

CDYQ Series

Impulse Voltage Test System, Q Structure, 200-3600kV



CDYQ series Impulse Voltage Test System is design as Q structure, it can be used to generate impulse voltage what simulate lightning strokes (LI: 1.2/50us) and switching surges (SI: 250/2500us). The total charging voltage range is from 200kV-4800kV with stage energy of 5 to 40kJ. Applications covered include testing according to IEC, ANSI/IEEE/GB as well as other national standards.

CDYQ series Impulse Voltage Test System allow to be modified for carrying out a variety of special tests such as on transformer, impulse current testing of surge arrestors and even components of wind generators or air craft as well as EMP testing of electrical equipment.

Q structure Impulse Voltage Test System not only integrate lots of advantages and features from the impulse generator in the markers, it also create some unique technical features. These advantages and features make the Q structure impulse voltage test system more reliable and intelligence.

Applications:

- Shunt reactors
- Power transformers
- Distribution transformer
- Instrument transformers
- Cables (type tests)
- Bushings
- Arresters (impulse current tests)
- Insulators
- GIS and air-insulated breakers
- R&D

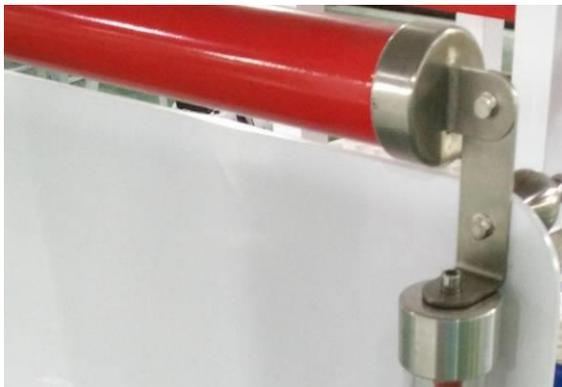
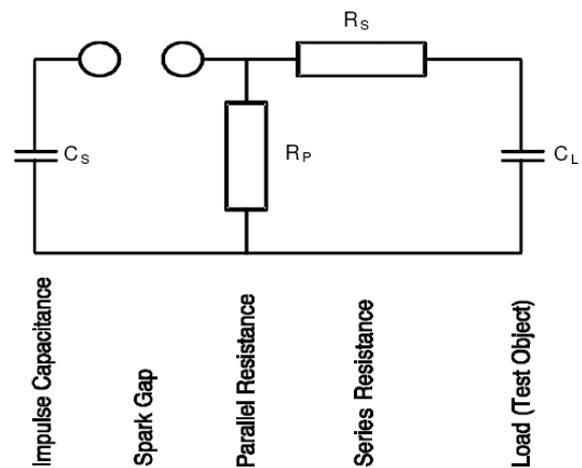
Testing Waveform Parameter:

- Lightning Impulse (1.2/50us)
- Switching Impulse (250/2500us)
- Lightning Current Impulse (8/20us)
- Lightning Chopping

Main Feature:

- Total charging voltage from 200kV to 4800kV;
- Energy per stage from 5kJ to 40kJ;
- Absolutely modular design, extremely easy for extension and upgradation;
- All air pressure drive instead of any mechanical drive;
- Suitable to working at harsh environment due to the gaps be install in the isolated tube and fill in the filter air;
- Automatic select the charging stage and discharge stage;
- No charging resistors in the impulse generator, uniformity of charging voltage;
- Computerized and microprocessor base control system;
- 12bit or 14bit, 100Ms/s Digital impulse analyzer system are available;

- Glaninger circuit and overshoot compensation device are available;
- Top quality material used, more than 90% component use stain steel;
- Use electrostatic coating instead of traditional printing, get better durability;
- Short reconfiguration times by utilizing handy plug in or out resistors and connections;
- Double contact surface than original, guarantee better contact and more stable T_1 and T_2 ;
- Quick coupling is widely used, easy installation and maintenance;



Theory:

The circuit of the impulse generators is a Marx multiplier circuit. The impulse capacitors, arranged in the stages of the generator are charged with DC voltages up to 200 kV against earth potential and in order to generate impulses, connected in series by spark gaps. For the adjustment of the front time and time to half value of the test impulse, the generator stages comprise front resistors and tail resistors. A short discharge loop guarantees low internal inductances and smooth voltage shape.

