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SENSITIVE

**MIL-HDBK-704-4**  
**9 April 2004**

**DEPARTMENT OF DEFENSE  
HANDBOOK**

**GUIDANCE FOR  
TEST PROCEDURES FOR DEMONSTRATION OF  
UTILIZATION EQUIPMENT COMPLIANCE TO  
AIRCRAFT ELECTRICAL POWER CHARACTERISTICS  
SINGLE PHASE, VARIABLE FREQUENCY, 115 VOLT  
( PART 4 OF 8 PARTS )**



**This Handbook is for guidance only.  
Do not cite this document as a requirement.**

**AMSC N/A**

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## MIL-HDBK-704-4

### FOREWORD

1. This handbook is approved for use by all Departments and Agencies of the Department of Defense.

2. This handbook provides guidance on test procedures for demonstration of single phase, variable frequency, 115 volt utilization equipment to determine compliance with the applicable edition of MIL-STD-704.

3. MIL-HDBK-704-4 is Part 4 in a series of 8 Parts. Part 4 describes the test methods and procedures to demonstrate that single phase, variable frequency, 115 volt utilization equipment is compatible with the electric power characteristics of MIL-STD-704. These series of handbooks and MIL-STD-704 are companion documents.

4. Comments, suggestions, or questions on this document should be addressed to Commander, Naval Air Systems Command, 4.1.4, Highway 547, Lakehurst, NJ 08733-5100 or email to [thomas.omara@navy.mil](mailto:thomas.omara@navy.mil). Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at [www.dodssp.daps.mil](http://www.dodssp.daps.mil).

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## 1. SCOPE

1.1 Scope. This handbook provides, as guidance, test methods used to demonstrate that single phase, variable frequency, 115 volt utilization equipment is compatible with the electric power characteristics of the applicable edition(s) of MIL-STD-704. This handbook is for guidance only and cannot be cited as a requirement.

## 2. APPLICABLE DOCUMENTS

2.1 General. The documents listed below are not necessarily all of the documents referenced herein, but are those needed to understand the information provided by this handbook.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein.

## DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-704

DoD Interface Standard for Aircraft Electric  
Power Characteristics

(A copy of this document is available online at <http://assist.daps.dla.mil/quicksearch> or [www.dodssp.daps.mil/](http://www.dodssp.daps.mil/) or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

## 3. DEFINITIONS

3.1 Acronyms and definitions. The acronyms and definitions of MIL-STD-704 are applicable to this handbook.

## 4. TEST METHODS INFORMATION

4.1 Demonstration of compatibility. This section contains the test methods which will ensure that single phase, variable frequency, 115 volt utilization equipment is compatible with the electric power characteristics of the applicable edition(s) of MIL-STD-704, by testing the Unit Under Test (UUT) in accordance with the test procedures as described in test methods SVF 101 through SVF 603.

4.1.1 Recording performance. In table SVF1, record the edition(s) of MIL-STD-704 that defined the aircraft electric power characteristics used for testing and the performance of the UUT for each of the test methods.

4.2 Calibration of test equipment. Test equipment and accessories required for measurement in accordance with this handbook should be calibrated in accordance with an approved calibration program traceable to the National Institute for Standards and Technology.

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The serial numbers, model, and calibration date of all test equipment should be included with the test data.

4.3 Test methods. The test methods listed in table SVF-I are provided in section 5 of this handbook.

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TABLE SVF-I. Summary of single phase, variable frequency, 115 volt utilization equipment MIL-STD-704 compliance tests.

<b>UUT:</b>			
<b>Compliance to MIL-STD-704 Edition(s):</b>			
<b>Test Dates:</b>			
Test Method	Description	Performance (Pass/Fail)	Comments
<b>Normal, Aircraft Electrical Operation</b>			
SVF101	Load and Current Harmonic Measurements		
SVF102	Steady State Limits for Voltage and Frequency		
SVF103	No Test, See Note #1	N/A	N/A
SVF104	Voltage Modulation		
SVF105	Frequency Modulation		
SVF106	Voltage Distortion Spectrum		
SVF107	Total Voltage Distortion		
SVF108	DC Voltage Component		
SVF109	Normal Voltage Transients		
SVF110	Normal Frequency Transients		
<b>Transfer, Aircraft Electrical Operation</b>			
SVF201	Power Interrupt		
<b>Abnormal, Aircraft Electrical Operation</b>			
SVF301	Abnormal Limits for Voltage and Frequency		
SVF302	Abnormal Voltage Transients (Overvoltage/Undervoltage)		
SVF303	Abnormal Frequency Transients (Overfrequency/Underfrequency)		
<b>Emergency, Aircraft Electrical Operation</b>			
SVF401	Emergency Limits for Voltage and Frequency		
<b>Starting, Aircraft Electrical Operation</b>			
SVF501	See Note #2		
<b>Power Failure, Aircraft Electrical Operation</b>			
SVF601	Power Failure (Single Phase)		
SVF602	No Test, See Note #1	N/A	N/A
SVF603	Phase Reversal		

Note 1: There are no tests required for SVF103 and SVF602. This is done so that the single phase test numbers coincide with the three phase test numbers.

Note 2: Starting operation conditions are usually not applicable to AC utilization equipment. No test is required for SVF501 unless specified by the equipment performance specification.

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## 5. TEST METHODS



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# **METHOD SVF101**

## **Load Measurements**

POWER GROUP: Single Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL  
OPERATING CONDITION: Normal

PARAMETER: Load Measurements

### 1. Scope.

1.1 Purpose. This test procedure is used to verify that single phase, 115 Volt, variable frequency power utilization equipment utilizes only 115 Volt line-to-neutral power, does not require more power than allowed, the power factor is within limits, and does not use half-wave rectification for the applicable edition(s) of MIL-STD-704. Additionally, when the utilization equipment performance specification document imposes current waveform requirements, this test procedure is used to verify that the utilization equipment current waveform is within total current distortion and current spectrum (current distortion vs. frequency) limits defined in the utilization equipment performance specification document.

2. Validation criteria. The utilization equipment is considered to have passed if the utilization equipment requires less than or equal to the power limit for single phase equipment, is within the power factor limits, and does not use half-wave rectification for the applicable edition(s) of MIL-STD-704 and as noted in table SVF101-I. If required by the utilization equipment performance specification document, the utilization equipment current waveform must be within the total current distortion and current spectrum limits defined in the utilization equipment performance specification document. The utilization equipment must not suffer damage or cause an unsafe condition.

TABLE SVF101-I. MIL-STD-704 limits for single phase power, power factor, rectification restriction, current distortion, and current spectrum for single phase, variable frequency utilization equipment.

Limit	704A	704B	704C	704D	704E	704F
Single Phase kVA	N/A	N/A	N/A	N/A	N/A	0.5 kVA
Power Factor	N/A	N/A	N/A	N/A	N/A	No Leading Power Factor for >100 VA
Rectification Restriction	N/A	N/A	N/A	N/A	N/A	No Half-Wave Rectification
Current Distortion	N/A	N/A	N/A	N/A	N/A	See Note 1/
Current Spectrum	N/A	N/A	N/A	N/A	N/A	See Note 1/

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1/. The utilization equipment performance specification document should include requirements that reduce the likelihood of the equipment having an adverse effect on the electrical power characteristics of the aircraft. Current distortion and current spectrum limits may be imposed to minimize undesirable effects to the electrical power characteristics. These limits should take into account the utilization equipment power draw, aircraft electrical system capacity and distribution characteristics, trade-offs with weight, volume, cost, and reliability that are specific to each type of equipment and aircraft.

3. Apparatus. The test equipment should be as follows:

- a. Adjustable AC power supply (rotating AC source for current waveform limits)
- b. True RMS voltmeter
- c. Frequency counter
- d. Power meter
- e. Spectrum Analyzer
- f. Distortion meter
- g. Current transformer
- h. Oscilloscope

4. Test setup. Configure the test setup as shown in figure SVF101-1. Measurements, except current, must be made within 10 cm of the input power terminals of the UUT. Current measurements must be taken from the 115 Volt conductors. If the utilization equipment performance specification document imposes current waveform limits, the AC power source must be a rotating machine.

5. Compliance test. With the power source off, install the UUT and the stimulation and monitoring equipment into the test setup of figure SVF101-1. Turn on the power source and adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz.

Close the circuit breaker, energizing the UUT. Allow sufficient time for the UUT to warm up. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions. Record the voltage, frequency, kVA, and power factor in table SVF101-2. Compare the kVA, power factor, and rectification with the required limits/restriction of the applicable edition(s) of MIL-STD-704. Confirm that the utilization equipment does not use half-wave rectification and record in table SVF101-II. Repeat for each mode of operation of the UUT. Repeat the testing at a steady state frequency of 360 Hz, 600 Hz, and 800 Hz.

If the utilization equipment performance specification document imposes current waveform limits, adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Record the total current distortion and current spectrum in the data sheet shown in table SVF101-II and compare to the limits defined in the utilization equipment performance specification document. Repeat for each mode of operation of the UUT.

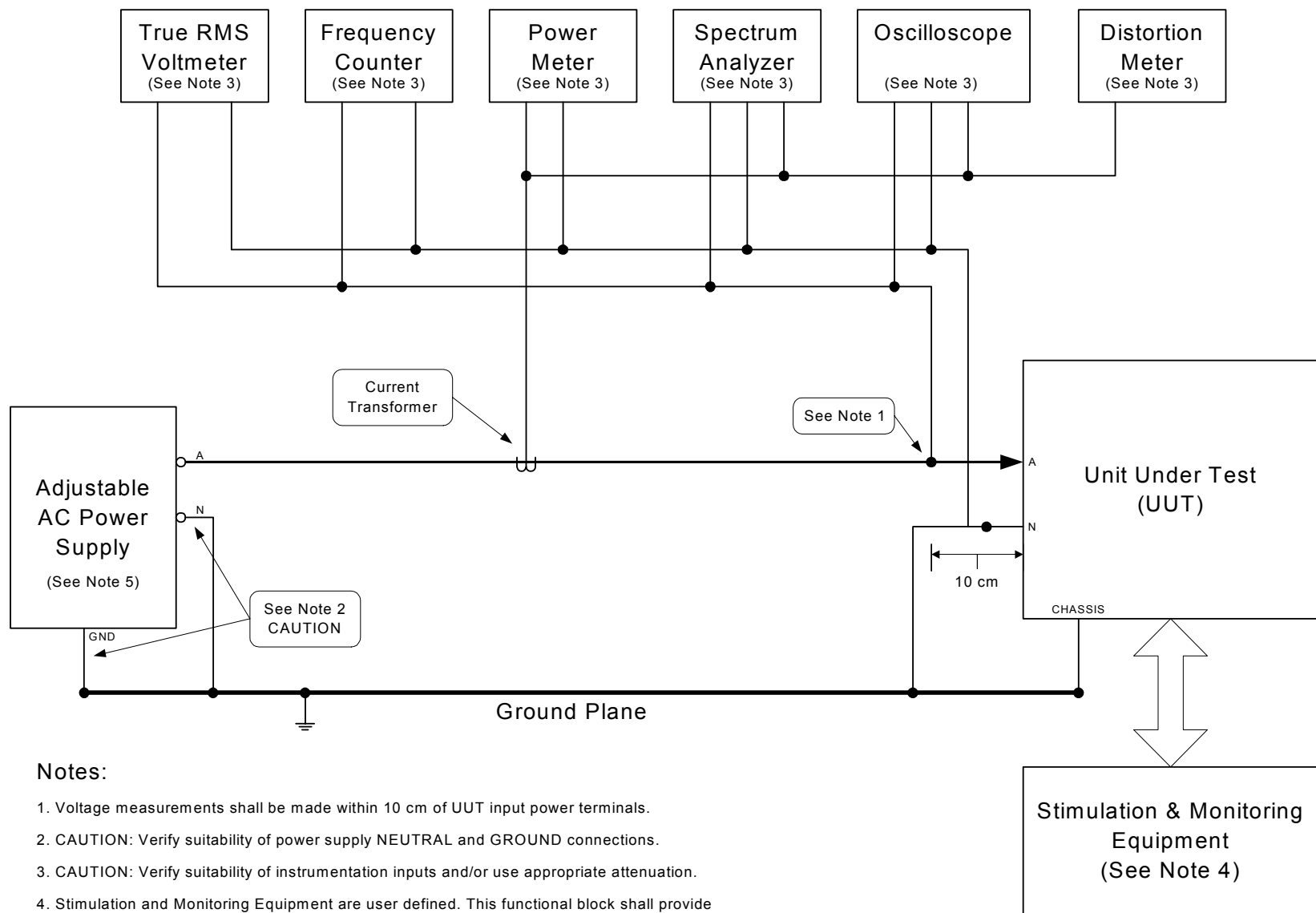
FIGURE SVF101-1. Load and current distortion measurement.

TABLE SVF101-II. Sample data sheet for SVF101 load measurement.

Test performed at <b>400 Hz</b> steady state frequency									
Load and Power Factor									
Voltage		Frequency		Volt-Amp		Power Factor		Pass/Fail	Comments
	V <sub>rms</sub>		Hz		VA		pf		
Rectification Type									
								Pass/Fail	
Does not use half-wave rectification.									
Current Waveform Measurements									
Total Current Distortion			Current Spectrum				Pass/Fail	Comments	
	% Distortion		Attach Spectrum Plot		Amplitude Vs. Frequency				
Test performed at <b>360 Hz</b> steady state frequency									
Load and Power Factor									
Voltage		Frequency		Volt-Amp		Power Factor		Pass/Fail	Comments
	V <sub>rms</sub>		Hz		VA		pf		
Test performed at <b>600 Hz</b> steady state frequency									
Load and Power Factor									
Voltage		Frequency		Volt-Amp		Power Factor		Pass/Fail	Comments
	V <sub>rms</sub>		Hz		VA		pf		
	% Distortion		Attach Spectrum Plot		Amplitude Vs. Frequency				

∞

TABLE SVF101-II. Sample data sheet for SVF101 load measurement. - Continued

Test performed at <b>800 Hz</b> steady state frequency									
Load and Power Factor									
Voltage		Frequency		Volt-Amp		Power Factor		Pass/Fail	Comments
	V <sub>rms</sub>		Hz		VA		pf		

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## METHOD SVF102

### Steady State Limits for Voltage and Frequency

POWER GROUP: Single Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL  
OPERATING CONDITION: Normal

PARAMETER: Steady State Limits for Voltage and Frequency

#### 1. Scope.

1.1 Purpose. This test procedure is used to verify that single phase, 115 Volt, variable frequency power utilization equipment operates and maintains specified performance when provided power with voltage and frequency at the Normal Low Steady State (NLSS) limits and the Normal High Steady State (NHSS) limits as specified in the applicable edition(s) of MIL-STD-704.

2. Validation criteria. The utilization equipment is considered to have passed if the utilization equipment operates and maintains performance as specified in the utilization equipment performance specification document for normal aircraft electrical conditions when supplied input power of voltage and frequency at the specified normal steady state limits of the applicable edition(s) of MIL-STD-704 and as noted in table SVF102-I. The utilization equipment must maintain specified performance for a length of time that confirms the utilization equipment can continuously operate at the steady state voltage and frequency limits and should be, not less than the time duration noted for the test conditions. The utilization equipment must demonstrate re-start at the steady state voltage and frequency limits. The utilization equipment must not suffer damage or cause an unsafe condition.

TABLE SVF102-I. MIL-STD-704 normal limits for steady state voltage and frequency for single phase, variable frequency utilization equipment.

Normal Limit	704A	704B	704C	704D	704E	704F
Voltage NLSS	N/A	N/A	N/A	N/A	N/A	108 V
Voltage NHSS	N/A	N/A	N/A	N/A	N/A	118 V
Frequency NLSS	N/A	N/A	N/A	N/A	N/A	360 Hz
Frequency NHSS	N/A	N/A	N/A	N/A	N/A	800 Hz

3. Apparatus. The test equipment should be as follows:

- a. Adjustable AC power supply
- b. True RMS voltmeter
- c. Frequency counter

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4. Test setup. Configure the test setup as shown in figure SVF102-1. Measurements, except current, must be made within 10 cm of the input power terminals of the UUT.

5. Compliance test. With the power source off, install the UUT and the stimulation and monitoring equipment into the test setup of figure SVF102-1. Turn on the power source and adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Energize the UUT. Allow sufficient time for the UUT to warm up. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions.

For each test condition A through NN noted in table SVF102-II, the UUT must remain for a length of time that confirms the utilization equipment can continuously operate at the steady state voltage and frequency limits and should be, not less than the time duration noted. For test conditions E through NN, after each test condition slowly adjust the frequency until the next test condition is reached. This subjects the UUT to all frequency between 360 Hz and 800 Hz at the low steady state voltage limit and the high steady state voltage limit. At each test condition A through NN conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions. For each test condition shutdown the UUT and verify that the UUT can be re-started. After re-start conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions. Record the voltage, frequency, time duration at test condition, successful/unsuccessful re-start and the performance of the UUT for each test condition in the data sheet shown in table SVF102-III. Repeat for each mode of operation of the UUT.

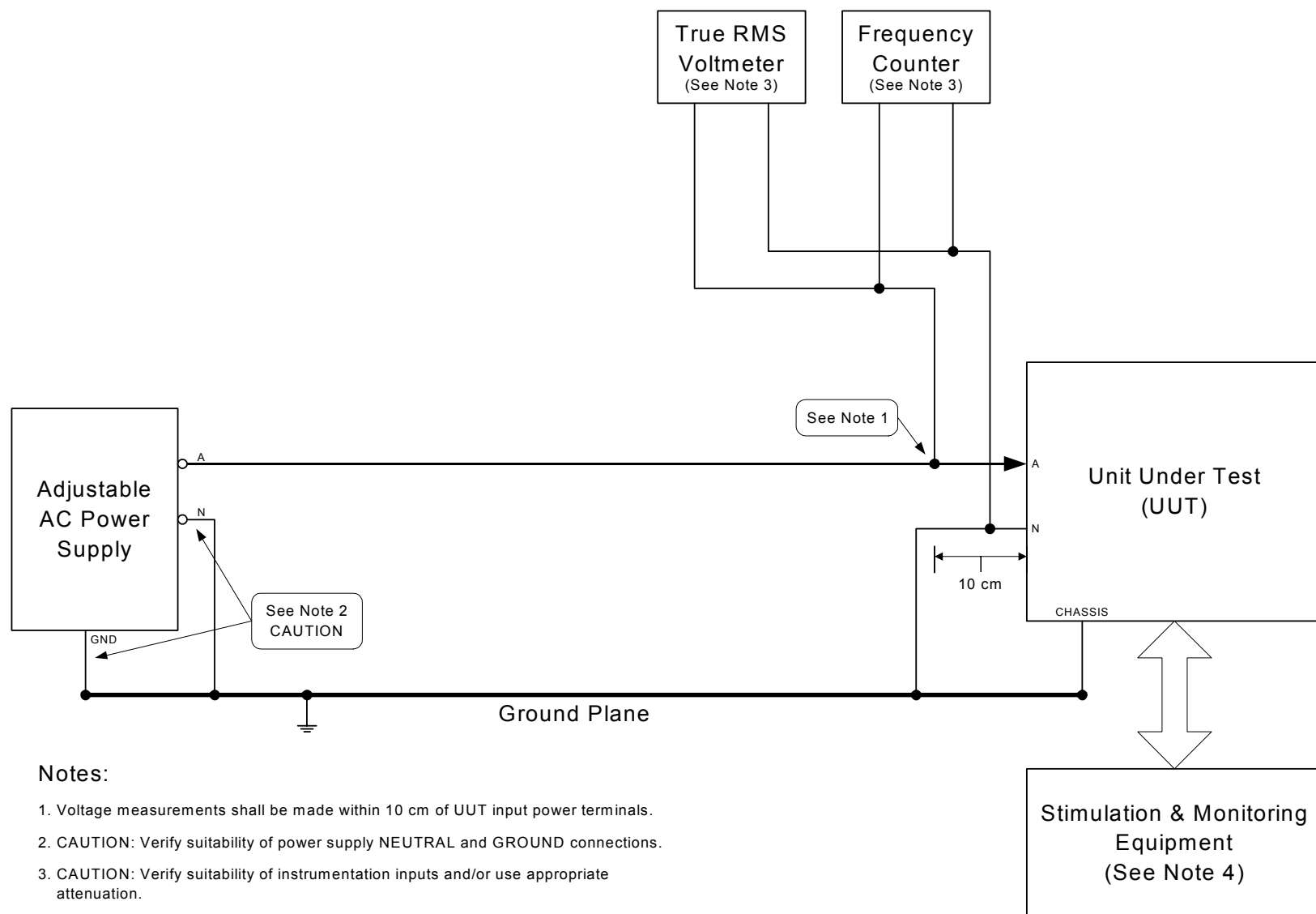
After all test conditions are complete, adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to confirm that the UUT has not suffered damage and is providing specified performance for normal aircraft electrical conditions.

