

Making Sense of MIL-STD-704 Testing

November 13, 2015

Topics: [AC Power Sources](#)



To ensure that aircraft electronics and other electrically-powered equipment will operate reliably, you must test them under extreme power conditions. In the military world, MIL-STD-704 (now up to rev. F), "Aircraft Electric Power Characteristics," establishes the requirements and characteristics of aircraft electric power. It deals strictly with power quality, and does not say anything about electromagnetic interference.

Even though we call the tests performed to ensure that equipment will perform properly on board an aircraft "MIL-STD-704 tests," the standard does not describe any tests. For guidance on testing, there is a series of handbooks that describe tests for different types of input power. These include:

- MIL-HDBK-704-1, Guidance for Test Procedures for Demonstration of Utilization Equipment Compliance to Aircraft Electrical Power Characteristics
- MIL-HDBK-704-2, Guidance for Test Procedures for Demonstration of Utilization Equipment Compliance to Aircraft Electrical Power Characteristics, Single Phase, 400 Hz, 115 Volt
- MIL-HDBK-704-3, Guidance for Test Procedures for Demonstration of Utilization Equipment Compliance to Aircraft Electrical Power Characteristics, Three Phase, 400 Hz, 115 Volt
- MIL-HDBK-704-4, Guidance for Test Procedures for Demonstration of Utilization Equipment Compliance to Aircraft Electrical Power Characteristics, Single Phase, Variable Frequency, 115 Volt
- MIL-HDBK-704-5, Guidance for Test Procedures for Demonstration of Utilization Equipment Compliance to Aircraft Electrical Power Characteristics, Three Phase, Variable Frequency, 115 Volt
- MIL-HDBK-704-6, Guidance for Test Procedures for Demonstration of Utilization Equipment Compliance to Aircraft Electrical Power Characteristics, Single Phase, 60 Hz, 115 Volt
- MIL-HDBK-704-7, Guidance for Test Procedures for Demonstration of Utilization Equipment Compliance to Aircraft Electrical Power Characteristics, 270 VDC
- MIL-HDBK-704-8, Guidance for Test Procedures for Demonstration of Utilization Equipment Compliance to Aircraft Electrical Power Characteristics, 28 VDC

These documents, including MIL-STD-704 tests (revisions A through F) are available online at EverySpec.Com.

The MIL-HDBKs describe up to 20 different tests. For example, MIL-HDBK-704-2 includes tests for load measurement, steady state operation at voltage and frequency limits, voltage modulation and distortion, DC voltage component, voltage and frequency transients (both normal and abnormal), and more.

Let's look at one of the test methods. Method SAC109 is the normal voltage transients test. During this test, equipment is subjected to a variety of voltage transients as shown in Table 1.

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	< 1.25 msec	135 Vrms	210 msec	< 1.25 msec
B	< 1.25 msec	135 Vrms	145 msec	130 msec
C	< 1.25 msec	145 Vrms	130 msec	< 1.25 msec
D	< 1.25 msec	145 Vrms	90 msec	80 msec
E	< 1.25 msec	160 Vrms	48 msec	< 1.25 msec
F	< 1.25 msec	160 Vrms	30 msec	40 msec
G	< 1.25 msec	160 Vrms (3 times)	25 msec every 0.5 sec	< 1.25 msec
Undervoltage Transients				
H	< 1.25 msec	90 Vrms	300 msec	< 1.25 msec
I	< 1.25 msec	90 Vrms	210 msec	180 msec
J	< 1.25 msec	70 Vrms	140 msec	< 1.25 msec
K	< 1.25 msec	70 Vrms	95 msec	85 msec
L	< 1.25 msec	58 Vrms	48 msec	< 1.25 msec
M	< 1.25 msec	58 Vrms	30 msec	40 msec
N	< 1.25 msec	58 Vrms (3 times)	25 msec every 0.5 sec	< 1.25 msec
Combined Transient				
O	< 1.25 msec then < 1.25 msec	58 Vrms 160 Vrms	25 msec 25 msec	< 1.25 msec 50 msec

After you apply the transient, and the power returns to normal steady-state limits, you must conduct a performance test of the unit under tests to ensure that it still meets specifications. For most of the transients, you have to repeat this test five times.

To simplify MIL-STD-704 testing, you need an AC power source that can supply the desired waveforms without having to rig up a lot of external equipment. The [California Instruments CSW Series](#) is perfect for this application. The CSW Series has waveform generation features and can be ordered with the software or firmware needed to support MIL-STD-704 tests. For more information, [contact AMETEK Programmable Power](#).