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**MIL-HDBK-704-5
9 April 2004**

**DEPARTMENT OF DEFENSE
HANDBOOK**

**GUIDANCE FOR
TEST PROCEDURES FOR DEMONSTRATION OF
UTILIZATION EQUIPMENT COMPLIANCE TO
AIRCRAFT ELECTRICAL POWER CHARACTERISTICS
THREE PHASE, VARIABLE FREQUENCY, 115 VOLT
(PART 5 OF 8 PARTS)**



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Do not cite this document as a requirement.**

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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 three phase, variable frequency, 115 volt utilization equipment to determine compliance with the applicable edition of MIL-STD-704.
3. MIL-HDBK-704-5 is Part 5 in a series of 8 Parts. Part 5 describes the test methods and procedures to demonstrate that three 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, Code 4.1.4, Highway 547, Lakehurst, NJ 08733-5100 or email to 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.

MIL-HDBK-704-5

CONTENTS

<u>PARAGRAPH</u>	<u>PAGE</u>
FOREWORD	ii
1. SCOPE	1
1.1 Scope.....	1
2. APPLICABLE DOCUMENTS	1
2.1 General.....	1
2.2 Government documents	1
2.2.1 Specifications, standards and handbooks.....	1
3. DEFINITIONS.....	1
3.1 Acronyms and definitions.....	1
4. TEST METHODS INFORMATION.....	1
4.1 Demonstration of compatibility.....	1
4.1.1 Recording performance.....	1
4.2 Calibration of test equipment.....	1
4.3 Test methods	2
5. TEST METHODS.....	4
METHOD TVF101 Load Measurements	5
METHOD TVF102 Steady State Limits for Voltage	
(Including Unbalance) and Frequency	13
METHOD TVF103 Voltage Phase Difference.....	24
METHOD TVF104 Voltage Modulation	29
METHOD TVF105 Frequency Modulation	44
METHOD TVF106 Voltage Distortion Spectrum.....	51
METHOD TVF107 Total Voltage Distortion	63
METHOD TVF108 DC Voltage Component.....	71
METHOD TVF109 Normal Voltage Transients	76
METHOD TVF110 Normal Frequency Transients	93
METHOD TVF201 Power Interrupt.....	99
METHOD TVF301 Abnormal Steady State Limits for Voltage	
and Frequency	115
METHOD TVF302 Abnormal Voltage Transients	121
METHOD TVF303 Abnormal Frequency Transients	136
METHOD TVF401 Emergency Steady State Limits for Voltage	
and Frequency	142
METHOD TVF501 No Tests	143
METHOD TVF601 Power Failure (Three Phase).....	144
METHOD TVF602 One and Two Phase Power Failures.....	151
METHOD TVF603 Phase Reversal (Three Phase)	163

MIL-HDBK-704-5

MIL-HDBK-704-5

1. SCOPE

1.1 Scope. This handbook provides, as guidance, test methods used to demonstrate that three 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

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch> or 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 three 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 TVF101 through TVF603.

4.1.1 Recording performance. In table TVF-I, 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.

MIL-HDBK-704-5

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 TVF-1 are provided in section 5 of this handbook.

MIL-HDBK-704-5

**TABLE TVF-I. Summary of three phase, variable frequency, 115 volt utilization equipment
MIL-STD-704 compliance tests.**

UUT:			
Compliance to MIL-STD-704 Edition(s):			
Test Dates:			
Test Method	Description	Performance (Pass/Fail)	Comments
Normal, Aircraft Electrical Operation			
TVF101	Three Phase Load and Current Harmonic Measurements		
TVF102	Steady State Limits for Voltage (Including Unbalance) and Frequency		
TVF103	Voltage Phase Difference		
TVF104	Voltage Modulation		
TVF105	Frequency Modulation		
TVF106	Voltage Distortion Spectrum		
TVF107	Total Voltage Distortion		
TVF108	DC Voltage Component		
TVF109	Normal Voltage Transients		
TVF110	Normal Frequency Transients		
Transfer, Aircraft Electrical Operation			
TVF201	Power Interrupt		
Abnormal, Aircraft Electrical Operation			
TVF301	Abnormal Limits for Voltage and Frequency		
TVF302	Abnormal Voltage Transients (Overvoltage/Undervoltage)		
TVF303	Abnormal Frequency Transients (Overfrequency/Underfrequency)		
Emergency, Aircraft Electrical Operation			
TVF401	Emergency Limits for Voltage and Frequency		
Starting, Aircraft Electrical Operation			
TVF501	See Note #1	N/A	N/A
Power Failure, Aircraft Electrical Operation			
TVF601	Power Failure (Single Phase)		
TVF602	One Phase and Two Phase Power Failures		
TVF603	Phase Reversal		

Note 1: Starting operation conditions are usually not applicable to AC utilization equipment. No test is required for TVF501 unless specified by the equipment performance specification.

MIL-HDBK-704-5

5. TEST METHODS

MIL-HDBK-704-5**METHOD TVF101**
Load Measurements

POWER GROUP: Three 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 three phase, 115 Volt, variable frequency power utilization equipment utilizes only 115 Volt line-to-neutral power, current inrush is within limits, has balanced power, 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 utilize only 115 Volt line-to-neutral power, is within current inrush limits, is within the balanced load limits, 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 TVF101-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.

MIL-HDBK-704-5

TABLE TVF101-I. MIL-STD-704 limits for inrush current, balanced load, power factor, rectification restriction, current distortion, and current spectrum for three phase, variable frequency utilization equipment.

Limit	704A	704B	704C	704D	704E	704F
Inrush Current	N/A	N/A	N/A	N/A	N/A	300 Percent for Loads >3 kVA
Percent Unbalanced Load	N/A	N/A	N/A	N/A	N/A	Figure 1 MIL-STD-704F or 3.33% for Loads >30 kVA
Power Factor	N/A	N/A	N/A	N/A	N/A	0.85 Lagging to Unity for Loads >500 VA and No Leading Power Factor for > 100VA
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/

1/. Utilization equipment specification 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 TVF101-1. Measurements, except current, must be made within 10 cm of the input power terminals of the UUT. Current

MIL-HDBK-704-5

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 TVF101-1. 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. Record the inrush currents (oscilloscope traces) and record the maximum rms current of each phase in the data sheet shown in table TVF101-II. 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 frequency in table TVF101-II. For each phase, record the voltage, VA, and power factor in the data sheet shown in table TVF101-II. Compare the calculated percent inrush current, the load unbalance, and power factor with the limits of the applicable edition(s) of MIL-STD-704. 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.

Confirm the UUT does not use half-wave rectification and record in the data sheet shown in table TVF101-II. 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. For each phase record the total current distortion and current spectrum in the data sheet shown in table TVF101-II and compare to the limits defined in the utilization equipment performance specification document. Repeat for each mode of operation of the UUT.

8

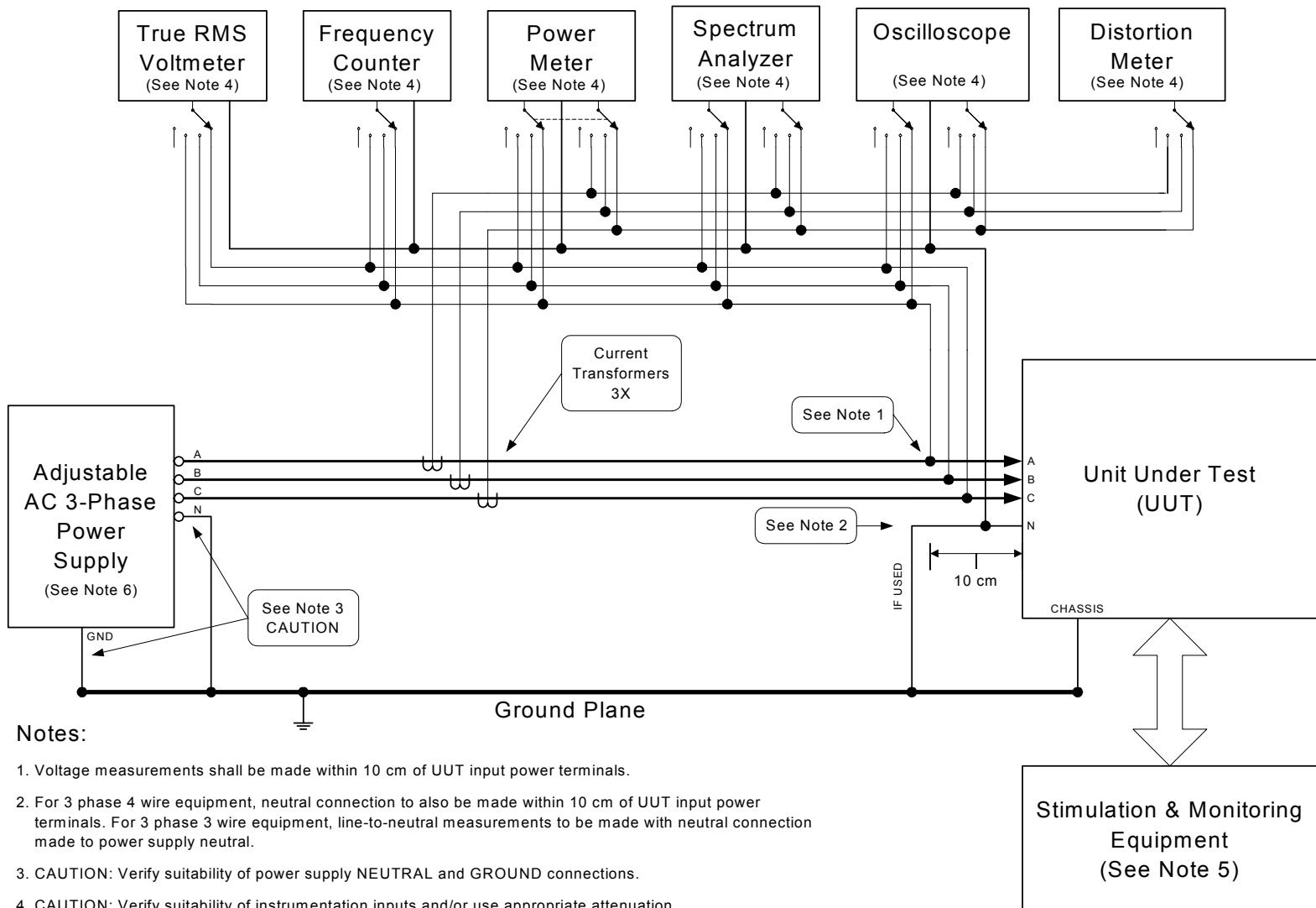


FIGURE TVF101-1. Load measurements.

TABLE TVF101-II. Sample data sheet for TVF101 load measurement.

Parameters									
Test performed at 400 Hz steady state frequency									
Inrush Current									
Phase	Inrush Current	Percent of Rated Current	Oscilloscope Trace		Pass/Fail	Comments			
A	A _{rms}	%	Attach Trace		A _{rms} vs Time				
B	A _{rms}	%	Attach Trace						
C	A _{rms}	%	Attach Trace						
Balanced Load and Power Factor									
Phase	Voltage	Frequency	Volt-Amp	Power Factor	Pass/Fail	Comments			
A	V _{rms}	Hz	VA	pf					
B	V _{rms}		VA	pf					
C	V _{rms}		VA	pf					
Total VA			VA	VA					
Maximum Unbalance (difference between highest and lowest phase load)									
Rectification Type					Pass/Fail	Comments			
Does not use half-wave rectification.									
Current Waveform Measurements									
Phase	Total Current Distortion		Current Spectrum		Pass/Fail	Comments			
A	% Distortion	Attach Spectrum Plot	Amplitude Vs Frequency						
B			Amplitude Vs Frequency						
C			Amplitude Vs Frequency						

TABLE TVF101-II. Sample data sheet for TVF101 load measurement - Continued

Parameters									
Test performed at 360 Hz steady state frequency									
Inrush Current									
Phase	Inrush Current	Percent of Rated Current	Oscilloscope Trace		Pass/Fail	Comments			
A	A_{rms}	%	Attach Trace	A_{rms} vs Time					
B	A_{rms}	%	Attach Trace	A_{rms} vs Time					
C	A_{rms}	%	Attach Trace	A_{rms} vs Time					
Balanced Load and Power Factor									
Phase	Voltage	Frequency	Volt-Amp	Power Factor	Pass/Fail	Comments			
A	V_{rms}	Hz	VA	pf					
B	V_{rms}		VA	pf					
C	V_{rms}		VA	pf					
Total VA			VA						
Maximum Unbalance (difference between highest and lowest phase load)			VA						

TABLE TVF101-II. Sample data sheet for TVF101 load measurement - Continued

Parameters							
Test performed at 360 Hz steady state frequency							
Inrush Current							
Phase	Inrush Current	Percent of Rated Current	Oscilloscope Trace		Pass/Fail	Comments	
A	A _{rms}	%	Attach Trace	A _{rms} vs Time			
B	A _{rms}	%	Attach Trace	A _{rms} vs Time			
C	A _{rms}	%	Attach Trace	A _{rms} vs Time			
Balanced Load and Power Factor							
Phase	Voltage	Frequency	Volt-Amp	Power Factor	Pass/Fail	Comments	
A	V _{rms}	Hz	VA	pf			
B	V _{rms}		VA	pf			
C	V _{rms}		VA	pf			
Total VA			VA				
Maximum Unbalance (difference between highest and lowest phase load)			VA				

TABLE TVF101-II. Sample data sheet for TVF101 load measurement - Continued

Parameters							
Test performed at 600 Hz steady state frequency							
Inrush Current							
Phase	Inrush Current	Percent of Rated Current	Oscilloscope Trace		Pass/Fail	Comments	
A	A _{rms}	%	Attach Trace	A _{rms} vs Time			
B	A _{rms}	%	Attach Trace	A _{rms} vs Time			
C	A _{rms}	%	Attach Trace	A _{rms} vs Time			
Balanced Load and Power Factor							
Phase	Voltage	Frequency	Volt-Amp	Power Factor	Pass/Fail	Comments	
A	V _{rms}	Hz	VA	pf			
B	V _{rms}		VA	pf			
C	V _{rms}		VA	pf			
Total VA			VA				
Maximum Unbalance (difference between highest and lowest phase load)			VA				

MIL-HDBK-704-5

METHOD TVF102
Steady State Limits for Voltage (Including Unbalance) and Frequency

POWER GROUP: Three Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL
OPERATING CONDITION: Normal

PARAMETER: Steady State Limits for Voltage (Including Unbalance) and Frequency

1. Scope.

1.1 Purpose. This test procedure is used to verify that three 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 TVF102-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 restart at the steady state voltage and frequency limits. The utilization equipment must not suffer damage or cause an unsafe condition.

TABLE TVF102-I. MIL-STD-704 normal limits for steady state voltage, voltage unbalance, and frequency for three 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
Voltage Unbalance	N/A	N/A	N/A	N/A	N/A	3.0V
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

MIL-HDBK-704-5

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 TVF102-1. 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 TVF102-1. 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 RR noted in table TVF102-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. Test conditions A through NN are three phase balanced voltages. Test conditions OO through RR are unbalanced voltage conditions.

At each test condition A through RR 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 voltages, 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 TVF102-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.

MIL-HDBK-704-5

TABLE TVF102-II. Test conditions for steady state limits of voltage and frequency for three phase, variable frequency utilization equipment.

Test Condition	Voltage	Frequency	Minimum Time Duration At test Condition
Balanced 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
Balanced 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
Balanced 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

MIL-HDBK-704-5

TABLE TVF102-II. Test conditions for steady state limits of voltage and frequency for three phase, variable frequency utilization equipment. - Continued

Test Condition	Voltage	Frequency	Minimum Time Duration At test Condition	
Unbalanced Voltages				
OO	Van Vbn Vcn	108 V 111 V 111 V	360 Hz	30 min
PP	Van Vbn Vcn	118 V 115 V 115 V	360 Hz	30 min
QQ	Van Vbn Vcn	108 V 111 V 111 V	800 Hz	30 min
RR	Van Vbn Vcn	118 V 115 V 115 V	800 Hz	30 min

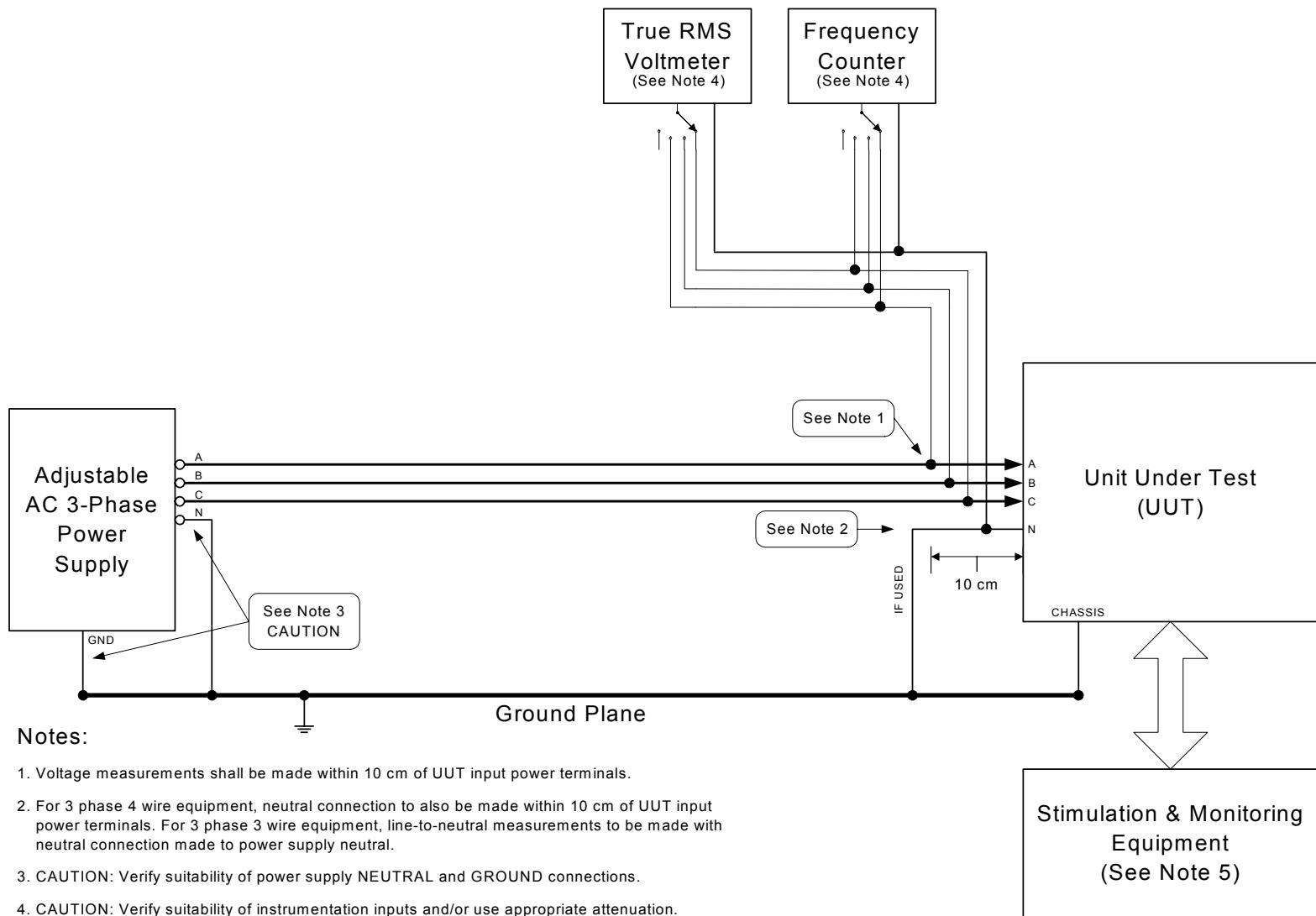
FIGURE TVF102-1. Steady state limits for voltage (including unbalance) and frequency.

TABLE TVF102-III. Sample data sheet for TVF102 steady state limits of voltage and frequency for three phase, variable frequency utilization equipment.