Components of the Q Structure Impulse Test System:

System:

- Impulse Generator
- DC Charging Device
- Weak Damped Voltage Divider
- Digital Impulse Control System
- Digital Impulse Measuring & Analyzer System

Options:

- External Overshoot Compensation Device
- Glaninger Circuit
- Chopping Gaps
- Isolation Transformer
- Additional Circuits for Impulse Current Generation
- Measuring Sphere Gap
- Resistive Divider
- Rogowski Winding / Shunt



Impulse Generator (Q Structure)

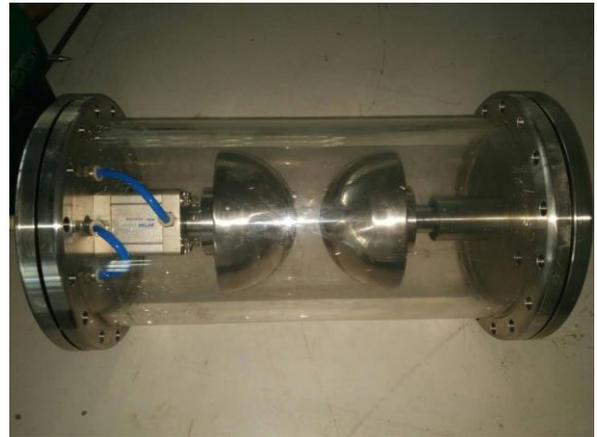


CDYQ Series Impulse Generator is the main part of the impulse voltage test system. Four epoxy glass support hangs on two capacitors each stage, constituting a stable components structure for the whole impulse voltage generator. The impulse generator has 2-24 stages, constituting a tower form structure, each stage is a cascade connection, disassembly and maintenance are convenient, and the whole structure is stable.

Spark gaps are be install in the encapsulated epoxy glass tube. The enclosure protects the spark gap from dust and dirt. It also damps the impulse noise and protects the close environment and

the operating personnel of the impulse generator from light flashes and ultra-violet radiation.

Impulse capacitors use dry type instead of oil filled capacitor, it has many advantage such as better inductance, lower weight, more wide working temperature and long life cycle. For 100kV per stage impulse generator consist of two units 50kV dry type impulse capacitors, for 200kV per stage impulse generator consist of two units 100kV dry type impulse capacitors.



Resistors are the wave shaping elements and wire-wound for high stability and linearity and are epoxy cast for high impulse loads. Each resistor value has a specific colour for easy identification. These resistors have a plug-in connection for quick and easy reconfiguration. The basic system includes a set of resistors for lightning and switching impulse voltages according to IEC 60060-1. The resistors are completely internal to the generator and ensure very low inductance. Multiple

series- and parallel connections enable the combination of resistors for additional values.



Top electrodes are used more than 400kV impulse generator, it is made by aluminum toroid or stainless steel discs. It makes to raise preliminary discharge voltage.

Fast connectors are be widely used in most components joint such as impulse capacitors, resistors and sphere gaps. A special design together with spring allow all components

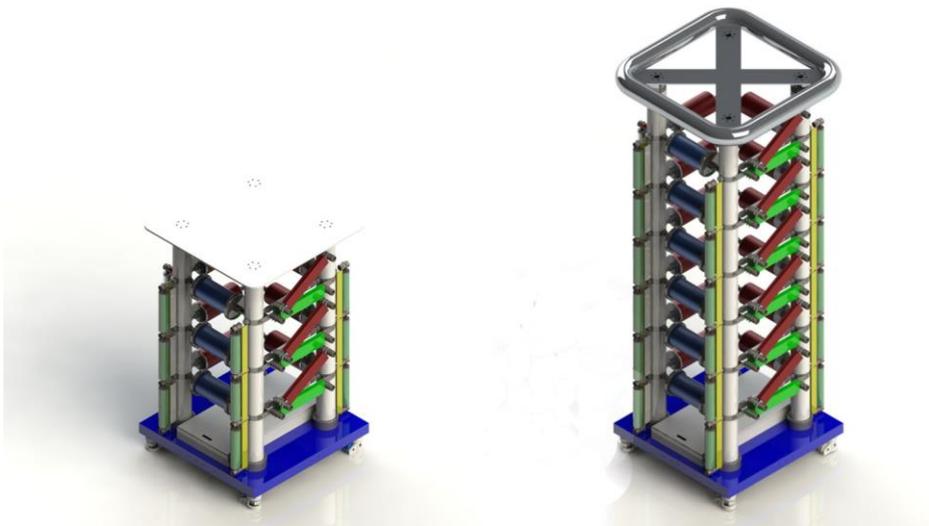
can strongly joint together without any screws. It make assemble and disassemble the components be particularly convenient.

