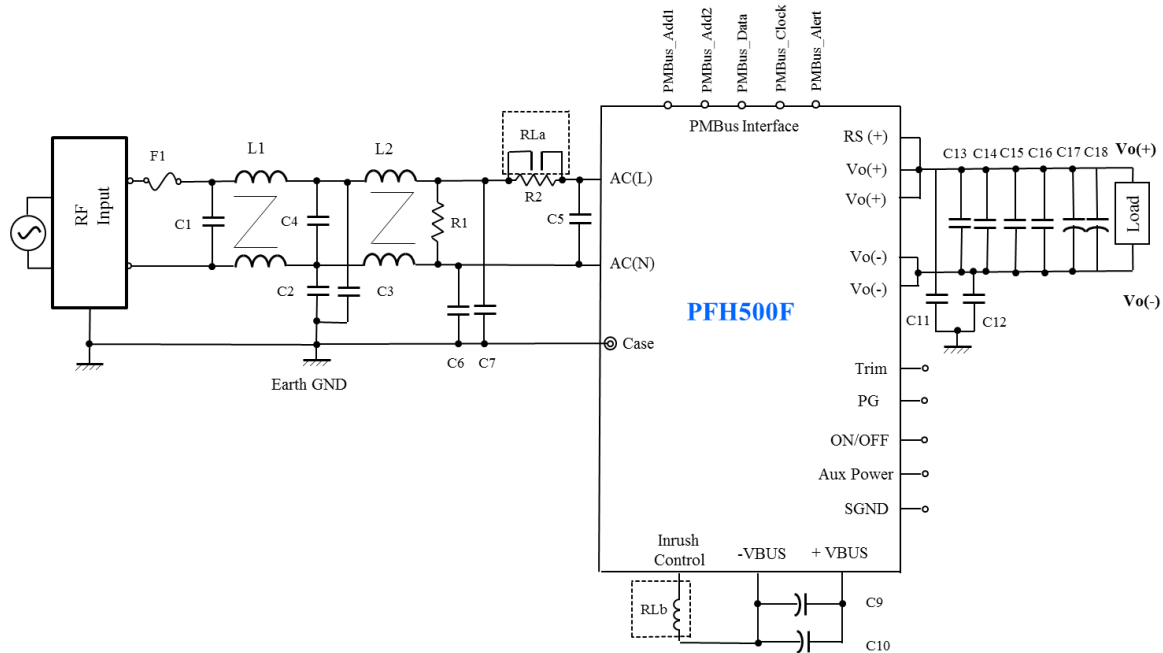
Input Voltage:	230Vac @ 50Hz
Output Current:	90% Resistive Loads
Test Level:	10 V/m
Modulation:	80% Depth, 1KHz AM Modulation
Frequency Range:	0.15 to 80 MHz
Step:	1%
Dwell Time:	3 Seconds
Performance Criteria:	A
Injection Point:	AC Mains
Injection Method:	CDN

#### 7.4 Test Method

According to IEC61000-4-6



## 7.5 Test Circuit



Circuit Code	Description	Circuit Code	Description
C1, C4	1 $\mu$ F Film Capacitor	C5	2.2 $\mu$ F Film Capacitor
C2, C3	3300pF Ceramic Capacitor	C6, C7	1000pF Ceramic Capacitor
R1	470Kohms	R2	22 Ohms
C17, C18	220 $\mu$ F Electrolytic Capacitor	C13, C14, C15, C16	10 $\mu$ F Ceramic Capacitor
C11, C12	470pF Ceramic Capacitor	C9, C10	470 $\mu$ F Electrolytic Capacitor
L1, L2	6.3mH	F1	10A, 250V, Fast Blow
RLa, RLb	1 Form A relay with 10A, 277VAC, power rating: 12VDC, 16.7mA, 200mW, High Sensitivity		

## 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	6-30-2017		
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**PASS** with Performance Criteria A.