Test Condition	Parameters						Performance	
	Phase	Voltage		Frequency		Time Duration at Test Condition		
A	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
B	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
C	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
D	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
E	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
F	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
G	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					

TABLE TVF102-III. Sample data sheet for TVF102 steady state limits of voltage and frequency for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters						Performance	
	Phase	Voltage		Frequency		Time Duration at Test Condition		
H	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
I	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
J	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
K	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
L	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
M	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
N	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
O	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					

TABLE TVF102-III. Sample data sheet for TVF102 steady state limits of voltage and frequency for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters						Performance	
	Phase	Voltage		Frequency		Time Duration at Test Condition		
P	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
Q	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
R	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
S	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
T	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
U	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
V	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
W	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					

TABLE TVF102-III. Sample data sheet for TVF102 steady state limits of voltage and frequency for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters						Performance	
	Phase	Voltage		Frequency		Time Duration at Test Condition		
X	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
Y	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
Z	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
AA	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
BB	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
CC	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
DD	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
EE	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					

TABLE TVF102-III. Sample data sheet for TVF102 steady state limits of voltage and frequency for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters						Performance	
	Phase	Voltage		Frequency		Time Duration at Test Condition		
FF	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
GG	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
HH	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
II	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
JJ	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
KK	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
LL	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					
MM	A		V _{rms}		Hz		min	
	B		V _{rms}					
	C		V _{rms}					

TABLE TVF102-III. Sample data sheet for TVF102 steady state limits of voltage and frequency for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters						Performance
	Phase	Voltage		Frequency		Time Duration at Test Condition	
NN	A	V _{rms}		Hz		min	
OO	B	V _{rms}					
PP	C	V _{rms}					
QQ	A	V _{rms}		Hz		min	
RR	B	V _{rms}					
RR	C	V _{rms}					

MIL-HDBK-704-5

METHOD TVF103
Voltage Phase Difference

POWER GROUP: Three Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL
OPERATING CONDITION: Normal

PARAMETER: Voltage Phase Difference

1. Scope.

1.1 Purpose. This test procedure is used to verify that three phase, 115 Volt, variable frequency power utilization equipment operates and maintains specified performance when provided voltages having phase angles within the limits 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 provided voltages having phase angles at the limits of the applicable edition(s) of MIL-STD-704 and as noted in table TVF103-I. The utilization equipment must maintain specified performance for a length of time that confirms the utilization equipment can continuously operate and should be, not less than thirty (30) minutes for each of the test conditions. The utilization equipment must not suffer damage or cause an unsafe condition.

TABLE TVF103-I. MIL-STD-704 limits for voltage phase difference for three phase variable frequency utilization equipment.

Limit	704A	704B	704C	704D	704E	704F
Voltage Phase Difference	N/A	N/A	N/A	N/A	N/A	116° to 124°

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

- a. Programmable AC power supply
- b. True RMS voltmeter
- c. Frequency counter
- d. Phase angle meter

4. Test setup. Configure the test setup as shown in figure TVF103-1. 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 TVF103-1. Turn on the power source and adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the

MIL-HDBK-704-5

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 and B noted in table TVF103-II, the UUT must remain for a length of time that confirms the utilization equipment can continuously operate with voltage phase differences and should be, not less than thirty (30) minutes. The phase angles are referenced to Van. 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 the voltages, frequency, phase angles, time duration at test condition, and the performance of the UUT for each test condition in the data sheet shown in table TVF103-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. Adjust the phase angles to Van 0°, Vbn 120°, and Vcn 240°. 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 TVF103-II. Test conditions for voltage phase difference for three phase, variable frequency utilization equipment.

Test Condition	Voltage Phase Angle Van	Voltage Phase Angle Vbn	Voltage Phase Angle Vcn
A	0°	116°	240°
B	0°	124°	240°

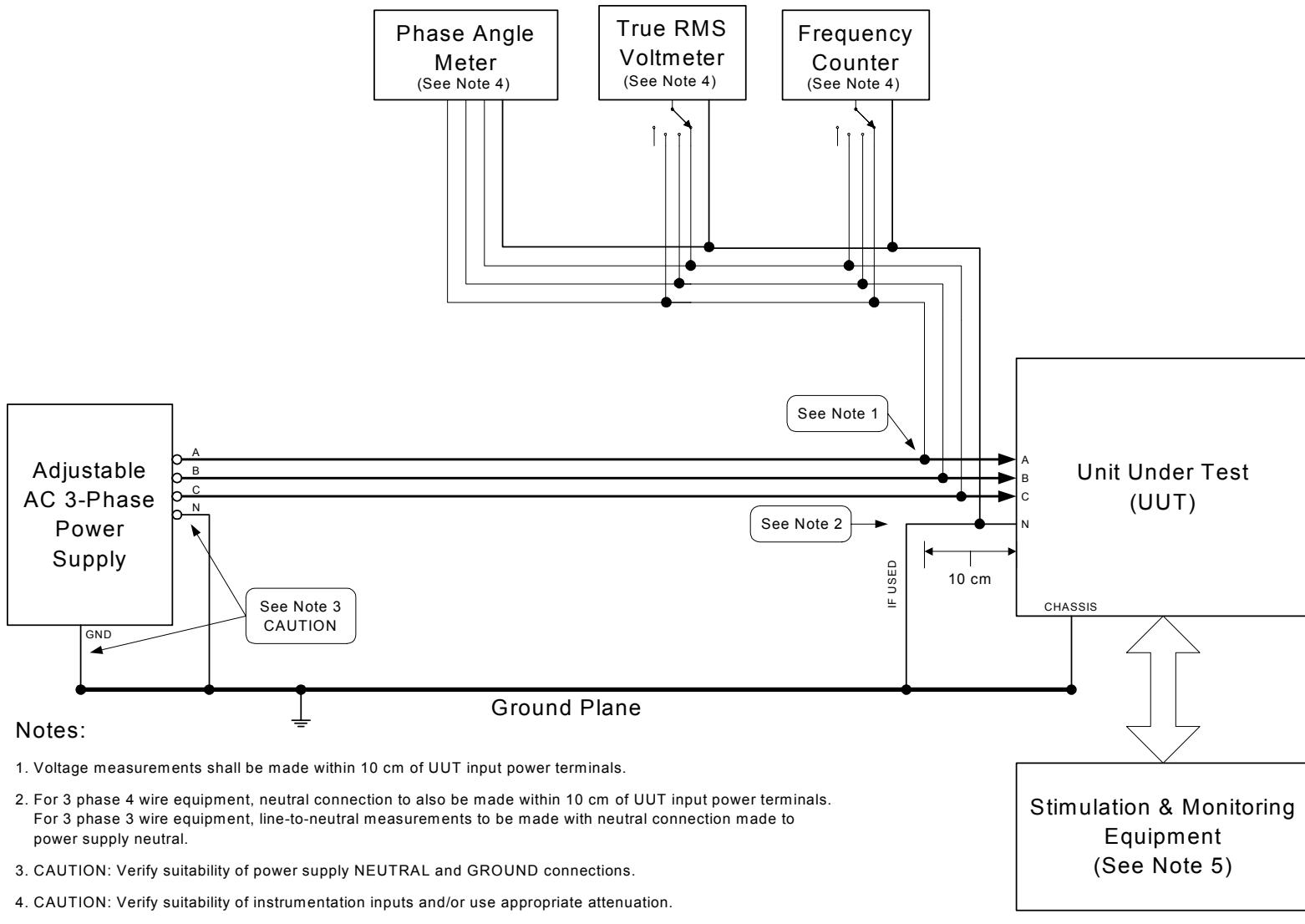
FIGURE TVF103-1. Voltage phase difference.

TABLE TVF103-III. Sample data sheet for TVF103 voltage phase difference for three phase, variable frequency utilization equipment.

Test Condition	Parameters							Performance	
	Phase	Voltage	Frequency	Phase Angle		Time Duration at Test Condition	Pass/Fail		
Test performed at 400 Hz steady state frequency									
A	A	V_{rms}		Hz	Van	°	min		
	B	V_{rms}			Vbn	°			
	C	V_{rms}			Vcn	°			
B	A	V_{rms}		Hz	Van	°	min		
	B	V_{rms}			Vbn	°			
	C	V_{rms}			Vcn	°			
Test performed at 360 Hz steady state frequency									
A	A	V_{rms}		Hz	Van	°	min		
	B	V_{rms}			Vbn	°			
	C	V_{rms}			Vcn	°			
B	A	V_{rms}		Hz	Van	°	min		
	B	V_{rms}			Vbn	°			
	C	V_{rms}			Vcn	°			
Test performed at 600 Hz steady state frequency									
A	A	V_{rms}		Hz	Van	°	min		
	B	V_{rms}			Vbn	°			
	C	V_{rms}			Vcn	°			
B	A	V_{rms}		Hz	Van	°	min		
	B	V_{rms}			Vbn	°			
	C	V_{rms}			Vcn	°			

TABLE TVF103-III. Sample data sheet for TVF103 voltage phase difference for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters						Performance	
	Phase	Voltage		Frequency	Phase Angle		Time Duration at Test Condition	Pass/Fail
Test performed at 800 Hz steady state frequency								
A	A	V _{rms}		Hz	V _{an}	°		min
	B	V _{rms}			V _{bn}	°		
	C	V _{rms}			V _{cn}	°		
B	A	V _{rms}		Hz	V _{an}	°		min
	B	V _{rms}			V _{bn}	°		
	C	V _{rms}			V _{cn}	°		

MIL-HDBK-704-5

METHOD TVF104
Voltage Modulation

POWER GROUP: Three 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 three 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 TVF104-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 TVF104-I. MIL-STD-704 limits for voltage modulation for three 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 TVF104-1. 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 TVF104-1. 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

MIL-HDBK-704-5

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 TVF104-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 voltages, 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 TVF104-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 TVF104-II. Test conditions for voltage modulation for three 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

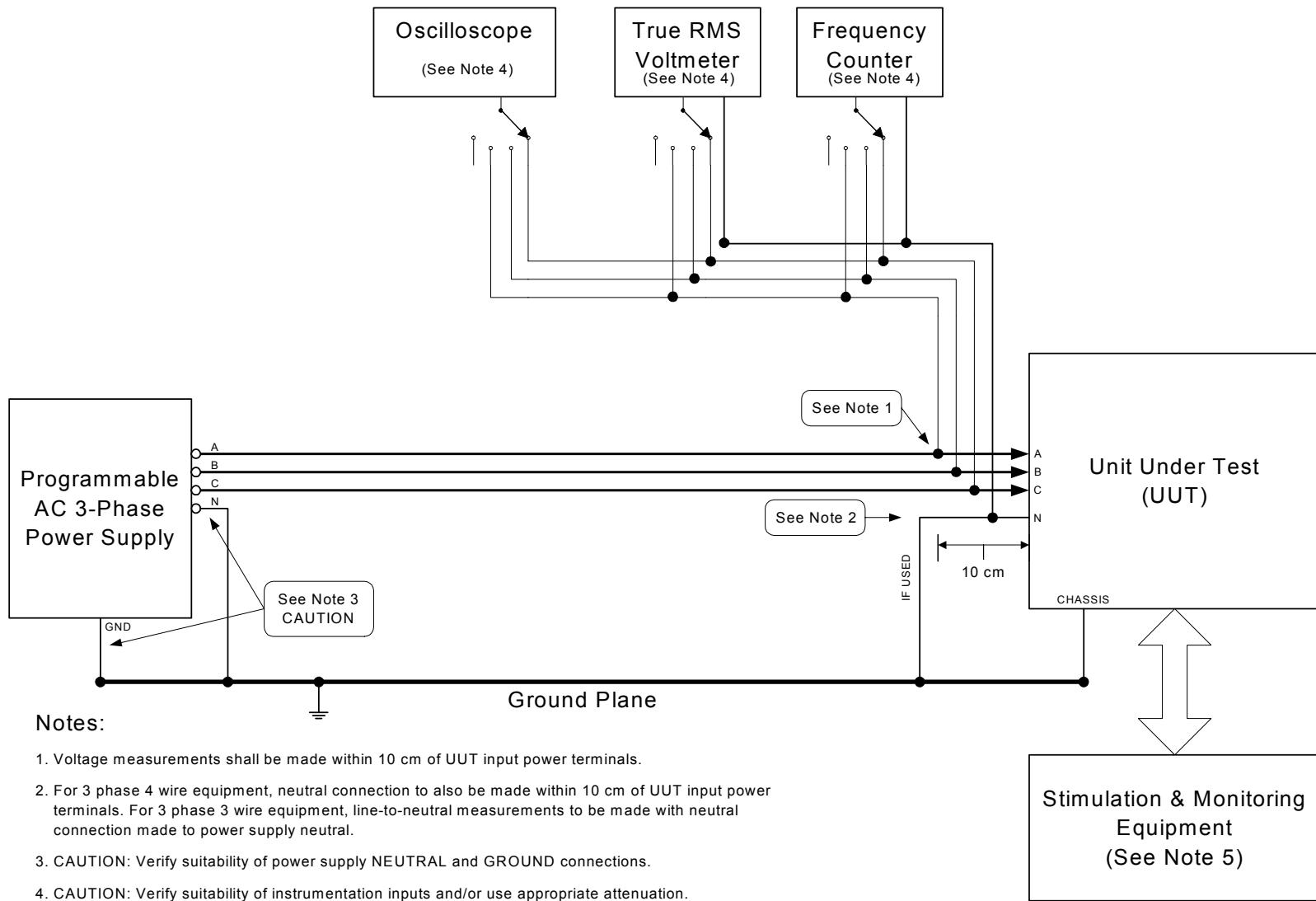
FIGURE TVF104-1. Voltage modulation

TABLE TVF104-III. Sample data sheet for TVF104 voltage modulation for three phase, variable frequency utilization equipment.

Test Condition	Parameters						Performance	
	Phase	Average Voltage	Frequency	Amplitude of Voltage Modulation	Frequency of Voltage Modulation	Time Duration at Test Condition		
Test performed at 400 Hz steady state frequency								
A-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
A-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
A-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
B-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
B-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
B-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
C-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			

TABLE TVF104-III. Sample data sheet for TVF104 voltage modulation for three phase, variable frequency utilization equipment. -
Continued

Test Condition	Parameters							Performance
	Phase	Average Voltage	Frequency	Amplitude of Voltage Modulation	Frequency of Voltage Modulation	Time Duration at Test Condition	Pass/Fail	
Test performed at 400 Hz steady state frequency								
C-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
C-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
D-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
D-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
D-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
E-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
E-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			

TABLE TVF104-III. Sample data sheet for TVF104 voltage modulation for three phase, variable frequency utilization equipment. -
Continued

Test Condition	Parameters							Performance
	Phase	Average Voltage	Frequency	Amplitude of Voltage Modulation	Frequency of Voltage Modulation	Time Duration at Test Condition	Pass/Fail	
Test performed at 400 Hz steady state frequency								
E-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
F-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
F-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
F-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
G-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
G-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
G-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			

TABLE TVF104-III. Sample data sheet for TVF104 voltage modulation for three phase, variable frequency utilization equipment. -
Continued

Test Condition	Parameters						Performance	
	Phase	Average Voltage	Frequency	Amplitude of Voltage Modulation	Frequency of Voltage Modulation	Time Duration at Test Condition		
Test performed at 360 Hz steady state frequency								
A-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
A-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
A-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
B-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
B-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
B-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
C-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			

TABLE TVF104-III. Sample data sheet for TVF104 voltage modulation for three phase, variable frequency utilization equipment. -
Continued

Test Condition	Parameters							Performance
	Phase	Average Voltage	Frequency	Amplitude of Voltage Modulation	Frequency of Voltage Modulation	Time Duration at Test Condition	Pass/Fail	
Test performed at 360 Hz steady state frequency								
C-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
C-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
D-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
D-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
D-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
E-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
E-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			

TABLE TVF104-III. Sample data sheet for TVF104 voltage modulation for three phase, variable frequency utilization equipment. -
Continued

Test Condition	Parameters							Performance
	Phase	Average Voltage	Frequency	Amplitude of Voltage Modulation	Frequency of Voltage Modulation	Time Duration at Test Condition	Pass/Fail	
Test performed at 360 Hz steady state frequency								
E-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
F-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
F-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
F-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
G-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
G-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
G-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			

TABLE TVF104-III. Sample data sheet for TVF104 voltage modulation for three phase, variable frequency utilization equipment. -
Continued

Test Condition	Parameters							Performance
	Phase	Average Voltage	Frequency	Amplitude of Voltage Modulation	Frequency of Voltage Modulation	Time Duration at Test Condition	Pass/Fail	
Test performed at 600 Hz steady state frequency								
A-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
A-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
A-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
B-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
B-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
B-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
C-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			

TABLE TVF104-III. Sample data sheet for TVF104 voltage modulation for three phase, variable frequency utilization equipment. -
Continued

Test Condition	Parameters							Performance
	Phase	Average Voltage	Frequency	Amplitude of Voltage Modulation	Frequency of Voltage Modulation	Time Duration at Test Condition	Pass/Fail	
Test performed at 600 Hz steady state frequency								
C-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
C-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
D-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
D-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
D-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
E-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
E-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			

TABLE TVF104-III. Sample data sheet for TVF104 voltage modulation for three phase, variable frequency utilization equipment. -
Continued

Test Condition	Parameters							Performance
	Phase	Average Voltage	Frequency	Amplitude of Voltage Modulation	Frequency of Voltage Modulation	Time Duration at Test Condition	Pass/Fail	
Test performed at 600 Hz steady state frequency								
E-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
F-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
F-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
F-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
G-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
G-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
G-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			

TABLE TVF104-III. Sample data sheet for TVF104 voltage modulation for three phase, variable frequency utilization equipment. -
Continued

Test Condition	Parameters							Performance
	Phase	Average Voltage	Frequency	Amplitude of Voltage Modulation	Frequency of Voltage Modulation	Time Duration at Test Condition	Pass/Fail	
Test performed at 800 Hz steady state frequency								
A-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
A-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
A-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
B-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
B-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
B-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
C-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			

TABLE TVF104-III. Sample data sheet for TVF104 voltage modulation for three phase, variable frequency utilization equipment. -
Continued

Test Condition	Parameters							Performance
	Phase	Average Voltage	Frequency	Amplitude of Voltage Modulation	Frequency of Voltage Modulation	Time Duration at Test Condition	Pass/Fail	
Test performed at 800 Hz steady state frequency								
C-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
C-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
D-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
D-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
D-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
E-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
E-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			

TABLE TVF104-III. Sample data sheet for TVF104 voltage modulation for three phase, variable frequency utilization equipment. -
Continued

Test Condition	Parameters							Performance
	Phase	Average Voltage	Frequency	Amplitude of Voltage Modulation	Frequency of Voltage Modulation	Time Duration at Test Condition	Pass/Fail	
Test performed at 800 Hz steady state frequency								
E-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
F-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
F-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
F-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
G-1	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
G-2	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			
G-3	A	V _{rms}	Hz	V _{rms}	Hz	min		
	B	V _{rms}		V _{rms}	Hz			
	C	V _{rms}		V _{rms}	Hz			

MIL-HDBK-704-5

METHOD TVF105
Frequency Modulation

POWER GROUP: Three 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 three 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 TVF105-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 TVF105-I. MIL-STD-704 limits for frequency modulation for three 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 TVF105-1. 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 TVF105-1. 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

MIL-HDBK-704-5

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 TVF105-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 TVF105-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 TVF105-II. Test conditions for frequency modulation for three 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)

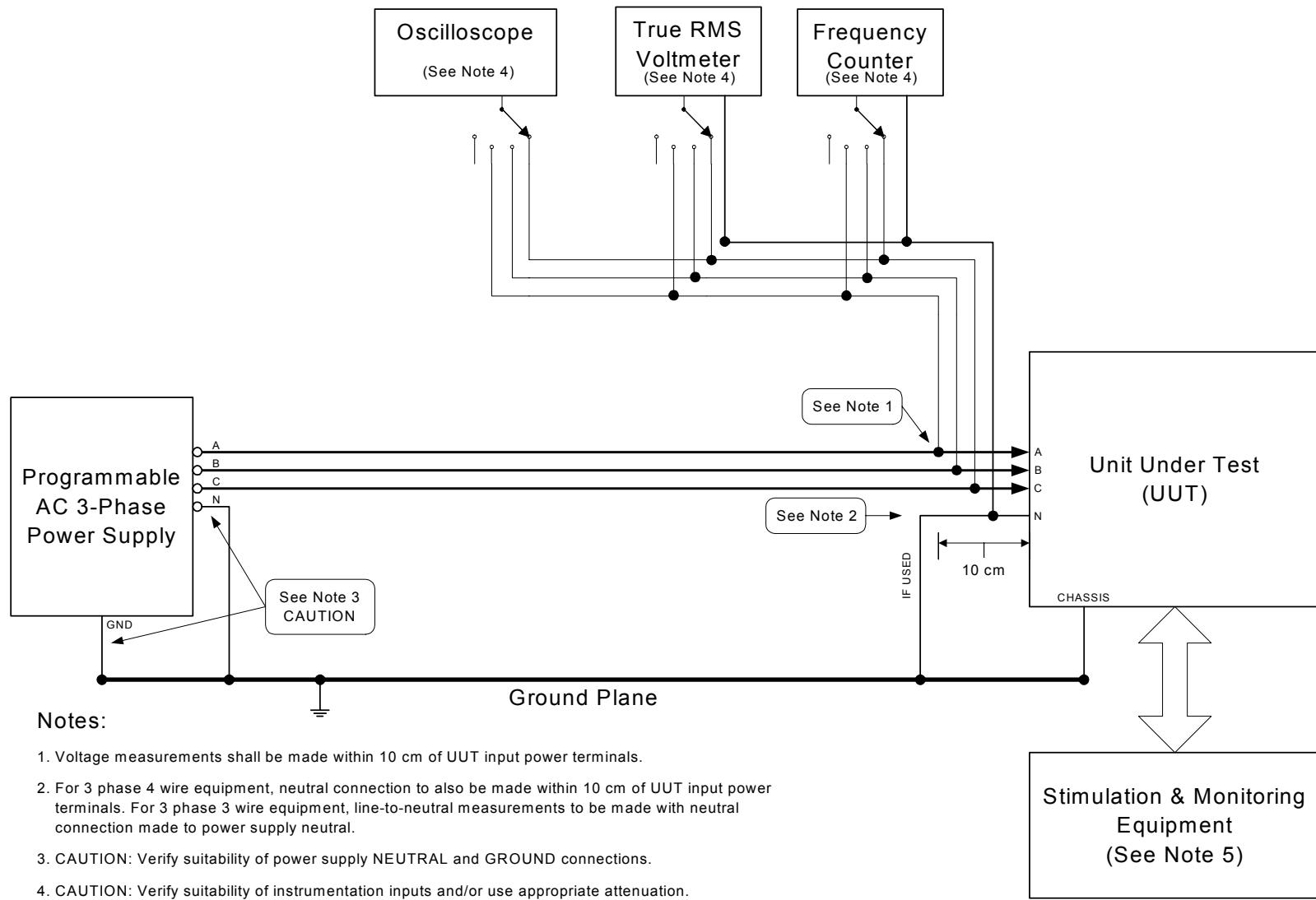
FIGURE TVF105-1. Frequency modulation.

