SXFJ-180612 Lightning Stroke System for Direct Current Test on Aircraft

Introduction

The aircraft is easy to be attacked by the direct lightning when it flies in the convective environment, which will generate high temperature, high pressure and strong electromagnetic force. This will cause some bad affection to the aircraft, such as burn, explosion, structural aberration, etc. The lightning stroke system for direct current test on aircraft is developed by our company and can simulate the direct lightning stoke with component A,B,C,D waveforms. It includes four sets impulse current test systems.

Characteristics

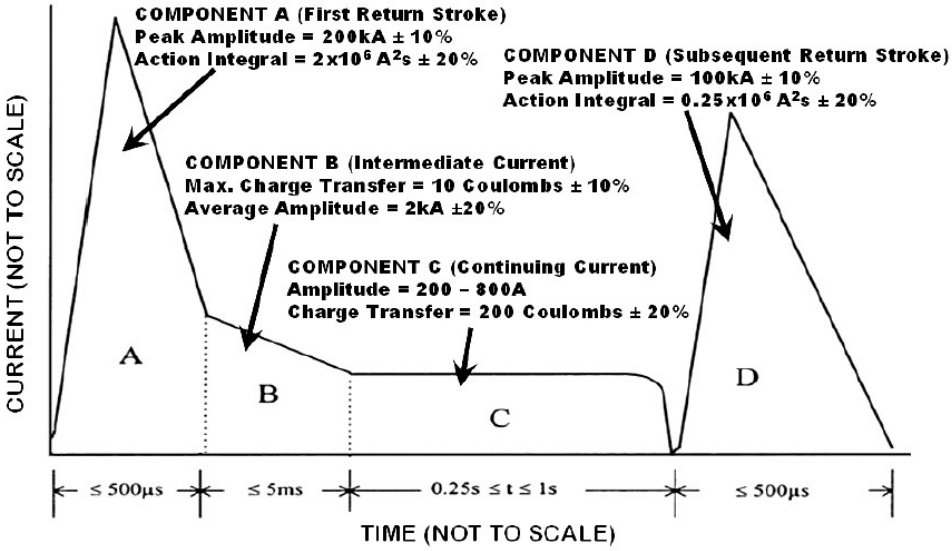
1) The four sets impulse current test systems can output 6 kinds waveforms;
2) Each set impulse current test system adopts individual control systems and can be used individually;
3) Automatic control of 4 sets impulse current test systems;
4) Optical fibre is used to isolate the signal between the control system and the impulse generator body;
5) Different test modes can be realized by the software in order to satisfy the test requirement;
6) Safety interlock of electrical parts, automatic short circuit of the impulse

capacitors to ensure personal safety;

Standards

1) MIL-STD-464C Electromagnetic environmental effects requirements for systems
2) SAE ARP5412 Aircraft lightning environment and related test waveforms
3) RTCA/DO-160F/G Environmental conditions and test procedures for airborne equipment section 23 lightning direct effects

Waveforms



1) Component A: exponential wave, peak amplitude=200kA±10%,minimum amplitude=20kA, action integral＝2*$10^6$$A^2$S±20%, time duration within 500 μs, wave front time (10%~90% before peak amplitude)≤ 37.5 μs;

2) Component A_H: exponential wave, peak amplitude =200kA±10%, action integral＝0.8*$10^6$$A^2$S±20%, time duration within 500s, wave front time (10%~90% before peak amplitude)≤ 37.5 μs;

3) Component B: exponential wave, average amplitude＝2kA±10%, maximum charge transfer less than 10 Coulombs±10%, duration time ≤ 5ms, long duration impulse current waveform (square wave);

4) Component C: DC current, average output current=200A~400A ,charge transfer=200 Coulombs±20%, duration time 1s (200A output current), 0.5s (400A output current);

5) Component C*: DC current, average output current=200A~400A ,charge transfer=200 Coulombs±20%, duration time 1s (200A output current), 0.5s (400A output current);