Injection Point	AC Mains		
Injection Method	<input type="checkbox"/> Clamp	<input checked="" type="checkbox"/> CDN	
<b>Additional Comments</b>			
Compliant	<input checked="" type="checkbox"/>	No Susceptibility Noted	
Non-Compliant	<input type="checkbox"/>		



**8. POWER FREQUENCY MAGNETIC FIELD IMMUNITY TEST (IEC61000-4-8)**

**8.1 Equipment Used**

Asset #	Device	Manufacturer	Model	Calibration Date	Calibration Due Date
Element -- TJC	Signal Conditioning Unit	TESEQ	CCN1000-1	4/3/2018	4/3/2019
Element -- TJD	AC Power Source	TESEQ	NSG1007	4/3/2018	4/3/2019
Element	Magnetic Coil	Northwest EMC	Helmholtz coil	9/26/2017	9/26/2020
TDK – IT0144	Multimeter	Fluke Corp	87 III	No Cal Required	No Cal Required

**8.2 Device Under Test (DUT)**

Model Series: PFH500F-28  
 Quantity: 1 unit

**8.3 Test Conditions**

Input Voltage: 230V @ 50Hz  
 Output Current: 90% Resistive Loads  
 Threat Level: 30A /m  
 Frequency: 50Hz and 60Hz  
 Test Axis: X, Y, Z  
 Duration Per Axis: 5 Minutes  
 Performance Criteria: A