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TABLE SVF102-II. Test conditions for steady state limits of voltage and frequency for single phase, variable frequency utilization equipment.

Test Condition	Voltage	Frequency	Minimum Time Duration At test Condition
Nominal Voltages			
A	115 V	360 Hz	30 min
B	115 V	400 Hz	30 min
C	115 V	600 Hz	30 min
D	115 V	800 Hz	30 min
Normal Low Steady State Voltages			
E	108 V	360 Hz	30 min
F	108 V	400 Hz	30 min
G	108 V	440 Hz	5 min
H	108 V	480 Hz	5 min
I	108 V	520 Hz	5 min
J	108 V	560 Hz	5 min
K	108 V	600 Hz	30 min
L	108 V	520 Hz	5 min
M	108 V	540 Hz	5 min
N	108 V	560 Hz	5 min
O	108 V	570 Hz	5 min
P	108 V	580 Hz	5 min
Q	108 V	600 Hz	30 min
R	108 V	640 Hz	5 min
S	108 V	680 Hz	5 min
T	108 V	720 Hz	5 min
U	108 V	760 Hz	5 min
V	108 V	800 Hz	30 min
Normal High Steady State Voltages			
W	118 V	360 Hz	30 min
X	118 V	400 Hz	30 min
Y	118 V	440 Hz	5 min
Z	118 V	480 Hz	5 min
AA	118 V	520 Hz	5 min
BB	118 V	560 Hz	5 min
CC	118 V	600 Hz	30 min
DD	118 V	520 Hz	5 min
EE	118 V	540 Hz	5 min
FF	118 V	560 Hz	5 min
GG	118 V	570 Hz	5 min
HH	118 V	580 Hz	5 min
II	118 V	600 Hz	30 min
JJ	118 V	640 Hz	5 min
KK	118 V	680 Hz	5 min
LL	118 V	720 Hz	5 min
MM	118 V	760 Hz	5 min
NN	118 V	800 Hz	30 min





**Notes:**

1. Voltage measurements shall be made within 10 cm of UUT input power terminals.
2. CAUTION: Verify suitability of power supply NEUTRAL and GROUND connections.
3. CAUTION: Verify suitability of instrumentation inputs and/or use appropriate attenuation.
4. Stimulation and Monitoring Equipment are user defined. This functional block shall provide appropriate inputs (stimulations) and monitor UUT outputs (e.g.: RPM, signals, data, etc.)

FIGURE SVF102-1. Steady state limits for voltage and frequency.

TABLE SVF102-III. Sample data sheet for SVF102 steady state limits of voltage and frequency for single phase, variable frequency utilization equipment.

Test Condition	Voltage		Frequency		Time Duration at Test Condition		Re-Start (Yes/No)	Pass/Fail
A		V <sub>rms</sub>		Hz		min		
B		V <sub>rms</sub>		Hz		min		
C		V <sub>rms</sub>		Hz		min		
D		V <sub>rms</sub>		Hz		min		
E		V <sub>rms</sub>		Hz		min		
F		V <sub>rms</sub>		Hz		min		
G		V <sub>rms</sub>		Hz		min		
H		V <sub>rms</sub>		Hz		min		
I		V <sub>rms</sub>		Hz		min		
J		V <sub>rms</sub>		Hz		min		
K		V <sub>rms</sub>		Hz		min		
L		V <sub>rms</sub>		Hz		min		
M		V <sub>rms</sub>		Hz		min		
N		V <sub>rms</sub>		Hz		min		
O		V <sub>rms</sub>		Hz		min		
P		V <sub>rms</sub>		Hz		min		
Q		V <sub>rms</sub>		Hz		min		
R		V <sub>rms</sub>		Hz		min		
S		V <sub>rms</sub>		Hz		min		
T		V <sub>rms</sub>		Hz		min		
U		V <sub>rms</sub>		Hz		min		
V		V <sub>rms</sub>		Hz		min		
W		V <sub>rms</sub>		Hz		min		

TABLE SVF102-III. Sample data sheet for SVF102 steady state limits of voltage and frequency for single phase, variable frequency utilization equipment. - Continued

Test Condition	Voltage		Frequency		Time Duration at Test Condition		Re-Start (Yes/No)	Pass/Fail
X		V <sub>rms</sub>		Hz		min		
Y		V <sub>rms</sub>		Hz		min		
Z		V <sub>rms</sub>		Hz		min		
AA		V <sub>rms</sub>		Hz		min		
BB		V <sub>rms</sub>		Hz		min		
CC		V <sub>rms</sub>		Hz		min		
DD		V <sub>rms</sub>		Hz		min		
EE		V <sub>rms</sub>		Hz		min		
FF		V <sub>rms</sub>		Hz		min		
GG		V <sub>rms</sub>		Hz		min		
HH		V <sub>rms</sub>		Hz		min		
II		V <sub>rms</sub>		Hz		min		
JJ		V <sub>rms</sub>		Hz		min		
KK		V <sub>rms</sub>		Hz		min		
LL		V <sub>rms</sub>		Hz		min		
MM		V <sub>rms</sub>		Hz		min		
NN		V <sub>rms</sub>		Hz		min		

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**METHOD SVF103**  
**(No Test Required)**

POWER GROUP: Single Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL  
OPERATING CONDITION: Normal

PARAMETER: No test required.  
Test number SVF103 is not used so that the Single Phase,  
Variable Frequency, 115 V (SVF) test numbers coincide with  
the Three Phase, Variable Frequency, 115 V (TVF) test  
sequence numbers.

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# **METHOD SVF104**

## **Voltage Modulation**

POWER GROUP: Single Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL  
OPERATING CONDITION: Normal

PARAMETER: Voltage Modulation

### 1. Scope.

1.1 Purpose. This test procedure is used to verify that single phase, 115 Volt, variable frequency power utilization equipment operates and maintains specified performance when subjected to voltage modulation as specified in the applicable edition(s) of MIL-STD-704.

2. Validation criteria. The utilization equipment is considered to have passed if the utilization equipment operates and maintains performance as specified in the utilization equipment performance specification document for normal aircraft electrical conditions when supplied input power having voltage modulation as specified in the applicable edition(s) of MIL-STD-704 and as noted in table SVF104-I. The utilization equipment must maintain specified performance for a length of time that confirms the utilization equipment can operate continuously when provided power having voltage modulation. The utilization equipment must not suffer damage or cause an unsafe condition.

TABLE SVF104-I. MIL-STD-704 limits for voltage modulation for single phase, variable frequency utilization equipment.

Limit	704A	704B	704C	704D	704E	704F
Voltage Modulation	N/A	N/A	N/A	N/A	N/A	2.5 Vrms max

3. Apparatus. The test equipment should be as follows:

- a. Programmable AC power supply
- b. True RMS voltmeter
- c. Frequency counter
- d. Oscilloscope

4. Test setup. Configure the test setup as shown in figure SVF104-1. Measurements, except current, must be made within 10 cm of the input power terminals of the UUT.

5. Compliance test. With the power source off, install the UUT and the stimulation and monitoring equipment into the test setup of figure SVF104-1. Turn on the power source and adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Energize the UUT. Allow sufficient time for the UUT to warm up. Conduct a performance test of the UUT according to the utilization

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equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions.

For each test condition A through G noted in table SVF104-II, set the voltage modulation amplitude and frequency of voltage modulation. The UUT must remain at the test condition for a length of time that confirms the utilization equipment can continuously operate, and should be at least ten (10) minutes at an average steady state voltage of 115 Vrms, at least ten (10) minutes at an average steady state voltage of 109.25 Vrms, and at least ten (10) minutes at an average steady state voltage of 116.75 Vrms. During the test condition, conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions. Record average voltage, frequency, amplitude of voltage modulation, frequency of voltage modulation, time duration at test condition, and the performance of the UUT for each test condition in the data sheet shown in table SVF104-III. Repeat for each mode of operation of the UUT. Repeat the testing at a steady state frequency of 360 Hz, 600 Hz, and 800 Hz.

After all test conditions are complete, adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to confirm that the UUT has not suffered damage and is providing specified performance for normal aircraft electrical conditions.

TABLE SVF104-II. Test conditions for voltage modulation for single phase, variable frequency utilization equipment.

Test Condition	Frequency of Voltage Modulation	MIL-STD-704F Amplitude of Voltage Modulation Vrms
A	1.0 Hz	0.375 Vrms
B	1.7 Hz	0.375 Vrms
C	10 Hz	2.5 Vrms
D	25 Hz	2.5 Vrms
E	70 Hz	0.375 Vrms
F	100 Hz	0.375 Vrms
G	200 Hz	0.375 Vrms

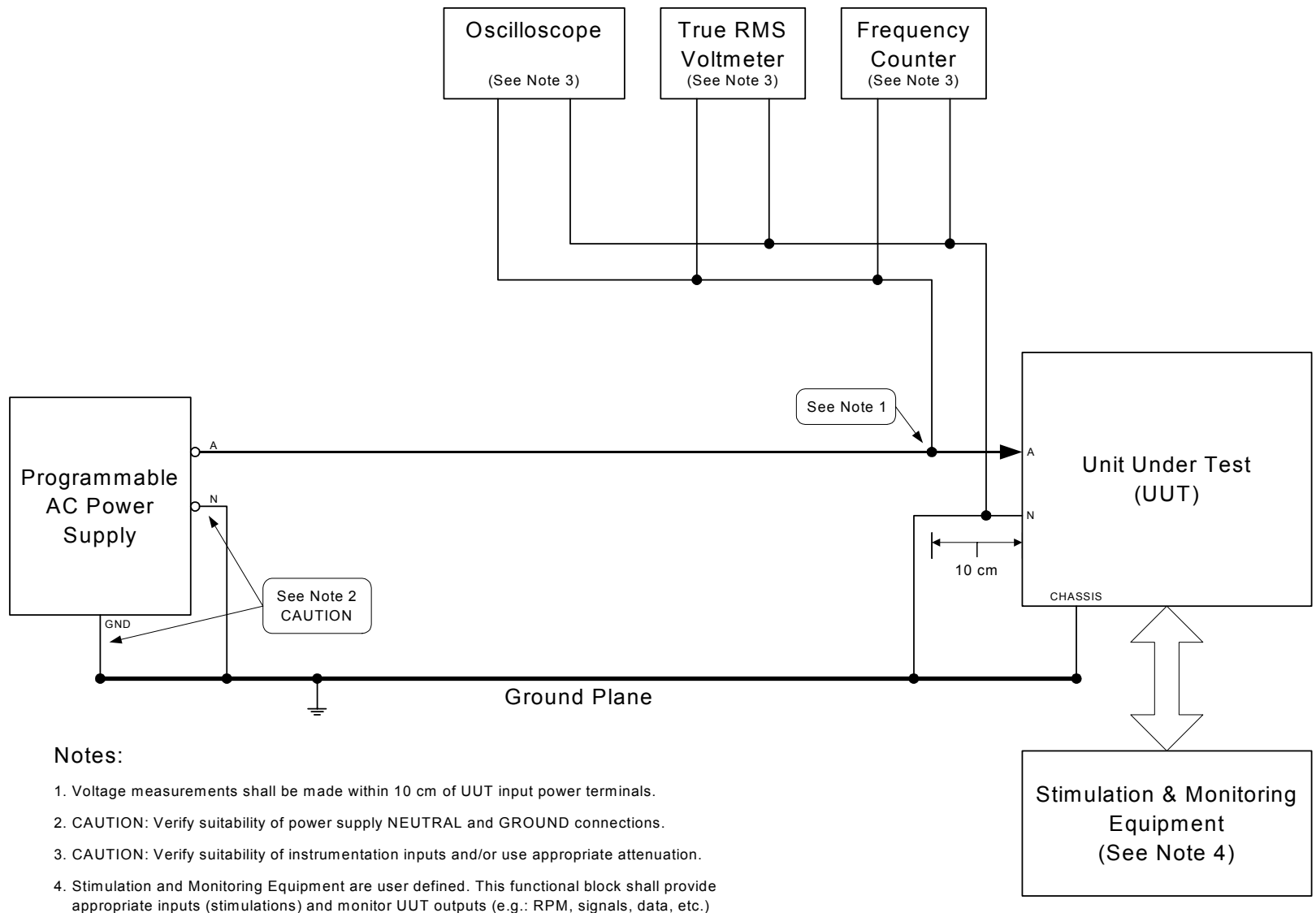
FIGURE SVF104-1. Voltage modulation.

TABLE SVF104-III. Sample data sheet for SVF104 voltage modulation for single phase, variable frequency utilization equipment.

Test Condition	Parameters										Performance
	Average Voltage		Frequency		Amplitude of Voltage Modulation		Frequency of Voltage Modulation		Time Duration at Test Condition		
Test performed at <b>400 Hz</b> steady state frequency											
A		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
B		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
C		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
D		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
E		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
F		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
G		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	



TABLE SVF104-III. Sample data sheet for SVF104 voltage modulation for single phase, variable frequency utilization equipment. -  
Continued

Test Condition	Parameters										Performance
	Average Voltage		Frequency		Amplitude of Voltage Modulation		Frequency of Voltage Modulation		Time Duration at Test Condition		
Test performed at <b>360 Hz</b> steady state frequency											
A		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
B		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
C		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
D		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
E		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
F		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
G		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	
		V <sub>rms</sub>		Hz		V <sub>rms</sub>		Hz		min	

TABLE SVF104-III. Sample data sheet for SVF104 voltage modulation for single phase, variable frequency utilization equipment. -  
Continued

Test Condition	Parameters										Performance
	Average Voltage	Frequency	Amplitude of Voltage Modulation	Frequency of Voltage Modulation	Time Duration at Test Condition						
Test performed at <b>600 Hz</b> steady state frequency											
A		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
B		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
C		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
D		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
E		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
F		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
G		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					

TABLE SVF104-III. Sample data sheet for SVF104 voltage modulation for single phase, variable frequency utilization equipment. -  
Continued

Test Condition	Parameters										Performance
	Average Voltage	Frequency	Amplitude of Voltage Modulation	Frequency of Voltage Modulation	Time Duration at Test Condition						
Test performed at <b>800 Hz</b> steady state frequency											
A		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
B		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
C		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
D		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
E		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
F		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
G		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					
		V <sub>rms</sub>	Hz	V <sub>rms</sub>	Hz	min					

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# **METHOD SVF105**

## **Frequency Modulation**

POWER GROUP: Single Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL  
OPERATING CONDITION: Normal

PARAMETER: Frequency Modulation

### 1. Scope.

1.1 Purpose. This test procedure is used to verify that single phase, 115 Volt, variable frequency power utilization equipment operates and maintains specified performance when subjected to frequency modulation as specified in the applicable edition(s) of MIL-STD-704.

2. Validation criteria. The utilization equipment is considered to have passed if the utilization equipment operates and maintains performance as specified in the utilization equipment performance specification document for normal aircraft electrical conditions when supplied input power having frequency modulation as specified in the applicable edition(s) of MIL-STD-704 and as noted in table SVF105-I. The utilization equipment must maintain specified performance for a length of time that confirms the utilization equipment can operate continuously when provided power having frequency modulation and should be, not less than thirty (30) minutes. The utilization equipment must not suffer damage or cause an unsafe condition.

TABLE SVF105-I. MIL-STD-704 limits for frequency modulation for single phase, variable frequency utilization equipment.

Limit	704A	704B	704C	704D	704E	704F
Frequency Modulation	N/A	N/A	N/A	N/A	N/A	4 Hz

3. Apparatus. The test equipment should be as follows:

- a. Programmable AC power supply
- b. True RMS voltmeter
- c. Frequency counter
- d. Oscilloscope

4. Test setup. Configure the test setup as shown in figure SVF105-1. Measurements, except current, must be made within 10 cm of the input power terminals of the UUT.

5. Compliance test. With the power source off, install the UUT and the stimulation and monitoring equipment into the test setup of figure SVF105-1. Turn on the power source and adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Energize the UUT. Allow sufficient time for the UUT to warm up. Conduct a performance test of the UUT according to the utilization

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equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions.

For each test condition A through E noted in table SVF105-II, set the amplitude of frequency modulation and rate of change for frequency modulation. The UUT must remain at the test condition for a length of time that confirms the utilization equipment can continuously operate, and should be at least thirty (30) minutes. At each test condition, conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions. Record voltages, average frequency, amplitude of frequency modulation, rate of change for frequency modulation, time duration at test condition, and the performance of the UUT for each test condition in the data sheet shown in table SVF105-III. Repeat for each mode of operation of the UUT. Repeat the testing at an average frequency of 362 Hz, 600 Hz, and 798 Hz.

After all test conditions are complete, adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to confirm that the UUT has not suffered damage and is providing specified performance for normal aircraft electrical conditions.

TABLE SVF105-II. Test conditions for frequency modulation for single phase, variable frequency utilization equipment.

Test Condition	Rate of change for frequency modulation	MIL-STD-704F Amplitude of Frequency Modulation
A	1 Hz/sec	4 Hz ( $\pm 2$ Hz)
B	5 Hz/sec	4 Hz ( $\pm 2$ Hz)
C	10 Hz/sec	4 Hz ( $\pm 2$ Hz)
D	25 Hz/sec	4 Hz ( $\pm 2$ Hz)
E	100 Hz/sec	4 Hz ( $\pm 2$ Hz)

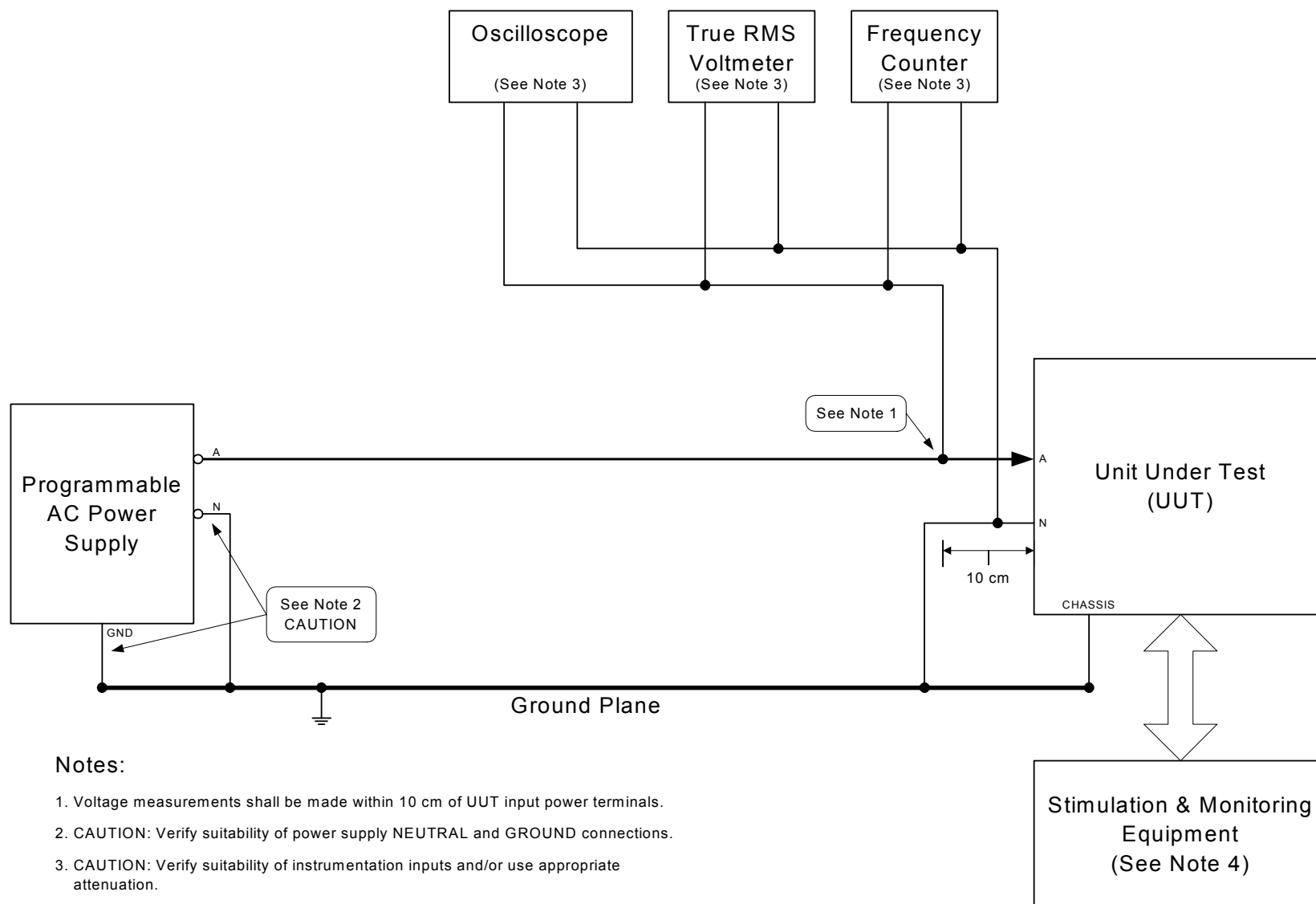
FIGURE SVF105-1. Frequency modulation.