6) Component D: exponential wave, peak amplitude＝100kA±10%, action integral＝0.25*$10^6$$A^2$S±20%, time duration within 500 μs, wave front time (10%~90% before peak amplitude)≤ 20 μs;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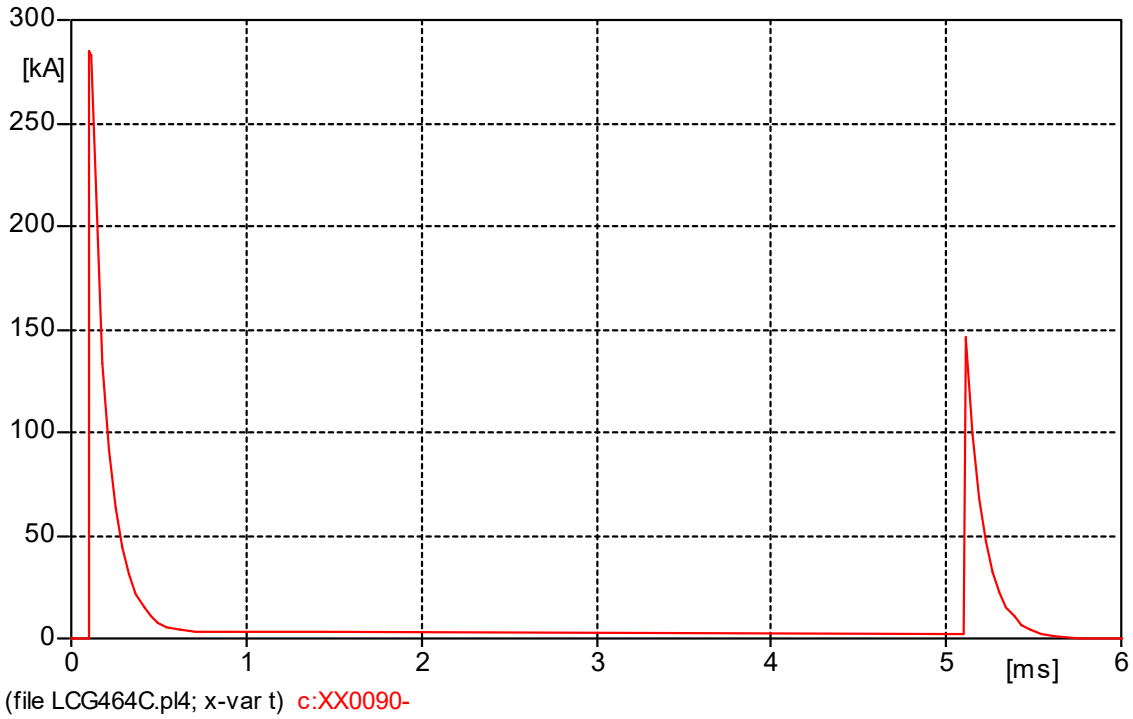
Delivery List of SXFJ-180612

Model No.	Product	Technical Data
component A & A_H; JCL200S/A Impulse current test system	Impulse current generator	Output waveform: component A and A_H; Wave front time≤37.5μs; Max energy $2*10^6$kJ/Ω; Peak amplitude:200kA (10%~100%);
	DC charging unit	100kV, 30kVA; Inbuilt bridge rectifier; Oil-insulated HV transformer; Automatic polarity change
	Open circuit protection unit	100kV open circuit test capacity; withstand 200kA high current
	HV impulse trigger system	Optical fibre;10kV trigger; 300mm diameter tungsten copper sphere; Withstand 100kV voltage, and 200kA current;
	Current coil	Rogowski current coil can measure impulse current upto 200kA
	Measurement system	SXMS60, industrial computer,19' computer screen, MDO3012 American Tektronix oscilloscope
	Control system	SXKZ20, control desk, 15' touch panel
component B JCL2M(5mS) Long duration impulse current test system	Impulse current generator	Output waveform:5ms; Duration time:5mS; Peak amplitude:2kA (±10%)
	5ms long duration unit	10 series LC circuit; 20 impulse capacitors; 21 high capacity inductances; Withstand 100kV
	DC charging unit	30kV, 30kVA; Inbuilt bridge rectifier; Oil-insulated HV transformer; Automatic polarity change
	Open circuit protection unit	100kV open circuit test capacity; withstand 2kA long duration current
	HV impulse	Optical fibre;10kV trigger; 300mm