**8.4 Test Method**

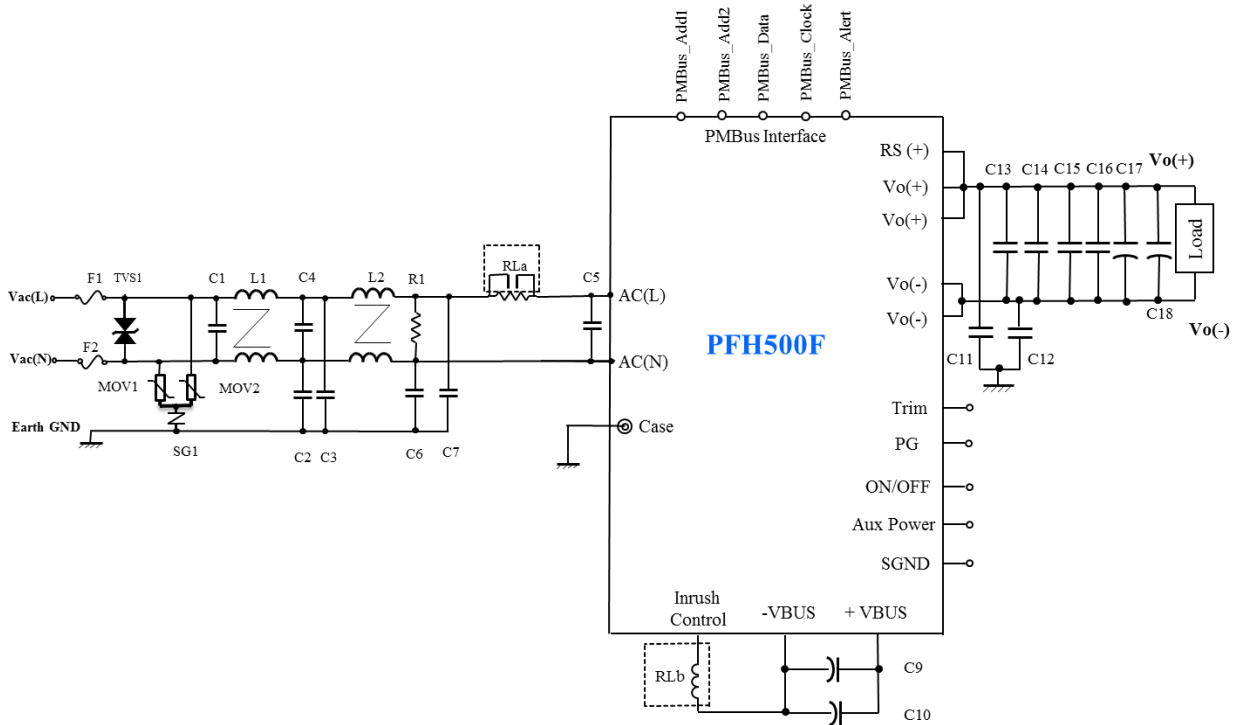
According to IEC61000-4-8







## 8.5 Test Circuit



Circuit Code	Description	Circuit Code	Description
C1, C4	1 $\mu$ F Film Capacitor	C2, C3	3300pF Ceramic Capacitor
C5	2.2 $\mu$ F Film Capacitor	C6, C7	1000pF Ceramic Capacitor
L1, L2	6.3mH	R2	22 Ohms
R1	470kOhms	C13, C14, C15, C16	10 $\mu$ F Ceramic Capacitor
C17, C18	220 $\mu$ F Electrolytic Capacitor	C9, C10	470 $\mu$ F Electrolytic Capacitor
C11, C12	470pF Ceramic Capacitor	F1, F2	10A, 250V, Fast Blow
MOV1, MOV2	B72220P3251K101	SG1	CG32.5L
RLa, RLb	1 Form A relay with 10A, 277VAC, power rating: 12VDC, 16.7mA, 200mW, High Sensitivity	TVS1	PTVS1-380C-TH

## 8.6 Acceptance Criteria

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

**8.7 Test Results**

Date of Test	9-14-2018		