TABLE TVF105-III. Sample data sheet for TVF105 frequency modulation for three phase, variable frequency utilization equipment.

Test Condition	Parameters							Performance
	Phase	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 400 Hz								
A	A	V _{rms}	Hz	± Hz	Hz/sec	min		
	B	V _{rms}						
	C	V _{rms}						
B	A	V _{rms}	Hz	± Hz	Hz/sec	min		
	B	V _{rms}						
	C	V _{rms}						
C	A	V _{rms}	Hz	± Hz	Hz/sec	min		
	B	V _{rms}						
	C	V _{rms}						
D	A	V _{rms}	Hz	± Hz	Hz/sec	min		
	B	V _{rms}						
	C	V _{rms}						
E	A	V _{rms}	Hz	± Hz	Hz/sec	min		
	B	V _{rms}						
	C	V _{rms}						

TABLE TVF105-III. Sample data sheet for TVF105 frequency modulation for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters							Performance
	Phase	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 362 Hz								
A	A	V_{rms}	Hz	\pm Hz	Hz/sec	min		
	B	V_{rms}						
	C	V_{rms}						
B	A	V_{rms}	Hz	\pm Hz	Hz/sec	min		
	B	V_{rms}						
	C	V_{rms}						
C	A	V_{rms}	Hz	\pm Hz	Hz/sec	min		
	B	V_{rms}						
	C	V_{rms}						
D	A	V_{rms}	Hz	\pm Hz	Hz/sec	min		
	B	V_{rms}						
	C	V_{rms}						
E	A	V_{rms}	Hz	\pm Hz	Hz/sec	min		
	B	V_{rms}						
	C	V_{rms}						

TABLE TVF105-III. Sample data sheet for TVF105 frequency modulation for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters							Performance
	Phase	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 600 Hz								
A	A	V_{rms}	Hz	\pm Hz	Hz/sec	min		
	B	V_{rms}						
	C	V_{rms}						
B	A	V_{rms}	Hz	\pm Hz	Hz/sec	min		
	B	V_{rms}						
	C	V_{rms}						
C	A	V_{rms}	Hz	\pm Hz	Hz/sec	min		
	B	V_{rms}						
	C	V_{rms}						
D	A	V_{rms}	Hz	\pm Hz	Hz/sec	min		
	B	V_{rms}						
	C	V_{rms}						
E	A	V_{rms}	Hz	\pm Hz	Hz/sec	min		
	B	V_{rms}						
	C	V_{rms}						

TABLE TVF105-III. Sample data sheet for TVF105 frequency modulation for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters							Performance
	Phase	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 798 Hz								
A	A	V_{rms}	Hz	\pm Hz	Hz/sec	min		
	B	V_{rms}						
	C	V_{rms}						
B	A	V_{rms}	Hz	\pm Hz	Hz/sec	min		
	B	V_{rms}						
	C	V_{rms}						
C	A	V_{rms}	Hz	\pm Hz	Hz/sec	min		
	B	V_{rms}						
	C	V_{rms}						
D	A	V_{rms}	Hz	\pm Hz	Hz/sec	min		
	B	V_{rms}						
	C	V_{rms}						
E	A	V_{rms}	Hz	\pm Hz	Hz/sec	min		
	B	V_{rms}						
	C	V_{rms}						

MIL-HDBK-704-5

METHOD TVF106
Voltage Distortion Spectrum

POWER GROUP: Three Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL
OPERATING CONDITION: Normal

PARAMETER: Voltage Distortion Spectrum

1. Scope.

1.1 Purpose. This test procedure is used to verify that three 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 TVF106-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 TVF106 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 TVF106 of this handbook.

TABLE TVF106-I. MIL-STD-704 limits for voltage distortion spectrum for three 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

MIL-HDBK-704-5

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. (3) Inductors, 50 μ H
- h. (3) Capacitor, 10 μ F
- i. Resistor, calibrated load

4. Test setup. Configure the test setup as shown in figure TVF106-1. 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 TVF106-1 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 TVF106-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 at steady state frequencies of 360 Hz, 600 Hz, and 800 Hz.

5. Compliance test. With the adjustable AC power supply off, install the UUT and the stimulation and monitoring equipment into the test setup of figure TVF106-1. Figure TVF106-1 shows the coupling transformer installed in phase A. The test will be repeated with the coupling transformer installed in Phase B and Phase C. 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 TVF106-II. For each test condition, record the phase tested, voltage,

MIL-HDBK-704-5

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 TVF106-III. Repeat for each mode of operation of the UUT. Turn the adjustable AC power supply off, install the coupling transformer in phase B, 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 and repeat the testing for phase B. Turn the adjustable AC power supply off, install the coupling transformer in phase C, 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 and repeat the testing for Phase C. 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 TVF106-II. Test conditions for voltage distortion spectrum for three phase, variable frequency utilization equipment.

Test Condition	Frequency of Voltage Distortion	MIL-STD-704B C, D, E & F ^{1/} 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	1.900 Vrms
H	10 kHz	0.950 Vrms

^{1/}. For utilization equipment being tested to MIL-STD-704 edition A, use MIL-STD-704B limits.

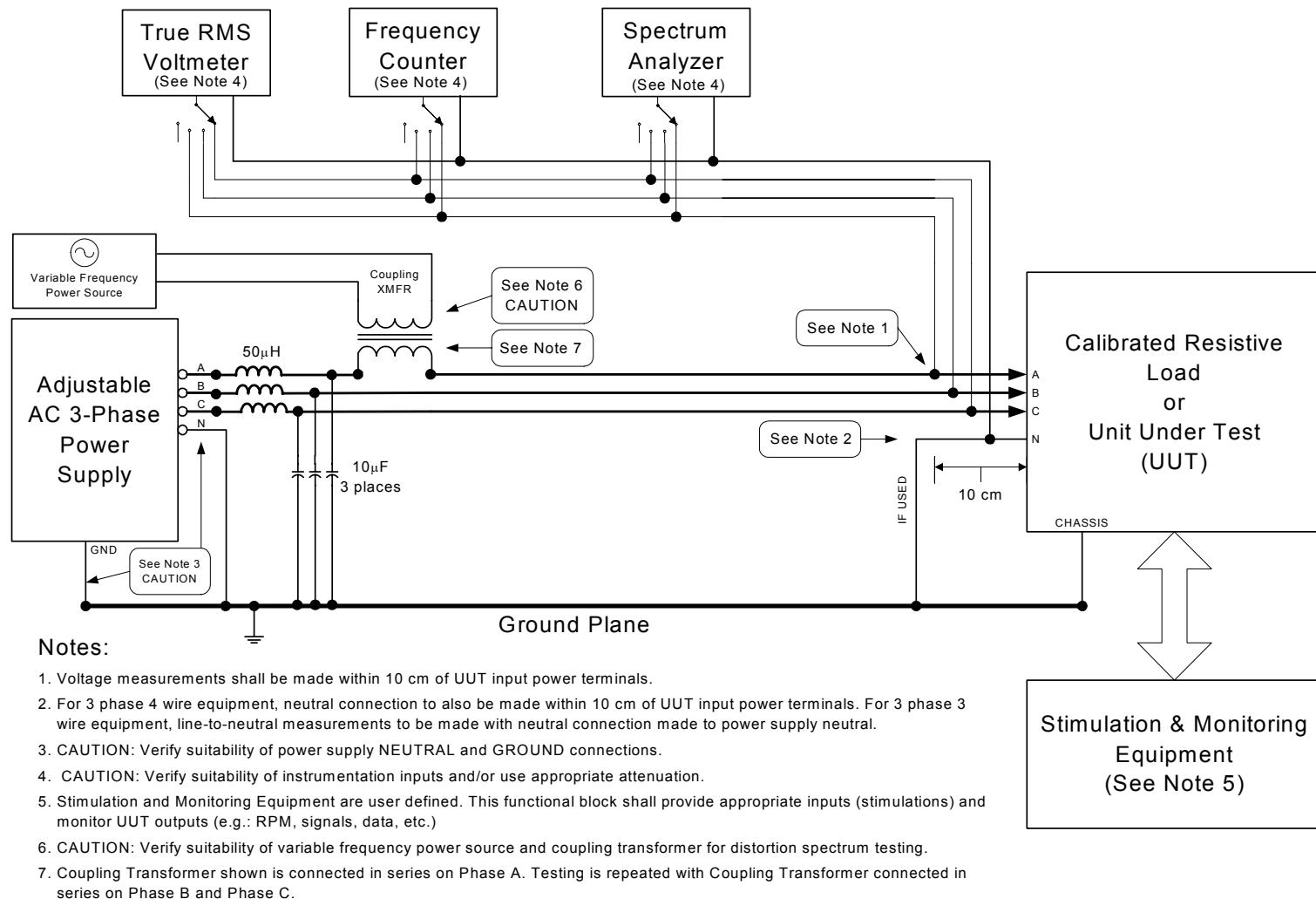
FIGURE TVF106-1. Normal operation - voltage distortion spectrum (50 Hz to 10 kHz).

TABLE TVF106-III. Sample data sheet for TVF106 voltage distortion spectrum for three phase, variable frequency utilization equipment.

Test Condition	Parameter							Performance	
	Phase	Voltage	Frequency	Frequency of Voltage Distortion	Amplitude of Voltage Distortion	Time Duration at Test Condition	Pass/Fail		
Testing performed at 400 Hz									
	A								
A			V _{rms}	Hz	Hz	V _{rms}	min		
B			V _{rms}	Hz	Hz	V _{rms}	min		
C			V _{rms}	Hz	Hz	V _{rms}	min		
D			V _{rms}	Hz	kHz	V _{rms}	min		
E			V _{rms}	Hz	kHz	V _{rms}	min		
F			V _{rms}	Hz	kHz	V _{rms}	min		
G			V _{rms}	Hz	kHz	V _{rms}	min		
H			V _{rms}	Hz	kHz	V _{rms}	min		
Testing performed at 400 Hz									
	B								
A			V _{rms}	Hz	Hz	V _{rms}	min		
B			V _{rms}	Hz	Hz	V _{rms}	min		
C			V _{rms}	Hz	Hz	V _{rms}	min		
D			V _{rms}	Hz	kHz	V _{rms}	min		
E			V _{rms}	Hz	kHz	V _{rms}	min		
F			V _{rms}	Hz	kHz	V _{rms}	min		
G			V _{rms}	Hz	kHz	V _{rms}	min		
H			V _{rms}	Hz	kHz	V _{rms}	min		

TABLE TVF106-III. Sample data sheet for TVF106 voltage distortion spectrum for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameter							Performance
	Phase	Voltage	Frequency	Frequency of Voltage Distortion	Amplitude of Voltage Distortion	Time Duration at Test Condition	Pass/Fail	
Testing performed at 400 Hz								
	C							
A		V_{rms}	Hz	Hz	V_{rms}	min		
B		V_{rms}	Hz	Hz	V_{rms}	min		
C		V_{rms}	Hz	Hz	V_{rms}	min		
D		V_{rms}	Hz	kHz	V_{rms}	min		
E		V_{rms}	Hz	kHz	V_{rms}	min		
F		V_{rms}	Hz	kHz	V_{rms}	min		
G		V_{rms}	Hz	kHz	V_{rms}	min		
H		V_{rms}	Hz	kHz	V_{rms}	min		

TABLE TVF106-III. Sample data sheet for TVF106 voltage distortion spectrum for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameter							Performance	
	Phase	Voltage	Frequency	Frequency of Voltage Distortion	Amplitude of Voltage Distortion	Time Duration at Test Condition	Pass/Fail		
Testing performed at 360 Hz									
	A								
A			V _{rms}	Hz	Hz	V _{rms}	min		
B			V _{rms}	Hz	Hz	V _{rms}	min		
C			V _{rms}	Hz	Hz	V _{rms}	min		
D			V _{rms}	Hz	kHz	V _{rms}	min		
E			V _{rms}	Hz	kHz	V _{rms}	min		
F			V _{rms}	Hz	kHz	V _{rms}	min		
G			V _{rms}	Hz	kHz	V _{rms}	min		
H			V _{rms}	Hz	kHz	V _{rms}	min		
Testing performed at 360 Hz									
	B								
A			V _{rms}	Hz	Hz	V _{rms}	min		
B			V _{rms}	Hz	Hz	V _{rms}	min		
C			V _{rms}	Hz	Hz	V _{rms}	min		
D			V _{rms}	Hz	kHz	V _{rms}	min		
E			V _{rms}	Hz	kHz	V _{rms}	min		
F			V _{rms}	Hz	kHz	V _{rms}	min		
G			V _{rms}	Hz	kHz	V _{rms}	min		
H			V _{rms}	Hz	kHz	V _{rms}	min		

TABLE TVF106-III. Sample data sheet for TVF106 voltage distortion spectrum for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameter							Performance
	Phase	Voltage	Frequency	Frequency of Voltage Distortion	Amplitude of Voltage Distortion	Time Duration at Test Condition	Pass/Fail	
Testing performed at 360 Hz								
	C							
A		V _{rms}	Hz	Hz	V _{rms}	min		
B		V _{rms}	Hz	Hz	V _{rms}	min		
C		V _{rms}	Hz	Hz	V _{rms}	min		
D		V _{rms}	Hz	kHz	V _{rms}	min		
E		V _{rms}	Hz	kHz	V _{rms}	min		
F		V _{rms}	Hz	kHz	V _{rms}	min		
G		V _{rms}	Hz	kHz	V _{rms}	min		
H		V _{rms}	Hz	kHz	V _{rms}	min		

TABLE TVF106-III. Sample data sheet for TVF106 voltage distortion spectrum for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameter							Performance	
	Phase	Voltage	Frequency	Frequency of Voltage Distortion	Amplitude of Voltage Distortion	Time Duration at Test Condition	Pass/Fail		
Testing performed at 600 Hz									
	A								
A			V _{rms}	Hz	Hz	V _{rms}	min		
B			V _{rms}	Hz	Hz	V _{rms}	min		
C			V _{rms}	Hz	Hz	V _{rms}	min		
D			V _{rms}	Hz	kHz	V _{rms}	min		
E			V _{rms}	Hz	kHz	V _{rms}	min		
F			V _{rms}	Hz	kHz	V _{rms}	min		
G			V _{rms}	Hz	kHz	V _{rms}	min		
H			V _{rms}	Hz	kHz	V _{rms}	min		
Testing performed at 600 Hz									
	B								
A			V _{rms}	Hz	Hz	V _{rms}	min		
B			V _{rms}	Hz	Hz	V _{rms}	min		
C			V _{rms}	Hz	Hz	V _{rms}	min		
D			V _{rms}	Hz	kHz	V _{rms}	min		
E			V _{rms}	Hz	kHz	V _{rms}	min		
F			V _{rms}	Hz	kHz	V _{rms}	min		
G			V _{rms}	Hz	kHz	V _{rms}	min		
H			V _{rms}	Hz	kHz	V _{rms}	min		

TABLE TVF106-III. Sample data sheet for TVF106 voltage distortion spectrum for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameter							Performance
	Phase	Voltage	Frequency	Frequency of Voltage Distortion	Amplitude of Voltage Distortion	Time Duration at Test Condition	Pass/Fail	
Testing performed at 600 Hz								
	C							
A		V_{rms}	Hz	Hz	V_{rms}	min		
B		V_{rms}	Hz	Hz	V_{rms}	min		
C		V_{rms}	Hz	Hz	V_{rms}	min		
D		V_{rms}	Hz	kHz	V_{rms}	min		
E		V_{rms}	Hz	kHz	V_{rms}	min		
F		V_{rms}	Hz	kHz	V_{rms}	min		
G		V_{rms}	Hz	kHz	V_{rms}	min		
H		V_{rms}	Hz	kHz	V_{rms}	min		

TABLE TVF106-III. Sample data sheet for TVF106 voltage distortion spectrum for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameter							Performance	
	Phase	Voltage	Frequency	Frequency of Voltage Distortion	Amplitude of Voltage Distortion	Time Duration at Test Condition	Pass/Fail		
Testing performed at 800 Hz									
	A								
A			V _{rms}	Hz	Hz	V _{rms}	min		
B			V _{rms}	Hz	Hz	V _{rms}	min		
C			V _{rms}	Hz	Hz	V _{rms}	min		
D			V _{rms}	Hz	kHz	V _{rms}	min		
E			V _{rms}	Hz	kHz	V _{rms}	min		
F			V _{rms}	Hz	kHz	V _{rms}	min		
G			V _{rms}	Hz	kHz	V _{rms}	min		
H			V _{rms}	Hz	kHz	V _{rms}	min		
Testing performed at 800 Hz									
	B								
A			V _{rms}	Hz	Hz	V _{rms}	min		
B			V _{rms}	Hz	Hz	V _{rms}	min		
C			V _{rms}	Hz	Hz	V _{rms}	min		
D			V _{rms}	Hz	kHz	V _{rms}	min		
E			V _{rms}	Hz	kHz	V _{rms}	min		
F			V _{rms}	Hz	kHz	V _{rms}	min		
G			V _{rms}	Hz	kHz	V _{rms}	min		
H			V _{rms}	Hz	kHz	V _{rms}	min		

TABLE TVF106-III. Sample data sheet for TVF106 voltage distortion spectrum for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameter							Performance
	Phase	Voltage	Frequency	Frequency of Voltage Distortion	Amplitude of Voltage Distortion	Time Duration at Test Condition	Pass/Fail	
Testing performed at 800 Hz								
	C							
A		V _{rms}	Hz	Hz	V _{rms}	min		
B		V _{rms}	Hz	Hz	V _{rms}	min		
C		V _{rms}	Hz	Hz	V _{rms}	min		
D		V _{rms}	Hz	kHz	V _{rms}	min		
E		V _{rms}	Hz	kHz	V _{rms}	min		
F		V _{rms}	Hz	kHz	V _{rms}	min		
G		V _{rms}	Hz	kHz	V _{rms}	min		
H		V _{rms}	Hz	kHz	V _{rms}	min		

MIL-HDBK-704-5

METHOD TVF107
Total Voltage Distortion

POWER GROUP: Three 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 three 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 TVF107-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 TVF107-I. MIL-STD-704 limits for total voltage distortion for three 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 TVF107-1. 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 TVF107-1 in place of the UUT. The resistive load must be sized to draw the same current as the UUT. Set

MIL-HDBK-704-5

the programmable power supply to produce a voltage waveform having harmonic contents listed in table TVF107-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 TVF107-II. 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 TVF107-1. 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 TVF107-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 sine waves 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.

