Lightning Direct Effect Test System
LCG 464C

- MIL-STD-464C
- SAE ARP5412
- RTCA/DO-160G
- HB 6129-1987
- GJB 3567-1999
- GJB 11190-2023

Features

> The system can generate 6 types of waveform;

> Using a rotating mechanism to achieve automatic switching of charging polarity;

> Electrical safety interlock, automatic short-circuit capacitor discharge, to protect personal safety;

> Using seamless Crowbar feedback circuit, the waveform has no oscillation;

> The control signals between the control and the main body are isolated through optical fibers;

> Each generator is used independently and adopts an independent control system;

> Multiple testing modes can be programmed freely to meet various waveform requirements within the testing range;

> The centralized control system can simultaneously operate 4 sets of generators and complete testing with just one click;

> Using multiple pneumatic units for high-voltage section switching, waveform automatic switching。

Introduction

When flying in severe convective weather, airplanes are susceptible to direct adhesion from lightning, generating high temperatures, high voltages, and strong electromagnetic forces, which can cause combustion, corrosion, explosion, structural distortion, and strength reduction effects on the aircraft. Our independently developed lightning direct effect testing system is a very complex pulse current testing system, mainly used for system level lightning direct effect testing and lightning testing of component materials. It fully complies with national military standards such as GJB1389A and GJB3567, and also meets the requirements of aircraft lightning testing standards such as MIL-STD-464C, SAE ARP5412 for aviation systems, and DO160 section 23. Can be applied to aircraft, aerospace materials, ships, missiles, military vehicles, radar and other equipment and facilities.

This lightning direct effect testing system includes a high-voltage attachment point zoning test system and a high current physical damage test system. The high-voltage attachment point zoning test system can simulate and test the probability of aircraft and other equipment being struck by lightning in different areas of the aircraft surface, and find attachment points that are prone to lightning strikes. The high current physical damage test system is used to simulate the damage effects of high temperature and strong electric force on the aircraft structure and other parts caused by the high current at the attachment point of the aircraft when it is struck by lightning.

Application Areas

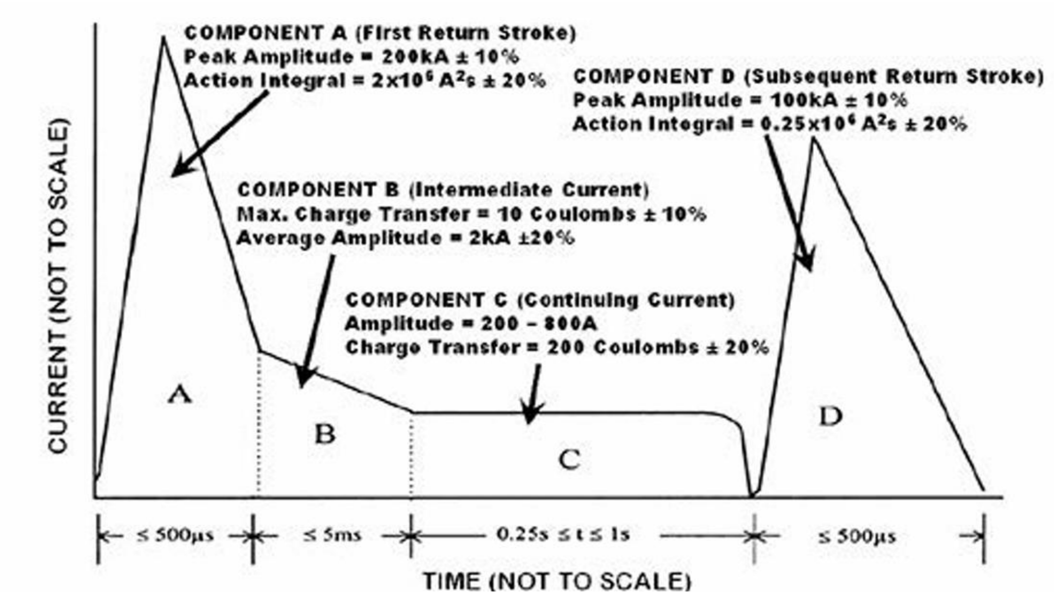
High current injection test system

summary

When flying in severe convective weather, airplanes are susceptible to direct adhesion from lightning, generating high temperatures, high voltages, and strong electromagnetic forces, which can cause combustion, corrosion, explosion, structural distortion, and strength reduction effects on the aircraft. The aircraft lightning protection testing system independently developed by our company is a very complex pulse current testing system, which fully complies with the requirements of aircraft lightning protection standards such as MIL-STD-464C, SAE ARP5412, DO160 section 23, etc. The simulated direct attached lightning strike area of the aircraft should withstand a continuous waveform composed of four waveforms, ABCD, for direct effect lightning strikes. The entire system includes four sets of pulse current generators.

Introduction to waveform

The LCG 464C aircraft lightning direct effect high current injection test system mainly includes six waveforms: A (AH), B, C (C *), and D, as shown in the following figure.