Grounding system & Isolation Switch are unique design from Samgor technology, it is made by numbers of isolation switch, it can use as a safety grounding system, also it is instead of the charging resistors, it perfectly solve the problem of

charging unbalance. In the meantime, each isolation switch can be control by PLC, so through digital impulse control system can remote control charging stage and discharge stage. Each isolation switch has long life permit, within 50000 time, it does not need any maintenance.

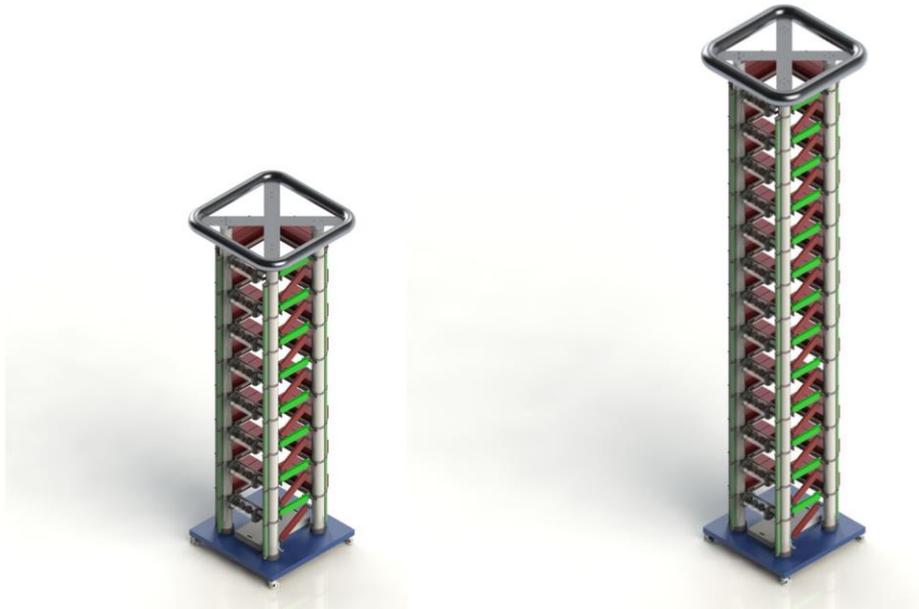
Internal ladder is used in impulse generator of 200kV per stage, it is in the stack made of insulating material makes it possible to reach the operating platforms.

Specification (200-1200kV):



Model	Voltage kV	Stage No.	Stage Voltage kV	Main Capacitance μ F	Total energy kJ	Dimension			Total weight kg	LI Safety distance (mm)
						L(mm)	W(mm)	H(mm)		
CDYQ-200/10	200	2	100	0.5	10	1250	1250	1675	400	500
CDYQ-200/20				1	20	1250	1250	1675	450	500
CDYQ-300/15	300	3		0.33	15	1250	1250	2125	500	800
CDYQ-300/30				0.66	30	1250	1250	2125	650	800
CDYQ-400/20	400	4		0.25	20	1250	1250	2575	600	1000
CDYQ-400/40				0.5	40	1250	1250	2575	800	1000
CDYQ-600/30	600	6		0.166	30	1250	1250	3585	850	1500
CDYQ-600/60				0.332	60	1250	1250	3585	1150	1500
CDYQ-800/40	800	8		0.125	40	1250	1250	4485	1050	2000
CDYQ-800/80				0.25	80	1250	1250	4485	1450	2000
CDYQ-1000/50	1000	10		0.1	50	1250	1250	5385	1250	2500
CDYQ-1000/100				0.2	100	1250	1250	5385	1750	2500
CDYQ-1200/60	1200	12	0.083	60	1250	1250	6285	1450	3000	
CDYQ-1200/120			0.166	120	1250	1250	6285	2050	3000	