MIL-HDBK-704-5

TABLE TVF107-II. Voltage harmonics as percent of fundamental for total voltage distortion test for three 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%

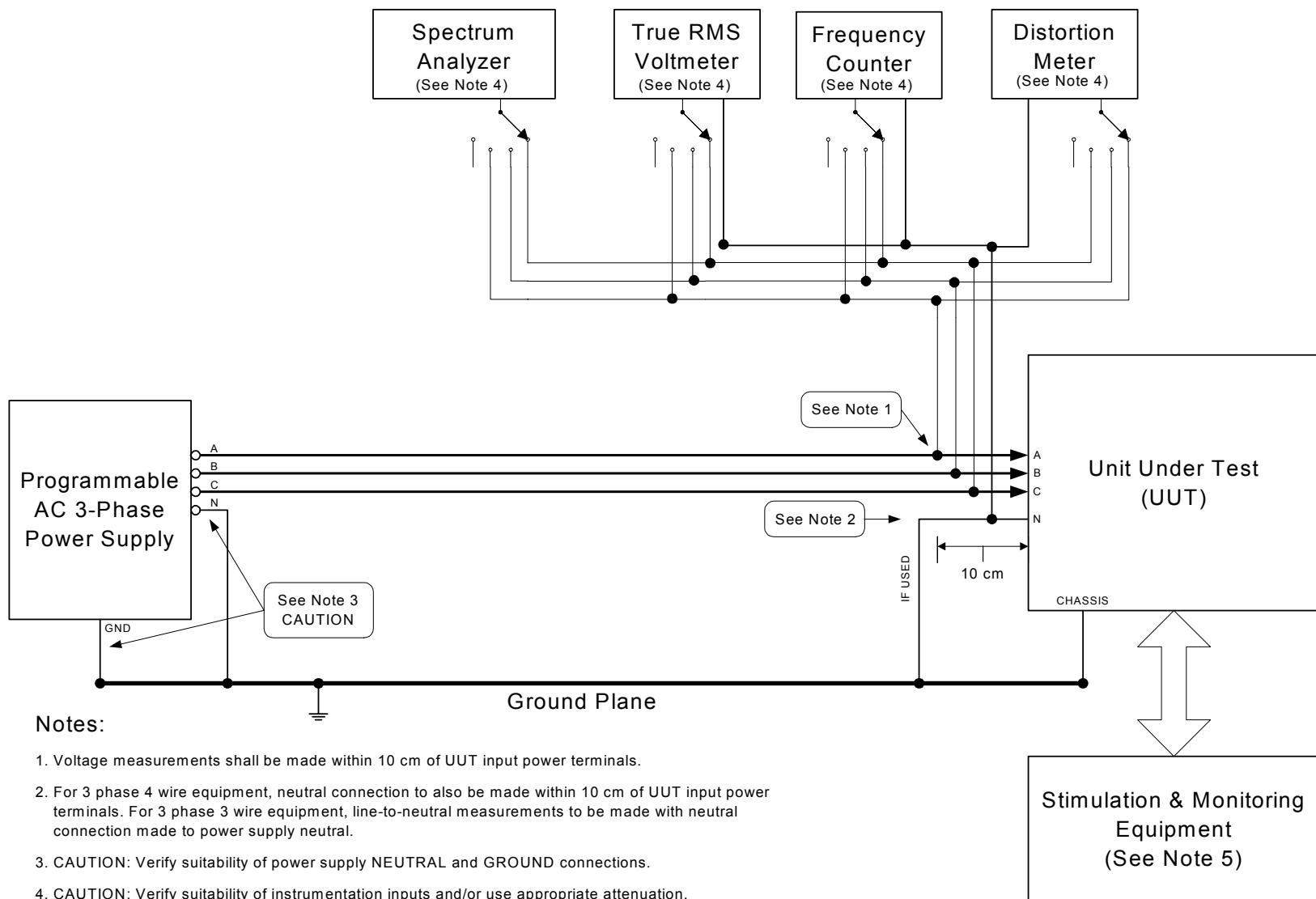
FIGURE TVF107-1. Total voltage distortion.

TABLE TVF107-III. Sample data sheet for TVF107 total voltage distortion for three phase, variable frequency utilization equipment.

Parameters					Performance	
Phase	Voltage	Frequency	Voltage Distortion Factor	Time Duration at Test Condition	Pass/Fail	
Testing performed at a fundamental frequency of 400 Hz						
A	V _{rms}	Hz	No units	min		
B	V _{rms}		No units			
C	V _{rms}		No units			
Voltage Harmonics Phase A			Voltage Harmonics Phase B		Voltage Harmonics Phase C	
Fund	%		Fund	%	Fund	%
2 nd	%		2 nd	%	2 nd	%
3 rd	%		3 rd	%	3 rd	%
4 th	%		4 th	%	4 th	%
5 th	%		5 th	%	5 th	%
6 th	%		6 th	%	6 th	%
7 th	%		7 th	%	7 th	%
8 th	%		8 th	%	8 th	%
9 th	%		9 th	%	9 th	%
10 th	%		10 th	%	10 th	%
11 th	%		11 th	%	11 th	%
12 th	%		12 th	%	12 th	%
13 th	%		13 th	%	13 th	%
14 th	%		14 th	%	14 th	%
15 th	%		15 th	%	15 th	%

TABLE TVF107-III. Sample data sheet for TVF107 total voltage distortion for three phase, variable frequency utilization equipment. - Continued

Phase	Parameters					Performance	
	Voltage	Frequency	Voltage Distortion Factor	Time Duration at Test Condition	Pass/Fail		
Testing performed at a fundamental frequency of 360 Hz							
A	V _{rms}	Hz	No units	min			
B	V _{rms}		No units				
C	V _{rms}		No units				
	Voltage Harmonics Phase A		Voltage Harmonics Phase B		Voltage Harmonics Phase C		
	Fund	%	Fund	%	Fund	%	
	2 nd	%	2 nd	%	2 nd	%	
	3 rd	%	3 rd	%	3 rd	%	
	4 th	%	4 th	%	4 th	%	
	5 th	%	5 th	%	5 th	%	
	6 th	%	6 th	%	6 th	%	
	7 th	%	7 th	%	7 th	%	
	8 th	%	8 th	%	8 th	%	
	9 th	%	9 th	%	9 th	%	
	10 th	%	10 th	%	10 th	%	
	11 th	%	11 th	%	11 th	%	
	12 th	%	12 th	%	12 th	%	
	13 th	%	13 th	%	13 th	%	
	14 th	%	14 th	%	14 th	%	
	15 th	%	15 th	%	15 th	%	

TABLE TVF107-III. Sample data sheet for TVF107 total voltage distortion for three phase, variable frequency utilization equipment. - Continued

Phase	Parameters					Performance	
	Voltage	Frequency	Voltage Distortion Factor	Time Duration at Test Condition	Pass/Fail		
Testing performed at a fundamental frequency of 600 Hz							
A	V _{rms}	Hz	No units	min	No units		
B	V _{rms}		No units				
C	V _{rms}		No units				
	Voltage Harmonics Phase A		Voltage Harmonics Phase B		Voltage Harmonics Phase C		
	Fund	%	Fund	%	Fund	%	
	2 nd	%	2 nd	%	2 nd	%	
	3 rd	%	3 rd	%	3 rd	%	
	4 th	%	4 th	%	4 th	%	
	5 th	%	5 th	%	5 th	%	
	6 th	%	6 th	%	6 th	%	
	7 th	%	7 th	%	7 th	%	
	8 th	%	8 th	%	8 th	%	
	9 th	%	9 th	%	9 th	%	
	10 th	%	10 th	%	10 th	%	
	11 th	%	11 th	%	11 th	%	
	12 th	%	12 th	%	12 th	%	
	13 th	%	13 th	%	13 th	%	
	14 th	%	14 th	%	14 th	%	
	15 th	%	15 th	%	15 th	%	

TABLE TVF107-III. Sample data sheet for TVF107 total voltage distortion for three phase, variable frequency utilization equipment. - Continued

Phase	Parameters					Performance	
	Voltage	Frequency	Voltage Distortion Factor	Time Duration at Test Condition	Pass/Fail		
Testing performed at a fundamental frequency of 800 Hz							
A	V _{rms}	Hz	No units	min			
B	V _{rms}		No units				
C	V _{rms}		No units				
	Voltage Harmonics Phase A		Voltage Harmonics Phase B		Voltage Harmonics Phase C		
	Fund	%	Fund	%	Fund	%	
	2 nd	%	2 nd	%	2 nd	%	
	3 rd	%	3 rd	%	3 rd	%	
	4 th	%	4 th	%	4 th	%	
	5 th	%	5 th	%	5 th	%	
	6 th	%	6 th	%	6 th	%	
	7 th	%	7 th	%	7 th	%	
	8 th	%	8 th	%	8 th	%	
	9 th	%	9 th	%	9 th	%	
	10 th	%	10 th	%	10 th	%	
	11 th	%	11 th	%	11 th	%	
	12 th	%	12 th	%	12 th	%	
	13 th	%	13 th	%	13 th	%	
	14 th	%	14 th	%	14 th	%	
	15 th	%	15 th	%	15 th	%	

MIL-HDBK-704-5

METHOD TVF108
DC Voltage Component

POWER GROUP: Three 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 three 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 TVF108-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 TVF108-I. MIL-STD-704 limits for direct current component of AC voltage for three 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	± 0.10 V

3. Apparatus. The test 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 TVF108-1. 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 TVF108-1. Set the programmable power

MIL-HDBK-704-5

supply to produce voltage waveforms having a DC component on each of the three phases for test condition A as noted in table TVF108-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 TVF108-II. Record the voltages, 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 TVF108-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 voltage sine waves 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 TVF108-II. Test conditions for direct current component of AC voltage for three phase, variable frequency utilization equipment.

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

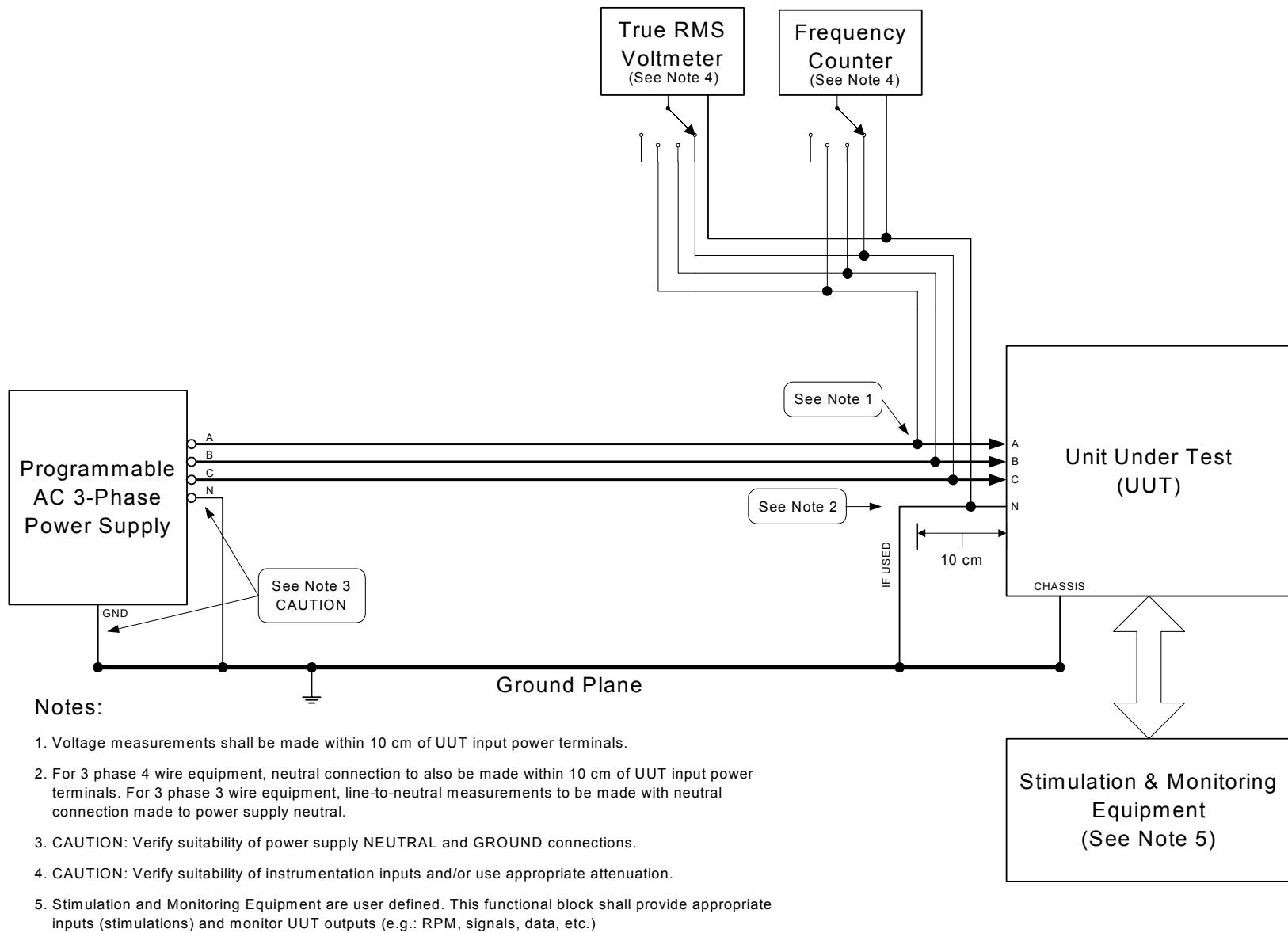
FIGURE TVF108-1. DC voltage component.

TABLE TVF108-III. Sample data sheet for TVF108 DC voltage component for three phase, variable frequency utilization equipment.

Test Condition	Parameters						Performance
	Phase	Voltage	Frequency	DC Voltage Component	Time Duration at Test Condition	Pass/Fail	
Testing Performed at 400 Hz							
A	A	V _{rms}	Hz	V _{dc}	min		
	B	V _{rms}		V _{dc}			
	C	V _{rms}		V _{dc}			
B	A	V _{rms}	Hz	V _{dc}	min		
	B	V _{rms}		V _{dc}			
	C	V _{rms}		V _{dc}			
Testing Performed at 360 Hz							
A	A	V _{rms}	Hz	V _{dc}	min		
	B	V _{rms}		V _{dc}			
	C	V _{rms}		V _{dc}			
B	A	V _{rms}	Hz	V _{dc}	min		
	B	V _{rms}		V _{dc}			
	C	V _{rms}		V _{dc}			
Testing Performed at 600 Hz							
A	A	V _{rms}	Hz	V _{dc}	min		
	B	V _{rms}		V _{dc}			
	C	V _{rms}		V _{dc}			
B	A	V _{rms}	Hz	V _{dc}	min		
	B	V _{rms}		V _{dc}			
	C	V _{rms}		V _{dc}			

TABLE TVF108-III. Sample data sheet for TVF108 DC voltage component for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters					Performance		
	Phase	Voltage	Frequency	DC Voltage Component	Time Duration at Test Condition			
Testing Performed at 800 Hz								
A	A		V _{rms}		Hz	V _{dc}	min	
	B		V _{rms}			V _{dc}		
	C		V _{rms}			V _{dc}		
B	A		V _{rms}		Hz	V _{dc}	min	
	B		V _{rms}			V _{dc}		
	C		V _{rms}			V _{dc}		

MIL-HDBK-704-5

METHOD TVF109
Normal Voltage Transients

POWER GROUP: Three 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 three 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 TVF109-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 TVF109-I. MIL-STD-704 limits for normal voltage transients for three 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 TVF109-1. 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 TVF109-1. 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

MIL-HDBK-704-5

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 TVF109-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 TVF109-II. The voltage must return to steady state over the time duration noted in table TVF109-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 voltages, 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 TVF109-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.

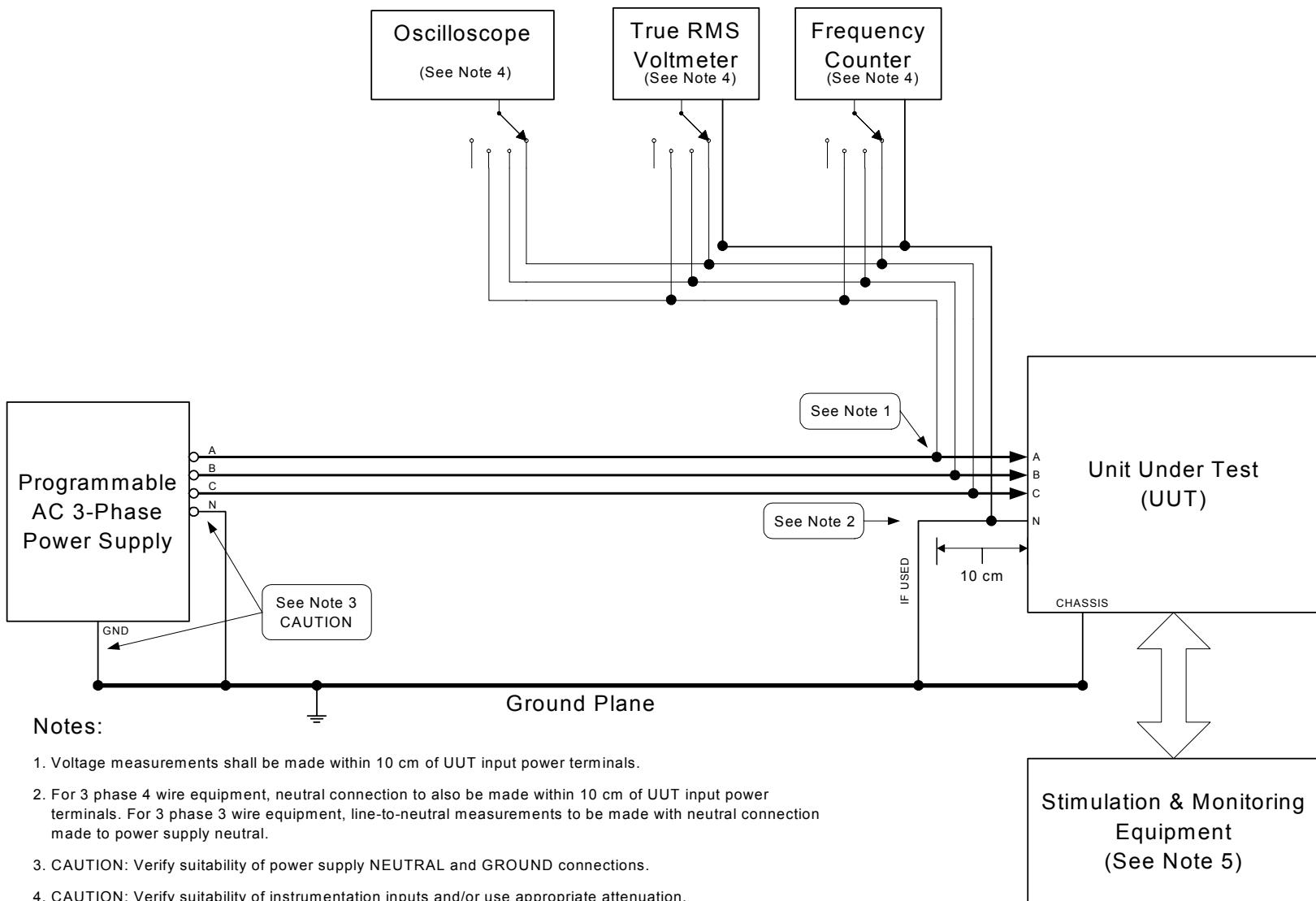
5.1 Repetitive normal voltage transients test. Program the power supply to provide a continually repeating voltage transient that decreases from 115 Vrms to 90 Vrms in $\frac{1}{2}$ cycle, then increases to 140 Vrms over 50 msec, then decreases to 115 Vrms over $\frac{1}{2}$ cycle. The voltage transient is repeated every 0.5 seconds, see figure TVF109-2. 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 voltages, 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 TVF109-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.

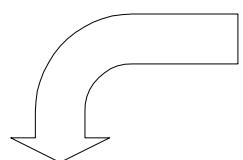
MIL-HDBK-704-5

TABLE TVF109-II. Test conditions for normal voltage transients for three 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
Overvoltage Transients				
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
Undervoltage Transients				
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
Combined Transient				
M	< ½ cycle then < ½ cycle	80 Vrms 180 Vrms	10 msec 10 msec	< ½ cycle 77 msec

FIGURE TVF109-1. Normal voltage transients.

