IMPULSE VOLTAGE GENERATORS

The impulse voltage generators are designed for testing high voltage equipment of power systems with lightning (LI: 1.2/50 µs), with chopping (LIC: 1.2/2÷6 µs) and switching (SI 250/2500 µs) impulses according to the IEC standard 60060-1 (IEEE, GOST, etc).

The generators can be modified to perform many different special tests, impulse voltage test on transformers, impulse current test of surge arresters, impulse voltage and current test of insulating materials for electrical equipment.

Our modular system ensure a very variable application in industries, in laboratories, in research centers or in universities.

The circuit of the impulse generators is a modified Marx multiplier circuit.

The capacitors, arranged in the stages of the generator are charged in parallel with DC voltages up to 100 kV (for IGS and IGM type) – up to 200kV (for IGL type) against the earth potential and in order to generate impulses, connected in series by spark gaps.

For the modification of the output voltage is possible to connect the stages in series (as standard), in series parallel (to increase energy with lower voltages) and in full parallel (to ensure full energy at lowest voltage [100kV @ IGS-IGM / 200kV @ IGL]).

For the modification of the front time and time to half value of the impulse waveform, the generator stages is equipped with series resistors (regulation of the front) and parallel resistors (regulation of the tail).

Our design ensure a very low inductance, providing a high efficiency and a smooth waveform.

In our production we have 3 different type of impulse generator:

- **IGS**
- **IGM**
- **IGL**

IGS type

Total charging voltage: 100 ÷ 1000 kV

Total impulse energy: 2.5 ÷ 50 kJ

Total charging voltage: 100 kV

Stages number: 1 ÷ 10

The maximum charging voltage is 100 kV per stage with a maximum energy of 5 kJ / per stage.

The maximum number of stages is 10.

This corresponds for 10 stages to maximum output voltages of 950 kV (LI-LIC) and 760 kV (SI) in the no-load status (efficiency ≥ 95%).

The impulse generator is realized with six column design.

All of these columns are made of glass-fiber; four of them serve as supports for the impulse capacitors in the generator stages. Two of them serve as support for the spark gaps and resistors in the generator stage.

All series and parallel resistors are arranged between one of the four columns and a one of the other 2.

The movable sphere gaps are connected together with an insulating bar (plexyglass) which can ensure a perfect contemporaneity of the horizontal movement for adjustment of all spark gaps with the help of a motor drive on earth potential.

The six insulating columns are placed on a common steel basement that is designed as mobile type, with rollers (air cushions under request).

For the safety of the operator, our impulse generators are equipped with 2 points pneumatic earthing system to place to the earth the HV terminal of each capacitor and its tank. With this solution each capacitor is short-circuited and connected to the earth.

The earthing system will act automatically, when the operator will turn off the impulse generator system or in case of failure or emergency.

To ensure a perfect working in all conditions, the pneumatic system is equipped with air pressure reserve to ensure a safety earthing procedure of the impulse generator also in case the air pipe will be damaged or removed.

All our impulse generators are equipped as standard with:

- Wheels in order to move the impulse generator by hand.
- Locking blocks after the movement of the impulse generator.
- Pneumatic earthing system (2 points) that will ensure the short circuit of all impulse capacitors after that the generator is switched off.