Specification (200-1200kV):

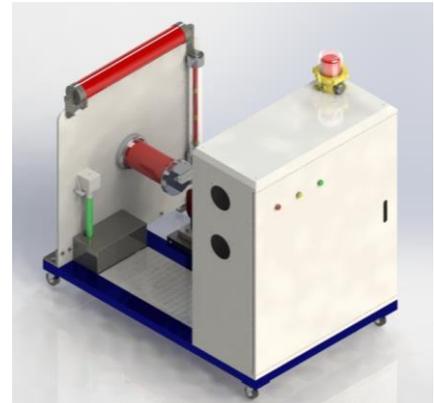


Model	Voltage kV	Stage No.	Stage Voltage kV	Main Capacitance μF	Total energy kJ	Dimension			Total weight kg	LI Safety distance (mm)
						L(mm)	W(mm)	H(mm)		
CDYQ-1400/70	1400	7	200	0.071	70	1600	1600	7185	1750	3500
CDYQ-1400/140				0.142	140	1600	1600	7185	2650	3500
CDYQ-1600/80	1600	8		0.0625	80	1800	1800	6225	2500	4000
CDYQ-1600/160				0.125	160	1800	1800	6225	3300	4000
CDYQ-1800/90	1800	9		0.0555	90	1800	1800	7525	3000	4500
CDYQ-1800/180				0.111	180	1800	1800	7525	3900	4500
CDYQ-2400/240	2400	12		0.0833	240	2200	2200	10225	4500	6000
CDYQ-2400/360				0.125	360	2200	2200	10225	5700	6000
CDYQ-3000/300	3000	15		0.066	300	2200	2200	14125	6000	7500
CDYQ-3000/450				0.1	450	2200	2200	14125	7200	7500
CDYQ-3600/360	3600	18		0.0555	360	2200	2200	18025	7500	9000
CDYQ-3600/480				0.0833	480	2200	2200	18025	9300	9000

120kV DC Charging Device

ZD-120 Series DC Charging Device use to charge impulse capacitor for impulse generator, charging method is unilateral doubler rectifier type, maximum output voltage is 120kV (DC), output current is 20mA or 40mA. DC charging device use the dry type charging transformer, primary voltage is 0.22kV, secondary voltage is 50kV (AC), rated capacity 5kVA or 10kVA; Use the dry type insulation transformer, primary voltage 0.22kV, secondary voltage 0.22kV, rated capacity 5kVA or 10kVA.

Two units 2DL-300kV/500mA high voltage diodes are be used, reverse withstanding $\geq 300\text{kV}$, average current $\geq 0.5\text{A}$, the high voltage rectifier is installed inside the PC tube motorized / air operated charging voltage polarity. The control panel has the polarity switch converting key.

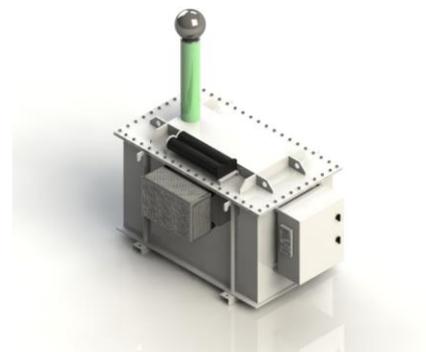


One unit DC resistance voltage divider, high voltage arm use 120kV, 200M Ω , the dry type metalized film resistor. The low voltage arm resistance is installed on the bottom flange of the voltage divider, the low voltage arm voltage of the low voltage arm signals use the shielding measuring cable into the control panel;

240kV DC Charging Device

ZD-240 Series DC Charging Device use to charge impulse capacitor for impulse generator, charging method is unilateral doubler rectifier type, maximum output voltage is 240kV (DC), output current is 50mA or 100mA. DC charging device use the dry type charging transformer, primary voltage is 0.22kV, secondary voltage is 100kV (AC), rated capacity 30kVA or 50kVA; Use the dry type insulation transformer, primary voltage 0.38kV, secondary voltage 0.38kV, rated capacity 30kVA or 50kVA.