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



Repetitive Normal Voltage Transient

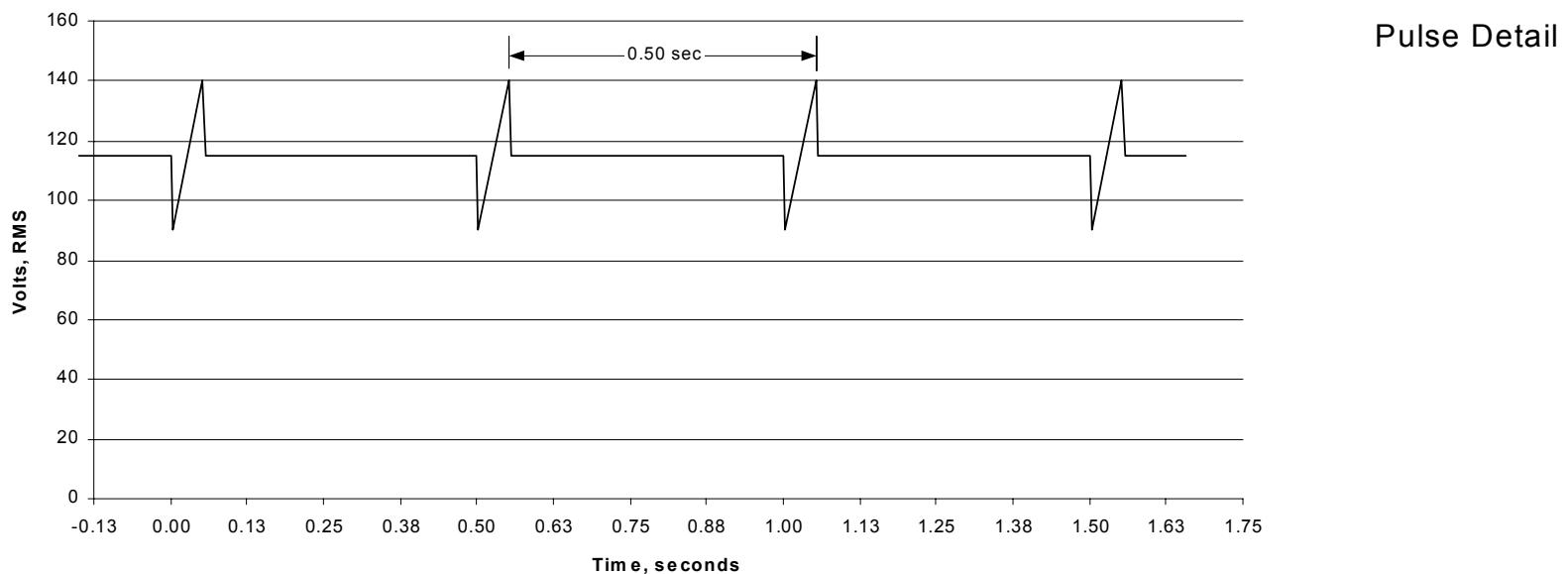
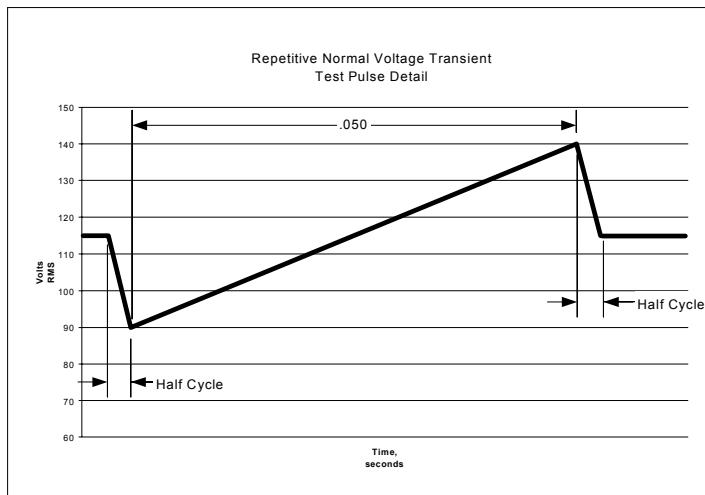


FIGURE TVF109-2. Repetitive Normal Voltage Transient.

TABLE TVF109-III. Sample data sheet for TVF109 normal voltage transients for three phase, variable frequency utilization equipment.

18

MIL-HDBK-704-5

Test Condition	Parameters							Performance	
	Phase	Steady State Voltage	Steady State Frequency	Voltage Transient	Time at Voltage Transient Level	Oscilloscope Trace		Pass/Fail	
Testing performed at 400 Hz									
A	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
B	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
C	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
D	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
E	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
F	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
G	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec

TABLE TVF109-III. Sample data sheet for TVF109 normal voltage transients for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters							Performance	
	Phase	Steady State Voltage	Steady State Frequency	Voltage Transient	Time at Voltage Transient Level	Oscilloscope Trace		Pass/Fail	
Testing performed at 400 Hz									
H	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
I	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
J	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
K	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
L	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
M	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
	A						V _{rms}		msec
	B						V _{rms}		msec
	C						V _{rms}		msec

TABLE TVF109-III. Sample data sheet for TVF109 normal voltage transients for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters							Performance	
	Phase	Steady State Voltage	Steady State Frequency	Voltage Transient	Time at Voltage Transient Level	Oscilloscope Trace		Pass/Fail	
Testing performed at 400 Hz									
Repetitive Transient	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
	A						V _{rms}		msec
	B						V _{rms}		msec
	C						V _{rms}		msec
		Time duration at test condition							

TABLE TVF109-III. Sample data sheet for TVF109 normal voltage transients for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters							Performance	
	Phase	Steady State Voltage	Steady State Frequency	Voltage Transient	Time at Voltage Transient Level	Oscilloscope Trace		Pass/Fail	
Testing performed at 360 Hz									
A	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
B	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
C	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
D	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
E	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
F	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
G	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec

TABLE TVF109-III. Sample data sheet for TVF109 normal voltage transients for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters							Performance	
	Phase	Steady State Voltage	Steady State Frequency	Voltage Transient	Time at Voltage Transient Level	Oscilloscope Trace		Pass/Fail	
Testing performed at 360 Hz									
H	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
I	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
J	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
K	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
L	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
M	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
	A						V _{rms}		msec
	B						V _{rms}		msec
	C						V _{rms}		msec

TABLE TVF109-III. Sample data sheet for TVF109 normal voltage transients for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters							Performance	
	Phase	Steady State Voltage	Steady State Frequency	Voltage Transient	Time at Voltage Transient Level	Oscilloscope Trace		Pass/Fail	
Testing performed at 360 Hz									
Repetitive Transient	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
	A						V _{rms}		msec
	B						V _{rms}		msec
	C						V _{rms}		msec
		Time duration at test condition							

TABLE TVF109-III. Sample data sheet for TVF109 normal voltage transients for three phase, variable frequency utilization equipment. - Continued

87

MIL-HDBK-704-5

Test Condition	Parameters							Performance	
	Phase	Steady State Voltage	Steady State Frequency	Voltage Transient	Time at Voltage Transient Level	Oscilloscope Trace		Pass/Fail	
Testing performed at 600 Hz									
A	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
B	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
C	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
D	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
E	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
F	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
G	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec

TABLE TVF109-III. Sample data sheet for TVF109 normal voltage transients for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters							Performance	
	Phase	Steady State Voltage	Steady State Frequency	Voltage Transient	Time at Voltage Transient Level	Oscilloscope Trace		Pass/Fail	
Testing performed at 600 Hz									
H	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
I	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
J	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
K	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
L	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
M	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
	A						V _{rms}		msec
	B						V _{rms}		msec
	C						V _{rms}		msec

TABLE TVF109-III. Sample data sheet for TVF109 normal voltage transients for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters							Performance	
	Phase	Steady State Voltage	Steady State Frequency	Voltage Transient	Time at Voltage Transient Level	Oscilloscope Trace		Pass/Fail	
Testing performed at 600 Hz									
Repetitive Transient	A		V_{rms}		Hz		V_{rms}		msec
	B		V_{rms}				V_{rms}		msec
	C		V_{rms}				V_{rms}		msec
	A						V_{rms}		msec
	B						V_{rms}		msec
	C						V_{rms}		msec
		Time duration at test condition							

TABLE TVF109-III. Sample data sheet for TVF109 normal voltage transients for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters							Performance	
	Phase	Steady State Voltage	Steady State Frequency	Voltage Transient	Time at Voltage Transient Level	Oscilloscope Trace		Pass/Fail	
Testing performed at 800 Hz									
A	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
B	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
C	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
D	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
E	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
F	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
G	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec

TABLE TVF109-III. Sample data sheet for TVF109 normal voltage transients for three phase, variable frequency utilization equipment. - Continued

91

MIL-HDBK-704-5

Test Condition	Parameters							Performance	
	Phase	Steady State Voltage	Steady State Frequency	Voltage Transient	Time at Voltage Transient Level	Oscilloscope Trace		Pass/Fail	
Testing performed at 800 Hz									
H	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
I	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
J	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
K	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
L	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
M	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
	A						V _{rms}		msec
	B						V _{rms}		msec
	C						V _{rms}		msec

TABLE TVF109-III. Sample data sheet for TVF109 normal voltage transients for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters							Performance	
	Phase	Steady State Voltage	Steady State Frequency	Voltage Transient	Time at Voltage Transient Level	Oscilloscope Trace		Pass/Fail	
Testing performed at 800 Hz									
Repetitive Transient	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
	A						V _{rms}		msec
	B						V _{rms}		msec
	C						V _{rms}		msec
		Time duration at test condition							

MIL-HDBK-704-5

METHOD TVF110
Normal Frequency Transients

POWER GROUP: Three 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 three 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 TVF110-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 TVF110-I. MIL-STD-704 limits for normal frequency transients for three 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 TVF110-1. Measurements, except current, must be made within 10 cm of the input power terminals of the UUT.

MIL-HDBK-704-5

5. Compliance test. With the power source off, install the UUT and the stimulation and monitoring equipment into the test setup of figure TVF110-1. 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 TVF110-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, monitoring 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 voltages, 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 TVF110-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.

MIL-HDBK-704-5

TABLE TVF110-II. Test conditions for MIL-STD-704 normal frequency transients for three phase, variable frequency utilization equipment.

Test Condition	Start Frequency	Time From Start Frequency to 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	$\frac{1}{2}$ cycle	1.76 seconds
B	360 Hz	1.76 seconds	800 Hz	1 second	1.76 seconds
C	360 Hz	0.96 seconds	600 Hz	$\frac{1}{2}$ cycle	0.96 seconds
D	360 Hz	0.96 seconds	600 Hz	1 second	0.96 seconds
Underfrequency Transients					
E	800 Hz	1.76 seconds	360 Hz	$\frac{1}{2}$ cycle	1.76 seconds
F	800 Hz	1.76 seconds	360 Hz	1 second	1.76 seconds
G	800 Hz	0.80 seconds	600 Hz	$\frac{1}{2}$ cycle	0.80 seconds
H	800 Hz	0.80 seconds	600 Hz	1 second	0.80 seconds
Combined Transient					
I	600 Hz	0.96 seconds then 0.80 seconds	360 Hz 800 Hz	$\frac{1}{2}$ cycle $\frac{1}{2}$ cycle	0.96 seconds 0.80 seconds

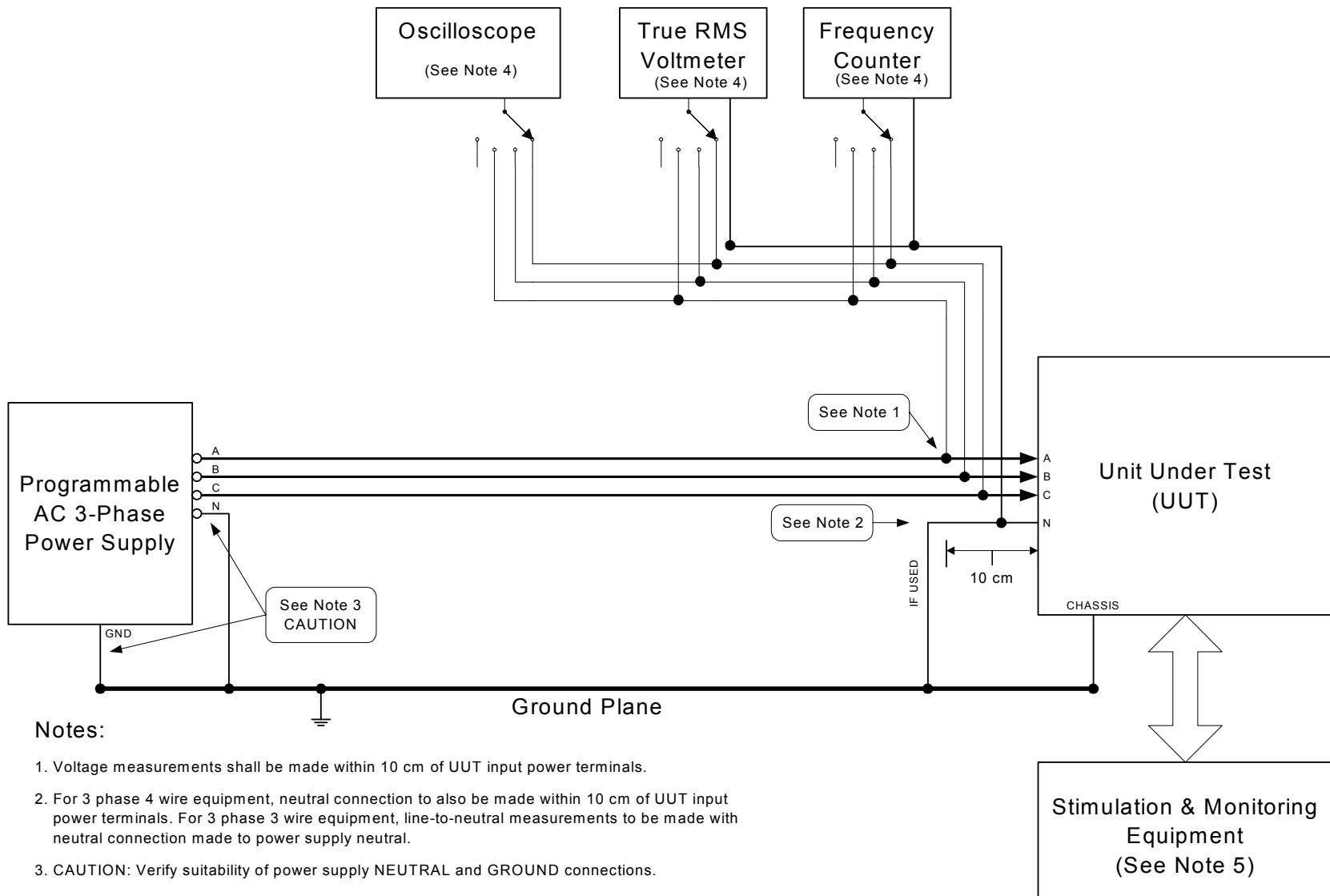
FIGURE TVF110-1. Normal frequency transients.

TABLE TVF110-III. Sample data sheet for TVF110 normal frequency transients for three phase, variable frequency utilization equipment.

97

MIL-HDBK-704-5

Test Condition	Parameters							Performance		
	Phase	Steady State Voltage		Start Frequency	Frequency Transient		Time at Frequency Transient Level	Oscilloscope Trace		Pass/Fail
A	A		V _{rms}		Hz		Hz	msec	Attach Trace	Hz vs Time
	B		V _{rms}							
	C		V _{rms}							
B	A		V _{rms}		Hz		Hz	sec	Attach Trace	Hz vs Time
	B		V _{rms}							
	C		V _{rms}							
C	A		V _{rms}		Hz		Hz	msec	Attach Trace	Hz vs Time
	B		V _{rms}							
	C		V _{rms}							
D	A		V _{rms}		Hz		Hz	sec	Attach Trace	Hz vs Time
	B		V _{rms}							
	C		V _{rms}							
E	A		V _{rms}		Hz		Hz	msec	Attach Trace	Hz vs Time
	B		V _{rms}							
	C		V _{rms}							
F	A		V _{rms}		Hz		Hz	sec	Attach Trace	Hz vs Time
	B		V _{rms}							
	C		V _{rms}							
G	A		V _{rms}		Hz		Hz	msec	Attach Trace	Hz vs Time
	B		V _{rms}							
	C		V _{rms}							

TABLE TVF110-III. Sample data sheet for TVF110 normal frequency transients for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters							Performance				
	Phase	Steady State Voltage		Start Frequency	Frequency Transient		Time at Frequency Transient Level	Oscilloscope Trace		Pass/Fail		
H	A		V _{rms}		Hz		Hz		sec	Attach Trace	Hz vs Time	
	B		V _{rms}									
	C		V _{rms}									
I	A		V _{rms}		Hz		Hz		msec	Attach Trace	Hz vs Time	
	B		V _{rms}									
	C		V _{rms}									
						Hz		msec				

MIL-HDBK-704-5

METHOD TVF201
Power Interrupt

POWER GROUP: Three 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 three 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 TVF201-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 TVF201-I. MIL-STD-704 power transfer limits for three 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 TVF201-1. The dummy resistive load placed in parallel to the UUT should be sized to draw three times the steady state current of the

MIL-HDBK-704-5

UUT up to a maximum of 25 kW dummy load. 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 TVF201-1. 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 TVF201-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 second. 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, monitor 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 voltages, 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 TVF201-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.

MIL-HDBK-704-5

TABLE TVF201-II. Test conditions for transfer interrupt for three 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)

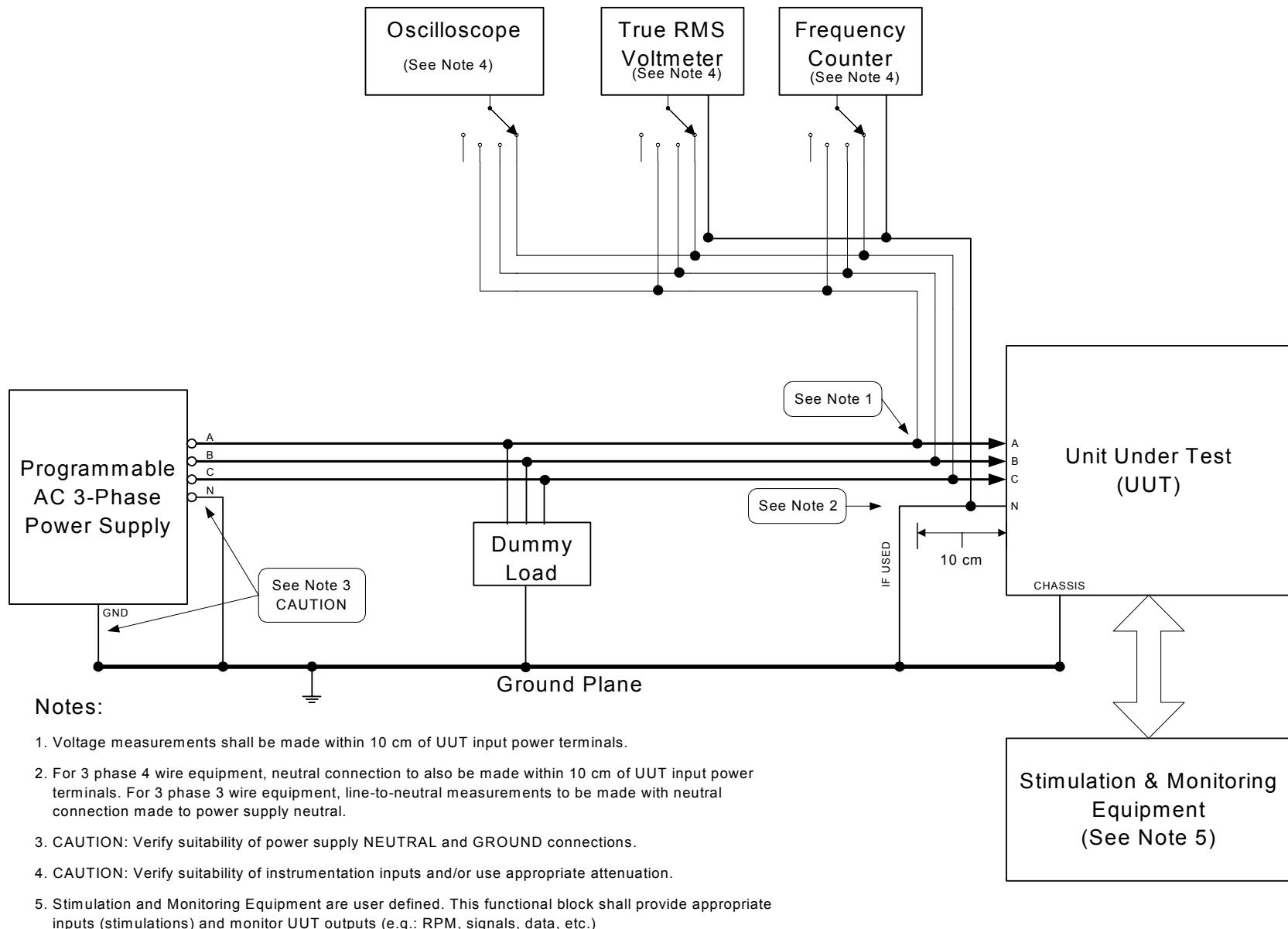
FIGURE TVF201-1. Power interrupt.

TABLE TVF201-III. Sample data sheet for TVF201 power interrupt for three phase, variable frequency utilization equipment.