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**PASS** 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
			<b>Additional Comments</b>
Compliant	<input checked="" type="checkbox"/>		No Susceptibility Noted
Non-Compliant	<input type="checkbox"/>		

**9. VOLTAGE DIPS, SHORT INTERRUPTIONS IMMUNITY TEST (IEC61000-4-11)**

**9.1 Equipment Used**

Asset #	Device	Manufacturer	Model	Calibration Date	Calibration Due Date
Element --TIQA	Transformer	TESEQ	INA6502-CIB	5/16/2018	3/16/2019
Element --TIQ	Transient Generator	TESEQ	NSG3040	5/16/2018	3/16/2019
TDK – IT0144	Multimeter	Fluke Corp	87 III	No Cal Required	No Cal Required

**9.2 Device Under Test (DUT)**

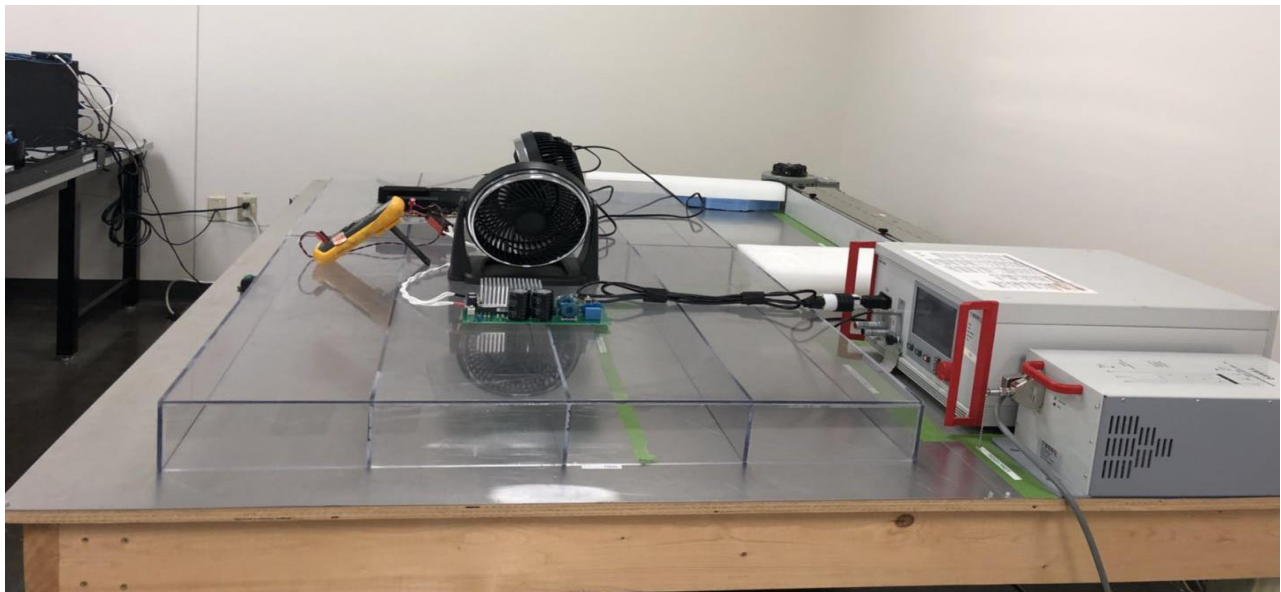
Model Series: PFH500F-28, PFH500F-12 and PFH500F-48  
 Quantity: 1 Unit each