Waveform A	The peak current is 200 kA ± 10%, with an integral of 2 × 106A2S ± 20% (within 500 μ s). The rise time (10% -90% before the peak) is not more than 50 μ s, and the time for the current to decay to 1% of the peak is not more than 500 μ s. At this stage, the current can be unidirectional or oscillatory.

Waveform AH	The peak current is 150 kA ± 10%, with an integral of 0.8 × 106A2S ± 20% (within 500 μ s). The rise time (10% -90% before the peak) is not more than 37.5 μ s, and the time for the current to decay to 1% of the peak is not more than 500 μ s. At this stage, the current can be unidirectional or oscillatory.
Waveform B	The average current amplitude is 2 kA ± 10%, the maximum charge is less than 10 Coulomb ± 10%, and the duration does not exceed 5 ms. At this stage, the current must be a unidirectional square wave current, or replaced by exponential or linear decay current.
Waveform C	The current amplitude is 200-800 A, the charge is 200 coulombs ± 20%, and the duration is 0.25-1s. At this stage, the current must be a unidirectional square wave current, or replaced by exponential or linear decay current.
Waveform C *	The average amplitude of the current is not less than 400 A, and the duration is the residence time of the combined waveform minus 5 ms. The duration interval of the combined waveform is 1-50 ms. At this stage, the current must be a unidirectional square wave current, or replaced by exponential or linear decay current.
Waveform D	The peak current is 100 kA ± 10%, with unidirectional or oscillating current. The rise time (10% -90% before the peak) is not more than 25 μ s, and the time for the current to decay to 1% of the peak is not more than 500 μ s. The integral of the action is 0.25 × 106A2S ± 20% (within 500 μ s).

Configuration

MIL-464C/DO-160G Section 23 Lightning Direct Effect Test System Configuration:
This lightning strike system mainly includes 5 control systems, 1 measurement and analysis system, and 4 generators for generating components A, B, C, and D. Each generator communicates with each other through an industrial fieldbus, allowing for independent testing and centralized control of the 4 generators. Generators A and D use non gap adaptive Crowbar units. Compared to gap Crowbar, which requires impulse voltage generator triggering and secondary delay control ignition, non gap Crowbar switches do not require impulse voltage generator triggering or secondary delay control ignition, truly achieving adaptive self triggering. Compared to the discharge sound of Crowbar switches with multiple gaps, the use of non gap switches greatly reduces the discharge noise. Its application in reducing energy storage capacitance while improving equipment output stability.

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Configure related attachmentsr

Serial number	Name/Model	Specifications/Parameters	collocation method
1	LCG 200S A-component generator	Outputwaveform: A component/wavefront less than 30 us; Integral function: 2 * 106A2s Peak output: 200 kA (10%~100%) Can output oscillating waves when used alone Equipped with touch screen control, it can run independently	standard configuration
2	CB100 Crowbar Unit	Rated working voltage: 100 kV Rated current: 200 kA Working mode: adaptive triggering Cooperate with the A-component generator to output exponential waves	optional
3	LCG 2M B component generator	Output waveform: B component/square wave Duration: 5 ms Peak output: 2 kA (± 10%) Equipped with touch screen control, it can run independently	standard configuration
4	CN 100 Coupling Decoupling Unit	Coupling current: B component Decoupling voltage: 100 kV Decoupling pulse width: 100 us Damage to the B component generator caused by parallel output of ABCD	standard configuration
5	LDC 200 C component generator	Output waveform: C component/DC waveform Duration: 0.02-2 seconds adjustable Output amplitude: 200 A (2 s), 400 A (0.5 s) Equipped with touch screen control, it can run independently	standard configuration
6	CN 100 Coupling Decoupling Unit	Coupling current: C component Decoupling voltage: 100 kV Decoupling pulse width: 100 us Damage to the C-component generator caused by parallel output of ABCD	standard configuration
7	DN5200 secondary decoupling Unit	Coupling current: 200A continuous, 800A (0.5 s) Decoupling voltage: 10 kV Decoupling method: differential mode decoupling Used to prevent damage to the C-component generator when outputting in parallel with ABCD	standard configuration
8	LCG 100S D component generator	Output waveform: D component/wavefront less than 15 us; Function integral: 0.25 * 106A2s Peak output: 100 kA (10%~100%) Can output oscillating waves when used alone Equipped with touch screen control, it can run independently	standard configuration

9	CB100 Crowbar Unit	Rated working voltage: 100 kV Rated current: 200 kA Working mode: adaptive triggering Cooperate with the D-component generator to output exponential waves	optional
10	MCS64C	6-way trigger fiber optic output Interval time: 0us-99s Trigger time: 0us-99s Using 4 Tektronix oscilloscopes for fiber networking measurement Four generators can be controlled simultaneously to achieve simultaneous operation and sequential discharge. MCS upper computer control measurement analysis integrated system 4 Wave Intelligent Analysis Combination Logarithmic coordinate display	standard configuration

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