TABLE SVF105-III. Sample data sheet for SVF105 frequency modulation for single phase, variable frequency utilization equipment.

Test Condition	Parameters										Performance
	Voltage	Average Frequency	Amplitude of Frequency Modulation	Rate of change for frequency modulation	Time Duration at Test Condition	Pass/Fail					
Testing performed at an average frequency of <b>400 Hz</b>											
A		V <sub>rms</sub>	Hz	± Hz	Hz/sec	min					
B		V <sub>rms</sub>	Hz	± Hz	Hz/sec	min					
C		V <sub>rms</sub>	Hz	± Hz	Hz/sec	min					
D		V <sub>rms</sub>	Hz	± Hz	Hz/sec	min					
E		V <sub>rms</sub>	Hz	± Hz	Hz/sec	min					
Testing performed at an average frequency of <b>362 Hz</b>											
A		V <sub>rms</sub>	Hz	± Hz	Hz/sec	min					
B		V <sub>rms</sub>	Hz	± Hz	Hz/sec	min					
C		V <sub>rms</sub>	Hz	± Hz	Hz/sec	min					
D		V <sub>rms</sub>	Hz	± Hz	Hz/sec	min					
E		V <sub>rms</sub>	Hz	± Hz	Hz/sec	min					
Testing performed at an average frequency of <b>600 Hz</b>											
A		V <sub>rms</sub>	Hz	± Hz	Hz/sec	min					
B		V <sub>rms</sub>	Hz	± Hz	Hz/sec	min					
C		V <sub>rms</sub>	Hz	± Hz	Hz/sec	min					
D		V <sub>rms</sub>	Hz	± Hz	Hz/sec	min					
E		V <sub>rms</sub>	Hz	± Hz	Hz/sec	min					

TABLE SVF105-III. Sample data sheet for SVF105 frequency modulation for single phase, variable frequency utilization equipment.  
- Continued

Test Condition	Parameters										Performance
	Voltage		Average Frequency		Amplitude of Frequency Modulation		Rate of change for frequency modulation		Time Duration at Test Condition		Pass/Fail
Testing performed at an average frequency of <b>798 Hz</b>											
A		V <sub>rms</sub>		Hz		± Hz		Hz/sec		min	
B		V <sub>rms</sub>		Hz		± Hz		Hz/sec		min	
C		V <sub>rms</sub>		Hz		± Hz		Hz/sec		min	
D		V <sub>rms</sub>		Hz		± Hz		Hz/sec		min	
E		V <sub>rms</sub>		Hz		± Hz		Hz/sec		min	



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# **METHOD SVF106**

## **Voltage Distortion Spectrum**

POWER GROUP: SVF106

AIRCRAFT ELECTRICAL  
OPERATING CONDITION: Normal

PARAMETER: Voltage Distortion Spectrum

1. Scope.

1.1 Purpose. This test procedure is used to verify that single phase, 115 Volt, variable frequency power utilization equipment operates and maintains specified performance when subjected to voltage distortion of frequencies and amplitudes as specified by the voltage distortion spectrum in the applicable edition(s) of MIL-STD-704.

2. Validation criteria. The utilization equipment is considered to have passed if the utilization equipment operates and maintains performance as specified in the utilization equipment performance specification document for normal aircraft electrical conditions when subjected to voltage distortions as specified by the voltage distortion spectrum in the applicable edition(s) of MIL-STD-704 and as noted in table SVF106-I. The utilization equipment must maintain specified performance for a length of time that confirms the utilization equipment can operate continuously when provided power having voltage distortion. The utilization equipment must not suffer damage or cause an unsafe condition.

Note: This test method subjects the UUT to voltage distortion having frequencies components from 50 Hz to 10 kHz. These voltage distortions simulate voltage distortions within aircraft due to the cumulative effects of generators, electrical distribution systems equipments, and aircraft loads. MIL-STD-461, (Requirements For The Control of Electromagnetic Interference Characteristics of Subsystems and Equipment), Test Method CS101, (Conducted Susceptibility, Power Leads, 30 Hz to 150 kHz) is a complimentary test. Power levels of the voltage distortions differ for the two test methods. Performance of Test Method SVF106 of this handbook does not relinquish the requirement to perform test Method CS101 of MIL-STD-461, and performance of Method CS101 of MIL-STD-461 does not relinquish the requirement to perform Test Method SVF106 of this handbook.

TABLE SVF106-I. MIL-STD-704 limits for voltage distortion spectrum for single phase, variable frequency utilization equipment.

Limit	704A	704B	704C	704D	704E	704F
Voltage Distortion Spectrum	N/A	N/A	N/A	N/A	N/A	figure 7 MIL-STD-704F

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3. Apparatus. The test equipment should be as follows:

- a. Adjustable AC power supply
- b. Variable frequency power source
- c. Coupling transformer
- d. True RMS voltmeter
- e. Frequency counter
- f. Spectrum analyzer
- g. (2) Inductors, 50  $\mu$ F
- h. Capacitor, 10  $\mu$ F
- i. Resistor, calibrated load

4. Test setup. Configure the test setup as shown in figure SVF106-1. Measurements, except current, must be made within 10 cm of the input power terminals of the UUT.

4.1 Calibration (50 Hz to 10 kHz). Install a calibrated resistive load in the test setup shown in figure SVF106-1 in place of the UUT. The calibrated resistive load must be sized to draw the same current as the UUT. Turn on the adjustable AC power supply and adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Set the variable frequency power source to output a sine wave and adjust the frequency and amplitude so that the voltage distortion measured at the input to the calibrated resistive load conforms to each test condition A through H in table SVF106-II of the applicable edition(s) of MIL-STD-704. Record the settings of the variable frequency power source for each test condition. Repeat the calibration with the adjustable AC power supply output at steady state frequencies of 360 Hz, 600 Hz, and 800 Hz.

5. Compliance test. With the power source off, install the UUT and the stimulation and monitoring equipment into the test setup of figure SVF106-1. Turn on the adjustable AC power supply and adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Energize the UUT. Allow sufficient time for the UUT to warm up. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions.

Set the variable frequency power source to the settings recorded for test condition A of the calibration procedure. For each test condition, remain for a length of time that confirms the utilization equipment can continuously operate with the voltage distortion and should be, not less than five (5) minutes. At each test condition, conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions. After each test condition, monitor the voltage distortion frequency and amplitude while slowly increasing the variable frequency power source frequency and adjusting the amplitude until the next test condition is reached. Do not exceed the voltage distortion spectrum limits. Repeat for each test condition A through H noted in table SVF106-II. For each test condition, record voltage, frequency, frequency of voltage distortion, amplitude of voltage distortion, time duration at test condition, and the performance of the UUT in the data sheet shown in table SVF106-III. Repeat for each

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mode of operation of the UUT. Repeat the testing at a steady state frequency of 360 Hz, 600 Hz, and 800 Hz.

After all test conditions are complete, turn the adjustable AC power supply off and remove the coupling transformer from the circuit. Turn on the adjustable AC power supply. Adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and the frequency to a steady state frequency of 400 Hz. Energize the UUT. Allow sufficient time for the UUT to warm up. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to confirm that the UUT has not suffered damage and is providing specified performance for normal aircraft electrical conditions.

TABLE SVF106-II. Test conditions for voltage distortion spectrum for single phase, variable frequency utilization equipment.

Test Condition	Frequency of Voltage Distortion	MIL-STD-704F Amplitude of Voltage Distortion Voltage rms
A	50 Hz	0.316 Vrms
B	100 Hz	0.316 Vrms
C	500 Hz	1.580 Vrms
D	1 kHz	3.160 Vrms
E	2 kHz	3.160 Vrms
F	3 kHz	3.160 Vrms
G	5 kHz	3.160 Vrms
H	10 kHz	1.900 Vrms

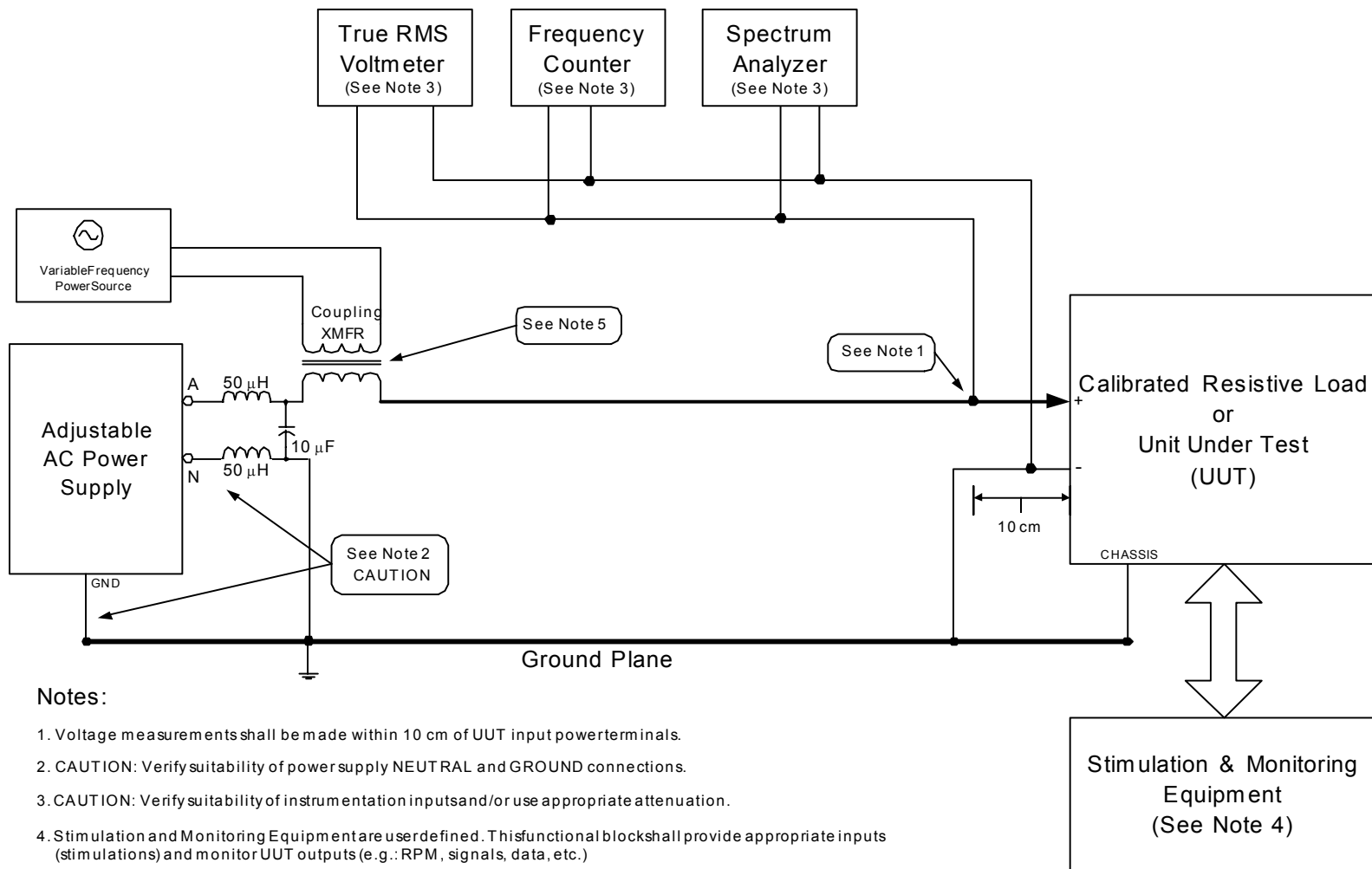


FIGURE SVF106-1. Normal operations - voltage distortion spectrum (50 Hz to 10 kHz).

TABLE. SVF106-III. Sample data sheet for SVF106 voltage distortion spectrum for single phase, variable frequency utilization equipment.

Test Condition	Parameter										Performance
	Voltage		Frequency		Frequency of Voltage Distortion		Amplitude of Voltage Distortion		Time Duration at Test Condition		Pass/Fail
Testing performed at <b>400 Hz</b>											
A		V <sub>rms</sub>		Hz		Hz		V <sub>rms</sub>		min	
B		V <sub>rms</sub>		Hz		Hz		V <sub>rms</sub>		min	
C		V <sub>rms</sub>		Hz		Hz		V <sub>rms</sub>		min	
D		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
E		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
F		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
G		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
H		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	

TABLE. SVF106-III. Sample data sheet for SVF106 voltage distortion spectrum for single phase, variable frequency utilization equipment.- Continued

Test Condition	Parameter										Performance
	Voltage		Frequency		Frequency of Voltage Distortion		Amplitude of Voltage Distortion		Time Duration at Test Condition		Pass/Fail
Testing performed at <b>360 Hz</b>											
A		V <sub>rms</sub>		Hz		Hz		V <sub>rms</sub>		min	
B		V <sub>rms</sub>		Hz		Hz		V <sub>rms</sub>		min	
C		V <sub>rms</sub>		Hz		Hz		V <sub>rms</sub>		min	
D		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
E		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
F		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
G		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
H		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
I		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
J		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
K		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	

TABLE. SVF106-III. Sample data sheet for SVF106 voltage distortion spectrum for single phase, variable frequency utilization equipment.- Continued

Test Condition	Parameter										Performance
	Voltage		Frequency		Frequency of Voltage Distortion		Amplitude of Voltage Distortion		Time Duration at Test Condition		Pass/Fail
Testing performed at <b>600 Hz</b>											
A		V <sub>rms</sub>		Hz		Hz		V <sub>rms</sub>		min	
B		V <sub>rms</sub>		Hz		Hz		V <sub>rms</sub>		min	
C		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
D		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
E		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
F		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
G		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
H		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
I		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
J		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
K		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	

TABLE. SVF106-III. Sample data sheet for SVF106 voltage distortion spectrum for single phase, variable frequency utilization equipment.- Continued

Test Condition	Parameter										Performance
	Voltage		Frequency		Frequency of Voltage Distortion		Amplitude of Voltage Distortion		Time Duration at Test Condition		Pass/Fail
Testing performed at <b>800 Hz</b>											
A		V <sub>rms</sub>		Hz		Hz		V <sub>rms</sub>		min	
B		V <sub>rms</sub>		Hz		Hz		V <sub>rms</sub>		min	
C		V <sub>rms</sub>		Hz		Hz		V <sub>rms</sub>		min	
D		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
E		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
F		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
G		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
H		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
I		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
J		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	
K		V <sub>rms</sub>		Hz		kHz		V <sub>rms</sub>		min	



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**METHOD SVF107**  
**Total Voltage Distortion**

POWER GROUP: Single Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL  
 OPERATING CONDITION: Normal

PARAMETER: Total Voltage Distortion

1. Scope.

1.1 Purpose. This test procedure is used to verify that single phase, 115 Volt, variable frequency power utilization equipment operates and maintains specified performance when subjected to voltage waveforms having a distortion factor as specified by the applicable edition(s) of MIL-STD-704.

2. Validation criteria. The utilization equipment is considered to have passed if the utilization equipment operates and maintains performance as specified in the utilization equipment performance specification document for normal aircraft electrical conditions when subjected to voltage waveforms having a distortion factor as specified by the applicable edition(s) of MIL-STD-704 and as noted in table SVF107-I. The utilization equipment must maintain specified performance for a length of time that confirms the utilization equipment can operate continuously when subjected to distorted voltage waveforms and should be not less than thirty (30) minutes. The utilization equipment must not suffer damage or cause an unsafe condition.

TABLE SVF107-I. MIL-STD-704 limits for total voltage distortion for single phase, variable frequency utilization equipment.

Limit	704A	704B	704C	704D	704E	704F
Voltage Distortion Factor	N/A	N/A	N/A	N/A	N/A	0.05

3. Apparatus. The test equipment should be as follows:

- a. Programmable AC power supply
- b. True RMS voltmeter
- c. Frequency counter
- d. Spectrum analyzer
- e. Distortion meter

4. Test setup. Configure the test setup as shown in figure SVF107-1. Measurements, except current, must be made within 10 cm of the input power terminals of the UUT.

4.1 Calibration. Install a resistive load in the test setup shown in figure SVF107-1 in place of the UUT. The resistive load must be sized to draw the same current as the UUT. Set

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the programmable power supply to produce a voltage waveform having harmonic contents listed in table SVF107-II. Turn on the power source and adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to the nominal steady state frequency of 400 Hz. Confirm that the programmable power supply is producing a voltage waveform having harmonic content listed in table SVF107-2. Record the settings of the programmable power supply.

5. Compliance test. With the power source off, install the UUT and the stimulation and monitoring equipment into the test setup of figure SVF107-1. Set the programmable power supply to the settings recorded during the calibration procedure. Turn on the power source and adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to the nominal steady state frequency of 400 Hz. Energize the UUT. Allow sufficient time for the UUT to warm up. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions. The UUT must remain for a length of time that confirms the utilization equipment can continuously operate with the total voltage distortion and should be not less than thirty (30) minutes. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions. Record the voltage, frequency, voltage distortion factor, voltage harmonics, time duration at test condition, and the performance of the UUT in the data sheet shown in table SVF107-III. Repeat for each mode of operation of the UUT. Repeat the testing at a fundamental frequency of 360 Hz, 600 Hz, and 800 Hz.

After all test conditions are complete, set the programmable power supply to produce a sine wave for each of the three phases. Adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to confirm that the UUT has not suffered damage and is providing specified performance for normal aircraft electrical conditions.

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TABLE SVF107-II. Voltage harmonics as percent of fundamental for total voltage distortion test for single phase, variable frequency utilization equipment.

Harmonic	MIL-STD-704F Percent of Fundamental
Fundamental	100%
2nd	0%
3rd	2.75%
4th	0%
5th	2.75%
6th	0%
7th	1.97%
8th	0%
9th	1.53%
10th	0%
11th	1.25%
12th	0%
13th	1.06%
14th	0%
15th	0.92%

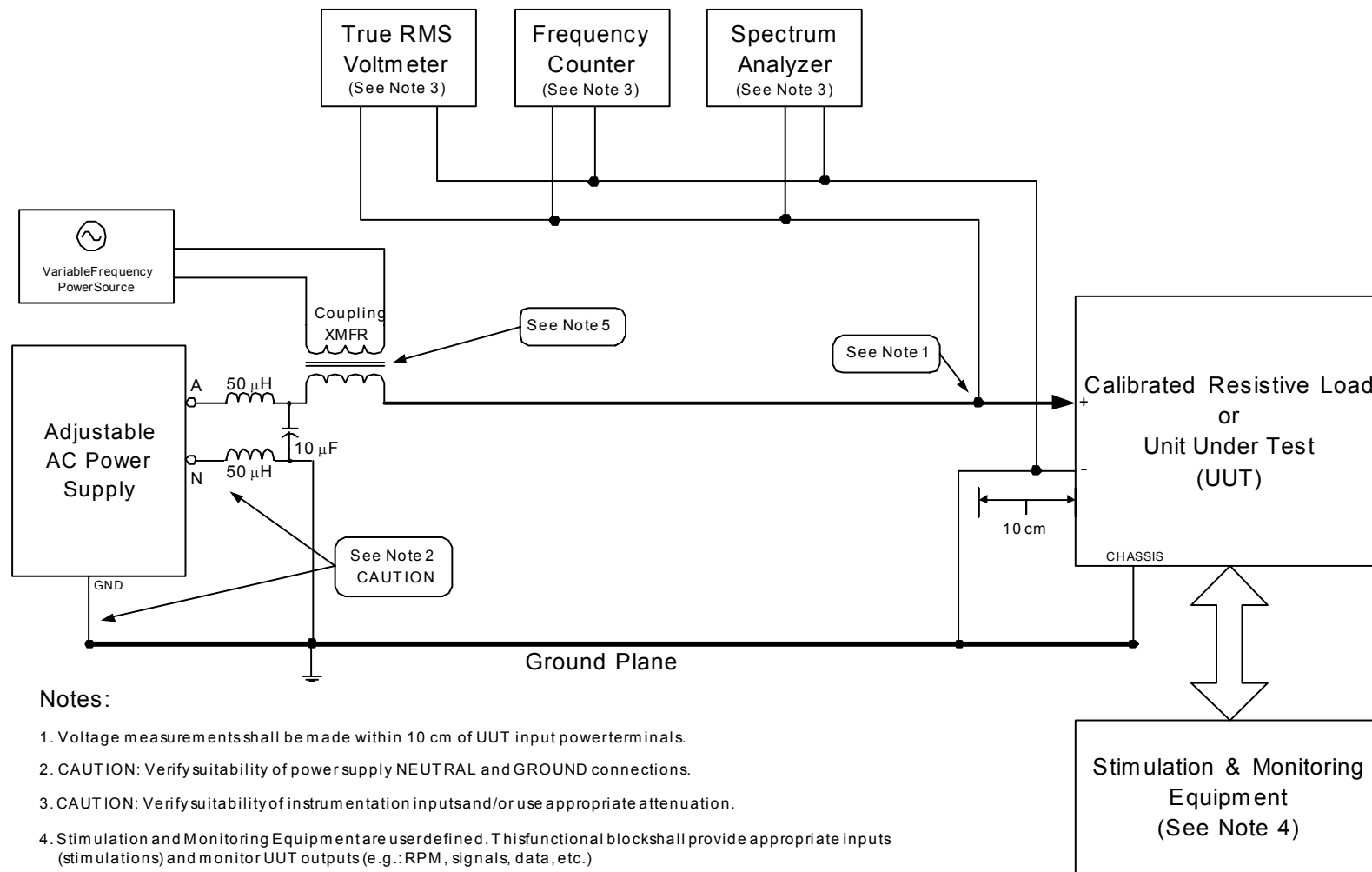


FIGURE SVF107-1. Normal operation - voltage distortion spectrum (50 Hz to 10 kHz).