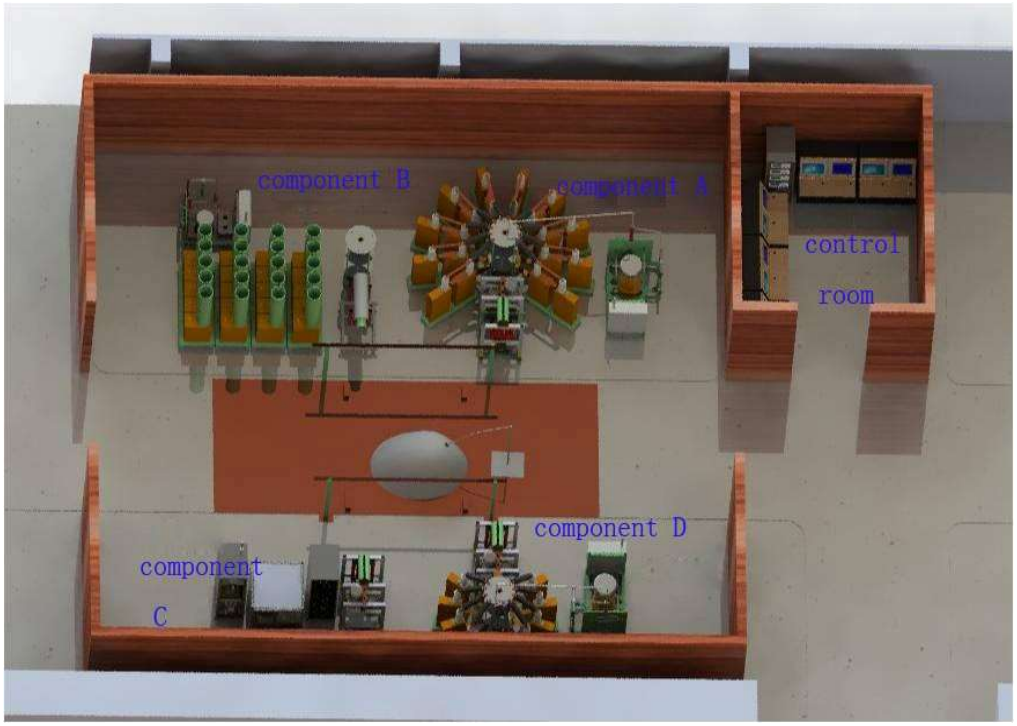
	trigger system	diameter tungsten copper sphere; Withstand 100kV voltage, and 200kA current;
	Current coil	Rogowski current coil can measure impulse current upto 10kA
	Measurement system	SXMS60, industrial computer,19' computer screen, MDO3012 American Tektronix oscilloscope
	Control system	SXKZ20, control desk, 15' touch panel
	Decoupling unit 1	Large power semiconductor; Reverse withstand 100kV; Can flow 5000A current, 10ms
	Decoupling unit 2	Decoupling type: inductance+ capacitor; Decoupling voltage:100kV; Decoupling inductance:1mH
component C & C* JDC 200	DC generator	Output voltage:1000V; Output current:200A 1s/ 400A 0.5s/800A 0.25s; Energy: 200C
	DC charging unit	1kV, 30kVA; Full isolation design; Isolation voltage is 20kV;
	Open circuit protection unit	100kV open circuit test capacity; withstand 2kA long duration current
	Trigger control	Optical fibre; Trigger time adjustable from 0~99 μ s; Time adjustable from 1ms~99s;
	Current coil	Rogowski current coil can measure impulse current upto 10kA
	Measurement system	SXMS60, industrial computer,19' computer screen, MDO3012 American Tektronix oscilloscope, current measurement sensor;
	Control system	SXKZ20, control desk, 12' touch panel
	Decoupling unit 1	Large power semiconductor; Reverse withstand 100kV;

		Can flow 1000A current;
	Decoupling unit 2	Decoupling type: inductance+ capacitor; Decoupling voltage:100kV; Decoupling inductance:1mH
	Impedance load unit	200A 1s; 400A 0.5s; 800A 0.25s;
component D JCL100S Impulse current test system	Impulse current generator	Output waveform: component D; Wave front time≤ 15 μs; Maximum energy: $0.25*10^6$kJ/Ω; Peak amplitude: 100kA(10%~100%)
	DC charging unit	100kV, 30kVA; Inbuilt bridge rectifier; Oil-insulated HV transformer; Automatic polarity change
	Open circuit protection unit	100kV open circuit test capacity; withstand 100kA high current
	HV impulse trigger system	Optical fibre;10kV trigger; 300mm diameter tungsten copper sphere; Withstand 100kV voltage, and 100kA current;
	Current coil	Rogowski current coil can measure impulse current upto 150kA
	Measurement system	SXMS60, industrial computer,19' computer screen, MDO3012 American Tektronix oscilloscope
	Control system	SXKZ20, control desk, 15' touch panel
JMC464	main control system	Control the four sets test equipment simultaneously; Mitsubishi PLC; Optical fiber network; Main cable control;
	Multi-channel time-delay control	Microcomputer control; Control the 6-channel time-delay; 0 μs~99s range for time delay; Resolution:0.1 μs;
	Optical fiber	Upper computer can read the