Test Condition	Parameter					Performance
	Phase	Voltage	Frequency	Time Duration of Power Interrupt		
Testing performed at 400 Hz						
A	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
B	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
C	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
D	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
E	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
F	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
G	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec

TABLE TVF201-III. Sample data sheet for TVF201 power interrupt for three phase, variable frequency utilization equipment. -
Continued

Test Condition	Parameter					Performance
	Phase	Voltage	Frequency	Time Duration of Power Interrupt	Pass/Fail	
Testing performed at 400 Hz						
H	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
I	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
J	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
K	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
	Voltage Transient Level			Time at Voltage Transient Level		
	A	V _{rms}				msec
	B	V _{rms}				msec
	C	V _{rms}				msec

TABLE TVF201-III. Sample data sheet for TVF201 power interrupt for three phase, variable frequency utilization equipment. -
Continued

Test Condition	Parameter					Performance
	Phase	Voltage	Frequency	Time Duration of Power Interrupt		
Testing performed at 400 Hz						
L	A	V _{rms}	Hz		msec	
	B	V _{rms}			msec	
	C	V _{rms}			msec	
	Voltage Transient Level			Time at Voltage Transient Level		
	A	V _{rms}			msec	
	B	V _{rms}			msec	
	C	V _{rms}			msec	

TABLE TVF201-III. Sample data sheet for TVF201 power interrupt for three phase, variable frequency utilization equipment. -
Continued

Test Condition	Parameter					Performance
	Phase	Voltage	Frequency	Time Duration of Power Interrupt	Pass/Fail	
Testing performed at 360 Hz						
A	A	V _{rms}		Hz	msec	
	B	V _{rms}			msec	
	C	V _{rms}			msec	
B	A	V _{rms}		Hz	msec	
	B	V _{rms}			msec	
	C	V _{rms}			msec	
C	A	V _{rms}		Hz	msec	
	B	V _{rms}			msec	
	C	V _{rms}			msec	
D	A	V _{rms}		Hz	msec	
	B	V _{rms}			msec	
	C	V _{rms}			msec	
E	A	V _{rms}		Hz	msec	
	B	V _{rms}			msec	
	C	V _{rms}			msec	
F	A	V _{rms}		Hz	msec	
	B	V _{rms}			msec	
	C	V _{rms}			msec	
G	A	V _{rms}		Hz	msec	
	B	V _{rms}			msec	
	C	V _{rms}			msec	

TABLE TVF201-III. Sample data sheet for TVF201 power interrupt for three phase, variable frequency utilization equipment. -
Continued

Test Condition	Parameter					Performance
	Phase	Voltage	Frequency	Time Duration of Power Interrupt	Pass/Fail	
Testing performed at 360 Hz						
H	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
I	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
J	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
K	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
	Voltage Transient Level			Time at Voltage Transient Level		
	A	V _{rms}				msec
	B	V _{rms}				msec
	C	V _{rms}				msec

TABLE TVF201-III. Sample data sheet for TVF201 power interrupt for three phase, variable frequency utilization equipment. -
Continued

Test Condition	Parameter					Performance
	Phase	Voltage	Frequency	Time Duration of Power Interrupt		
Testing performed at 360 Hz						
L	A	V _{rms}	Hz		msec	
	B	V _{rms}			msec	
	C	V _{rms}			msec	
	Voltage Transient Level			Time at Voltage Transient Level		
	A	V _{rms}			msec	
	B	V _{rms}			msec	
	C	V _{rms}			msec	

TABLE TVF201-III. Sample data sheet for TVF201 power interrupt for three phase, variable frequency utilization equipment. -
Continued

Test Condition	Parameter					Performance
	Phase	Voltage	Frequency	Time Duration of Power Interrupt	Pass/Fail	
Testing performed at 600 Hz						
A	A	V _{rms}		Hz	msec	
	B	V _{rms}			msec	
	C	V _{rms}			msec	
B	A	V _{rms}		Hz	msec	
	B	V _{rms}			msec	
	C	V _{rms}			msec	
C	A	V _{rms}		Hz	msec	
	B	V _{rms}			msec	
	C	V _{rms}			msec	
D	A	V _{rms}		Hz	msec	
	B	V _{rms}			msec	
	C	V _{rms}			msec	
E	A	V _{rms}		Hz	msec	
	B	V _{rms}			msec	
	C	V _{rms}			msec	
F	A	V _{rms}		Hz	msec	
	B	V _{rms}			msec	
	C	V _{rms}			msec	
G	A	V _{rms}		Hz	msec	
	B	V _{rms}			msec	
	C	V _{rms}			msec	

TABLE TVF201-III. Sample data sheet for TVF201 power interrupt for three phase, variable frequency utilization equipment. -
Continued

Test Condition	Parameter					Performance
	Phase	Voltage	Frequency	Time Duration of Power Interrupt	Pass/Fail	
Testing performed at 600 Hz						
H	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
I	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
J	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
K	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
	Voltage Transient Level			Time at Voltage Transient Level		
	A	V _{rms}				msec
	B	V _{rms}				msec
	C	V _{rms}				msec

TABLE TVF201-III. Sample data sheet for TVF201 power interrupt for three phase, variable frequency utilization equipment. -
Continued

Test Condition	Parameter					Performance
	Phase	Voltage	Frequency	Time Duration of Power Interrupt		
Testing performed at 600 Hz						
L	A	V _{rms}	Hz		msec	
	B	V _{rms}			msec	
	C	V _{rms}			msec	
	Voltage Transient Level			Time at Voltage Transient Level		
	A	V _{rms}			msec	
	B	V _{rms}			msec	
	C	V _{rms}			msec	

TABLE TVF201-III. Sample data sheet for TVF201 power interrupt for three phase, variable frequency utilization equipment. -
Continued

Test Condition	Parameter					Performance
	Phase	Voltage	Frequency	Time Duration of Power Interrupt	Pass/Fail	
Testing performed at 800 Hz						
A	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
B	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
C	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
D	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
E	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
F	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
G	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec

TABLE TVF201-III. Sample data sheet for TVF201 power interrupt for three phase, variable frequency utilization equipment. -
Continued

Test Condition	Parameter					Performance
	Phase	Voltage	Frequency	Time Duration of Power Interrupt	Pass/Fail	
Testing performed at 800 Hz						
H	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
I	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
J	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
K	A	V _{rms}		Hz		msec
	B	V _{rms}				msec
	C	V _{rms}				msec
	Voltage Transient Level			Time at Voltage Transient Level		
	A	V _{rms}				msec
	B	V _{rms}				msec
	C	V _{rms}				msec

TABLE TVF201-III. Sample data sheet for TVF201 power interrupt for three phase, variable frequency utilization equipment. -
Continued

Test Condition	Parameter					Performance
	Phase	Voltage	Frequency	Time Duration of Power Interrupt		
Testing performed at 800 Hz						
L	A	V _{rms}	Hz		msec	
	B	V _{rms}			msec	
	C	V _{rms}			msec	
	Voltage Transient Level			Time at Voltage Transient Level		
	A	V _{rms}			msec	
	B	V _{rms}			msec	
	C	V _{rms}			msec	

MIL-HDBK-704-5

METHOD TVF301
Abnormal Steady State Limits for Voltage and Frequency

POWER GROUP: Three 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 three phase, 115 Volt, variable frequency power utilization equipment klkklk 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 TVF301-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 TVF301-I. MIL-STD-704 abnormal limits for steady state voltage and frequency for three 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

MIL-HDBK-704-5

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 TVF301-1. 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 TVF301-1. 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 TVF301-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 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 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 voltages, 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 TVF301-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.

MIL-HDBK-704-5

TABLE TVF301-II. Test conditions for abnormal steady state limits of voltage and frequency for three 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

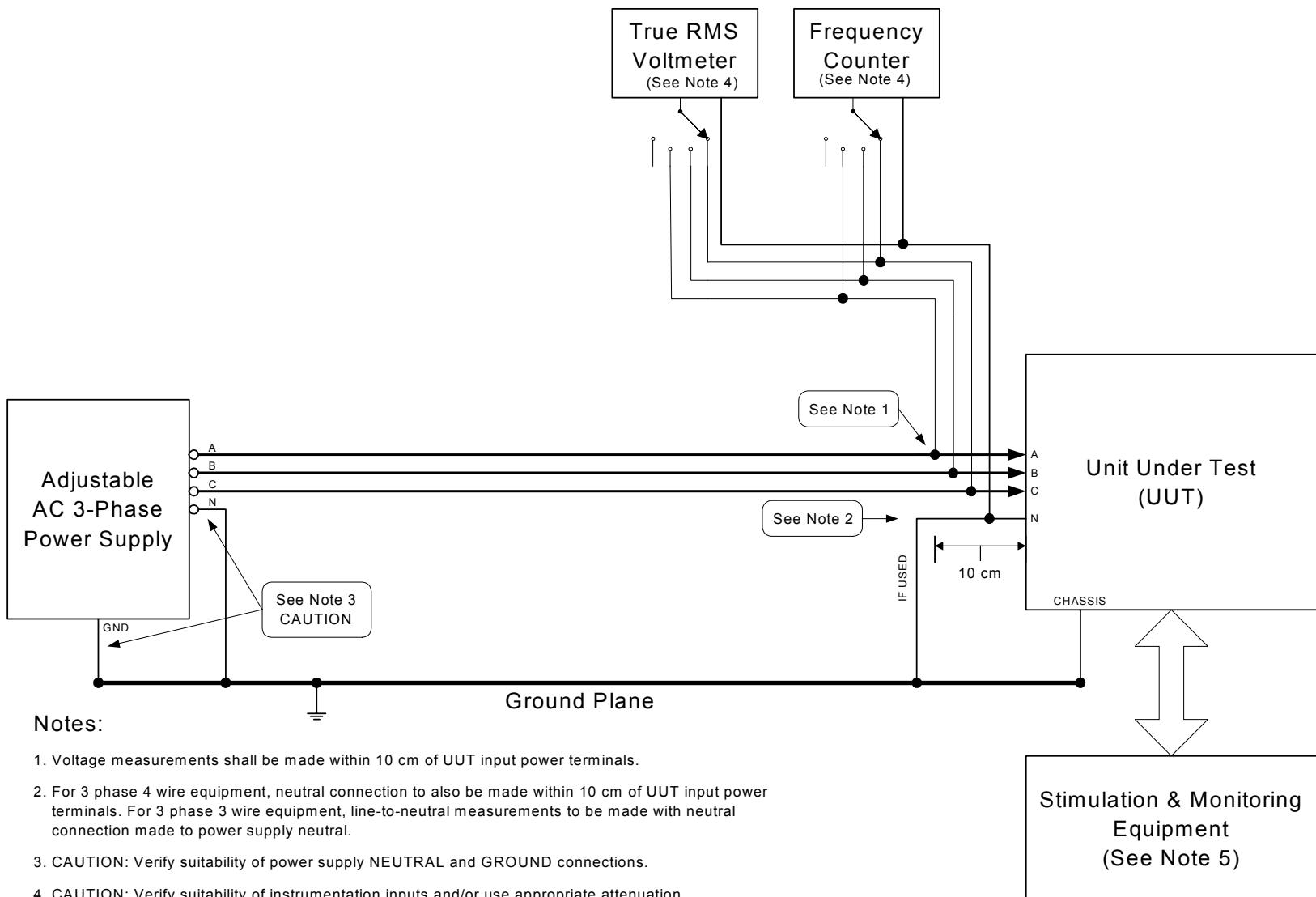
FIGURE TVF301-1. Abnormal steady state limits for voltage and frequency.

TABLE TVF301-III. Sample data sheet for TVF301 abnormal steady state limits for voltage and frequency for three phase, variable frequency utilization equipment.

Test Condition	Parameter					Performance
	Phase	Voltage		Frequency	Time Duration at Test Condition	
A	A	V _{rms}		Hz		min
	B	V _{rms}				
	C	V _{rms}				
B	A	V _{rms}		Hz		min
	B	V _{rms}				
	C	V _{rms}				
C	A	V _{rms}		Hz		min
	B	V _{rms}				
	C	V _{rms}				
D	A	V _{rms}		Hz		min
	B	V _{rms}				
	C	V _{rms}				
E	A	V _{rms}		Hz		min
	B	V _{rms}				
	C	V _{rms}				
F	A	V _{rms}		Hz		min
	B	V _{rms}				
	C	V _{rms}				

TABLE TVF301-III. Sample data sheet for TVF301 abnormal steady state limits for voltage and frequency for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameter					Performance		
	Phase	Voltage		Frequency	Time Duration at Test Condition			
G	A		V_{rms}		Hz		min	
	B		V_{rms}					
	C		V_{rms}					
H	A		V_{rms}		Hz		min	
	B		V_{rms}					
	C		V_{rms}					

MIL-HDBK-704-5

METHOD TVF302
Abnormal Voltage Transients

POWER GROUP: Three 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 three 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 TVF302-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 TVF302-I. MIL-STD-704 limits for abnormal voltage transients for three 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 TVF302-1. 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 TVF302-1. Turn on the power source and adjust the voltage to the nominal steady state voltage of 115 Vrms (line-to-neutral) and adjust the

MIL-HDBK-704-5

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 TVF302-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 TVF302-II. The voltage must return to steady state over the time duration noted in table TVF302-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 voltages, 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 TVF302-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.

MIL-HDBK-704-5

TABLE TVF302-II. Test conditions for abnormal voltage transients for three 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
	< ½ cycle	140 Vrms	180 msec	87 msec
	then	135 Vrms	decreasing	253 msec
B	then	130 Vrms	decreasing	6.41 sec
	then	125 Vrms	decreasing	>10 sec
		115 Vrms		
C	< ½ cycle	160 Vrms	78 msec	< ½ cycle
	< ½ cycle	160 Vrms	78 msec	31 msec
	then	150 Vrms	decreasing	71 msec
D	then	140 Vrms	decreasing	87 msec
	then	135 Vrms	decreasing	253 msec
	then	130 Vrms	decreasing	6.41 sec
	then	125 Vrms	decreasing	>10 sec
		115 Vrms		
E	< ½ cycle	180 Vrms	50 msec	< ½ cycle
	< ½ cycle	180 Vrms	50 msec	11 msec
	then	170 Vrms	decreasing	17 msec
F	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	>10 sec
		115 Vrms		
G	< ½ cycle	180 Vrms (3 times)	20 msec every 0.5 sec	< ½ cycle

MIL-HDBK-704-5

TABLE TVF302-II. Test conditions for abnormal voltage transients for three 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
Undervoltage Transients				
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	>10 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	>10 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	>10 sec
		115 Vrms		
N	< ½ cycle	45 Vrms (3 times)	20 msec every 0.5 sec	< ½ cycle
Combined Transient				
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	>10 sec
		115 Vrms		

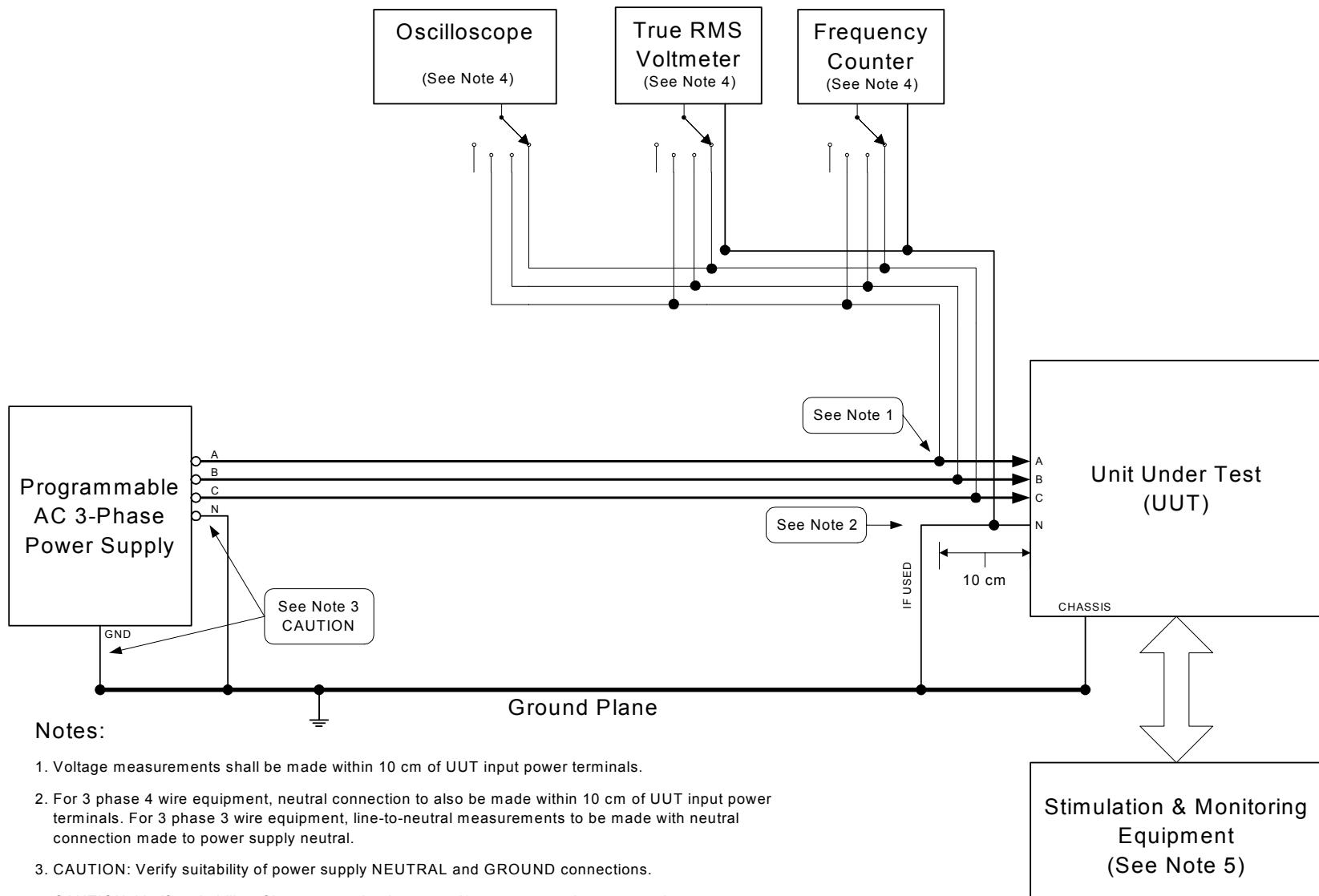
FIGURE TVF302-1. Abnormal voltage transients.

TABLE TVF302-III. Sample data sheet for TVF302 abnormal voltage transients for three phase, variable frequency utilization equipment.

126

MIL-HDBK-704-5

Test Condition	Parameters							Performance	
	Phase	Steady State Voltage	Steady State Frequency	Voltage Transient	Time at Voltage Transient Level	Oscilloscope Trace		Pass/Fail	
Testing Performed at 400 Hz									
A	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
B	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
C	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
D	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
E	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
F	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
G	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec

TABLE TVF302-III. Sample data sheet for TVF302 abnormal voltage transients for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters							Performance	
	Phase	Steady State Voltage	Steady State Frequency	Voltage Transient	Time at Voltage Transient Level	Oscilloscope Trace		Pass/Fail	
Testing Performed at 400 Hz									
H	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
I	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
J	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
K	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
L	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
M	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec

TABLE TVF302-III. Sample data sheet for TVF302 abnormal voltage transients for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters							Performance	
	Phase	Steady State Voltage	Steady State Frequency	Voltage Transient	Time at Voltage Transient Level	Oscilloscope Trace		Pass/Fail	
Testing Performed at 400 Hz									
N	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
O	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
	A						V _{rms}		msec
	B						V _{rms}		msec
	C						V _{rms}		msec
Testing Performed at 360 Hz									
A	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
B	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
C	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
D	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec

TABLE TVF302-III. Sample data sheet for TVF302 abnormal voltage transients for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters							Performance	
	Phase	Steady State Voltage	Steady State Frequency	Voltage Transient	Time at Voltage Transient Level	Oscilloscope Trace		Pass/Fail	
Testing Performed at 360 Hz									
E	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
F	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
G	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
H	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
I	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
J	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
K	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec

TABLE TVF302-III. Sample data sheet for TVF302 abnormal voltage transients for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters							Performance	
	Phase	Steady State Voltage	Steady State Frequency	Voltage Transient	Time at Voltage Transient Level	Oscilloscope Trace		Pass/Fail	
Testing Performed at 360 Hz									
L	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
M	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
N	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
O	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
	A						V _{rms}		msec
	B						V _{rms}		msec
	C						V _{rms}		msec
Testing Performed at 600 Hz									
A	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
B	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec

TABLE TVF302-III. Sample data sheet for TVF302 abnormal voltage transients for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters							Performance	
	Phase	Steady State Voltage	Steady State Frequency	Voltage Transient	Time at Voltage Transient Level	Oscilloscope Trace		Pass/Fail	
Testing Performed at 600 Hz									
C	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
D	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
E	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
F	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
G	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
H	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
I	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec

TABLE TVF302-III. Sample data sheet for TVF302 abnormal voltage transients for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters							Performance	
	Phase	Steady State Voltage	Steady State Frequency	Voltage Transient	Time at Voltage Transient Level	Oscilloscope Trace		Pass/Fail	
Testing Performed at 600 Hz									
J	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
K	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
L	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
M	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
N	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
O	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
	A						V _{rms}		msec
	B						V _{rms}		msec
	C						V _{rms}		msec

TABLE TVF302-III. Sample data sheet for TVF302 abnormal voltage transients for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters							Performance	
	Phase	Steady State Voltage	Steady State Frequency	Voltage Transient	Time at Voltage Transient Level	Oscilloscope Trace		Pass/Fail	
Testing Performed at 800 Hz									
A	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
B	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
C	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
D	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
E	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
F	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
G	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec

TABLE TVF302-III. Sample data sheet for TVF302 abnormal voltage transients for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters							Performance	
	Phase	Steady State Voltage	Steady State Frequency	Voltage Transient	Time at Voltage Transient Level	Oscilloscope Trace		Pass/Fail	
Testing Performed at 800 Hz									
H	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
I	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
J	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
K	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
L	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
M	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec

TABLE TVF302-III. Sample data sheet for TVF302 abnormal voltage transients for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters							Performance	
	Phase	Steady State Voltage	Steady State Frequency	Voltage Transient	Time at Voltage Transient Level	Oscilloscope Trace		Pass/Fail	
Testing Performed at 800 Hz									
N	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
O	A		V _{rms}		Hz		V _{rms}		msec
	B		V _{rms}				V _{rms}		msec
	C		V _{rms}				V _{rms}		msec
	A						V _{rms}		msec
	B						V _{rms}		msec
	C						V _{rms}		msec

MIL-HDBK-704-5

METHOD TVF303
Abnormal Frequency Transients

POWER GROUP: Three 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 three 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 TVF303-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 TVF303-I. MIL-STD-704 limits for abnormal frequency transients for three 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 TVF303-1. Measurements, except current, must be made within 10 cm of the input power terminals of the UUT.