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TABLE SVF107-III. Sample data sheet for SVF107 total voltage distortion for single phase, variable frequency utilization equipment.

Parameters							Performance		
Voltage		Frequency		Voltage Distortion Factor		Time Duration at Test Condition		Pass/Fail	
Testing performed at a fundamental frequency of <b>400 Hz</b>									
	V <sub>rms</sub>		Hz		No units		min		
		Voltage Harmonics							
		Fund		%					
		2 <sup>nd</sup>		%					
		3 <sup>rd</sup>		%					
		4 <sup>th</sup>		%					
		5 <sup>th</sup>		%					
		6 <sup>th</sup>		%					
		7 <sup>th</sup>		%					
		8 <sup>th</sup>		%					
		9 <sup>th</sup>		%					
		10 <sup>th</sup>		%					
		11 <sup>th</sup>		%					
		12 <sup>th</sup>		%					
		13 <sup>th</sup>		%					
		14 <sup>th</sup>		%					
15 <sup>th</sup>		%							

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TABLE SVF107-III. Sample data sheet for SVF107 total voltage distortion for single phase, variable frequency utilization equipment. - Continued

Parameters							Performance	
Voltage	Frequency		Voltage Distortion Factor	Time Duration at Test Condition		Pass/Fail		
Testing performed at a fundamental frequency of <b>360 Hz</b>								
	V <sub>rms</sub>		Hz		No units		min	
		Voltage Harmonics						
		Fund		%				
		2 <sup>nd</sup>		%				
		3 <sup>rd</sup>		%				
		4 <sup>th</sup>		%				
		5 <sup>th</sup>		%				
		6 <sup>th</sup>		%				
		7 <sup>th</sup>		%				
		8 <sup>th</sup>		%				
		9 <sup>th</sup>		%				
		10 <sup>th</sup>		%				
		11 <sup>th</sup>		%				
		12 <sup>th</sup>		%				
		13 <sup>th</sup>		%				
		14 <sup>th</sup>		%				
15 <sup>th</sup>		%						

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TABLE SVF107-III. Sample data sheet for SVF107 total voltage distortion for single phase, variable frequency utilization equipment. - Continued

Parameters							Performance	
Voltage		Frequency		Voltage Distortion Factor		Time Duration at Test Condition		Pass/Fail
Testing performed at a fundamental frequency of <b>600 Hz</b>								
	V <sub>rms</sub>		Hz		No units		min	
		Voltage Harmonics						
		Fund		%				
		2 <sup>nd</sup>		%				
		3 <sup>rd</sup>		%				
		4 <sup>th</sup>		%				
		5 <sup>th</sup>		%				
		6 <sup>th</sup>		%				
		7 <sup>th</sup>		%				
		8 <sup>th</sup>		%				
		9 <sup>th</sup>		%				
		10 <sup>th</sup>		%				
		11 <sup>th</sup>		%				
		12 <sup>th</sup>		%				
		13 <sup>th</sup>		%				
		14 <sup>th</sup>		%				
15 <sup>th</sup>		%						

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TABLE SVF107-III. Sample data sheet for SVF107 total voltage distortion for single phase, variable frequency utilization equipment. - Continued

Parameters							Performance			
Voltage		Frequency		Voltage Distortion Factor		Time Duration at Test Condition		Pass/Fail		
Testing performed at a fundamental frequency of <b>800 Hz</b>										
	V <sub>rms</sub>		Hz		No units		min			
		Voltage Harmonics								
		Fund								%
		2 <sup>nd</sup>								%
		3 <sup>rd</sup>								%
		4 <sup>th</sup>								%
		5 <sup>th</sup>								%
		6 <sup>th</sup>								%
		7 <sup>th</sup>								%
		8 <sup>th</sup>								%
		9 <sup>th</sup>								%
		10 <sup>th</sup>								%
		11 <sup>th</sup>								%
		12 <sup>th</sup>								%
		13 <sup>th</sup>								%
		14 <sup>th</sup>								%
15 <sup>th</sup>				%						



## MIL-HDBK-704-4

# METHOD SVF108

## DC Voltage Component

POWER GROUP: Single Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL  
OPERATING CONDITION: Normal

PARAMETER: DC Voltage Component

### 1. Scope.

1.1 Purpose. This test procedure is used to verify that single phase, 115 Volt, variable frequency power utilization equipment operates and maintains specified performance when subjected to a direct current component of AC voltage as specified by the applicable edition(s) of MIL-STD-704.

2. Validation criteria. The utilization equipment is considered to have passed if the utilization equipment operates and maintains performance as specified in the utilization equipment performance specification document for normal aircraft electrical conditions when subjected to a direct current component of AC voltage as specified by the applicable edition(s) of MIL-STD-704 and as noted in table SVF108-I. The utilization equipment must maintain specified performance for a length of time that confirms the utilization equipment can operate continuously when subjected to a direct current component of AC voltage and should be not less than thirty (30) minutes. The utilization equipment must not suffer damage or cause an unsafe condition.

TABLE SVF108-I. MIL-STD-704 limits for direct current component of AC voltage for single phase, variable frequency utilization equipment.

Limit	704A	704B	704C	704D	704E	704F
DC Voltage Component of the AC Voltage	N/A	N/A	N/A	N/A	N/A	$\pm 0.10$ V

3. Apparatus. The test set equipment should be as follows:

- a. Programmable AC power supply
- b. True RMS voltmeter (with capability to measure DC component of AC waveform)
- c. Frequency counter

4. Test setup. Configure the test setup as shown in figure SVF108-1. Measurements, except current, must be made within 10 cm of the input power terminals of the UUT.

5. Compliance test. With the power source off, install the UUT and the stimulation and monitoring equipment into the test setup of figure SVF108-1. Set the programmable power

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supply to produce a voltage waveform having a DC component for test condition A as noted in table SVF108-II. Turn on the power source and adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Energize the UUT. Allow sufficient time for the UUT to warm up. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions. The UUT must remain for a length of time that confirms the utilization equipment can continuously operate with the direct current component of the AC voltage and should be not less than thirty (30) minutes. Repeat the test for test condition B as noted in table SVF108-II. Record the voltage, frequency, DC voltage component, time duration at test condition, and the performance of the UUT for each test condition in the data sheet shown in table SVF108-III. Repeat for each mode of operation of the UUT. Repeat the testing at a steady state frequency of 360 Hz, 600 Hz, and 800 Hz.

After all test conditions are complete, set the programmable power supply to produce a voltage sine wave without a DC component. Adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to confirm that the UUT has not suffered damage and is providing specified performance for normal aircraft electrical conditions.

TABLE SVF108-II. Test conditions for direct current component of the AC voltage for single phase, variable frequency utilization equipment.

Test Condition	MIL-STD-704F Direct Current Component of AC Voltage
A	+ 0.10V
B	– 0.10 V

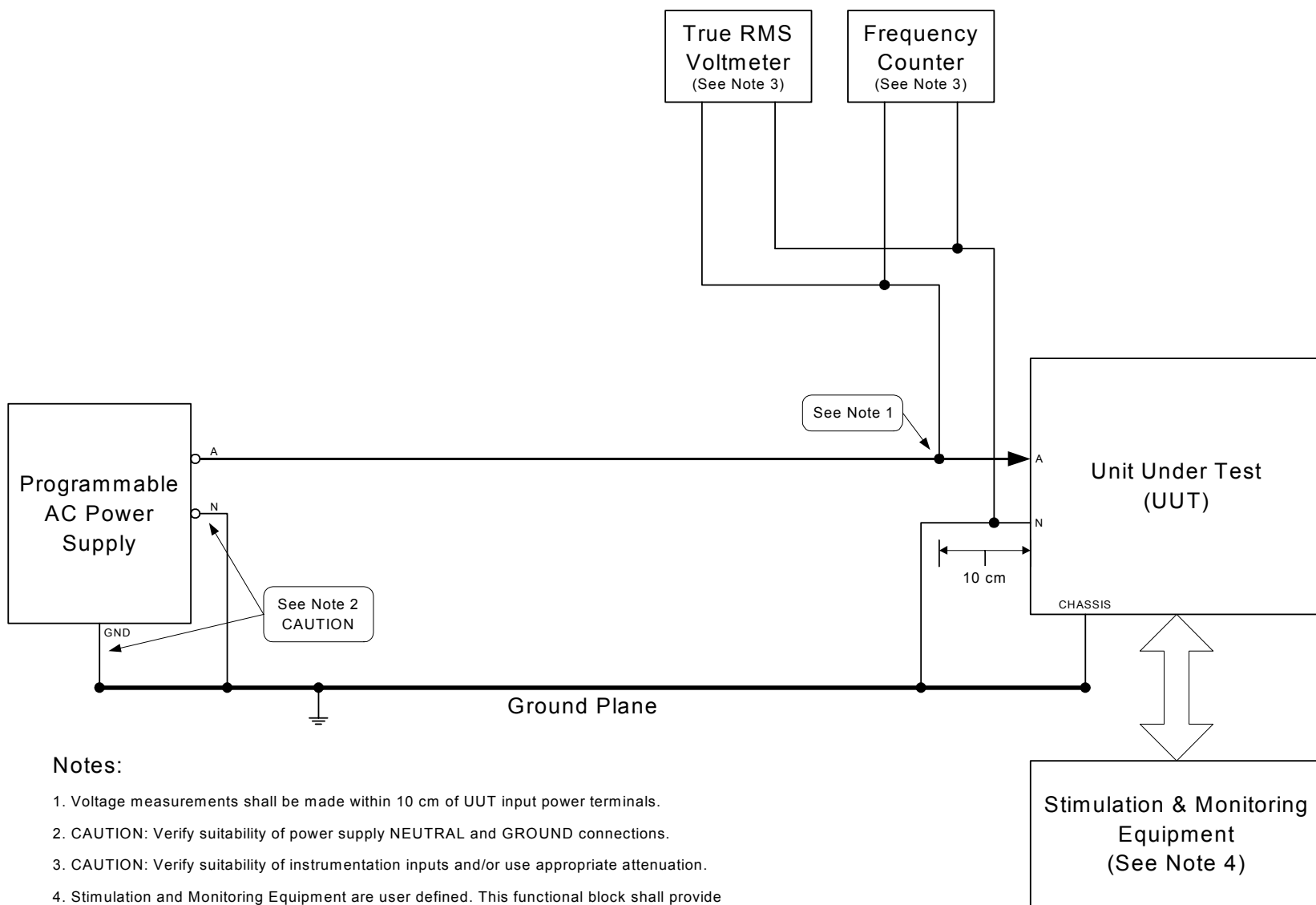
FIGURE SVF108-1. DC voltage component.

TABLE SVF108-III. Sample data sheet for SVF108 DC voltage component for single phase, variable frequency utilization equipment.

Test Condition	Parameters								Performance
	Voltage		Frequency		DC Voltage Component		Time Duration at Test Condition		Pass/Fail
Testing Performed at <b>400 Hz</b>									
A		V <sub>rms</sub>		Hz		V <sub>dc</sub>		min	
B		V <sub>rms</sub>		Hz		V <sub>dc</sub>		min	
Testing Performed at <b>360 Hz</b>									
A		V <sub>rms</sub>		Hz		V <sub>dc</sub>		min	
B		V <sub>rms</sub>		Hz		V <sub>dc</sub>		min	
Testing Performed at <b>600 Hz</b>									
A		V <sub>rms</sub>		Hz		V <sub>dc</sub>		min	
B		V <sub>rms</sub>		Hz		V <sub>dc</sub>		min	
Testing Performed at <b>800 Hz</b>									
A		V <sub>rms</sub>		Hz		V <sub>dc</sub>		min	
B		V <sub>rms</sub>		Hz		V <sub>dc</sub>		min	

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# **METHOD SVF109**

## **Normal Voltage Transients**

POWER GROUP: Single Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL  
OPERATING CONDITION: Normal

PARAMETER: Normal Voltage Transients

### 1. Scope.

1.1 Purpose. This test procedure is used to verify that single phase, 115 Volt, variable frequency power utilization equipment operates and maintains specified performance when subjected to normal voltage transients as specified in the applicable edition(s) of MIL-STD-704.

2. Validation criteria. The utilization equipment is considered to have passed if the utilization equipment operates and maintains performance as specified in the utilization equipment performance specification document for normal aircraft electrical conditions when subjected to voltage transients within the normal limits of the applicable edition(s) of MIL-STD-704 and as noted in table SVF109-I. The utilization equipment must maintain specified performance during and after the voltage transients. The utilization equipment must not suffer damage or cause an unsafe condition.

TABLE SVF109-I. MIL-STD-704 limits for normal voltage transients for single phase, variable frequency utilization equipment.

Limit	704A	704B	704C	704D	704E	704F
Normal Voltage Transients	N/A	N/A	N/A	N/A	N/A	figure 3 MIL-STD-704F

3. Apparatus. The test equipment should be as follows:

- a. Programmable AC power supply
- b. True RMS voltmeter
- c. Frequency counter
- d. Oscilloscope

4. Test setup. Configure the test setup as shown in figure SVF109-1. Measurements, except current, must be made within 10 cm of the input power terminals of the UUT.

5. Compliance test. With the power source off, install the UUT and the stimulation and monitoring equipment into the test setup of figure SVF109-1. Turn on the power source and adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Energize the UUT. Allow sufficient time for the UUT to warm up. Conduct a performance test of the UUT according to the utilization

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equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions.

The UUT must be subjected to the voltage transients for each test condition A through M noted in table SVF109-II. The voltage must increase or decrease from steady state voltage to the voltage transient level within  $\frac{1}{2}$  cycle. The voltage must remain at the voltage transient level for the duration noted in table SVF109-II. The voltage must return to steady state over the time duration noted in table SVF109-II. For test condition G, three overvoltage transients of 180 Vrms for 10 milliseconds are performed, separated by 0.5 seconds. For test condition L, three undervoltage transients of 80 Vrms for 10 milliseconds are performed, separated by 0.5 seconds. For test condition M, an undervoltage transient of 80 Vrms for 10 milliseconds is immediately followed by an overvoltage transient of 180 Vrms for 10 milliseconds and the voltage returns to steady state over the time duration noted. For each test condition, monitor the performance of the UUT during the voltage transient according to the equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions. Repeat each test condition 5 times. After the power returns to normal steady state limits, conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions. Record the steady state voltage, steady state frequency, voltage transient level, time duration at voltage transient, oscilloscope trace, and the performance of the UUT for each test condition in the data sheet shown in table SVF109-III. Repeat for each mode of operation of the UUT. In addition perform the repetitive normal voltage transient test described below. Repeat the testing at a steady state frequency of 360 Hz, 600 Hz, and 800 Hz.

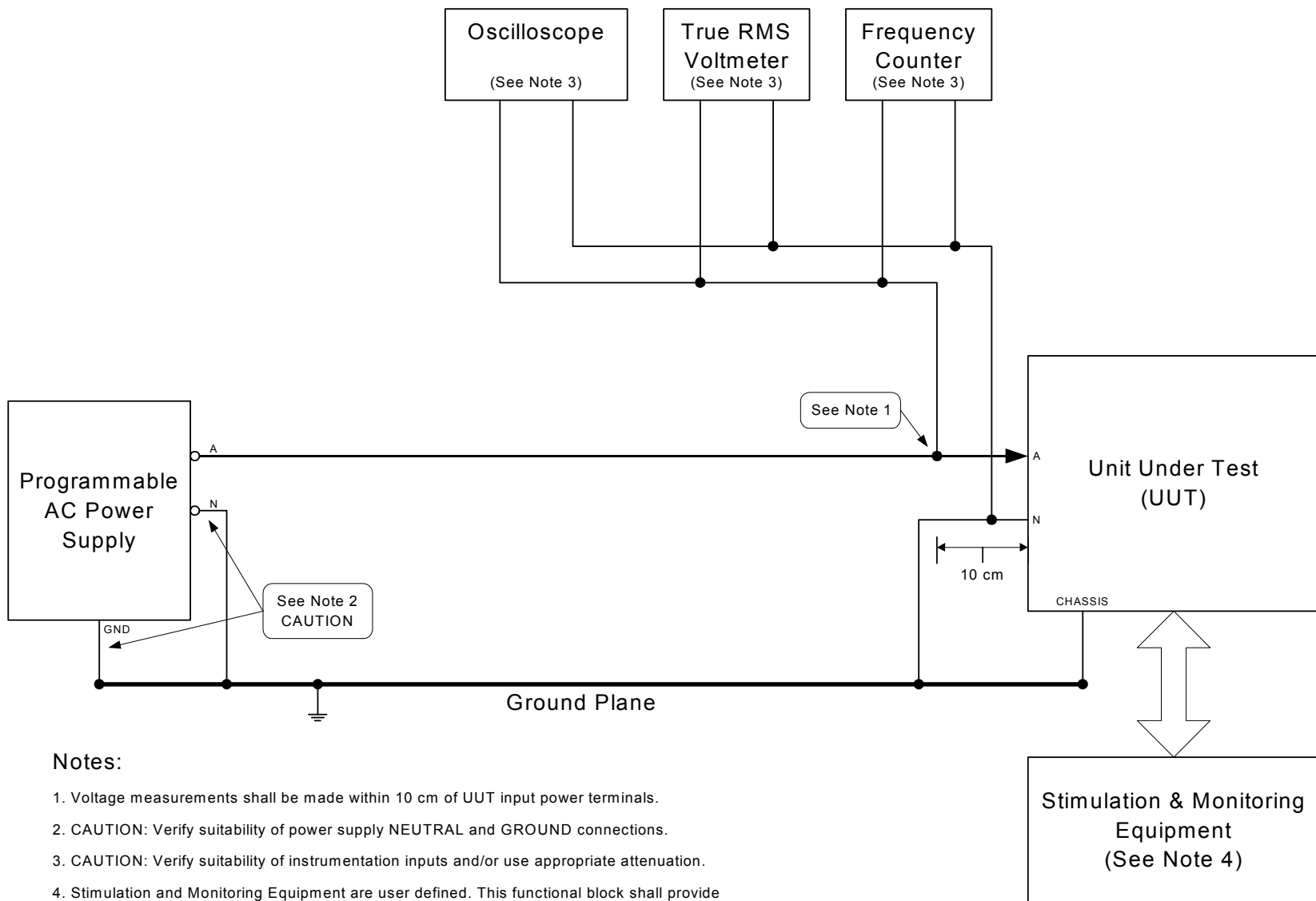
5.1 Repetitive normal voltage transients test. Program the power supply to provide a continually repeating voltage transient that decreases from 115 Vrms to 90 Vrms in  $\frac{1}{2}$  cycle, then increases to 140 Vrms over 50 msec, then decreases to 115 Vrms over  $\frac{1}{2}$  cycle. The voltage transient is repeated every 0.5 seconds, see figure2. The UUT must be subjected to the repetitive voltage transient for a length of time that confirms the utilization equipment can continuously operate and should be not less than thirty (30) minutes. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions. Record the steady state voltage, steady state frequency, high voltage transient level, low voltage transient level, oscilloscope trace, time duration at test condition, and the performance of the UUT in the data sheet shown in table SVF109-III. Repeat for each mode of operation of the UUT. Repeat the testing at a steady state frequency of 360 Hz, 600 Hz, and 800 Hz.