Impulse generator parameters

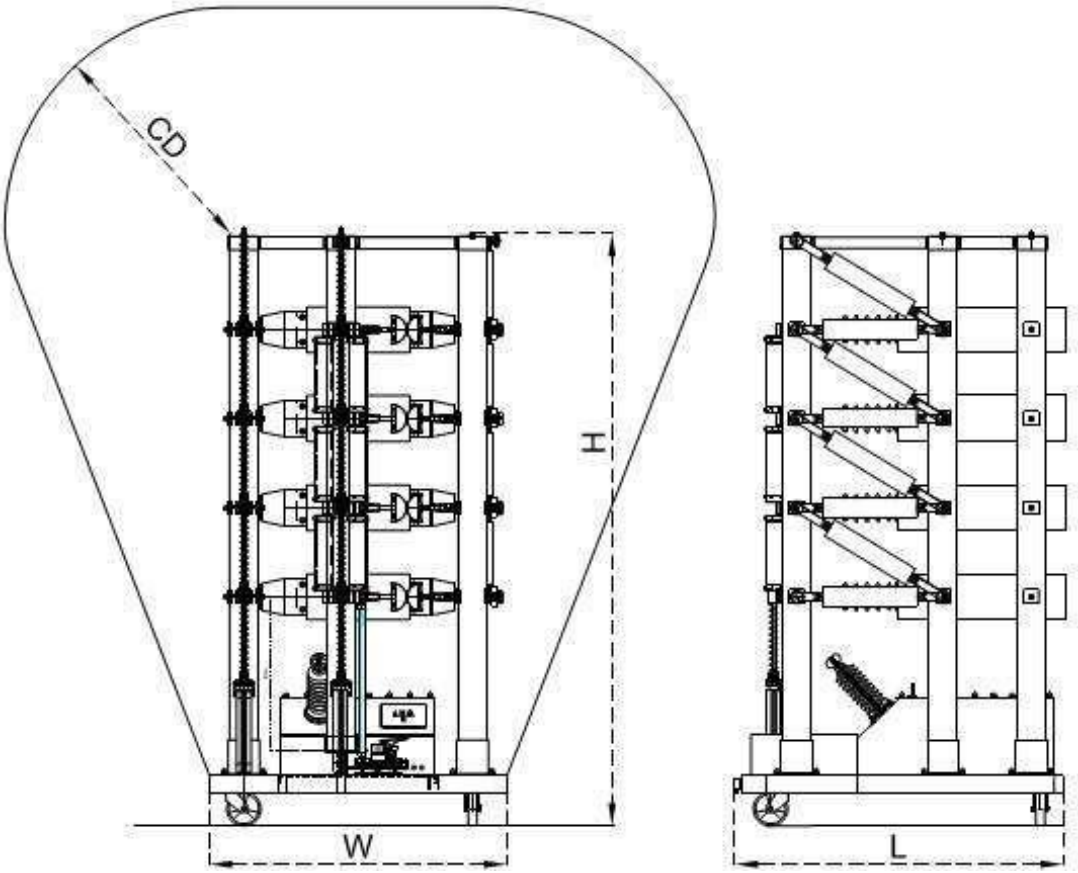
Stage energy		2,5kJ		5kJ	
Charging voltage kV	Number of stages	Total energy kJ	Total capacitance nF	Total energy kJ	Total capacitance nF
100	1	2,5	500	5	1000
200	2	5	250	10	500
300	3	7,5	167	15	333
400	4	10	125	20	250
500	5	12,5	100	25	200
600	6	15	83	30	167
700	7	17,5	71	35	143
800	8	20	63	40	125
900	9	22,5	56	45	111
1000	10	25	50	50	100

Overall dimensions and weight

Charging voltage	Number of stages	Height (H)	Safety clearance (CD)*	Basement frame L x W	Weight Kg	
kV		mm	mm	mm	2,5kJ	5kJ
100	1	1350	743	1800 X 1650	276	360
200	2	1700	935		341	465
300	3	2050	1128		406	570
400	4	2400	1320		471	675
500	5	2750	1513		536	780
600	6	3100	1705		601	885
700	7	3450	1898		666	990
800	8	3800	2090		731	1095
900	9	4150	2283		796	1200
1000	10	4500	2475		861	1305

*The safety clearance indicated is for LI impulse shape. The safety clearance distance depends from the impulse shape (LI or SI), dimensions of the top electrode and from the dimensions and geometry of the test room.

Dimensional drawing



Accessories on request:

- set of resistors for switching impulse test of transformers;
- air cushions for the impulse generator to move it on smooth horizontal;
- additional resistors for the lightning impulse voltage test of transformers;
- Glaninger circuit to perform lightning impulse test on transformer with low voltage
- Reactors for the generation of impulse currents
- Spark-gaps contained in insulating pipe with purification area system to perform impulse test in areas with high dust pollution (standard for impulse generator ≥ 800kV)

IGM type

Total charging voltage: 100 ÷ 2000 kV

Total impulse energy: 2.5 ÷ 200 kJ

Total charging voltage: 100 kV

Stages number: 1 ÷ 20

The maximum charging voltage is 100 kV per stage with a maximum energy of 10 kJ / per stage.

The maximum number of stages is 20.

This corresponds for 20 stages to maximum output voltages of 1900 kV (LI-LIC) and 1550 kV (SI) in the no-load status (efficiency ≥ 95%).

The impulse generator is realized with six column design.

All of these columns are made of glass-fiber; four of them serve as supports for the impulse capacitors in the generator stages.

Two of them serve as support for the spark gaps and resistors in the generator stage.

All series and parallel resistors are arranged between one of the four columns and one of the other 2.

The movable sphere gaps are connected together with an insulating bar (plexyglass) which can ensure a perfect contemporaneity of the horizontal movement for adjustment of all spark gaps with the help of a motor drive on earth potential.