MIL-HDBK-704-5

5. Compliance test. With the power source off, install the UUT and the stimulation and monitoring equipment into the test setup of figure TVF303-1. 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 TVF303-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 voltages, 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 TVF303-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.

MIL-HDBK-704-5

TABLE TVF303-II. Test conditions for MIL-STD-704F abnormal frequency transients for three 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	$\frac{1}{2}$ cycle	0.88 seconds
B	360 Hz	0.88 seconds	800 Hz	1 second	0.88 seconds
C	360 Hz	0.48 seconds	600 Hz	$\frac{1}{2}$ cycle	0.48 seconds
D	360 Hz	0.48 seconds	600 Hz	1 second	0.48 seconds
Underfrequency Transients					
E	800 Hz	0.88 seconds	360 Hz	$\frac{1}{2}$ cycle	0.88 seconds
F	800 Hz	0.88 seconds	360 Hz	1 second	0.88 seconds
G	800 Hz	0.40 seconds	600 Hz	$\frac{1}{2}$ cycle	0.40 seconds
H	800 Hz	0.40 seconds	600 Hz	1 second	0.40 seconds
Combined Transient					
I	600 Hz	0.48 seconds then 0.40 seconds	360 Hz 800 Hz	$\frac{1}{2}$ cycle $\frac{1}{2}$ cycle	0.48 seconds 0.40 seconds

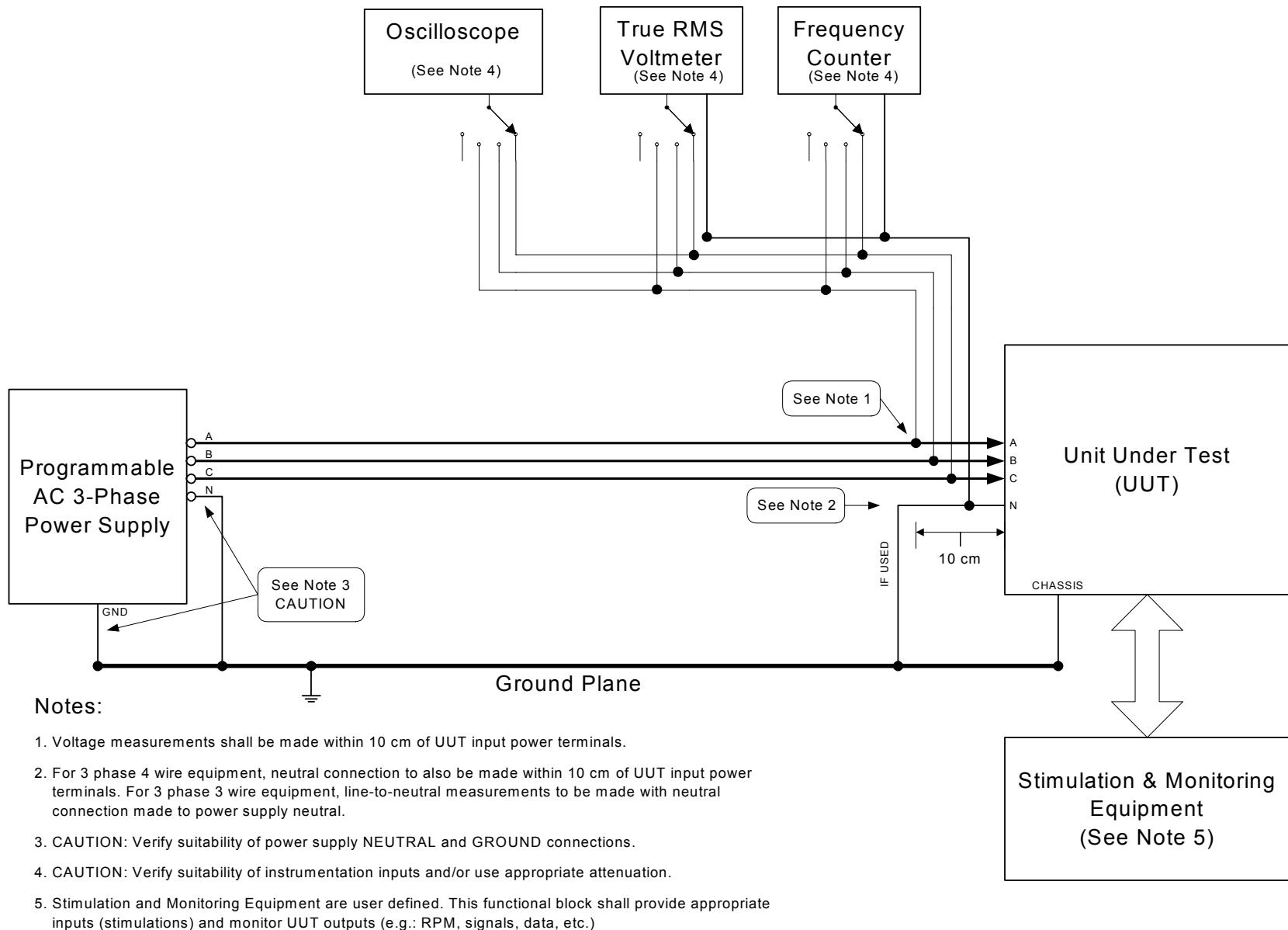
FIGURE TVF303-1. Abnormal frequency transients.

TABLE TVF303-III. Sample data sheet for TVF303 abnormal frequency transients for three phase, variable frequency utilization equipment.

Test Condition	Parameters								Performance		
	Phase	Steady State Voltage		Start Frequency		Frequency Transient		Time at Frequency Transient Level			
A	A		V _{rms}		Hz		Hz		msec	Attach Trace	Hz vs Time
	B		V _{rms}								
	C		V _{rms}								
B	A		V _{rms}		Hz		Hz		sec	Attach Trace	Hz vs Time
	B		V _{rms}								
	C		V _{rms}								
C	A		V _{rms}		Hz		Hz		msec	Attach Trace	Hz vs Time
	B		V _{rms}								
	C		V _{rms}								
D	A		V _{rms}		Hz		Hz		sec	Attach Trace	Hz vs Time
	B		V _{rms}								
	C		V _{rms}								
E	A		V _{rms}		Hz		Hz		msec	Attach Trace	Hz vs Time
	B		V _{rms}								
	C		V _{rms}								
F	A		V _{rms}		Hz		Hz		sec	Attach Trace	Hz vs Time
	B		V _{rms}								
	C		V _{rms}								
G	A		V _{rms}		Hz		Hz		msec	Attach Trace	Hz vs Time
	B		V _{rms}								
	C		V _{rms}								

TABLE TVF303-III. Sample data sheet for TVF303 abnormal frequency transients for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters								Performance			
	Phase	Steady State Voltage		Start Frequency		Frequency Transient		Time at Frequency Transient Level				
H	A		V _{rms}		Hz		Hz		sec	Attach Trace	Hz vs Time	
	B		V _{rms}									
	C		V _{rms}									
I	A		V _{rms}		Hz		Hz		msec	Attach Trace	Hz vs Time	
	B		V _{rms}									
	C		V _{rms}									
						Hz		msec				

MIL-HDBK-704-5

METHOD TVF401
Emergency Steady State Limits for Voltage and Frequency

POWER GROUP: Three 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 three phase, 115 Volt, variable frequency power utilization equipment operates and maintains specified performance when provided power with voltage and frequency at 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 three 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 three phase, 115 Volt, variable frequency equipment are noted in table TVF401-I. Performance of test method TVF102 will constitute performance of test method TVF401.

TABLE TVF401-I. MIL-STD-704 Emergency limits for steady state voltage and frequency for three 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

MIL-HDBK-704-5

METHOD TVF501
No Tests

POWER GROUP: Three Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL
OPERATING CONDITION: Starting

PARAMETER: No Tests

Starting operations are usually not applicable to AC Utilization Equipment.

METHOD TVF601
Power Failure (Three Phase)

POWER GROUP: Three Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL
OPERATING CONDITION: Power Failure

PARAMETER: Power Failure (Three Phase)

1. Scope.

1.1 Purpose. This test procedure is used to verify that three phase, 115 volt, variable frequency power utilization equipment operates and maintains specified performance when subjected to three phase 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 three phase power failures as specified by the applicable edition(s) of MIL-STD-704 and as noted in table TVF601-I. The utilization equipment must maintain the specified performance during the three phase 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 TVF601-I. MIL-STD-704 power failure limits for three 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 TVF601-1. Measurements, except current, must be made within 10 cm of the input power terminals of the UUT.

MIL-HDBK-704-5

5. Compliance test. With the power source off, install the UUT and the stimulation and monitoring equipment into the test setup of figure TVF601-1. 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 D noted in table TVF601-II, perform a three phase 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 voltages, 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 TVF601-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 TVF601-II. Test conditions for three phase power failures for three phase, variable frequency utilization equipment.

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

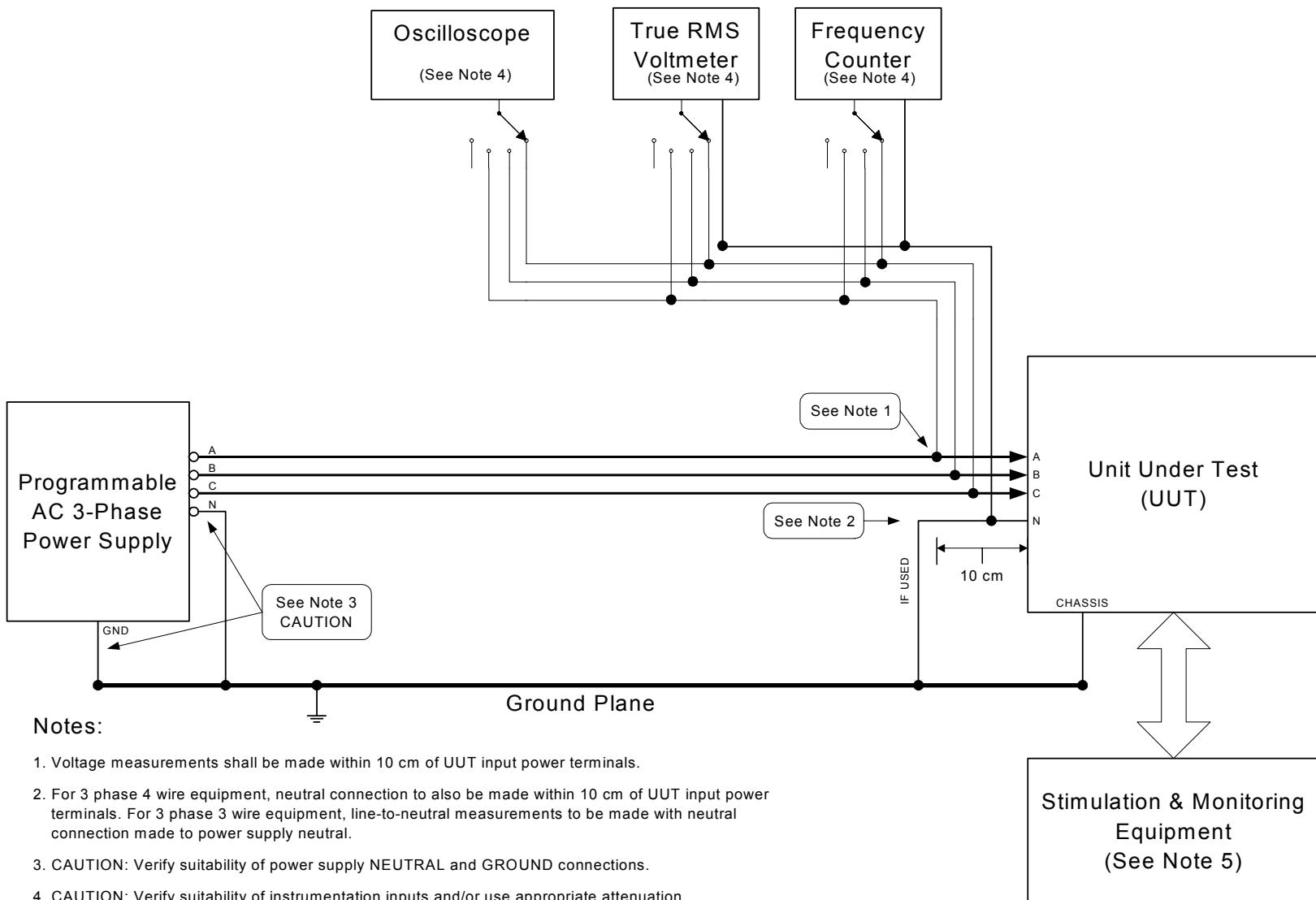
FIGURE TVF601-1. Power failure (three phase).

TABLE TVF601-III. Sample data sheet for TVF601 power failure (three phase) for three phase, variable frequency utilization equipment.

Test Condition	Parameters						Performance
	Phase	Steady State Voltage	Steady State Frequency	Voltage during Power Failure	Time Duration of Power Failure	Pass/Fail	
Testing Performed at 400 Hz							
A	A	V _{rms}		Hz	V _{rms}	msec	
	B	V _{rms}			V _{rms}	msec	
	C	V _{rms}			V _{rms}	msec	
B	A	V _{rms}		Hz	V _{rms}	msec	
	B	V _{rms}			V _{rms}	msec	
	C	V _{rms}			V _{rms}	msec	
C	A	V _{rms}		Hz	V _{rms}	sec	
	B	V _{rms}			V _{rms}	sec	
	C	V _{rms}			V _{rms}	sec	
D	A	V _{rms}		Hz	V _{rms}	sec	
	B	V _{rms}			V _{rms}	sec	
	C	V _{rms}			V _{rms}	sec	

TABLE TVF601-III. Sample data sheet for TVF601 power failure (three phase) for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters						Performance
	Phase	Steady State Voltage	Steady State Frequency	Voltage during Power Failure	Time Duration of Power Failure	Pass/Fail	
Testing Performed at 360 Hz							
A	A	V _{rms}		Hz	V _{rms}	msec	
	B	V _{rms}			V _{rms}	msec	
	C	V _{rms}			V _{rms}	msec	
B	A	V _{rms}		Hz	V _{rms}	msec	
	B	V _{rms}			V _{rms}	msec	
	C	V _{rms}			V _{rms}	msec	
C	A	V _{rms}		Hz	V _{rms}	sec	
	B	V _{rms}			V _{rms}	sec	
	C	V _{rms}			V _{rms}	sec	
D	A	V _{rms}		Hz	V _{rms}	sec	
	B	V _{rms}			V _{rms}	sec	
	C	V _{rms}			V _{rms}	sec	

TABLE TVF601-III. Sample data sheet for TVF601 power failure (three phase) for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters						Performance
	Phase	Steady State Voltage	Steady State Frequency	Voltage during Power Failure	Time Duration of Power Failure	Pass/Fail	
Testing Performed at 600 Hz							
A	A	V _{rms}		Hz	V _{rms}	msec	
	B	V _{rms}			V _{rms}	msec	
	C	V _{rms}			V _{rms}	msec	
B	A	V _{rms}		Hz	V _{rms}	msec	
	B	V _{rms}			V _{rms}	msec	
	C	V _{rms}			V _{rms}	msec	
C	A	V _{rms}		Hz	V _{rms}	sec	
	B	V _{rms}			V _{rms}	sec	
	C	V _{rms}			V _{rms}	sec	
D	A	V _{rms}		Hz	V _{rms}	sec	
	B	V _{rms}			V _{rms}	sec	
	C	V _{rms}			V _{rms}	sec	

TABLE TVF601-III. Sample data sheet for TVF601 power failure (three phase) for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters						Performance
	Phase	Steady State Voltage	Steady State Frequency	Voltage during Power Failure	Time Duration of Power Failure	Pass/Fail	
Testing Performed at 800 Hz							
A	A	V _{rms}		Hz	V _{rms}	msec	
	B	V _{rms}			V _{rms}	msec	
	C	V _{rms}			V _{rms}	msec	
B	A	V _{rms}		Hz	V _{rms}	msec	
	B	V _{rms}			V _{rms}	msec	
	C	V _{rms}			V _{rms}	msec	
C	A	V _{rms}		Hz	V _{rms}	sec	
	B	V _{rms}			V _{rms}	sec	
	C	V _{rms}			V _{rms}	sec	
D	A	V _{rms}		Hz	V _{rms}	sec	
	B	V _{rms}			V _{rms}	sec	
	C	V _{rms}			V _{rms}	sec	

MIL-HDBK-704-5

METHOD TVF602
One and Two Phase Power Failures

POWER GROUP: Three Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL

OPERATING CONDITION: Power Failure

PARAMETER: One and Two Phase Power Failures

1. Scope.

1.1 Purpose. This test procedure is used to verify that three phase, 115 volt, variable frequency power utilization equipment operates and maintains specified performance when subjected to one and two phase power failures (7 seconds and indefinitely) 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 TVF602-I. The utilization equipment must maintain the specified performance during one and two phase power failures. The utilization equipment must maintain specified performance for a length of time that confirms the utilization equipment can continuously operate with one and two phase power failures 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 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 TVF602-I. MIL-STD-704 power failure limits for three phase, variable frequency utilization equipment.

Limit	704A	704B	704C	704D	704E	704F
Single Phase and Two Phase Power Failure	N/A	N/A	N/A	N/A	N/A	7 sec and indefinitely 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

MIL-HDBK-704-5

4. Test setup. Configure the test setup as shown in figure TVF602-1. 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 TVF602-1. 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 J noted in table TVF602-II, perform a power failure (0 V) on the phase(s) noted and 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. For the indefinite time duration, 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 thirty (30) minutes for each of the test 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 voltages, 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 TVF602-III. Repeat test conditions A, B, C, G, and H 5 times. Test conditions D, E, F, I, and J are required to be performed once each. 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.

MIL-HDBK-704-5

TABLE TVF602-II. Test conditions for one and two phase power failures for three phase, variable frequency utilization equipment.

Test Condition	Phases	Duration of Power Failure
One Phase Power Failure		
A	Phase A	7 seconds
B	Phase B	7 seconds
C	Phase C	7 seconds
D	Phase A	Indefinitely
E	Phase B	Indefinitely
F	Phase C	Indefinitely
Two Phase Power Failures		
G	Phase A & B	7 seconds
H	Phase B & C	7 seconds
I	Phase A & B	Indefinitely
J	Phase B & C	Indefinitely

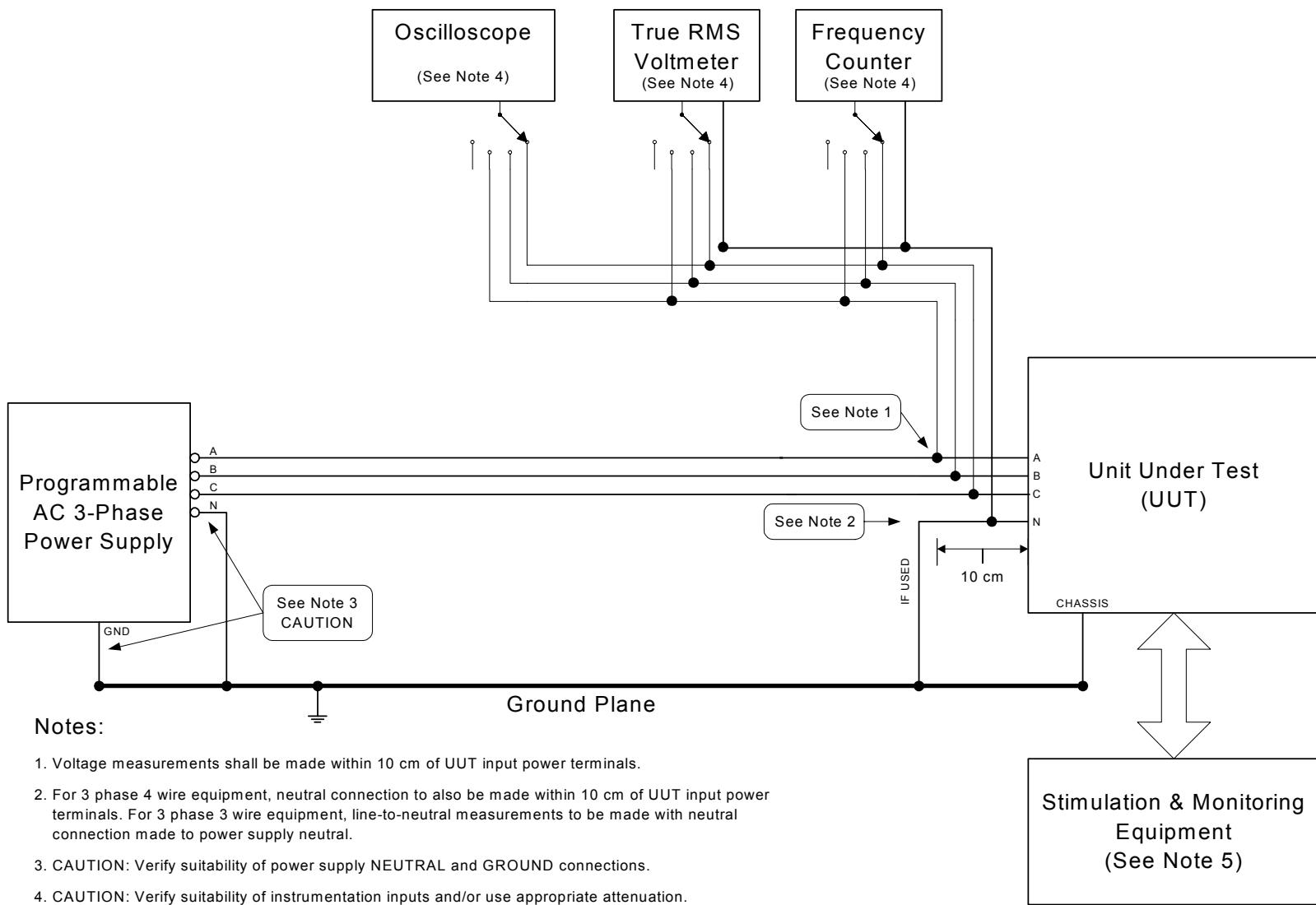
FIGURE TVF602-1. One and two phase power failures.