After all test conditions are complete, adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to confirm that the UUT has not suffered damage and is providing specified performance for normal aircraft electrical conditions.

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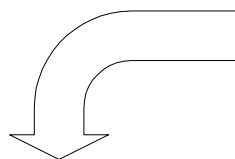
TABLE SVF109-II. Test conditions for normal voltage transients for single phase, variable frequency utilization equipment.

Test Condition	Time From Steady State Voltage to Voltage Transient Level milliseconds	Voltage Transient Level Vrms	Duration at Voltage Transient Level milliseconds	Time From Voltage Transient Level to Steady State Voltage milliseconds
<b>Overvoltage Transients</b>				
A	< ½ cycle	140 Vrms	60 msec	< ½ cycle
B	< ½ cycle	140 Vrms	60 msec	25 msec
C	< ½ cycle	160 Vrms	34 msec	< ½ cycle
D	< ½ cycle	160 Vrms	34 msec	52 msec
E	< ½ cycle	180 Vrms	10 msec	< ½ cycle
F	< ½ cycle	180 Vrms	10 msec	77 msec
G	< ½ cycle	180 Vrms (3 times)	10 msec every 0.5 sec	< ½ cycle
<b>Undervoltage Transients</b>				
H	< ½ cycle	90 Vrms	35 msec	< ½ cycle
I	< ½ cycle	90 Vrms	35 msec	45 msec
J	< ½ cycle	80 Vrms	10 msec	< ½ cycle
K	< ½ cycle	80 Vrms	10 msec	70 msec
L	< ½ cycle	80 Vrms (3 times)	10 msec every 0.5 sec	< ½ cycle
<b>Combined Transient</b>				
M	< ½ cycle then < ½ cycle	80 Vrms 180 Vrms	10 msec 10 msec	< ½ cycle 77 msec

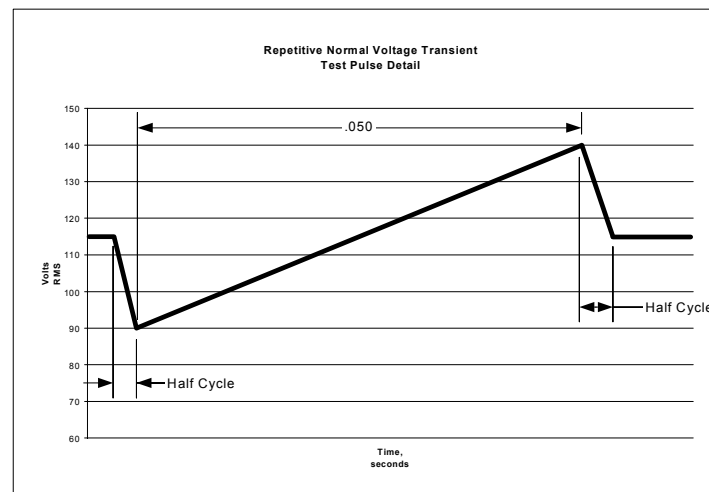
FIGURE SVF109-1. Normal voltage transients.



Repetition Rate (f) for transient pulse is twice per second.



Repetitive Normal Voltage Transient



Pulse Detail

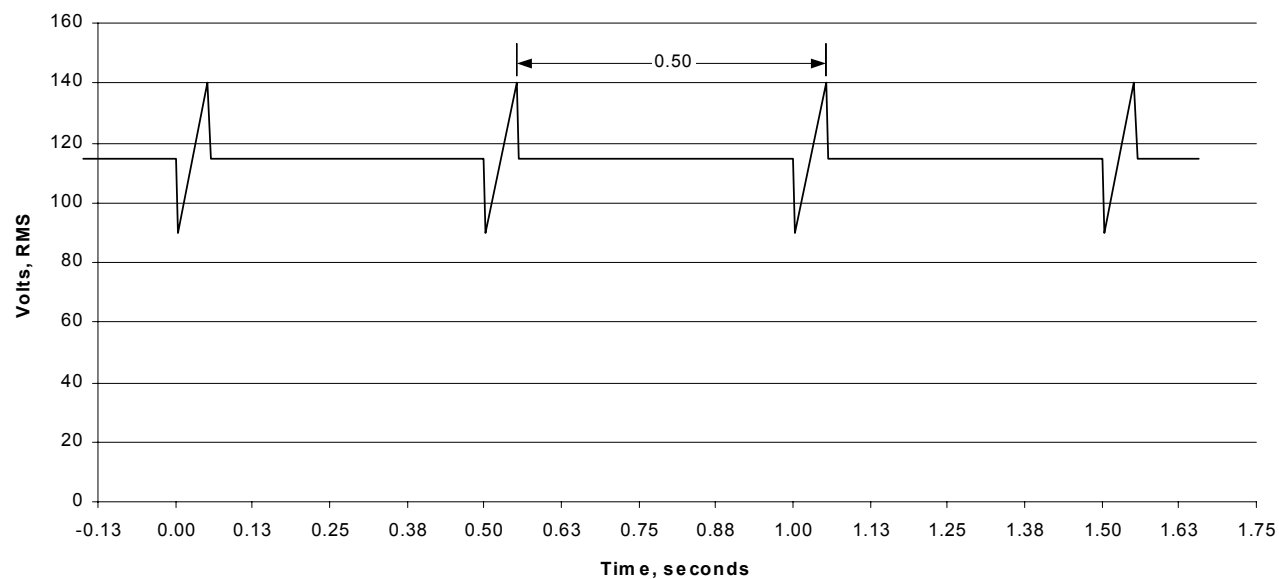


FIGURE SVF109-2. Repetitive normal voltage transient.

TABLE SVF109-III. Sample data sheet for SVF109 normal voltage transients for single phase, variable frequency utilization equipment.

Test Condition	Parameters										Performance
	Steady State Voltage		Steady State Frequency		Voltage Transient		Time at Voltage Transient Level		Oscilloscope Trace		Pass/Fail
Testing performed at <b>400 Hz</b>											
A		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
B		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
C		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
D		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
E		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
F		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
G		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
H		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
I		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
J		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
K		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
L		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
M		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
						V <sub>rms</sub>		msec			
Repetitive Transient		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
						V <sub>rms</sub>		msec			
	Time duration at test condition									min	

TABLE SVF109-III. Sample data sheet for SVF109 normal voltage transients for single phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters										Performance
	Steady State Voltage		Steady State Frequency		Voltage Transient		Time at Voltage Transient Level		Oscilloscope Trace		Pass/Fail
Testing performed at <b>360 Hz</b>											
A		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
B		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
C		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
D		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
E		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
F		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
G		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
H		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
I		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
J		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
K		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
L		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
M		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
						V <sub>rms</sub>		msec			
Repetitive Transient		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
						V <sub>rms</sub>		msec			
	Time duration at test condition									min	

TABLE SVF109-III. Sample data sheet for SVF109 normal voltage transients for single phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters									Performance	
	Steady State Voltage		Steady State Frequency		Voltage Transient		Time at Voltage Transient Level		Oscilloscope Trace		Pass/Fail
Testing performed at <b>600 Hz</b>											
A		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
B		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
C		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
D		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
E		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
F		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
G		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
H		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
I		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
J		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
K		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
L		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
M		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
						V <sub>rms</sub>		msec			
Repetitive Transient		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
						V <sub>rms</sub>		msec			
	Time duration at test condition									min	

TABLE SVF109-III. Sample data sheet for SVF109 normal voltage transients for single phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters										Performance
	Steady State Voltage		Steady State Frequency		Voltage Transient		Time at Voltage Transient Level		Oscilloscope Trace		Pass/Fail
Testing performed at <b>800 Hz</b>											
A		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
B		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
C		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
D		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
E		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
F		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
G		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
H		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
I		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
J		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
K		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
L		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
M		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
						V <sub>rms</sub>		msec			
Repetitive Transient		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
						V <sub>rms</sub>		msec			
	Time duration at test condition									min	

## MIL-HDBK-704-4

# **METHOD SVF110**

## **Normal Frequency Transients**

POWER GROUP: Single Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL  
OPERATING CONDITION: Normal

PARAMETER: Normal Frequency Transients

### 1. Scope.

1.1 Purpose. This test procedure is used to verify that single phase, 115 Volt, variable frequency power utilization equipment operates and maintains specified performance when subjected to normal frequency transients as specified in the applicable edition(s) of MIL-STD-704.

2. Validation criteria. The utilization equipment is considered to have passed if the utilization equipment operates and maintains performance as specified in the utilization equipment performance specification document for normal aircraft electrical conditions when subjected to frequency transients within the normal limits of the applicable edition(s) of MIL-STD-704 and as noted in table SVF110-I. The utilization equipment must maintain specified performance during and after the frequency transients. The utilization equipment must not suffer damage or cause an unsafe condition.

TABLE SVF110-I. MIL-STD-704 limits for normal frequency transients for single phase, variable frequency utilization equipment.

Limit	704A	704B	704C	704D	704E	704F
Normal Frequency Transients	N/A	N/A	N/A	N/A	N/A	360 Hz to 800 Hz  Maximum Rate of Change of Frequency 250 Hz/sec

3. Apparatus. The test equipment should be as follows:

- a. Programmable AC power supply
- b. True RMS voltmeter
- c. Frequency counter
- d. Oscilloscope

4. Test setup. Configure the test setup as shown in figure SVF110-1. Measurements, except current, must be made within 10 cm of the input power terminals of the UUT.

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5. Compliance test. With the power source off, install the UUT and the stimulation and monitoring equipment into the test setup of figure SVF110-1. Turn on the power source and adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Energize the UUT. Allow sufficient time for the UUT to warm up. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions.

The UUT must be subjected to the frequency transients for each test condition A through I noted in table SVF110-II. The frequency must increase or decrease from the start frequency to the frequency transient level over the duration noted; the frequency must remain at the frequency transient level for the duration noted; and the frequency must return from the frequency transient level over the duration noted. For test condition I, an underfrequency transient is immediately followed by an overfrequency transient. For each test condition, monitor the performance of the UUT during the frequency transient according to the equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions. Repeat each test condition 5 times. After the power returns to the start frequency, conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions. Record the steady state voltage, start frequency, frequency transient level, time at frequency transient, oscilloscope trace (Hz vs. time), and the performance of the UUT for each test condition in the data sheet shown in table SVF110-III. Repeat for each mode of operation of the UUT.

After all test conditions are complete, adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to confirm that the UUT has not suffered damage and is providing specified performance for normal aircraft electrical conditions.

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TABLE SVF110-II. Test conditions for MIL-STD-704 normal frequency transients for single phase, variable frequency utilization equipment.

Test Condition	Start Frequency	Time From Start Frequency to Frequency Transient Level	Frequency Transient Level	Duration at Frequency Transient Level	Time From Frequency Transient Level to Start Frequency
Overfrequency Transients					
A	360 Hz	1.76 seconds	800 Hz	½ cycle	1.76 seconds
B	360 Hz	1.76 seconds	800 Hz	1second	1.76 seconds
C	360 Hz	0.96 seconds	600 Hz	½ cycle	0.96 seconds
D	360 Hz	0.96 seconds	600 Hz	1second	0.96 seconds
Underfrequency Transients					
E	800 Hz	1.76 seconds	360 Hz	½ cycle	1.76 seconds
F	800 Hz	1.76 seconds	360 Hz	1second	1.76 seconds
G	800 Hz	0.80 seconds	600 Hz	½ cycle	0.80 seconds
H	800 Hz	0.80 seconds	600 Hz	1second	0.80 seconds
Combined Transient					
I	600 Hz	0.96 seconds then 0.80 seconds	360 Hz 800 Hz	½ cycle ½ cycle	0.96 seconds 0.80 seconds



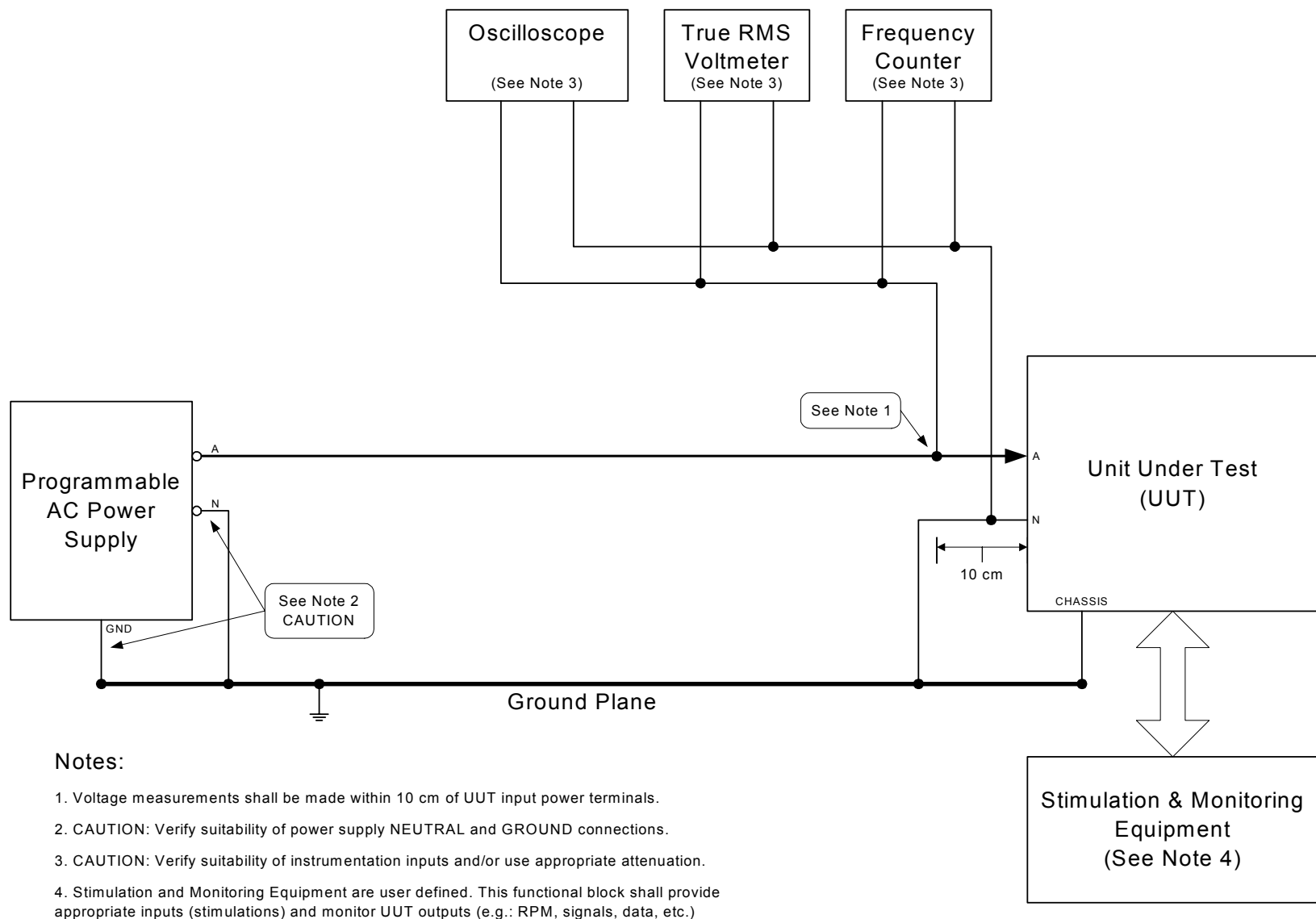
FIGURE SVF110-1. Normal frequency transients.

TABLE SVF110-III. Sample data sheet for SVF110 normal frequency transients for single phase, variable frequency utilization equipment.

Test Condition	Parameters										Performance
	Steady State Voltage		Start Frequency		Frequency Transient		Time at Frequency Transient Level		Oscilloscope Trace		Pass/Fail
A		V <sub>rms</sub>		Hz		Hz		msec	Attach Trace	Hz vs. Time	
B		V <sub>rms</sub>		Hz		Hz		msec	Attach Trace	Hz vs. Time	
C		V <sub>rms</sub>		Hz		Hz		msec	Attach Trace	Hz vs. Time	
D		V <sub>rms</sub>		Hz		Hz		msec	Attach Trace	Hz vs. Time	
E		V <sub>rms</sub>		Hz		Hz		msec	Attach Trace	Hz vs. Time	
F		V <sub>rms</sub>		Hz		Hz		msec	Attach Trace	Hz vs. Time	
G		V <sub>rms</sub>		Hz		Hz		msec	Attach Trace	Hz vs. Time	
H		V <sub>rms</sub>		Hz		Hz		msec	Attach Trace	Hz vs. Time	
I		V <sub>rms</sub>		Hz		Hz		msec	Attach Trace	Hz vs. Time	
						Hz		msec			

## MIL-HDBK-704-4

# **METHOD SVF201**

## **Power Interrupt**

POWER GROUP: Single Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL  
OPERATING CONDITION: Transfer Interrupt

PARAMETER: Power Interrupt

### 1. Scope.

1.1 Purpose. This test procedure is used to verify that single phase, 115 Volt, variable frequency power utilization equipment operates and maintains specified performance when subjected to power interrupts as specified in the applicable edition(s) of MIL-STD-704.

2. Validation criteria. The utilization equipment is considered to have passed if the utilization equipment operates and maintains performance as specified in the utilization equipment performance specification document for transfer aircraft electrical conditions when subjected to power interrupts as specified by the applicable edition(s) of MIL-STD-704 and as noted in table SVF201-I. The utilization equipment must maintain the specified performance during power interrupts. Unless otherwise specified in the utilization equipment performance specification document, the utilization equipment must automatically return to the performance specified for normal aircraft electrical conditions when the power returns to within normal limits. The utilization equipment must not suffer damage or cause an unsafe condition.

TABLE SVF201-I. MIL-STD-704 power transfer limits for single phase, variable frequency utilization equipment.

Limit	704A	704B	704C	704D	704E	704F
Power Interrupt	N/A	N/A	N/A	N/A	N/A	50 msec
Voltage NLSS	N/A	N/A	N/A	N/A	N/A	108 V
Voltage NHSS	N/A	N/A	N/A	N/A	N/A	118 V

### 3. Apparatus. The test equipment should be as follows:

- a. Programmable AC power supply
- b. True RMS voltmeter
- c. Frequency counter
- d. Oscilloscope
- e. Resistive dummy load

4. Test setup. Configure the test setup as shown in figure SVF201-1. The dummy resistive load placed in parallel to the UUT should be sized to draw three times the steady state current of the

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UUT. Note: This is done to ensure that the UUT test does not lose stored energy to other aircraft loads during power interrupts. Measurements, except current, must be made within 10 cm of the input power terminals of the UUT.

5. Compliance test. With the power source off, install the UUT and the stimulation and monitoring equipment into the test setup of figure SVF201-1. Turn on the power source and adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Energize the UUT. Allow sufficient time for the UUT to warm up. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions.

For each test condition A through K noted in table SVF201-II, adjust the voltage to the steady state voltage listed. Perform a power interrupt (0 V) of the duration listed. The voltage must decrease from the steady state voltage to 0 Volts within  $\frac{1}{2}$  cycle, remain at 0 Volts for the duration listed for the test condition, and return from 0 Volts to the Steady State voltage within  $\frac{1}{2}$  cycle. For test condition J, three 50 milliseconds power interrupts are performed, separated by 0.5 seconds. For test condition K a normal overvoltage transient follows the power interrupt. The normal voltage transient is 160 Vrms for 30 milliseconds and returns to nominal voltage over the next 40 milliseconds. For test condition L a normal undervoltage transient follows the power interrupt. The normal voltage transient is 70 Vrms for 30 milliseconds and returns to nominal voltage over the next 40 milliseconds. For each test condition, monitoring the performance of the UUT according to the utilization equipment performance test procedures for power transfer operation to verify that the UUT is providing specified performance for transfer aircraft electrical conditions. After the power returns to normal limits, conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT is providing the performance specified for normal aircraft electrical conditions (if the UUT is allowed degraded performance during power interrupts, verify the UUT has automatically returned to the performance specified for normal aircraft electrical conditions, and has not suffered damage). Record the steady state voltage, steady state frequency, time duration of power interrupts, and the performance of the UUT for each test condition in the data sheet shown in table SVF201-III. Repeat each test condition 5 times. Repeat for each mode of operation of the UUT. Repeat the testing at a steady state frequency of 360 Hz, 600 Hz, and 800 Hz.

After all test conditions are complete, adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to confirm that the UUT has not suffered damage and is providing specified performance for normal aircraft electrical conditions.