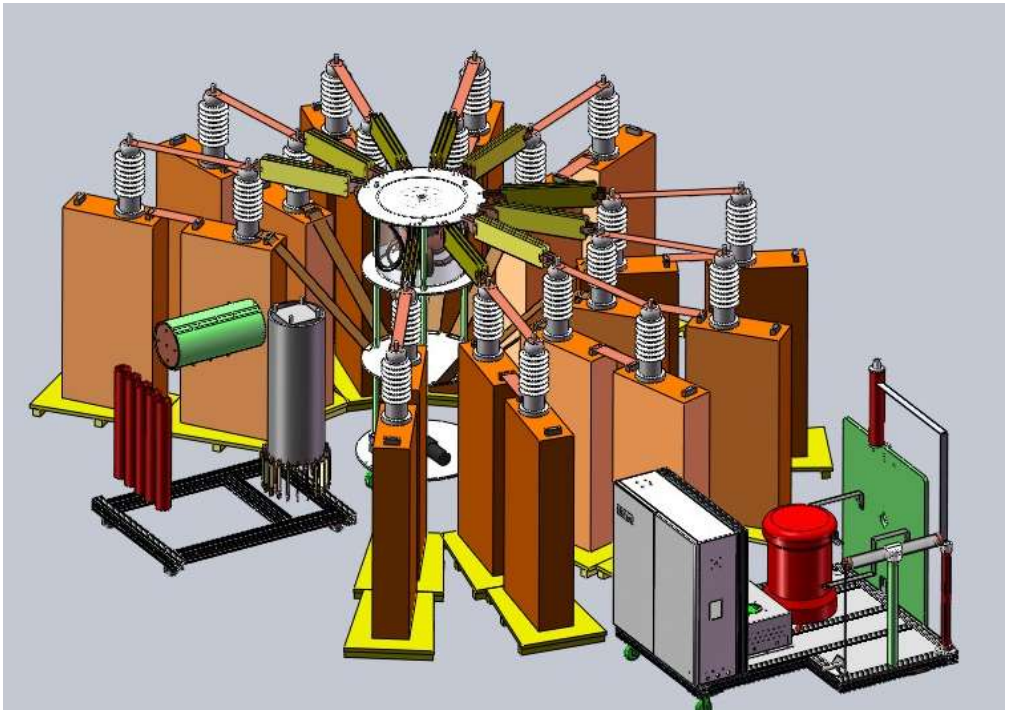
	ethernet communication network	waveforms from the 4 channels (4 oscilloscopes and 5 computers connected with optical fibers)
	SX464C software	Control and measurement software, measure component A,B,C,D waves simultaneously; Display 4 waves (continuously); Display 4 waves individually;