Two units 2DL-300kV/500mA high voltage diodes are be used, reverse withstanding $\geq 300\text{kV}$, average current $\geq 0.5\text{A}$, the high voltage rectifier is installed inside the PC tube motorized / air operated charging voltage polarity. The control panel has the polarity switch converting key.



One unit DC resistance voltage divider, high voltage arm use 220kV, 400M Ω , the dry type metalized film resistor. The low voltage arm resistance is installed on the bottom flange of the voltage divider, the low voltage arm voltage of the low voltage arm signals use the shielding measuring cable into the control panel;

Weak Damped Voltage Divider

DF Series Weak Damped Voltage Divider is a major part of high voltage surge measurement. It converts the high voltage surge to low voltage surge what can be measure by OSC.

Weak damped capacitance voltage divider is constituted by a block of impulse serial capacitor model no MWVF200, the damped resistance uses a multi stage distributor, the capacitor has a non inductive structure, the low voltage arm is constitute by a non inductive monolithic capacitor connection. The divider has mobile type structure (the wheels are made with polyurethane and have grounding proprieties); the top is equipped with a shielding device. Low damping capacitance



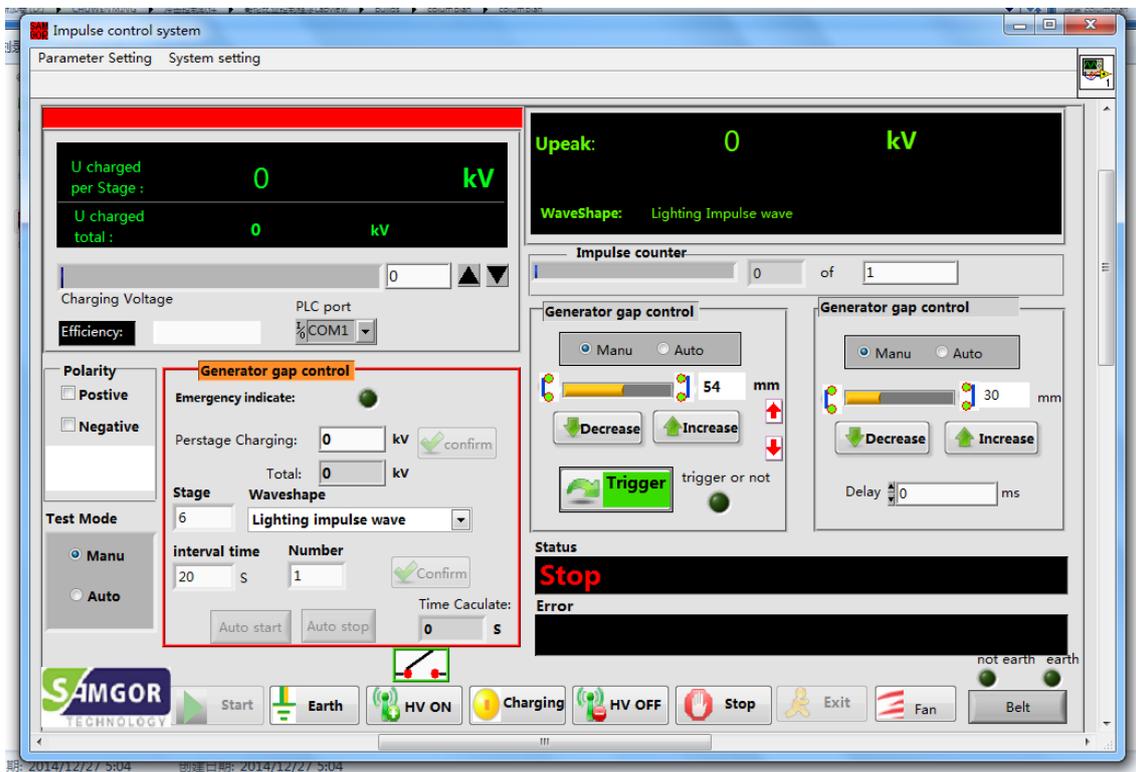
divider's square wave response characteristics meets GB/T311.1 and IEC60060-2 standard requirements.