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TABLE SVF201-II. Test conditions for transfer interrupt for single phase, variable frequency utilization equipment.

Test Condition	Steady State Voltage	Duration of Interrupt
A	Nominal Voltage	50 msec
B	NLSS Voltage	50 msec
C	NHSS Voltage	50 msec
D	Nominal Voltage	30 msec
E	NLSS Voltage	30 msec
F	NHSS Voltage	30 msec
G	Nominal Voltage	10 msec
H	NLSS Voltage	10 msec
I	NHSS Voltage	10 msec
J	Nominal Voltage	50 msec (repeated 3 times, separated by 0.5 sec )
K	Nominal Voltage	50 msec (followed by a normal voltage transient of 160 Vrms for 30 msec and return to steady state voltage in 40 msec)
L	Nominal Voltage	50 msec (followed by a normal voltage transient of 70 Vrms for 30 msec and return to steady state voltage in 40 msec)

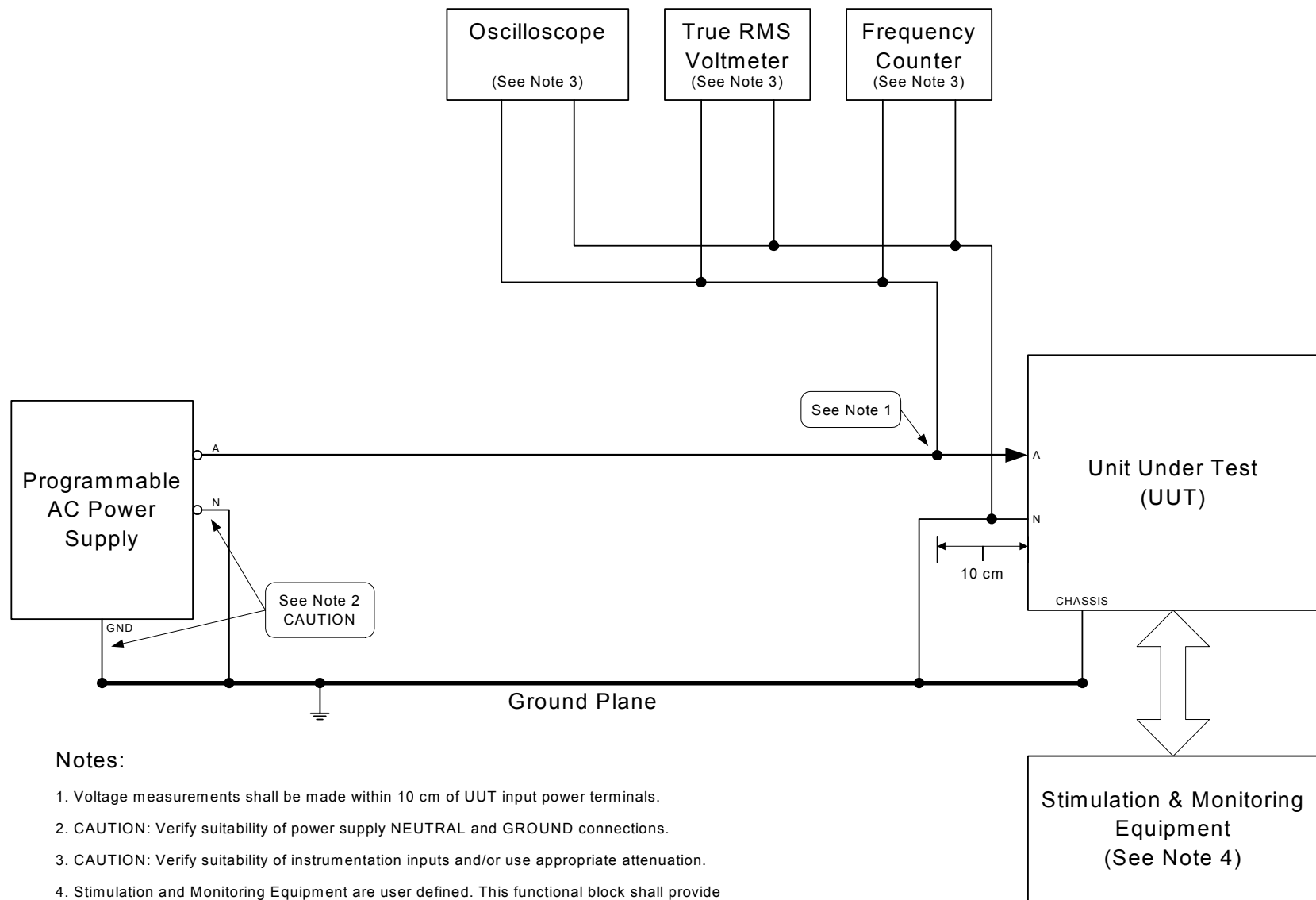
FIGURE SVF201-1. Power interrupt.

TABLE SVF201-III. Sample data sheet for SVF201 power interrupt for single phase, variable frequency utilization equipment.

Test Condition	Parameter						Performance
	Voltage		Frequency		Time Duration of Power Interrupt		Pass/Fail
Testing performed at <b>400 Hz</b>							
A		V <sub>rms</sub>		Hz		msec	
B		V <sub>rms</sub>		Hz		msec	
C		V <sub>rms</sub>		Hz		msec	
D		V <sub>rms</sub>		Hz		msec	
E		V <sub>rms</sub>		Hz		msec	
F		V <sub>rms</sub>		Hz		msec	
G		V <sub>rms</sub>		Hz		msec	
H		V <sub>rms</sub>		Hz		msec	
I		V <sub>rms</sub>		Hz		msec	
J		V <sub>rms</sub>		Hz		msec	
K		V <sub>rms</sub>		Hz		msec	
	Voltage Transient Level				Time at Voltage Transient Level		
		V <sub>rms</sub>				msec	
L		V <sub>rms</sub>		Hz		msec	
	Voltage Transient Level				Time at Voltage Transient Level		
		V <sub>rms</sub>				msec	

TABLE SVF201-III. Sample data sheet for SVF201 power interrupt for single phase, variable frequency utilization equipment. -  
Continued

Test Condition	Parameter						Performance
	Voltage		Frequency		Time Duration of Power Interrupt		Pass/Fail
Testing performed at <b>360 Hz</b>							
A		V <sub>rms</sub>		Hz		msec	
B		V <sub>rms</sub>		Hz		msec	
C		V <sub>rms</sub>		Hz		msec	
D		V <sub>rms</sub>		Hz		msec	
E		V <sub>rms</sub>		Hz		msec	
F		V <sub>rms</sub>		Hz		msec	
G		V <sub>rms</sub>		Hz		msec	
H		V <sub>rms</sub>		Hz		msec	
I		V <sub>rms</sub>		Hz		msec	
J		V <sub>rms</sub>		Hz		msec	
K		V <sub>rms</sub>		Hz		msec	
	Voltage Transient Level				Time at Voltage Transient Level		
		V <sub>rms</sub>				msec	
L		V <sub>rms</sub>		Hz		msec	
	Voltage Transient Level				Time at Voltage Transient Level		
		V <sub>rms</sub>				msec	



TABLE SVF201-III. Sample data sheet for SVF201 power interrupt for single phase, variable frequency utilization equipment. -  
Continued

Test Condition	Parameter						Performance
	Voltage		Frequency		Time Duration of Power Interrupt		Pass/Fail
Testing performed at <b>600 Hz</b>							
A		V <sub>rms</sub>		Hz		msec	
B		V <sub>rms</sub>		Hz		msec	
C		V <sub>rms</sub>		Hz		msec	
D		V <sub>rms</sub>		Hz		msec	
E		V <sub>rms</sub>		Hz		msec	
F		V <sub>rms</sub>		Hz		msec	
G		V <sub>rms</sub>		Hz		msec	
H		V <sub>rms</sub>		Hz		msec	
I		V <sub>rms</sub>		Hz		msec	
J		V <sub>rms</sub>		Hz		msec	
K		V <sub>rms</sub>		Hz		msec	
	Voltage Transient Level				Time at Voltage Transient Level		
		V <sub>rms</sub>				msec	
L		V <sub>rms</sub>		Hz		msec	
	Voltage Transient Level				Time at Voltage Transient Level		
		V <sub>rms</sub>				msec	

TABLE SVF201-III. Sample data sheet for SVF201 power interrupt for single phase, variable frequency utilization equipment. -  
Continued

Test Condition	Parameter						Performance
	Voltage		Frequency		Time Duration of Power Interrupt		Pass/Fail
Testing performed at <b>800 Hz</b>							
A		V <sub>rms</sub>		Hz		msec	
B		V <sub>rms</sub>		Hz		msec	
C		V <sub>rms</sub>		Hz		msec	
D		V <sub>rms</sub>		Hz		msec	
E		V <sub>rms</sub>		Hz		msec	
F		V <sub>rms</sub>		Hz		msec	
G		V <sub>rms</sub>		Hz		msec	
H		V <sub>rms</sub>		Hz		msec	
I		V <sub>rms</sub>		Hz		msec	
J		V <sub>rms</sub>		Hz		msec	
K		V <sub>rms</sub>		Hz		msec	
	Voltage Transient Level				Time at Voltage Transient Level		
		V <sub>rms</sub>				msec	
L		V <sub>rms</sub>		Hz		msec	
	Voltage Transient Level				Time at Voltage Transient Level		
		V <sub>rms</sub>				msec	

## MIL-HDBK-704-4

**METHOD SVF301**  
**Abnormal Steady State Limits for Voltage and Frequency**

POWER GROUP: Single Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL  
 OPERATING CONDITION: Abnormal

PARAMETER: Abnormal Steady State Limits for Voltage and Frequency

1. Scope.

1.1 Purpose. This test procedure is used to verify that single phase, 115 Volt, variable frequency power utilization equipment operates and maintains specified performance when provided power with voltage and frequency at the Abnormal Low Steady State (ALSS) limits and the Abnormal High Steady State (AHSS) limits as specified in the applicable edition(s) of MIL-STD-704.

2. Validation criteria. The utilization equipment is considered to have passed if the utilization equipment operates and maintains performance as specified in the utilization equipment performance specification document for abnormal aircraft electrical conditions when supplied input power of voltage and frequency at the specified abnormal steady state limits of the applicable edition(s) of MIL-STD-704 and as noted in table SVF301-I. The utilization equipment must maintain specified performance for a length of time that confirms the utilization equipment can continuously operate at the abnormal steady state voltage and frequency limits and should be, not less than thirty (30) minutes for each of the test conditions. Unless otherwise specified in the utilization equipment performance specification document, the utilization equipment must demonstrate re-start at the abnormal steady state voltage and frequency limits. Unless otherwise specified in the utilization equipment performance specification document, the utilization equipment must automatically return to the performance specified for normal aircraft electrical conditions when the power returns to within normal limits. The utilization equipment must not suffer damage or cause an unsafe condition.

TABLE SVF301-I. MIL-STD-704 abnormal limits for steady state voltage and frequency for single phase, variable frequency utilization equipment.

Abnormal Limit	704A	704B	704C	704D	704E	704F
Voltage ALSS	N/A	N/A	N/A	N/A	N/A	100 V
Voltage AHSS	N/A	N/A	N/A	N/A	N/A	125 V
Frequency ALSS	N/A	N/A	N/A	N/A	N/A	360 Hz
Frequency AHSS	N/A	N/A	N/A	N/A	N/A	800 Hz

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3. Apparatus. The test equipment should be as follows:
  - a. Adjustable AC power supply
  - b. True RMS voltmeter
  - c. Frequency counter
4. Test setup. Configure the test setup as shown in figure SVF301-1. Measurements, except current, must be made within 10 cm of the input power terminals of the UUT.
5. Compliance test. With the power source off, install the UUT and the stimulation and monitoring equipment into the test setup of figure SVF301-1. Turn on the power source and adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Energize the UUT. Allow sufficient time for the UUT to warm up. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions.

For each test condition A through H noted in table SVF301-II, the UUT must remain for a length of time that confirms the utilization equipment can perform as specified at the abnormal steady state voltage and frequency limits and should be, not less than thirty (30) minutes. At each test condition conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT is providing specified performance for abnormal aircraft electrical conditions. For each test condition shut down the UUT and verify that the UUT can be re-started. After re-start conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT is providing specified performance for abnormal aircraft electrical conditions. Adjust the voltage to the nominal steady state voltage of 115 Vrms and adjust the frequency to the steady state frequency of the test condition. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to confirm that the UUT has automatically returned to the performance specified for normal aircraft electrical conditions, and has not suffered damage. Record the voltage, frequency, time duration at test condition, successful/unsuccessful re-start and the performance of the UUT for each test condition in the data sheet shown in table SVF301-III. Repeat for each mode of operation of the UUT.

After all test conditions are complete, adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to confirm that the UUT has not suffered damage and is providing specified performance for normal aircraft electrical conditions.

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TABLE SVF301-II. Test conditions for abnormal steady state limits of voltage and frequency for single phase, variable frequency utilization equipment.

Test Condition	Voltage	Frequency
Balanced Voltages		
A	100 V	400 Hz
B	100 V	360 Hz
C	100 V	600 Hz
D	100 V	800 Hz
E	125 V	400 Hz
F	125 V	360 Hz
G	125 V	600 Hz
H	125 V	800 Hz

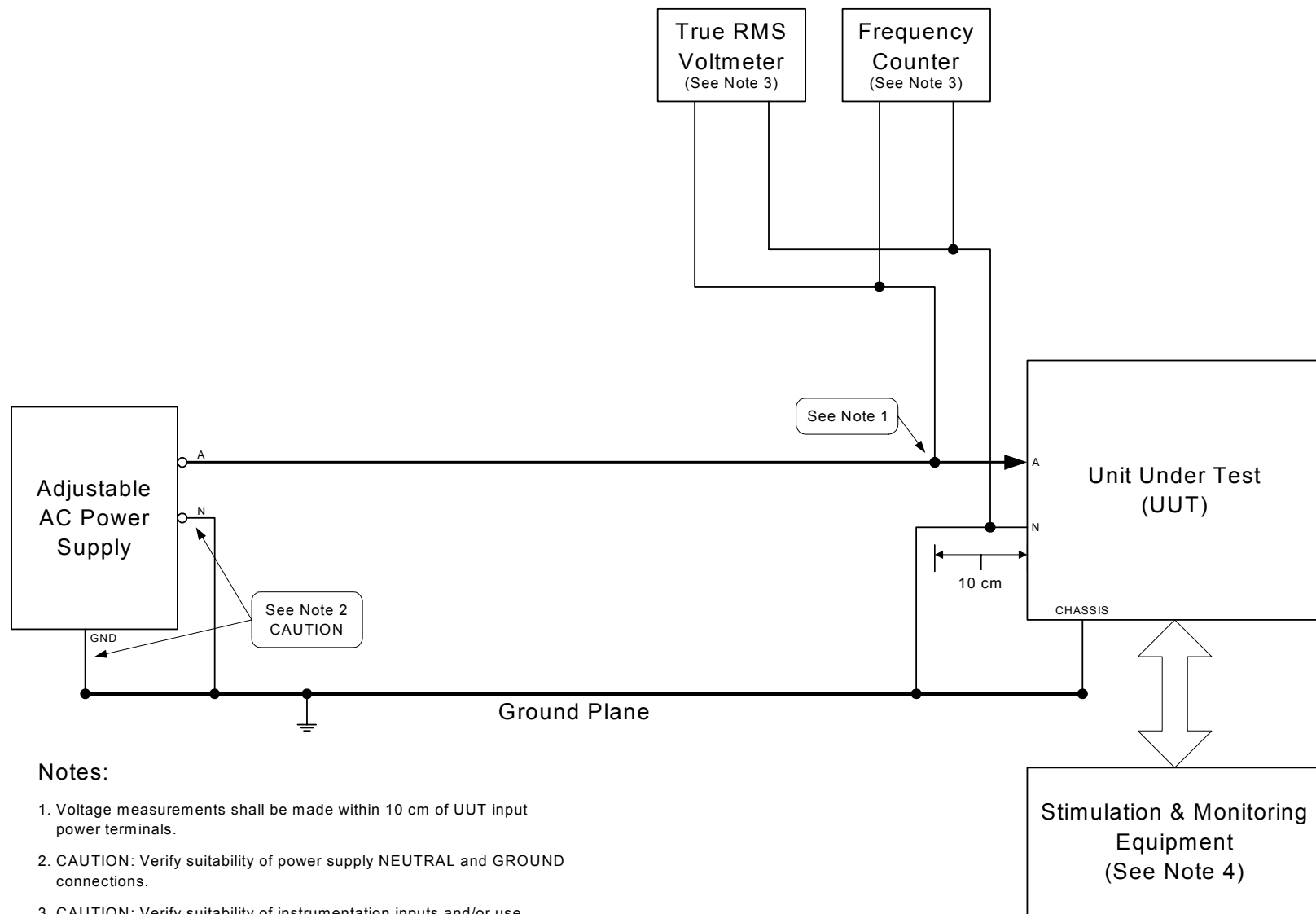
FIGURE SVF301-1. Abnormal steady state limits for voltage and frequency.

TABLE SVF301-III. Sample data sheet for SVF301 abnormal steady state limits for voltage and frequency for single phase, variable frequency utilization equipment.

Test Condition	Parameter						Performance
	Voltage		Frequency		Time Duration at Test Condition		Pass/Fail
A		V <sub>rms</sub>		Hz		min	
B		V <sub>rms</sub>		Hz		min	
C		V <sub>rms</sub>		Hz		min	
D		V <sub>rms</sub>		Hz		min	
E		V <sub>rms</sub>		Hz		min	
F		V <sub>rms</sub>		Hz		min	
G		V <sub>rms</sub>		Hz		min	
H		V <sub>rms</sub>		Hz		min	

## MIL-HDBK-704-4

# **METHOD SVF302**

## **Abnormal Voltage Transients**

POWER GROUP: Single Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL  
OPERATING CONDITION: Abnormal

PARAMETER: Abnormal Voltage Transients

### 1. Scope.

1.1 Purpose. This test procedure is used to verify that single phase, 115 Volt, variable frequency power utilization equipment operates and maintains specified performance when subjected to abnormal voltage transients as specified in the applicable edition(s) of MIL-STD-704.

2. Validation criteria. The utilization equipment is considered to have passed if the utilization equipment operates and maintains performance as specified in the utilization equipment performance specification document for abnormal aircraft electrical conditions when subjected to voltage transients within the abnormal limits of the applicable edition(s) of MIL-STD-704 and as noted in table SVF302-I. Unless otherwise specified in the utilization equipment performance specification document, the utilization equipment must automatically return to the performance specified for normal aircraft electrical conditions when the power returns to within normal limits. The utilization equipment must not suffer damage or cause an unsafe condition.

TABLE SVF302-I. MIL-STD-704 limits for abnormal voltage transients for single phase, variable frequency utilization equipment.

Limit	704A	704B	704C	704D	704E	704F
Abnormal Voltage Transients	N/A	N/A	N/A	N/A	N/A	figure 4 MIL-STD-704F

3. Apparatus. The test equipment should be as follows:

- a. Programmable AC power supply
- b. True RMS voltmeter
- c. Frequency counter
- d. Oscilloscope

4. Test setup. Configure the test setup as shown in figure SVF302-1. Measurements, except current, must be made within 10 cm of the input power terminals of the UUT.

5. Compliance test. With the power source off, install the UUT and the stimulation and monitoring equipment into the test setup of figure SVF302-1. Turn on the power source and adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the



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frequency to a steady state frequency of 400 Hz. Energize the UUT. Allow sufficient time for the UUT to warm up. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions.

The UUT must be subjected to the voltage transients for each test condition A through O noted in table SVF302-II. The voltage must increase or decrease from steady state voltage to the voltage transient level within  $\frac{1}{2}$  cycle. The voltage must remain at the voltage transient level for the duration noted in table SVF302-II. The voltage must return to steady state over the time duration noted in table SVF302-II. For test condition G, three over-voltage transients of 180 Vrms for 20 milliseconds are performed, separated by 0.5 seconds. For test condition N, three under-voltage transients of 45 Vrms for 20 milliseconds are performed, separated by 0.5 seconds. For test condition O, an under-voltage transient of 45 Vrms for 20 milliseconds is immediately followed by an overvoltage transient of 180 Vrms for 50 milliseconds and the voltage returns to steady state over the time duration noted. For each test condition, monitor the performance of the UUT during the voltage transient according to the equipment performance test procedures to verify that the UUT is providing specified performance for abnormal aircraft electrical conditions. Repeat each test condition 5 times. After the power returns to normal limits, conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT automatically returns to specified performance for normal aircraft electrical conditions when the power returns to within normal limits, and has not suffered damage. Record the steady state voltage, steady state frequency, voltage transient level, time duration at voltage transient, oscilloscope trace, and the performance of the UUT for each test condition in the data sheet shown in table SVF302-III. Repeat for each mode of operation of the UUT. Repeat the testing at a steady state frequency of 360 Hz, 600 Hz, and 800 Hz.