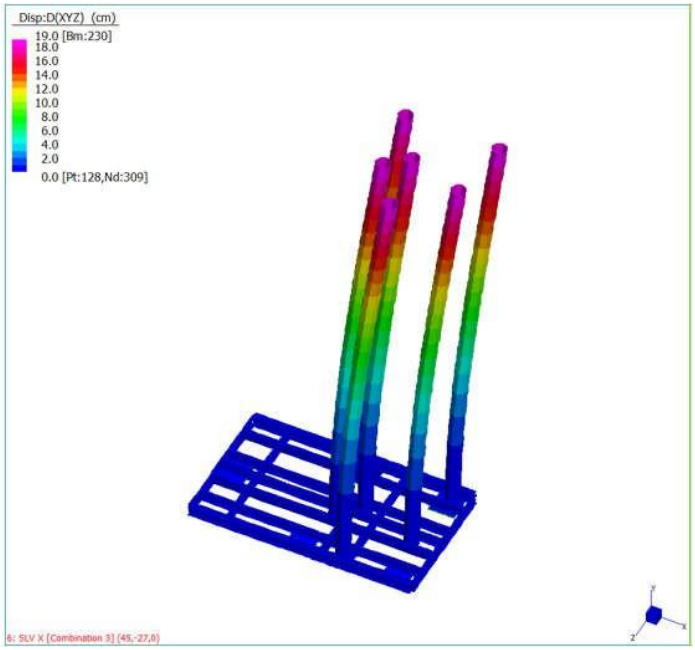
The six insulating columns are placed on a common steel basement that is designed as mobile type, with rollers (only up to 1200kV, > 1200kV it is stationery or air cushions under request).

For the safety of the operator, our impulse generators are equipped with 2 points pneumatic earthing system to place to the earth the HV terminal of each capacitor and its tank. With this solution each capacitor is short-circuited and connected to the earth.

The earthing system will act automatically, when the operator will turn off the impulse generator system or in case of failure or emergency.

To ensure a perfect working in all conditions, the pneumatic system is equipped with air pressure reserve to ensure a safety earthing procedure of the impulse generator also in case the air pipe will be damaged or removed.

All our impulse generators are specifically designed to withstand disasters such as earthquakes.



All our impulse generators are equipped as standard with:

- Wheels in order to move the impulse generator by hand (only up to 1000kV, > 1000kV it is stationery or with air cushions as option).
- Standing pads after the movement of the impulse generator.
- Pneumatic earthing system (2 points) that will ensure the short circuit of all impulse capacitors after that the generator is switched off.

Impulse generator parameters

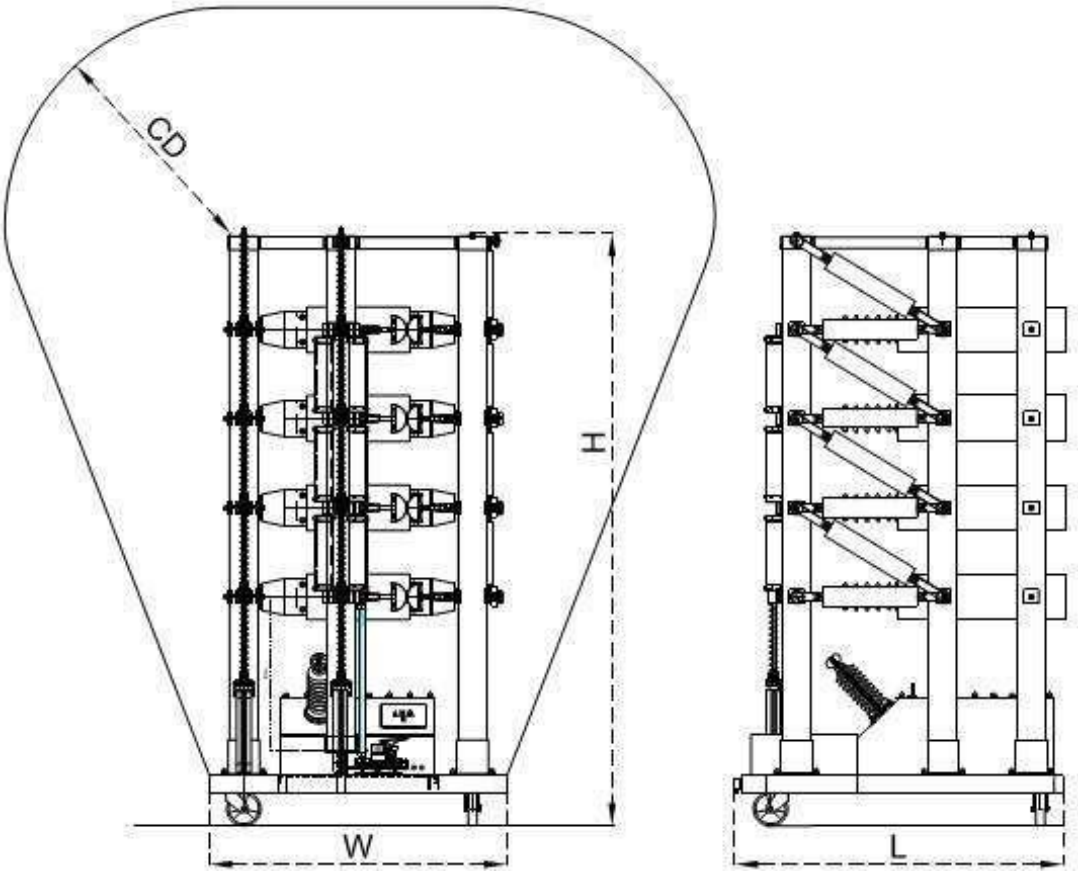
Stage energy		2,5kJ		5kJ		10kJ	
Charging voltage kV	Number of stages	Total energy kJ	Total capacitance nF	Total energy kJ	Total capacitance nF	Total energy kJ	Total capacitance nF
100	1	2,5	500	5	1000	10	2000
200	2	5	250	10	500	20	1000
300	3	7,5	167	15	333	30	667
400	4	10	125	20	250	40	500
500	5	12,5	100	25	200	50	400
600	6	15	83	30	167	60	333
700	7	17,5	71	35	143	70	286
800	8	20	63	40	125	80	250
900	9	22,5	56	45	111	90	222
1000	10	25	50	50	100	100	200
1100	11	27,5	45	55	91	110	182
1200	12	30	42	60	83	120	167
1300	13	32,5	38	65	77	130	154
1400	14	35	36	70	71	140	143
1500	15	37,5	33	75	67	150	133
1600	16	40	31	80	63	160	125
1700	17	42,5	29	85	59	170	118
1800	18	45	28	90	56	180	111
1900	19	47,5	26	95	53	190	105
2000	20	50	25	100	50	200	100