Low voltage arm is made by low inductance mica capacitor, 1500V rating, it can guarantee perfect temperature coefficient, voltage coefficient, lowest self inductance.

Digital Impulse Control System

IMS-2001 is made for high voltage testing laboratory operating environment, especially considering the impulse test characteristics used as high magnetic interference design, the technology performances indexes meet IEC61083 and IEEE1122、GB/T16896.1-1997/200X、IEC61000 standards requirements.

The operating system is written under Labview environment, based on Windows 7 operating system with 23.5' TFT screen, in order to insure the system compatibility and universality. Simple visual interface, easy operation.



Digital Impulse Measuring & Analyzer System

High voltage impulse test is used to assess the quality of any high voltage equipment. The test object is subjected to a fast voltage impulse of defined wave shape caused by the test object are used for detection of insulation strengths and/or faults. It is commonly used for routine testing of transformer, bushings or other high voltage equipment.

SG3004-12(14) Digital Impulse Measuring & Analyzer System is an excellent and reliable tool for accurate measurement of all kinds of wave-shapes. It also manufactures complete impulse voltage test systems to meet most requirement. This impulse generation capability plus impulse measurement offers a complete solution to modern testing

needs.

SG3004-12(14) equips 12bit or 14bit, 100Ms/S sampling rating A/D card inside and user friendly software and powerful curve analyzing tools along with the report generating.

Measurement evaluation and analysis of impulse voltages and currents can be performed according to IEC 61083, IEC 60060, IEC 60076, IEC 60099 and IEC 60230, automatic evaluation of the impulse of the impulse shapes specified in the above standards.

SG3004-12(14) is controlled by the host computer, using the USB or Ethernet interface. SG3004-12(14) is complete system to be integrated with impulse voltage test system.



Comparison of Samgor / Other Chinese / European Impulse Generator

The following tables describes generally a comparison impulse generator of Samgor and other major manufactories in the market. It shows the advantages and draw-backs of each system.

	Samgor Impulse Generator	Other Chinese Impulse Generator	European Impulse Generator	Remarks
Delivery Time	Two weeks for common spec, 45 days for special spec;	2-4 months	6-12 months	
Installation and Commissioning Time	<7 days	>10 days	>10 days	Absolutely modular design from Samgor
Trigger Range	>20% @ 100% rated voltage (Use multiple stages trigger)	Approx. 15% @ 100% rated voltage (Trigger first stage)	Approx. 20% @ 100% rated voltage (Trigger first stage)	
Stability of Charging	Stability at all working condition	Stability at only dry and low dust condition	Stability at only dry condition	Samgor gap install in the isolated tube and fill in filter clean air;
Stability of Trigger	Very good, trigger all stages;	Good, trigger first stage;	Good, trigger first stage;	
Capacity Upgrading Future	Possible double the capacity by add one more capacitors;	Impossible	Impossible	
Stage Upgrading Future	Very easy upgrading at the whole life for any stage;	Difficult upgrading and take long tiime	Difficult upgrading and take long tiime	
Investment	Low	Low	High	
Safety Grounding System	Include, use air pressure operation switches to act as safety grounding system;	May include, use safety grounding belt;	Include, use safety grounding belt	
Operation Time of Safety Grounding System	<2 seconds for any impulse generator;	10-60 second depend on impulse generator size;	5-30 second depend on impulse generator size.	
Reliability of Safety Grounding System	>30000 time	Not reliable	>10000 time	

Balance of Charging	Total balance (Directly charging all stages without charging resistor)	1-5% Difference (Charging through charging resistors)	1-5% Difference (Charging through charging resistors)	
Automatic Select Charging and Discharge Stage	Automatic select by computer	Manual select	Manual select	
Loop Inductance	Low	High	Low	
Material of Joint and Connector	304 Stainless Steel	Iron and Aluminum	Iron and Aluminum	

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