After all test conditions are complete, adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to confirm that the UUT has not suffered damage and is providing specified performance for normal aircraft electrical conditions.

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TABLE SVF302-II. Test conditions for abnormal voltage transients for single phase, variable frequency utilization equipment.

Test Condition	Time From Steady State Voltage to Voltage Transient Level milliseconds	Voltage Transient Level Vrms	Duration at Voltage Transient Level milliseconds	Time From Voltage Transient Level to Steady State Voltage or Next Voltage Level
Overvoltage Transients				
A	< ½ cycle	140 Vrms	180 msec	< ½ cycle
B	< ½ cycle	140 Vrms	180 msec	87 msec
	then	135 Vrms	decreasing	253 msec
	then	130 Vrms	decreasing	6.41 sec
	then	125 Vrms	decreasing	30 sec
		115 Vrms		
C	< ½ cycle	160 Vrms	78 msec	< ½ cycle
D	< ½ cycle	160 Vrms	78 msec	31 msec
	then	150 Vrms	decreasing	71 msec
	then	140 Vrms	decreasing	87 msec
	then	135 Vrms	decreasing	253 msec
	then	130 Vrms	decreasing	6.41 sec
	then	125 Vrms	decreasing	30 sec
		115 Vrms		
E	< ½ cycle	180 Vrms	50 msec	< ½ cycle
F	< ½ cycle	180 Vrms	50 msec	11 msec
	then	170 Vrms	decreasing	17 msec
	then	160 Vrms	decreasing	31 msec
	then	150 Vrms	decreasing	71 msec
	then	140 Vrms	decreasing	87 msec
	then	135 Vrms	decreasing	253 msec
	then	130 Vrms	decreasing	6.41 sec
	then	125 Vrms	decreasing	30 sec
		115 Vrms		
G	< ½ cycle	180 Vrms (3 times)	20 msec every 0.5 sec	< ½ cycle

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TABLE SVF302-II. Test conditions for abnormal voltage transients for single phase, variable frequency utilization equipment. - Continued

Test Condition	Time From Steady State Voltage to Voltage Transient Level milliseconds	Voltage Transient Level Vrms	Duration at Voltage Transient Level milliseconds	Time From Voltage Transient Level to Steady State Voltage or Next Voltage Level
<b>Undervoltage Transients</b>				
H	< ½ cycle	85 Vrms	180 msec	< ½ cycle
I	< ½ cycle	85 Vrms	180 msec	87 msec
	then	90 Vrms	increasing	253 msec
	then	95 Vrms	increasing	6.41 sec
	then	100 Vrms	increasing	30 sec
		115 Vrms		
J	< ½ cycle	66 Vrms	78 msec	< ½ cycle
K	< ½ cycle	65 Vrms	78 msec	31 msec
	then	75 Vrms	increasing	71 msec
	then	85 Vrms	increasing	87 msec
	then	90 Vrms	increasing	253 msec
	then	95 Vrms	increasing	6.41 sec
	then	100 Vrms	increasing	30 sec
		115 Vrms		
L	< ½ cycle	45 Vrms	50 msec	< ½ cycle
M	< ½ cycle	45 Vrms	50 msec	11 msec
	then	55 Vrms	increasing	17 msec
	then	65 Vrms	increasing	31 msec
	then	75 Vrms	increasing	71 msec
	then	85 Vrms	increasing	87 msec
	then	90 Vrms	increasing	253 msec
	then	95 Vrms	increasing	6.41 sec
	then	100 Vrms	increasing	30 sec
		115 Vrms		
N	< ½ cycle	45 Vrms (3 times)	20 msec every 0.5 sec	< ½ cycle
<b>Combined Transient</b>				
O	< ½ cycle	45 Vrms then	20 msec	< ½ cycle
	< ½ cycle	180 Vrms	50 msec	11 msec
	then	170 Vrms	decreasing	17 msec
	then	160 Vrms	decreasing	31 msec
	then	150 Vrms	decreasing	71 msec
	then	140 Vrms	decreasing	87 msec
	then	135 Vrms	decreasing	253 msec
	then	130 Vrms	decreasing	6.41 sec
	then	125 Vrms	decreasing	30 sec
		115 Vrms		

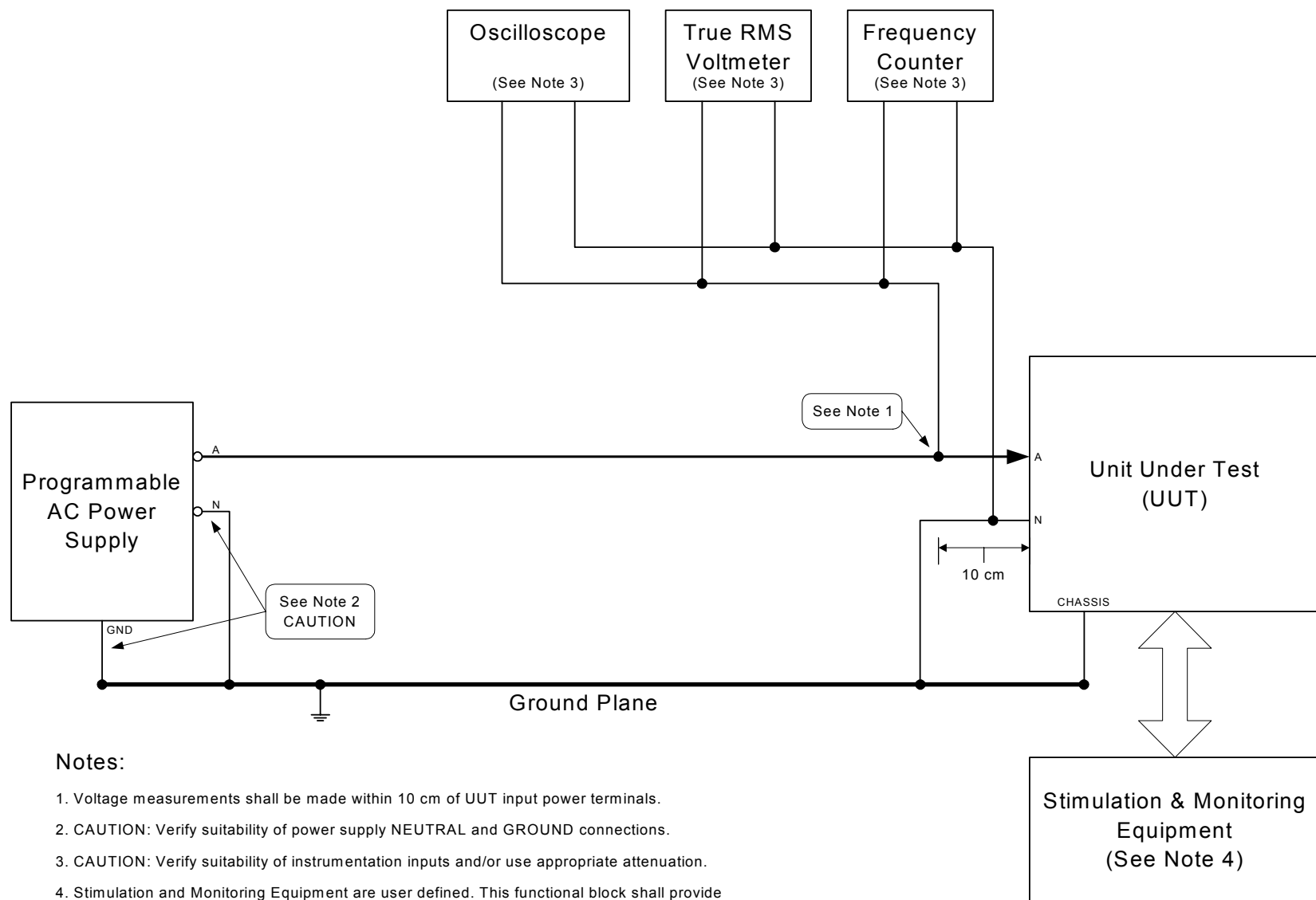
FIGURE SVF302-1. Abnormal voltage transients.

TABLE SVF302-III. Sample data sheet for SVF302 abnormal voltage transients for single phase, variable frequency utilization equipment.

Test Condition	Parameters									Performance	
	Steady State Voltage		Steady State Frequency		Voltage Transient		Time at Voltage Transient Level		Oscilloscope Trace	Pass/Fail	
Testing Performed at <b>400 Hz</b>											
A		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
B		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
C		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
D		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
E		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
F		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
G		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
H		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
I		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
J		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
K		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
L		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
M		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
N		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
O		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
						V <sub>rms</sub>		msec			

TABLE SVF302-III. Sample data sheet for SVF302 abnormal voltage transients for single phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters									Performance	
	Steady State Voltage		Steady State Frequency		Voltage Transient		Time at Voltage Transient Level		Oscilloscope Trace	Pass/Fail	
Testing Performed at <b>360 Hz</b>											
A		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
B		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
C		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
D		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
E		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
F		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
G		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
H		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
I		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
J		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
K		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
L		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
M		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
N		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
O		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
						V <sub>rms</sub>		msec			

TABLE SVF302-III. Sample data sheet for SVF302 abnormal voltage transients for single phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters									Performance	
	Steady State Voltage		Steady State Frequency		Voltage Transient		Time at Voltage Transient Level		Oscilloscope Trace		Pass/Fail
Testing Performed at <b>600 Hz</b>											
A		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
B		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
C		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
D		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
E		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
F		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
G		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
H		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
I		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
J		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
K		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
L		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
M		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
N		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
O		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
						V <sub>rms</sub>		msec			

TABLE SVF302-III. Sample data sheet for SVF302 abnormal voltage transients for single phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters									Performance	
	Steady State Voltage		Steady State Frequency		Voltage Transient		Time at Voltage Transient Level		Oscilloscope Trace		Pass/Fail
Testing Performed at <b>800 Hz</b>											
A		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
B		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
C		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
D		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
E		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
F		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
G		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
H		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
I		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
J		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
K		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
L		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
M		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
N		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
O		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	Attach Trace	V <sub>rms</sub> vs. Time	
						V <sub>rms</sub>		msec			



## MIL-HDBK-704-4

# **METHOD SVF303**

## **Abnormal Frequency Transients**

POWER GROUP: Single Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL  
OPERATING CONDITION: Abnormal

PARAMETER: Abnormal Frequency Transients

### 1. Scope.

1.1 Purpose. This test procedure is used to verify that single phase, 115 Volt, variable frequency power utilization equipment operates and maintains specified performance when subjected to abnormal frequency transients as specified in the applicable edition(s) of MIL-STD-704.

2. Validation criteria. The utilization equipment is considered to have passed if the utilization equipment operates and maintains performance as specified in the utilization equipment performance specification document for abnormal aircraft electrical conditions when subjected to frequency transients within the abnormal limits of the applicable edition(s) of MIL-STD-704 and as noted in table SVF303-I. Unless otherwise specified in the utilization equipment performance specification document, the utilization equipment must automatically return to the performance specified for normal aircraft electrical conditions when the power returns to within normal limits. The utilization equipment must not suffer damage or cause an unsafe condition.

TABLE SVF303-I. MIL-STD-704 limits for abnormal frequency transients for single phase, variable frequency utilization equipment.

Limit	704A	704B	704C	704D	704E	704F
Abnormal Frequency Transients	N/A	N/A	N/A	N/A	N/A	360 Hz to 800 Hz  Maximum Rate of Change of Frequency 500 Hz/sec

3. Apparatus. The test equipment should be as follows:

- a. Programmable AC power supply
- b. True RMS voltmeter
- c. Frequency counter
- d. Oscilloscope

4. Test setup. Configure the test setup as shown in figure SVF303-1. Measurements, except current, must be made within 10 cm of the input power terminals of the UUT.

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5. Compliance test. With the power source off, install the UUT and the stimulation and monitoring equipment into the test setup of figure SVF303-1. Turn on the power source and adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Energize the UUT. Allow sufficient time for the UUT to warm up. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT is providing specified performance for abnormal aircraft electrical conditions.

The UUT must be subjected to the frequency transients for each test condition A through I noted in table SVF303-II. The frequency must increase or decrease from the start frequency to the frequency transient level over the duration noted; the frequency must remain at the frequency transient level for the duration noted; and the frequency must return from the frequency transient level over the duration noted. For test condition E, an underfrequency transient is immediately followed by an overfrequency transient. For each test condition, monitor the performance of the UUT during the frequency transient according to the equipment performance test procedures to verify that the UUT is providing specified performance for abnormal aircraft electrical conditions. Repeat each test condition 5 times. After the power returns to start frequency, conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions, and has not suffered damage. Record the steady state voltage, start frequency, frequency transient level, time at frequency transient, oscilloscope trace (Hz vs. time), and the performance of the UUT for each test condition in the data sheet shown in table SVF303-III. Repeat for each mode of operation of the UUT.

After all test conditions are complete, adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to confirm that the UUT has not suffered damage and is providing specified performance for normal aircraft electrical conditions.

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TABLE SVF303-II. Test conditions for MIL-STD-704 abnormal frequency transients for single phase, variable frequency utilization equipment.

Test Condition	Start Frequency	Time From Start Frequency to Frequency Transient Level	Frequency Transient Level	Duration at Frequency Transient Level	Time From Frequency Transient Level to Start Frequency
Overfrequency Transients					
A	360 Hz	0.88 seconds	800 Hz	½ cycle	0.88 seconds
B	360 Hz	0.88 seconds	800 Hz	1second	0.88 seconds
C	360 Hz	0.48 seconds	600 Hz	½ cycle	0.48 seconds
D	360 Hz	0.48 seconds	600 Hz	1second	0.48 seconds
Underfrequency Transients					
E	800 Hz	0.88 seconds	360 Hz	½ cycle	0.88 seconds
F	800 Hz	0.88 seconds	360 Hz	1second	0.88 seconds
G	800 Hz	0.40 seconds	600 Hz	½ cycle	0.40 seconds
H	800 Hz	0.40 seconds	600 Hz	1second	0.40 seconds
Combined Transient					
I	600 Hz	0.48 seconds then 0.40 seconds	360 Hz 800 Hz	½ cycle ½ cycle	0.48 seconds 0.40 seconds

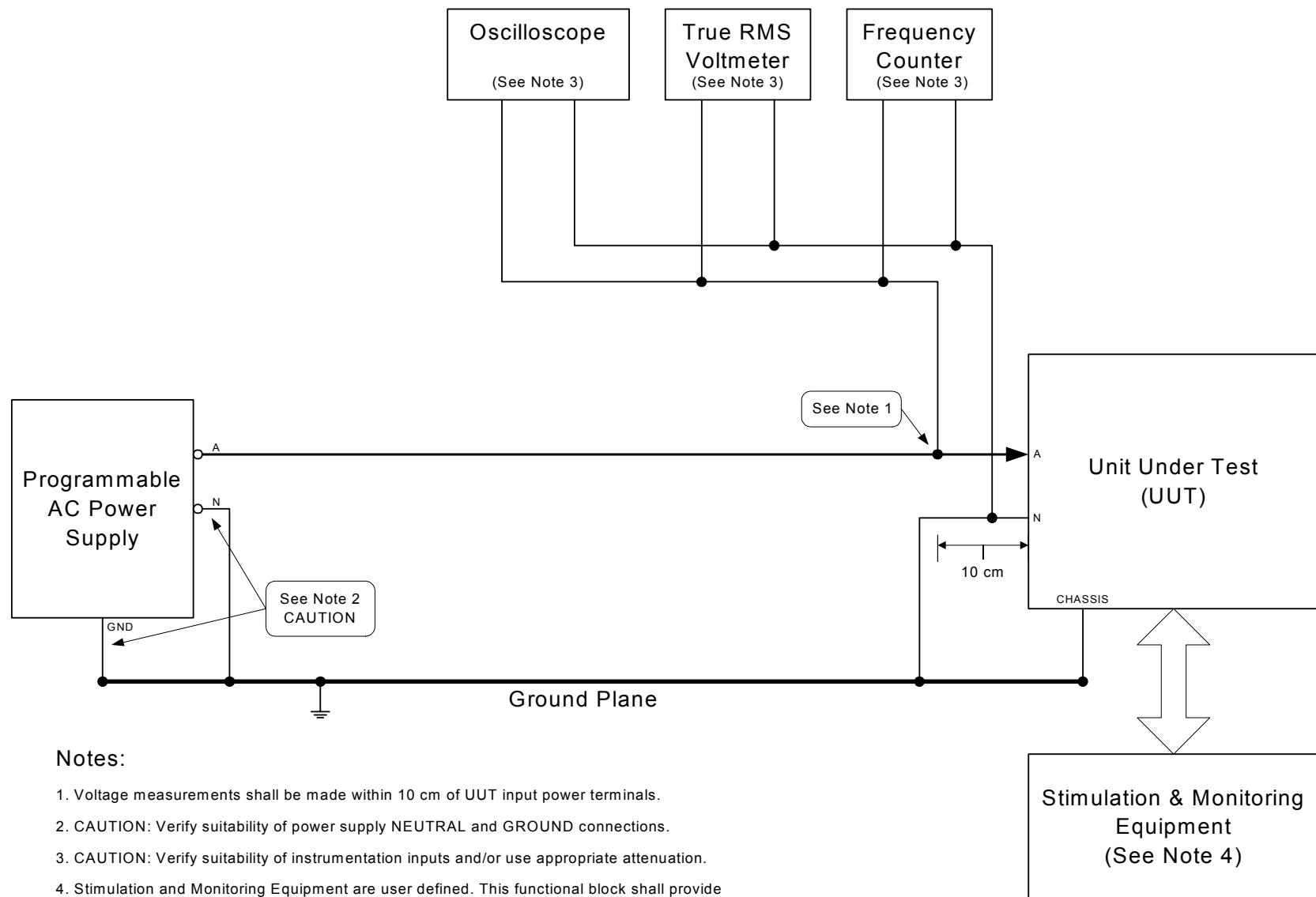
FIGURE SVF303-1. Abnormal frequency transients.

TABLE SVF303-III. Sample data sheet for SVF303 abnormal frequency transients for single phase, variable frequency utilization equipment.

Test Condition	Parameters										Performance
	Steady State Voltage		Start Frequency		Frequency Transient		Time at Frequency Transient Level		Steady State Voltage		Pass/Fail
A		V <sub>rms</sub>		Hz		Hz		msec	Attach Trace	Hz vs. Time	
B		V <sub>rms</sub>		Hz		Hz		msec	Attach Trace	Hz vs. Time	
C		V <sub>rms</sub>		Hz		Hz		msec	Attach Trace	Hz vs. Time	
D		V <sub>rms</sub>		Hz		Hz		msec	Attach Trace	Hz vs. Time	
E		V <sub>rms</sub>		Hz		Hz		msec	Attach Trace	Hz vs. Time	
F		V <sub>rms</sub>		Hz		Hz		msec	Attach Trace	Hz vs. Time	
G		V <sub>rms</sub>		Hz		Hz		msec	Attach Trace	Hz vs. Time	
H		V <sub>rms</sub>		Hz		Hz		msec	Attach Trace	Hz vs. Time	
I		V <sub>rms</sub>		Hz		Hz		msec	Attach Trace	Hz vs. Time	
						Hz		msec			

## MIL-HDBK-704-4

**METHOD SVF401**  
**Emergency Steady State Limits for Voltage and Frequency**

POWER GROUP: Single Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL  
 OPERATING CONDITION: Emergency

PARAMETER: Emergency Steady State Limits for Voltage and Frequency

1. Scope.

1.1 Purpose. This test procedure is used to verify that single phase, 115 Volt, variable frequency power utilization equipment operates and maintains specified performance when provided power with voltage and frequency at that the Emergency Low Steady State (ELSS) limits and the Emergency High Steady State (EHSS) limits as specified in the applicable edition(s) of MIL-STD-704.

2. Validation criteria. For MIL-STD-704F, the single phase, 115 Volt, variable frequency power utilization equipment normal steady state limits are the same as the emergency steady state limits. The emergency steady state limits for single phase, 115 Volt, variable frequency equipment are noted in table SVF401-I. Performance of test method SVF102 will constitute performance of test method SVF401,

TABLE SVF401-I. MIL-STD-704 emergency limits for steady state voltage and frequency for single phase, variable frequency utilization equipment.