**9.3 Test Conditions**

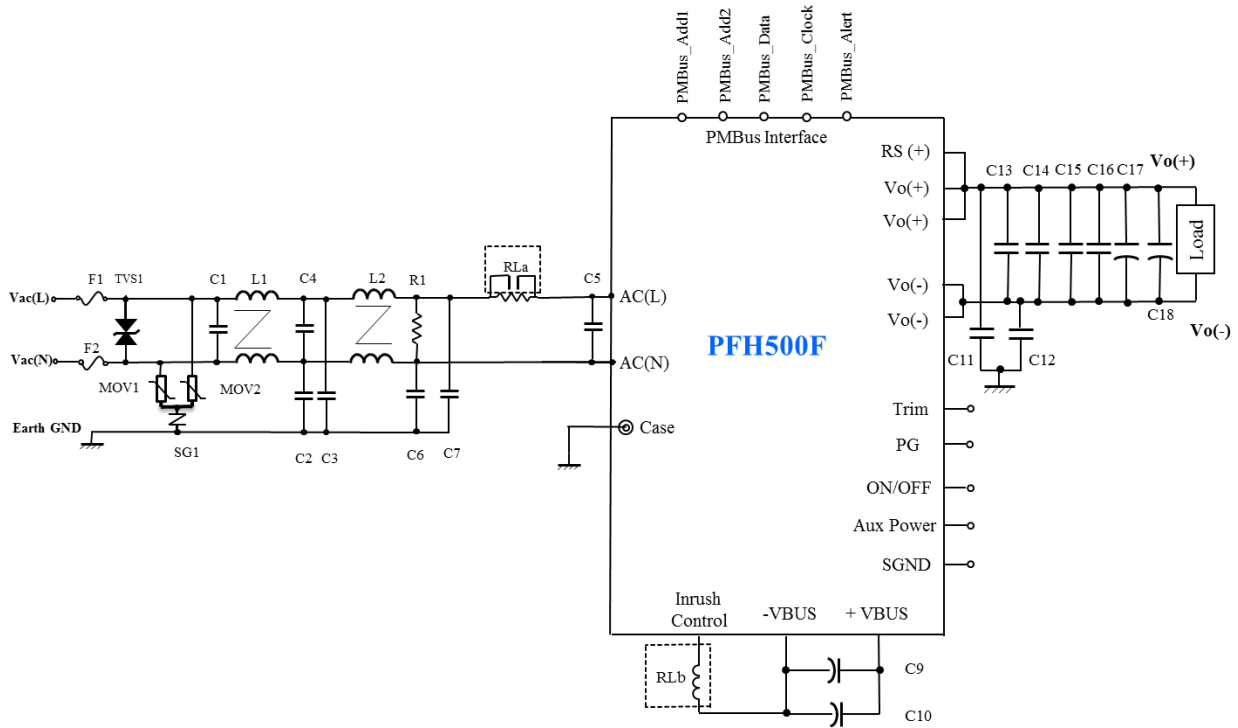
Input Voltage: 100Vac / 50Hz, 240Vac/50Hz  
 Output Current: 90% Resistive Load  
 Performance Criteria: Per Test Plan  
 Changes at Phase Angle: 0°, 45°, 90°, 135°, 180°, 215°, 270°, 315°.  
 Repetitions: 3 shots each condition.

**9.4 Test Method**

According to IEC61000-4-11



**9.5 Test Circuit**



Circuit Code	Description	Circuit Code	Description
C1, C4	1µF Film Capacitor	C2, C3	3300pF Ceramic Capacitor
C5	2.2µF Film Capacitor	C6, C7	1000pF Ceramic Capacitor
L1, L2	6.3mH	R2	22 Ohms
R1	470kOhms	C13, C14, C15, C16	10µF Ceramic Capacitor
C17, C18	220µF Electrolytic Capacitor	C9, C10	470µF Electrolytic Capacitor
C11, C12	470pF Ceramic Capacitor	F1, F2	10A, 250V, Fast Blow
MOV1, MOV2	B72220P3251K101	SG1	CG32.5L
RLa, RLb	1 Form A relay with 10A, 277VAC, power rating: 12VDC, 16.7mA, 200mW, High Sensitivity	TVS1	PTVS1-380C-TH

**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	9-14-2018		
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**PASS** with minimum Performance Criteria B.