TABLE TVF602-III. Sample data sheet for TVF602 one and two phase power failures for three phase, variable frequency utilization equipment.

Test Condition	Parameters						Performance
	Phase	Steady State Voltage	Steady State Frequency	Voltage during Power Failure	Time Duration of Power Failure	Pass/Fail	
Testing Performed at 400 Hz							
A	A	V _{rms}	Hz	V _{rms}	sec		
	B	V _{rms}		V _{rms}	sec		
	C	V _{rms}		V _{rms}	sec		
B	A	V _{rms}	Hz	V _{rms}	sec		
	B	V _{rms}		V _{rms}	sec		
	C	V _{rms}		V _{rms}	sec		
C	A	V _{rms}	Hz	V _{rms}	sec		
	B	V _{rms}		V _{rms}	sec		
	C	V _{rms}		V _{rms}	sec		
D	A	V _{rms}	Hz	V _{rms}	sec		
	B	V _{rms}		V _{rms}	sec		
	C	V _{rms}		V _{rms}	sec		
E	A	V _{rms}	Hz	V _{rms}	sec		
	B	V _{rms}		V _{rms}	sec		
	C	V _{rms}		V _{rms}	sec		
F	A	V _{rms}	Hz	V _{rms}	sec		
	B	V _{rms}		V _{rms}	sec		
	C	V _{rms}		V _{rms}	sec		
G	A	V _{rms}	Hz	V _{rms}	sec		
	B	V _{rms}		V _{rms}	sec		
	C	V _{rms}		V _{rms}	sec		
H	A	V _{rms}	Hz	V _{rms}	sec		
	B	V _{rms}		V _{rms}	sec		
	C	V _{rms}		V _{rms}	sec		

TABLE TVF602-III. Sample data sheet for TVF602 one and two phase power failures for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters						Performance
	Phase	Steady State Voltage	Steady State Frequency	Voltage during Power Failure	Time Duration of Power Failure	Pass/Fail	
Testing Performed at 400 Hz							
I	A	V _{rms}		Hz	V _{rms}		sec
	B	V _{rms}			V _{rms}		sec
	C	V _{rms}			V _{rms}		sec
J	A	V _{rms}		Hz	V _{rms}		sec
	B	V _{rms}			V _{rms}		sec
	C	V _{rms}			V _{rms}		sec

TABLE TVF602-III. Sample data sheet for TVF602 one and two phase power failures for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters						Performance
	Phase	Steady State Voltage	Steady State Frequency	Voltage during Power Failure	Time Duration of Power Failure	Pass/Fail	
Testing Performed at 360 Hz							
A	A	V _{rms}	Hz	V _{rms}	sec		
	B	V _{rms}		V _{rms}	sec		
	C	V _{rms}		V _{rms}	sec		
B	A	V _{rms}	Hz	V _{rms}	sec		
	B	V _{rms}		V _{rms}	sec		
	C	V _{rms}		V _{rms}	sec		
C	A	V _{rms}	Hz	V _{rms}	sec		
	B	V _{rms}		V _{rms}	sec		
	C	V _{rms}		V _{rms}	sec		
D	A	V _{rms}	Hz	V _{rms}	sec		
	B	V _{rms}		V _{rms}	sec		
	C	V _{rms}		V _{rms}	sec		
E	A	V _{rms}	Hz	V _{rms}	sec		
	B	V _{rms}		V _{rms}	sec		
	C	V _{rms}		V _{rms}	sec		
F	A	V _{rms}	Hz	V _{rms}	sec		
	B	V _{rms}		V _{rms}	sec		
	C	V _{rms}		V _{rms}	sec		
G	A	V _{rms}	Hz	V _{rms}	sec		
	B	V _{rms}		V _{rms}	sec		
	C	V _{rms}		V _{rms}	sec		
H	A	V _{rms}	Hz	V _{rms}	sec		
	B	V _{rms}		V _{rms}	sec		
	C	V _{rms}		V _{rms}	sec		

TABLE TVF602-III. Sample data sheet for TVF602 one and two phase power failures for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters					Performance				
	Phase	Steady State Voltage	Steady State Frequency	Voltage during Power Failure	Time Duration of Power Failure					
Testing Performed at 360 Hz										
I	A		V _{rms}		Hz		V _{rms}		sec	
	B		V _{rms}				V _{rms}		sec	
	C		V _{rms}				V _{rms}		sec	
J	A		V _{rms}		Hz		V _{rms}		sec	
	B		V _{rms}				V _{rms}		sec	
	C		V _{rms}				V _{rms}		sec	

TABLE TVF602-III. Sample data sheet for TVF602 one and two phase power failures for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters					Performance	
	Phase	Steady State Voltage	Steady State Frequency	Voltage during Power Failure	Time Duration of Power Failure	Pass/Fail	
Testing Performed at 600 Hz							
A	A	V _{rms}		Hz	V _{rms}		sec
	B	V _{rms}			V _{rms}		sec
	C	V _{rms}			V _{rms}		sec
B	A	V _{rms}		Hz	V _{rms}		sec
	B	V _{rms}			V _{rms}		sec
	C	V _{rms}			V _{rms}		sec
C	A	V _{rms}		Hz	V _{rms}		sec
	B	V _{rms}			V _{rms}		sec
	C	V _{rms}			V _{rms}		sec
D	A	V _{rms}		Hz	V _{rms}		sec
	B	V _{rms}			V _{rms}		sec
	C	V _{rms}			V _{rms}		sec
E	A	V _{rms}		Hz	V _{rms}		sec
	B	V _{rms}			V _{rms}		sec
	C	V _{rms}			V _{rms}		sec
F	A	V _{rms}		Hz	V _{rms}		sec
	B	V _{rms}			V _{rms}		sec
	C	V _{rms}			V _{rms}		sec
G	A	V _{rms}		Hz	V _{rms}		sec
	B	V _{rms}			V _{rms}		sec
	C	V _{rms}			V _{rms}		sec

TABLE TVF602-III. Sample data sheet for TVF602 one and two phase power failures for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters						Performance
	Phase	Steady State Voltage	Steady State Frequency	Voltage during Power Failure	Time Duration of Power Failure	Pass/Fail	
Testing Performed at 600 Hz							
H	A	V _{rms}		Hz	V _{rms}		sec
	B	V _{rms}			V _{rms}		sec
	C	V _{rms}			V _{rms}		sec
I	A	V _{rms}		Hz	V _{rms}		sec
	B	V _{rms}			V _{rms}		sec
	C	V _{rms}			V _{rms}		sec
J	A	V _{rms}		Hz	V _{rms}		sec
	B	V _{rms}			V _{rms}		sec
	C	V _{rms}			V _{rms}		sec

TABLE TVF602-III. Sample data sheet for TVF602 one and two phase power failures for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters						Performance
	Phase	Steady State Voltage	Steady State Frequency	Voltage during Power Failure	Time Duration of Power Failure	Pass/Fail	
Testing Performed at 800 Hz							
A	A	V _{rms}	Hz	V _{rms}	sec		
	B	V _{rms}		V _{rms}	sec		
	C	V _{rms}		V _{rms}	sec		
B	A	V _{rms}	Hz	V _{rms}	sec		
	B	V _{rms}		V _{rms}	sec		
	C	V _{rms}		V _{rms}	sec		
C	A	V _{rms}	Hz	V _{rms}	sec		
	B	V _{rms}		V _{rms}	sec		
	C	V _{rms}		V _{rms}	sec		
D	A	V _{rms}	Hz	V _{rms}	sec		
	B	V _{rms}		V _{rms}	sec		
	C	V _{rms}		V _{rms}	sec		
E	A	V _{rms}	Hz	V _{rms}	sec		
	B	V _{rms}		V _{rms}	sec		
	C	V _{rms}		V _{rms}	sec		
F	A	V _{rms}	Hz	V _{rms}	sec		
	B	V _{rms}		V _{rms}	sec		
	C	V _{rms}		V _{rms}	sec		
G	A	V _{rms}	Hz	V _{rms}	sec		
	B	V _{rms}		V _{rms}	sec		
	C	V _{rms}		V _{rms}	sec		

TABLE TVF602-III. Sample data sheet for TVF602 one and two phase power failures for three phase, variable frequency utilization equipment. - Continued

Test Condition	Parameters						Performance
	Phase	Steady State Voltage	Steady State Frequency	Voltage during Power Failure	Time Duration of Power Failure	Pass/Fail	
Testing Performed at 800 Hz							
H	A	V _{rms}		Hz	V _{rms}		sec
	B	V _{rms}			V _{rms}		sec
	C	V _{rms}			V _{rms}		sec
I	A	V _{rms}		Hz	V _{rms}		sec
	B	V _{rms}			V _{rms}		sec
	C	V _{rms}			V _{rms}		sec
J	A	V _{rms}		Hz	V _{rms}		sec
	B	V _{rms}			V _{rms}		sec
	C	V _{rms}			V _{rms}		sec

METHOD TVF603
Phase Reversal (Three Phase)

POWER GROUP: Three Phase, Variable Frequency, 115 V

AIRCRAFT ELECTRICAL
OPERATING CONDITION: Power Failure

PARAMETER: Phase Reversal (Three Phase)

1. Scope.

1.1 Purpose. This test procedure is used to verify that three 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 TVF603-I. A positive physical means to prevent phase sequence reversal may be used to fulfill this requirement.

TABLE TVF603-I. MIL-STD-704 phase sequence reversal requirement for three 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 TVF603-1. Measurements, except current, must be made within 10 cm of the input power terminals of the UUT.

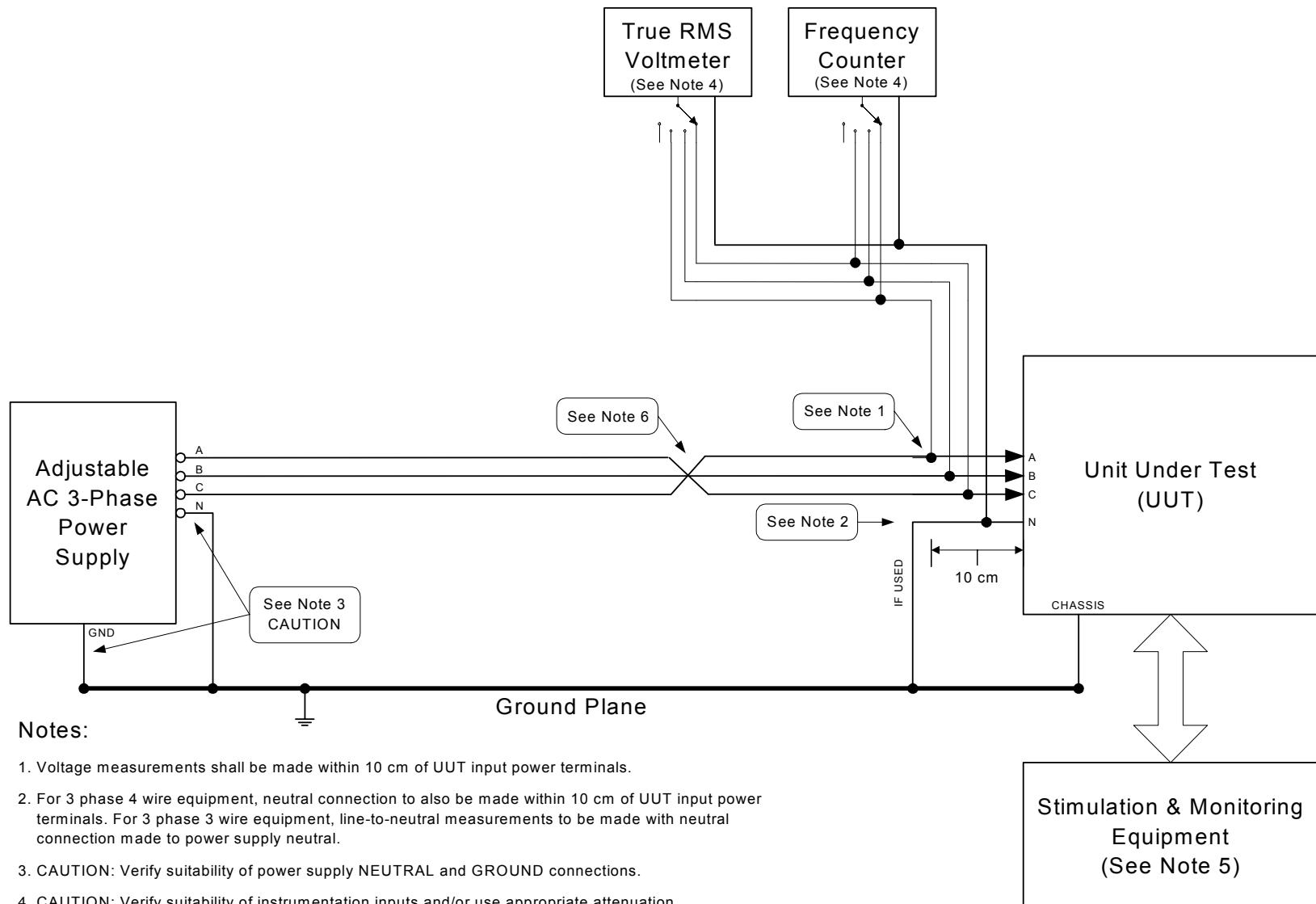
5. Compliance test. If a positive physical means is employed to prevent phase sequence reversal, confirm that the phase conductors cannot be reversed.

If the phase sequence can be reversed, with the power source off, install the UUT and the stimulation and monitoring equipment into the test setup of figure TVF603-1 (reversed phase

MIL-HDBK-704-5

sequence of C-B-A). 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. 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 sequence reversal and should be not less than thirty (30) minutes. Record the steady state voltages, steady state frequency, time duration at phase sequence reversal test condition, and the performance of the UUT in the data sheet shown in table TVF603-II. 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 TVF603-2 (correct phase sequence of A-B-C). 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. 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 sequence 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 voltages, steady state frequency, time duration at test condition, and the performance of the UUT in the data sheet shown in table TVF603-II. Repeat for each mode of operation of the UUT.

FIGURE TVF603-1. Phase reversal.

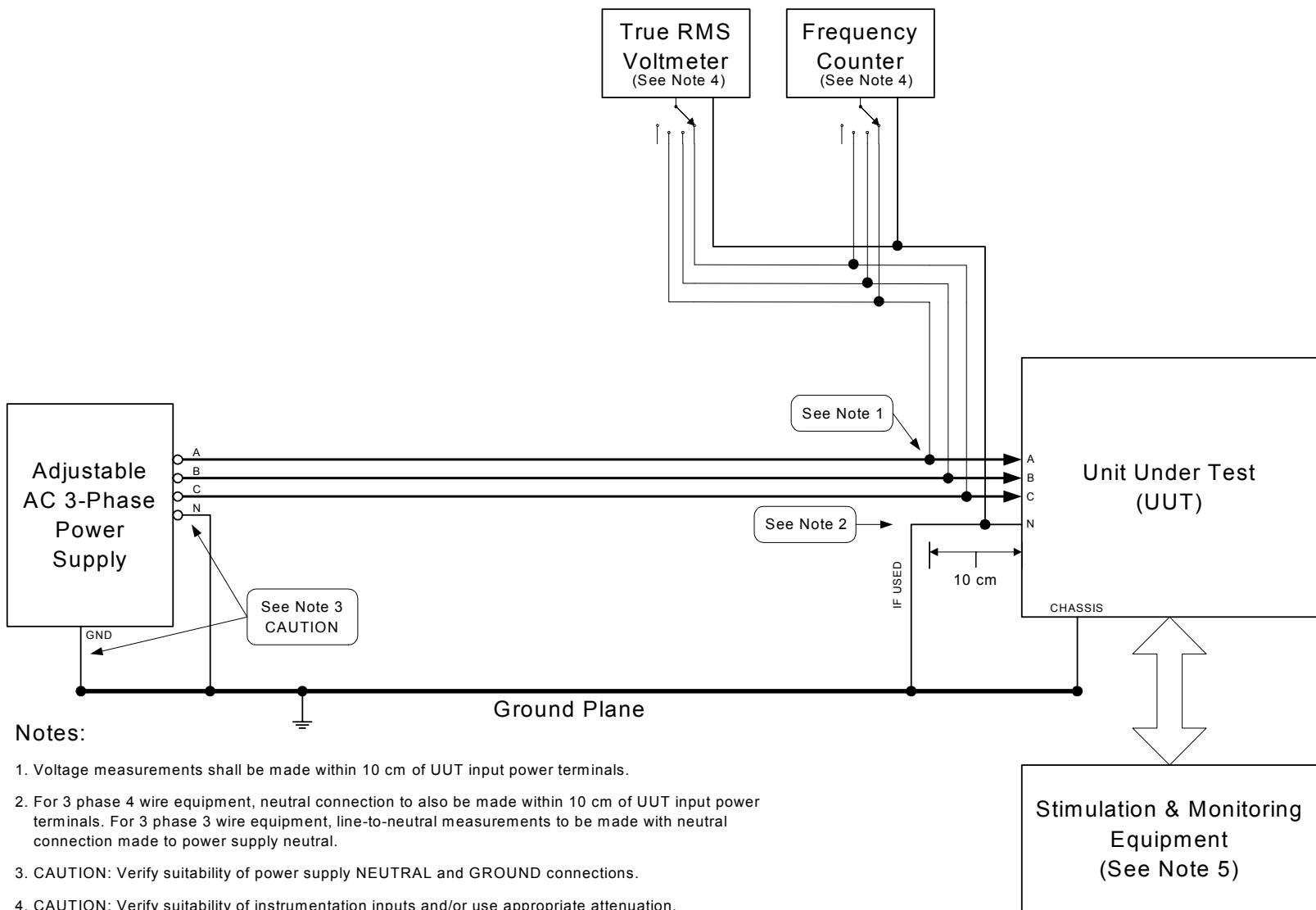
FIGURE TVF603-2. Correct phase connection.

TABLE TVF603-II. Sample data sheet for TVF603 phase sequence reversal for three phase, variable frequency utilization equipment.

Test Condition	Parameters					Performance Yes/No	
	Phase	Voltage	Frequency	Time Duration at Test Condition	Pass/Fail		
Phase Sequence Reversal Prevented by Positive Physical Means							
If No							
Testing Performed at 400 Hz	A	V _{rms}		Hz		min	
	B	V _{rms}					
	C	V _{rms}					
Testing Performed at 360 Hz							
Phase Sequence Reversed (C-B-A)	A	V _{rms}		Hz		min	
	B	V _{rms}					
	C	V _{rms}					
Testing Performed at 600 Hz							
Phase Sequence Reversed (C-B-A)	A	V _{rms}		Hz		min	
	B	V _{rms}					
	C	V _{rms}					
Testing Performed at 800 Hz							
Phase Sequence Reversed (C-B-A)	A	V _{rms}		Hz		min	
	B	V _{rms}					
	C	V _{rms}					
Testing Performed at 400 Hz							
Correct Phase Sequence (A-B-C)	A	V _{rms}		Hz		min	
	B	V _{rms}					
	C	V _{rms}					

MIL-HDBK-704-5

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 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-0051)

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.