Emergency Limit	704A	704B	704C	704D	704E	704F
Voltage ELSS	N/A	N/A	N/A	N/A	N/A	108 V
Voltage EHSS	N/A	N/A	N/A	N/A	N/A	118 V
Frequency ELSS	N/A	N/A	N/A	N/A	N/A	360 Hz
Frequency EHSS	N/A	N/A	N/A	N/A	N/A	800 Hz

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**METHOD SVF501**  
**(No Tests)**

POWER GROUP: Single Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL  
OPERATING CONDITION: Starting

PARAMETER: No Tests

Starting operations are usually not applicable to AC utilization equipment.

## MIL-HDBK-704-4

**METHOD SVF601**  
**Power Failure**

POWER GROUP: Single Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL  
OPERATING CONDITION: Power Failure

PARAMETER: Power Failure

1. Scope.

1.1 Purpose. This test procedure is used to verify that single phase, 115 Volt, variable frequency power utilization equipment operates and maintains specified performance when subjected to power failures as specified in the applicable edition(s) of MIL-STD-704.

2. Validation criteria. The utilization equipment is considered to have passed if the utilization equipment operates and maintains performance as specified in the utilization equipment performance specification document for power failure aircraft electrical conditions when subjected to power failures as specified by the applicable edition(s) of MIL-STD-704 and as noted in table SVF601-I. The utilization equipment must maintain the specified performance during the power failures. Unless otherwise specified in the utilization equipment performance specification document, the utilization equipment must automatically return to the performance specified for normal aircraft electrical conditions when the power returns to within normal limits. The utilization equipment must not suffer damage or cause an unsafe condition.

TABLE SVF601-I. MIL-STD-704 power failure limits for single phase, variable frequency utilization equipment.

Limit	704A	704B	704C	704D	704E	704F
Power Failure	N/A	N/A	N/A	N/A	N/A	7 sec figure 4 MIL-STD- 704F

3. Apparatus. The test equipment should be as follows:

- a. Programmable AC power supply
- b. True RMS voltmeter
- c. Frequency counter
- d. Oscilloscope

4. Test setup. Configure the test setup as shown in figure SVF601-1. Measurements, except current, must be made within 10 cm of the input power terminals of the UUT.

5. Compliance test. With the power source off, install the UUT and the stimulation and monitoring equipment into the test setup of figure SVF601-1. Turn on the power source and



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adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Energize the UUT. Allow sufficient time for the UUT to warm up. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to verify that the UUT is providing specified performance for normal aircraft electrical conditions.

For each test condition A through D noted in table SVF601-II, perform a power failure (0 V) of the duration listed. The voltage must decrease from the steady state voltage to 0 Volts within  $\frac{1}{2}$  cycle, remain at 0 Volts for the duration listed for the test condition, and return from 0 Volts to the steady state voltage within  $\frac{1}{2}$  cycle. For each test condition, monitor the performance of the UUT according to the utilization equipment performance test procedures for power failure operation to verify that the UUT is providing specified performance for power failure aircraft electrical conditions. After the power returns to normal limits, conduct a performance test of the UUT according to the utilization equipment performance test procedures to confirm that the UUT has automatically returned to the performance specified for normal aircraft electrical conditions, and has not suffered damage. Record the steady state voltage, steady state frequency, time duration of power failure, and the performance of the UUT for each test condition in the data sheet shown in table SVF601-III. Repeat each test condition 5 times. Repeat for each mode of operation of the UUT. Repeat the testing at a steady state frequency of 360 Hz, 600 Hz, and 800 Hz.

After all test conditions are complete, adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to a steady state frequency of 400 Hz. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to confirm that the UUT has not suffered damage and is providing specified performance for normal aircraft electrical conditions.

TABLE SVF601-II. Test conditions for power failures for single phase, variable frequency utilization equipment.

Test Condition	Duration of Power Failure
A	100 msec
B	500 msec
C	3 seconds
D	7 seconds

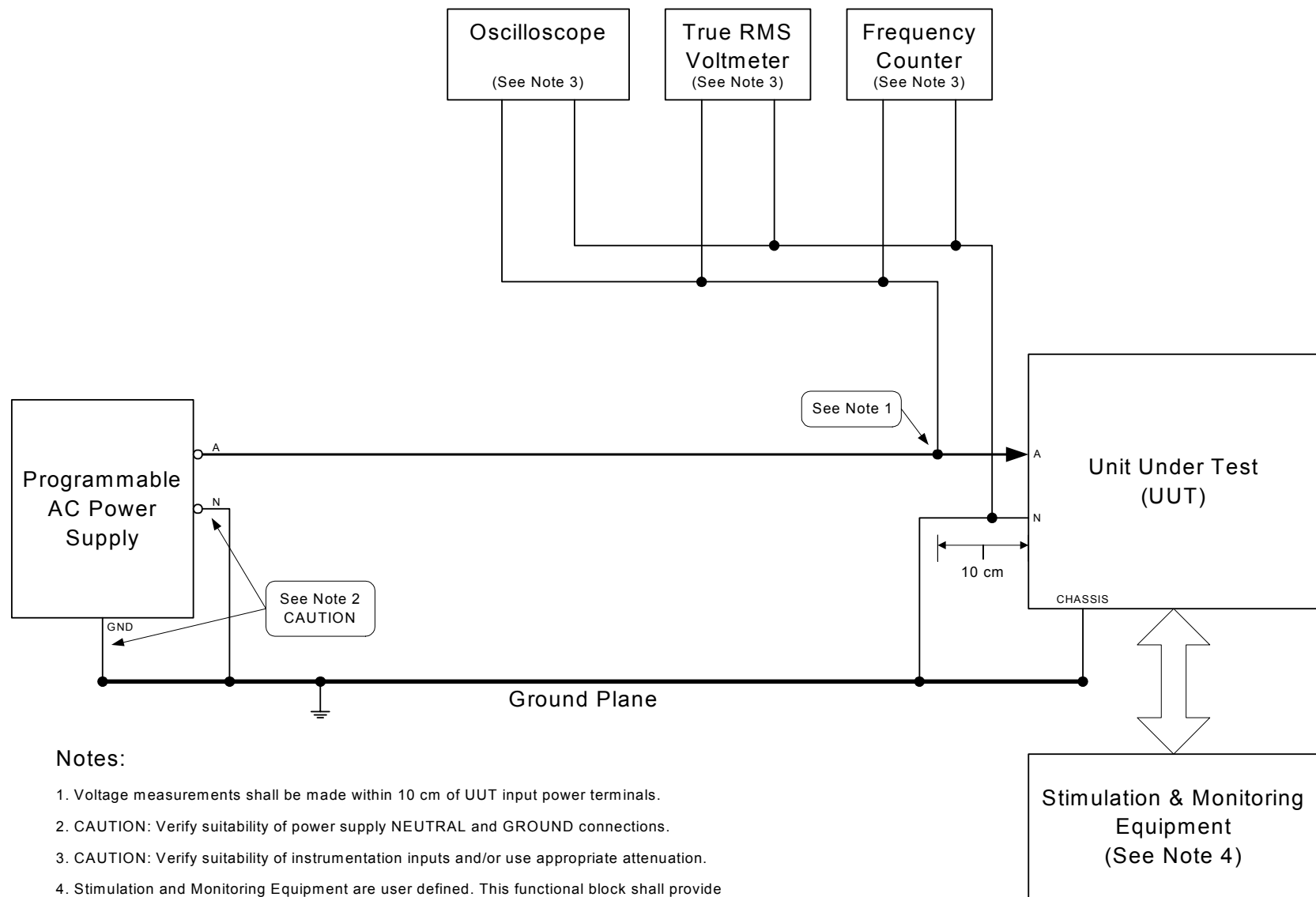
FIGURE SVF601-1. Power failure.

TABLE SVF601-III. Sample data sheet for SVF601 power failure (three phase) for single phase, variable frequency utilization equipment.

Test Condition	Parameters								Performance
	Steady State Voltage		Steady State Frequency		Voltage during Power Failure		Time Duration of Power Failure		Pass/Fail
Testing Performed at 400 Hz									
A		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	
B		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	
C		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	
D		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	
Testing Performed at 360 Hz									
A		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	
B		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	
C		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	
D		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	
Testing Performed at 600 Hz									
A		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	
B		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	
C		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	
D		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	
Testing Performed at 800 Hz									
A		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	
B		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	
C		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	
D		V <sub>rms</sub>		Hz		V <sub>rms</sub>		msec	

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**METHOD SVF602**  
**(No Test Required)**

POWER GROUP: Single Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL  
OPERATING CONDITION: Power Failure

PARAMETER: No Test Required.  
Test number SVF602 is not used so that the Single Phase, Variable Frequency, 115 V (SVF) test numbers coincide with the Three Phase, Variable Frequency, 115 V (TVF) test sequence numbers.

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**METHOD SVF603**  
**Phase Reversal**

POWER GROUP: Single Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL  
OPERATING CONDITION: Power Failure

PARAMETER: Phase Reversal

1. Scope.

1.1. Purpose. This test procedure is used to verify that single phase, 115 Volt, variable frequency power utilization equipment is not damaged by phase reversal or a positive physical means is employed to prevent phase reversal.

2. Validation criteria. The utilization equipment is considered to have passed if the utilization equipment is not damaged and does not cause an unsafe condition when the input phase sequence is reversed for the applicable edition(s) of MIL-STD-704 and as noted in table SVF603-I. A positive physical means to prevent phase sequence reversal may be used to fulfill this requirement.

TABLE SCF603-I. MIL-STD-704 phase sequence reversal requirement for single phase, variable frequency utilization equipment.

Limit	704A	704B	704C	704D	704E	704F
Phase Reversal	N/A	N/A	N/A	N/A	N/A	Phase Sequence Reversal Does not Cause Damage

3. Apparatus. The test equipment should be as follows:

- a. Adjustable AC power supply
- b. True RMS voltmeter
- c. Frequency counter

4. Test setup. Configure the test setup as shown in figure SVF603-1. Measurements, except current, must be made within 10 cm of the input power terminals of the UUT.

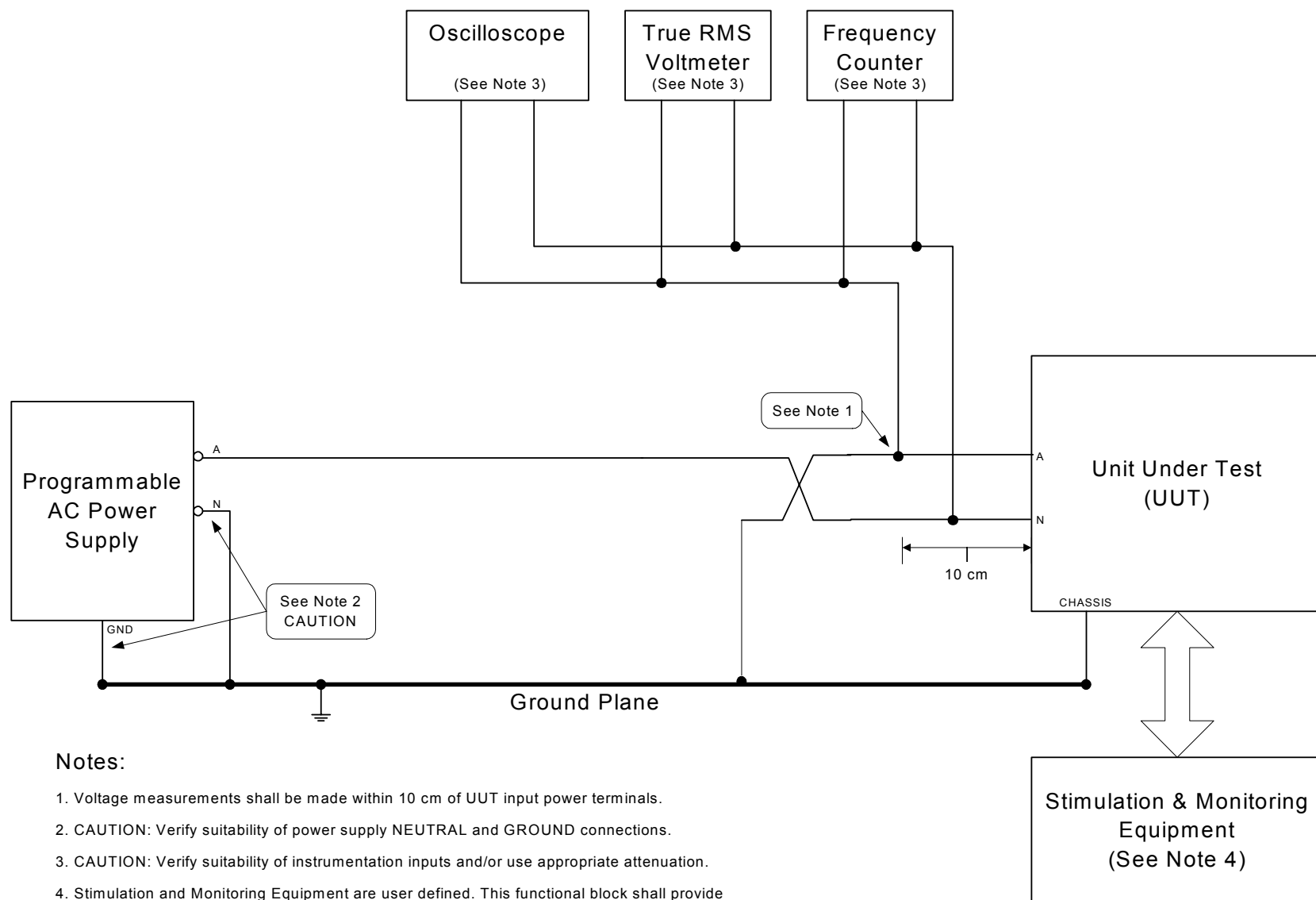
5. Compliance test. If a positive physical means is employed to prevent phase reversal, confirm that the line and neutral conductor cannot be reversed.

If the line and neutral conductor can be reversed, with the power source off, install the UUT and the stimulation and monitoring equipment into the test setup of figure SVF603-1 (line and

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neutral conductors reversed). Turn on the power source and adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to the nominal steady state frequency of 400 Hz. Energize the UUT. The UUT must remain for a length of time that confirms the utilization equipment is not damaged and does not cause an unsafe condition due to phase reversal and should be, not less than thirty (30) minutes. Record the steady state voltage, steady state frequency, time duration at phase reversal test condition, and the performance of the UUT in the data sheet shown in table SVF603-II. Repeat for each mode of operation of the UUT. Repeat the testing at a steady state frequency of 360 Hz, 600 Hz, and 800 Hz.

With the power source off, install the UUT and the stimulation and monitoring equipment into the test setup of figure SVF603-2 (line and neutral conductors connected properly). Turn on the power source and adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the frequency to the nominal steady state frequency of 400 Hz. Energize the UUT. The UUT must remain for a length of time that confirms the utilization equipment was not damaged and does not cause an unsafe condition after the phase reversal and should be not less than thirty (30) minutes. Conduct a performance test of the UUT according to the utilization equipment performance test procedures to confirm that the UUT has returned to the performance specified for normal aircraft electrical conditions and has not suffered damage. Record the steady state voltage, steady state frequency, time duration at test condition, and the performance of the UUT in the data sheet shown in table SVF603-II. Repeat for each mode of operation of the UUT.

FIGURE SVF603-1. Phase reversal.

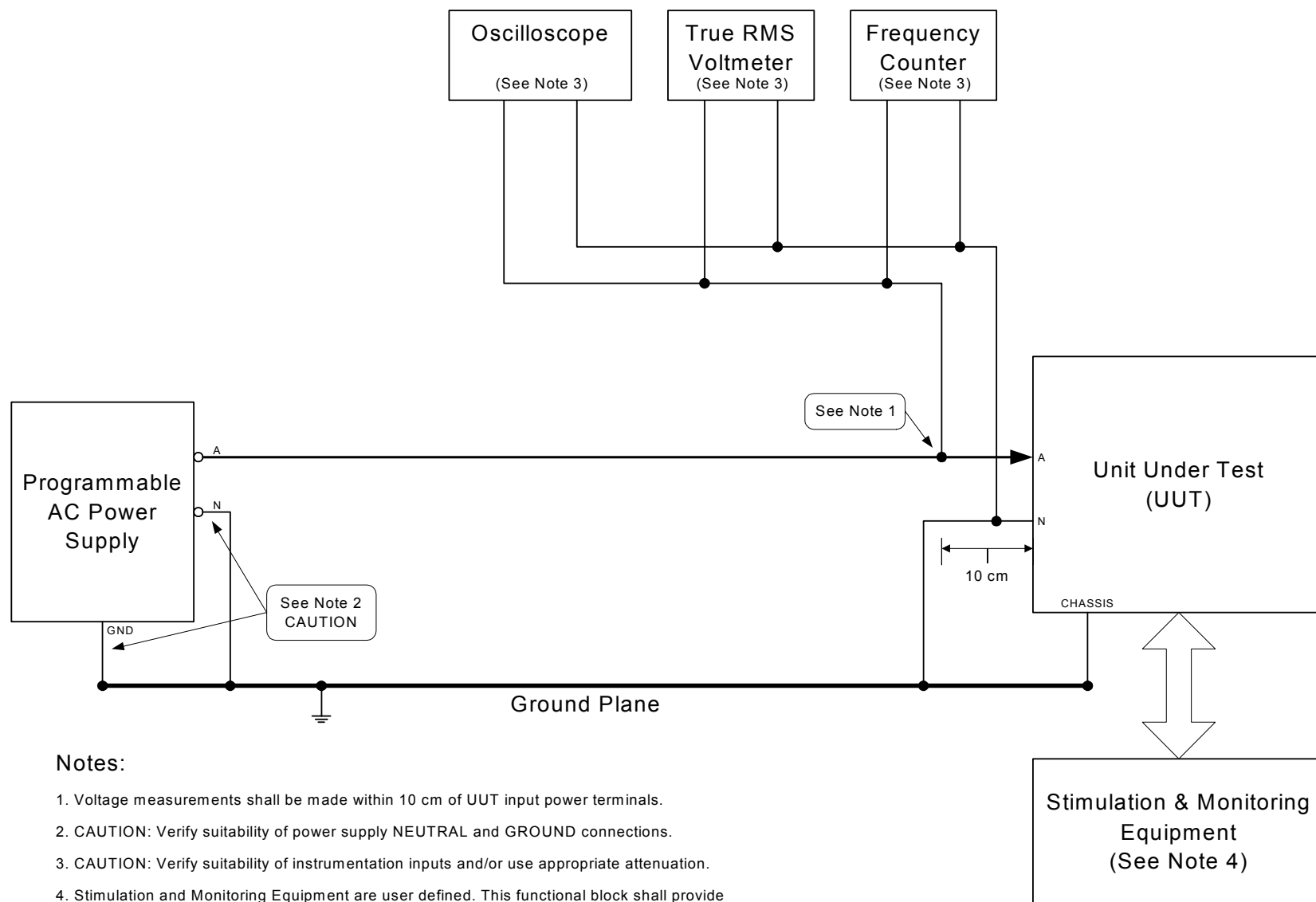
FIGURE SVF603-2. Correct phase connection.



TABLE SVF603-II. Sample data sheet for SVF603 phase sequence reversal for single phase, variable frequency utilization equipment.

Test Condition	Parameters						Performance
							Yes/No
Phase Sequence Reversal Prevented by Positive Physical Means							
If No							
	Voltage		Frequency		Time Duration at Test Condition		Pass/Fail
Testing Performed at <b>400 Hz</b>							
Phase Reversal		V <sub>rms</sub>		Hz		min	
Testing Performed at <b>360 Hz</b>							
Phase Reversal		V <sub>rms</sub>		Hz		min	
Testing Performed at <b>600 Hz</b>							
Phase Reversal		V <sub>rms</sub>		Hz		min	
Testing Performed at <b>800 Hz</b>							
Correct Phase Connection		V <sub>rms</sub>		Hz		min	

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## 6. NOTES

6.1 Intended use. This handbook should be used as guidance when establishing test requirements, for inclusion in performance specifications developed for the procurement of utilization equipment, to ensure compliance with the aircraft electrical power characteristics as specified by MIL-STD-704.

6.2 Single phase test numbers. There are no tests required for SVF103 and SVF602. This is done so that the single phase test numbers coincide with the three phase test numbers.

6.3 Subject term (keyword) listing.

Aircraft, electrical power  
Aircraft, electrical test  
Electrical operating areas  
Equipment, utilization  
Power groups  
Specification, utilization equipment

## CONCLUDING MATERIAL

## Custodians:

Army - AV  
Navy - AS  
Air Force - 11

## Preparing Activity:

Navy - AS

(Project No. SESS-0050)

## Review Activities:

Army - CR, MI, TE  
Navy - EC, MC, SA, SH, YD

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at [www.dodssp.daps.mil](http://www.dodssp.daps.mil).