Ref	Dip Level	Duration	240V	Result
A	0%	½ cycle	0 Vac	Criteria B
B	0%	1 cycle	0 Vac	Criteria B
C	40%	10 cycles	96 Vac	Criteria B
D	70%	25 cycles	168 Vac	Criteria B
E	80%	250 cycles	192 Vac	Criteria B
F	0%	250 cycles	0 Vac	Criteria B

Ref	Dip Level	Duration	100V	Result
A	0%	½ cycle	0 Vac	Criteria B
B	0%	1 cycle	0 Vac	Criteria B
C	40%	10 cycles	40 Vac	Criteria B
D	70%	25 cycles	70 Vac	Criteria B
E	80%	250 cycles	80 Vac	Criteria B
F	0%	250 cycles	0 Vac	Criteria B

## 10. Ring Wave TEST (IEC61000-4-12)

### 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: PFH500F-28, PFH500F-12 and PFH500F-48  
Quantity: 1 Unit each

### 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	60 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
EUT Mode	95% Resistive Load

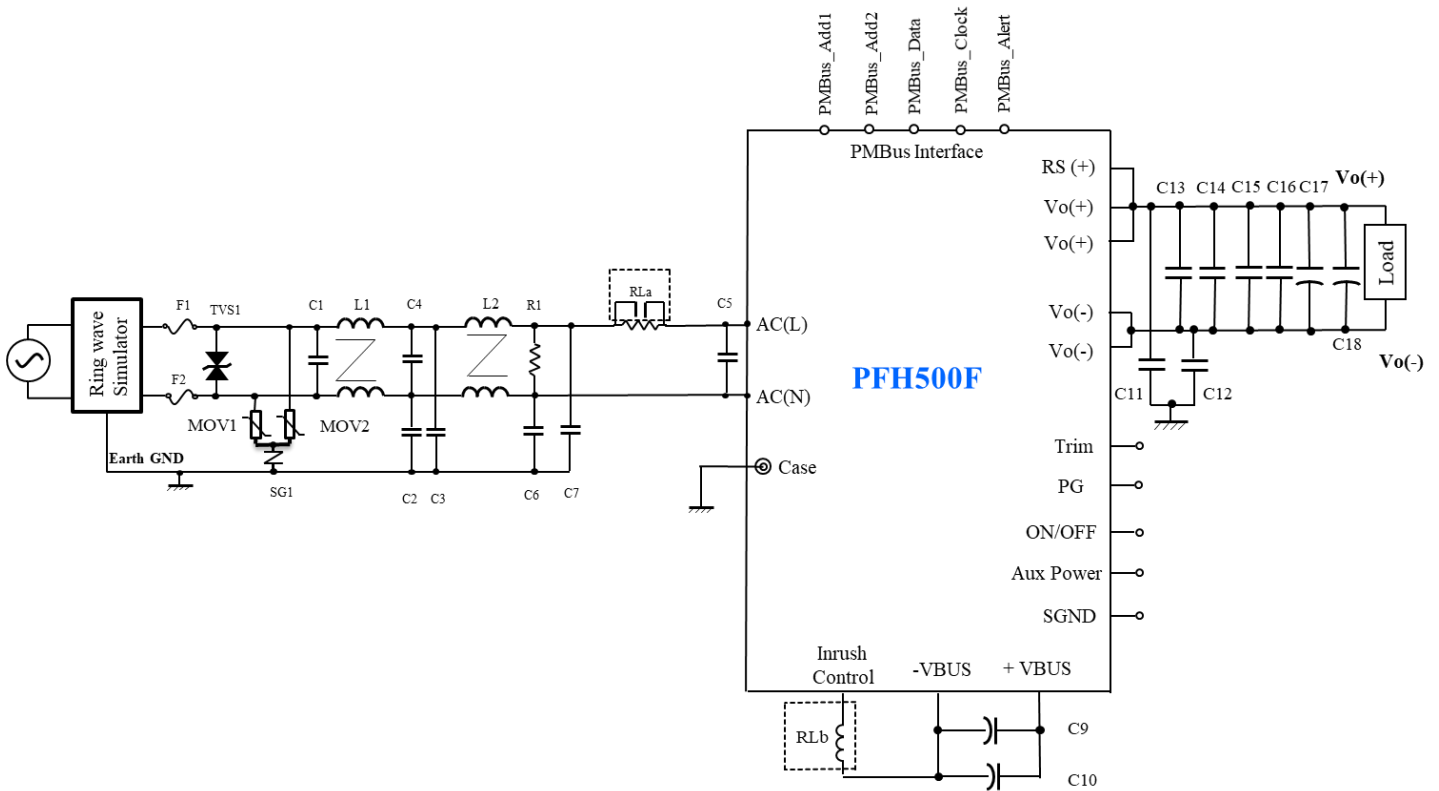


## 10.4 Test Method





### 10.5 Test Circuit



Circuit Code	Description	Circuit Code	Description
C1, C4	1 $\mu$ F Film Capacitor	C2, C3	3300pF Ceramic Capacitor
C5	2.2 $\mu$ F Film Capacitor	C6, C7	1000pF Ceramic Capacitor
R1	470kOhms	R2	22 Ohms
C17, C18	220 $\mu$ F Electrolytic Capacitor	C13, C14, C15, C16	10 $\mu$ F Ceramic Capacitor
C11, C12	470pF Ceramic Capacitor	C9, C10	470 $\mu$ F Electrolytic Capacitor
MOV1, MOV2	B72220P3251K101	SG1	CG32.5L
TVS1	PTVS1-380C-TH	F1, F2	10A, 250V, Fast Blow
RLa, RLb	1 Form A relay with 10A, 277VAC, power rating: 12VDC, 16.7mA, 200mW, High Sensitivity	L1, L2	6.3mH

**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	07-23-2019		
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**PASS** with Performance Criteria B

**Test Strikes Accomplished**

	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"/>
					<b>Additional Comments</b>			
Compliant			<input checked="" type="checkbox"/>		No Susceptibility Noted			
Non-Compliant			<input type="checkbox"/>					

## 11. VOLTAGE FLUCTUATION IMMUNITY TEST (IEC61000-4-14)

### 11.1 Equipment Used

Asset #	Device	Manufacturer	Model	Calibration Date	Calibration Due Date
Element -- TJC	Signal Conditioning Unit	TESEQ	CCN1000-1	4/3/2018	4/3/2019
Element -- TJD	AC Power Source	TESEQ	NSG1007	4/3/2018	4/3/2019
TDK – IT0144	Multimeter	Fluke Corp	87 III	No Cal Required	No Cal Required