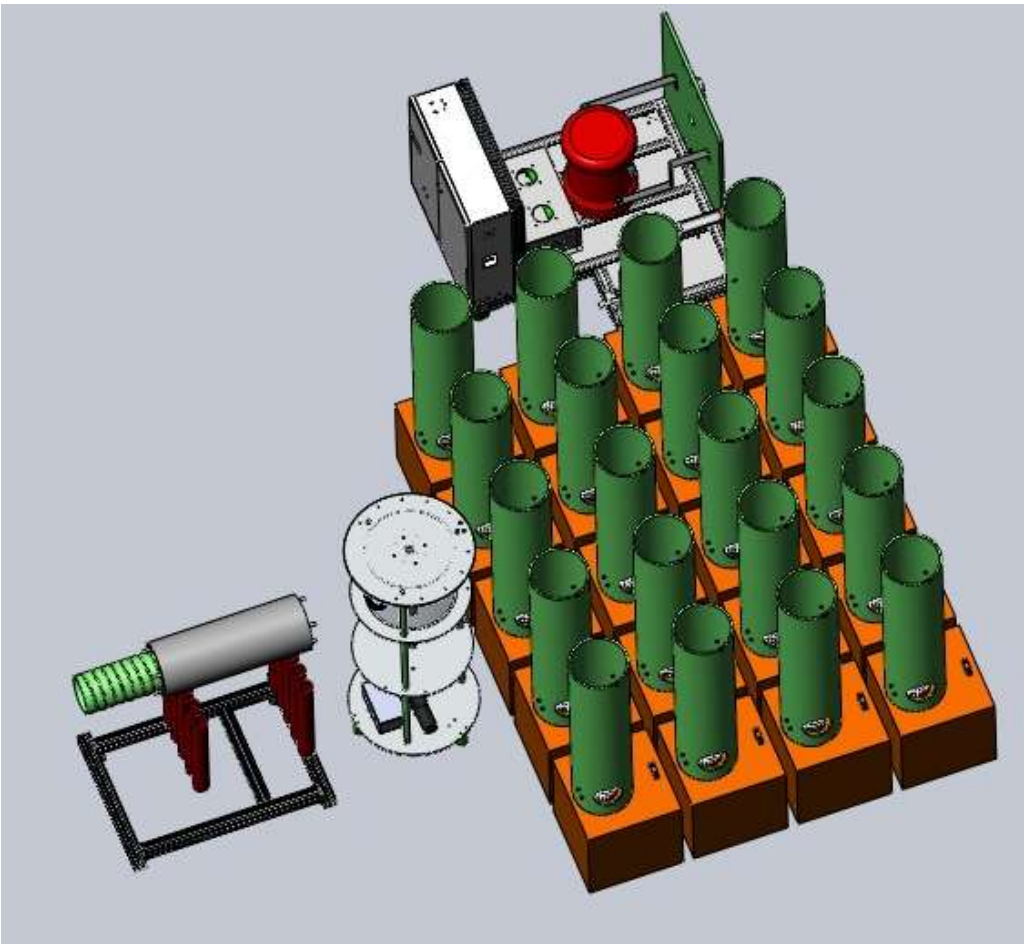
Below is the layout of the whole test system.



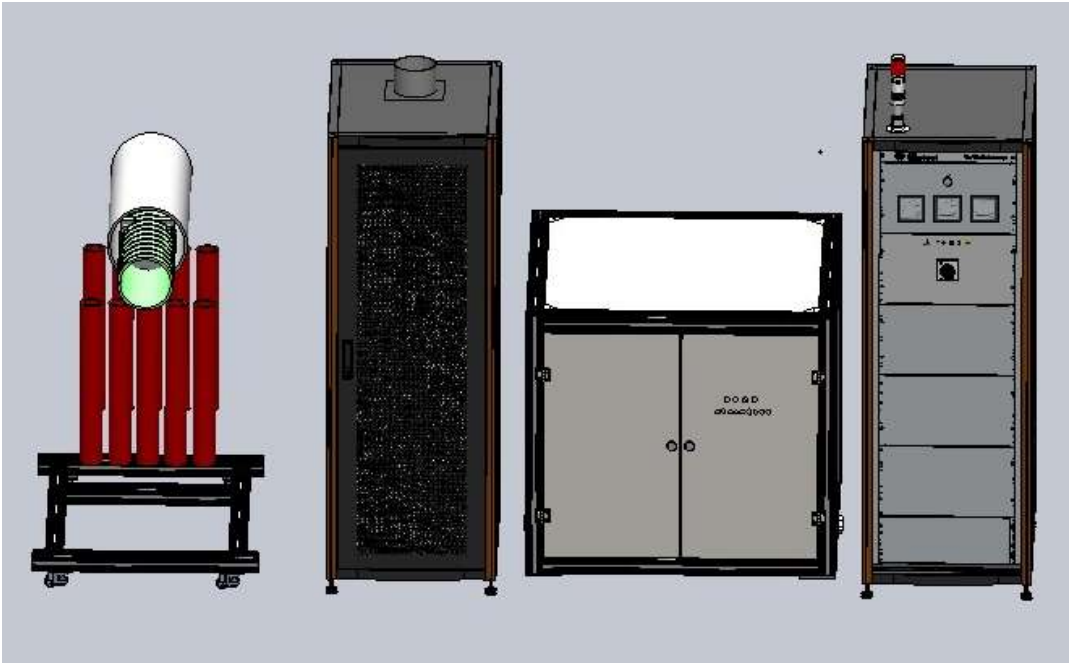
Below is design sketch of JCL200S (component A).



Below is design sketch of JCL2M (component B).



Below is design sketch of JDC200 (component C).



Below is design sketch of JCL100S (component D).