### 11.2 Device Under Test (DUT)

Model Series: PFH500F-28

Quantity: 1 Unit

### 11.3 Test Conditions

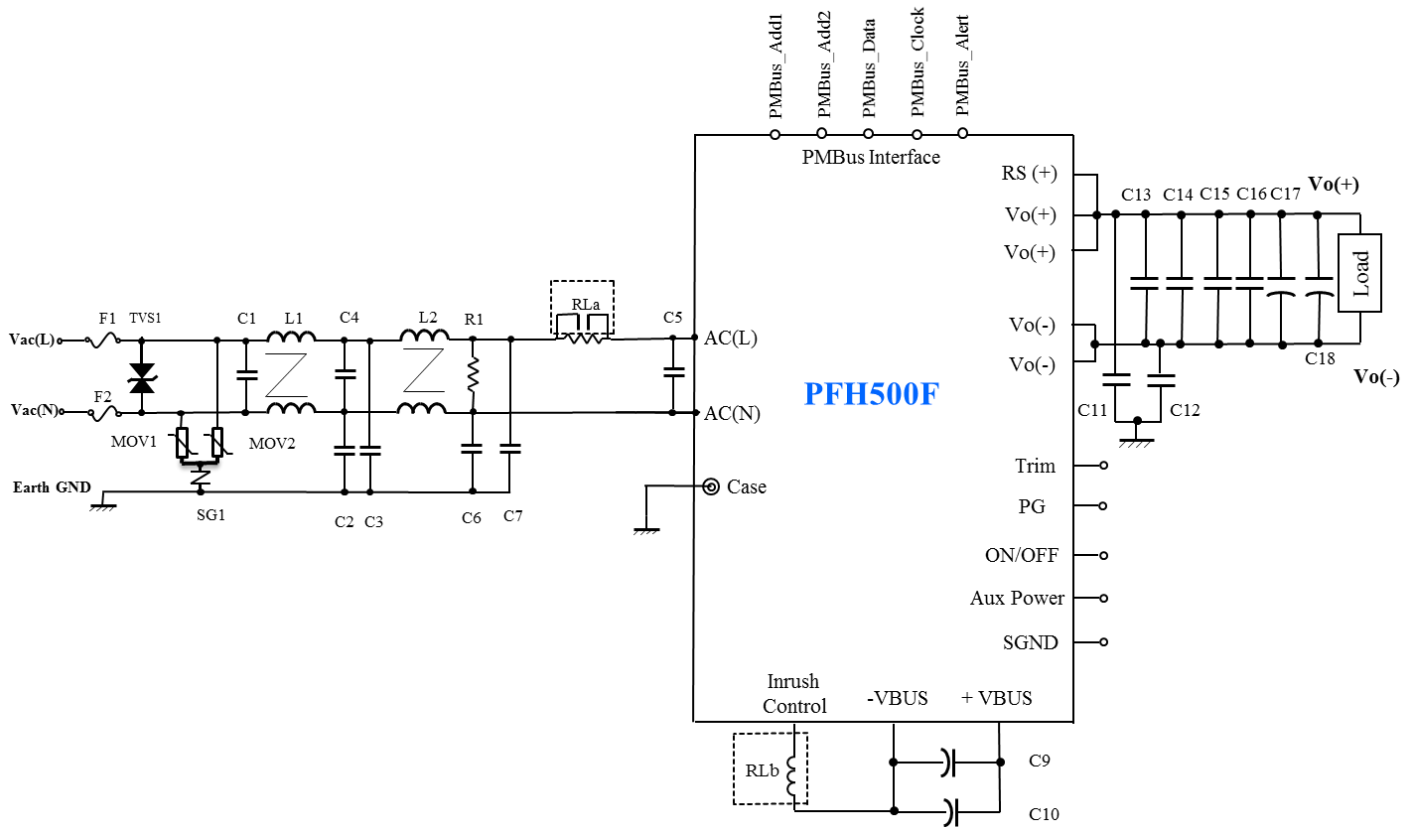
Nominal Input Voltage:	230Vac / 50Hz
EUT Mode:	90% Resistive Load
Performance Criteria:	A
Falling Voltage Changes:	Begin at 270 deg, Finish at 360 deg
Rising Voltage Changes:	Begin at 180 deg, Finish at 270 deg
Test Level:	Class 3 –12%
	230V rising and falling 12%
	207V rising 12%
	253V falling 12%
Repetitions:	6 times each test condition
Duration of the Voltage Fluctuations:	5s

#### 11.4 Test Method

Per IEC61000-4-14



### 11.5 Test Circuit



Circuit Code	Description	Circuit Code	Description
C1, C4	1 $\mu$ F Film Capacitor	C2, C3	3300pF Ceramic Capacitor
C5	2.2 $\mu$ F Film Capacitor	C6, C7	1000pF Ceramic Capacitor
L1, L2	6.3mH	R2	22 Ohms
R1	470kOhms	C13, C14, C15, C16	10 $\mu$ F Ceramic Capacitor
C17, C18	220 $\mu$ F Electrolytic Capacitor	C9, C10	470 $\mu$ F Electrolytic Capacitor
C11, C12	470pF Ceramic Capacitor	F1, F2	10A, 250V, Fast Blow
MOV1, MOV2	B72220P3251K101	SG1	CG32.5L
RLa, RLb	1 Form A relay with 10A, 277VAC, power rating: 12VDC, 16.7mA, 200mW, High Sensitivity	TVS1	PTVS1-380C-TH

**11.6 Acceptance Criteria**

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

**11.7 Test Results**

Date of Test	9-14-2018		
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**PASS** 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
Compliant	<input checked="" type="checkbox"/> No Susceptibility Noted
Non-Compliant	<input type="checkbox"/>



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