Overall dimensions and weight

Charging voltage	Number of stages	Height (H)	Safety clearance (CD)*	Basement frame L x W	Weight Kg		
kV		mm	mm	mm	2,5kJ	5kJ	10kJ
100	1	1400	770	2100 x 2300	276	360	480
200	2	1800	990		341	465	700
300	3	2200	1210		406	570	920
400	4	2600	1430		471	675	1140
500	5	3000	1650		536	780	1360
600	6	3400	1870		601	885	1580
700	7	3800	2090		666	990	1800
800	8	4200	2310		731	1095	2020
900	9	4600	2530		796	1200	2240
1000	10	5000	2750		861	1305	2460
1100	11	5400	2970		926	1410	2680
1200	12	5800	3190		991	1515	2900
1300	13	6200	3410		1056	1620	3120
1400	14	6600	3630		1121	1725	3340
1500	15	7000	3850		1186	1830	3560
1600	16	7400	4070		1251	1935	3780
1700	17	7800	4290		1316	2040	4000
1800	18	8200	4510		1381	2145	4220
1900	19	8600	4730		1446	2250	4440
2000	20	9000	4950		1511	2355	4660

*The safety clearance indicated is for LI impulse shape. The safety clearance distance depends from the impulse shape (LI or SI), dimensions of the top electrode and from the dimensions and geometry of the test room.

Dimensional drawing



Accessories on request:

- set of resistors for switching impulse test of transformers;
- air cushions for the impulse generator to move it on smooth horizontal;
- additional resistors for the lightning impulse voltage test of transformers;
- Glaninger circuit to perform lightning impulse test on transformer with low voltage
- Reactors for the generation of impulse currents
- Spark-gaps contained in insulating pipe with purification area system to perform impulse test in areas with high dust pollution (standard for impulse generator ≥ 800kV)

IGL type

Total charging voltage: 200 ÷ 4800 kV

Total impulse energy: 5 ÷ 720 kJ

Total charging voltage: 200 kV

Stages number: 4 ÷ 24

The maximum charging voltage is 200 kV per stage with a maximum energy of 30 kJ / per stage.

The maximum number of stages is 24.

This corresponds for 24 stages to maximum output voltages of 4610 kV (LI-LIC) and 3740 kV (SI) in the no-load status (efficiency ≥ 96%).

The impulse generator is realized with six column design.

All of these columns are made of glass-fiber; four of them serve as supports for the impulse capacitors in the generator stages.

Two of them serve as support for the spark gaps and resistors in the generator stage.

All series and parallel resistors are arranged between one of the four columns and one of the other 2.

The movable sphere gaps are connected together with an insulating bar (plexyglass) which can ensure a perfect contemporaneity of the horizontal movement for adjustment of all spark gaps with the help of a motor drive on earth potential.

The six insulating columns are placed on a common steel basement that is designed as stationery type (air cushions under request).

A stable construction is ensured by triangular frames in each stage.

These platforms are accessible without risk through a insulating ladder (fiber-glass) throughout all generator stages.

In each third stage there is a platform that can allow a convenient replacement of the resistors.

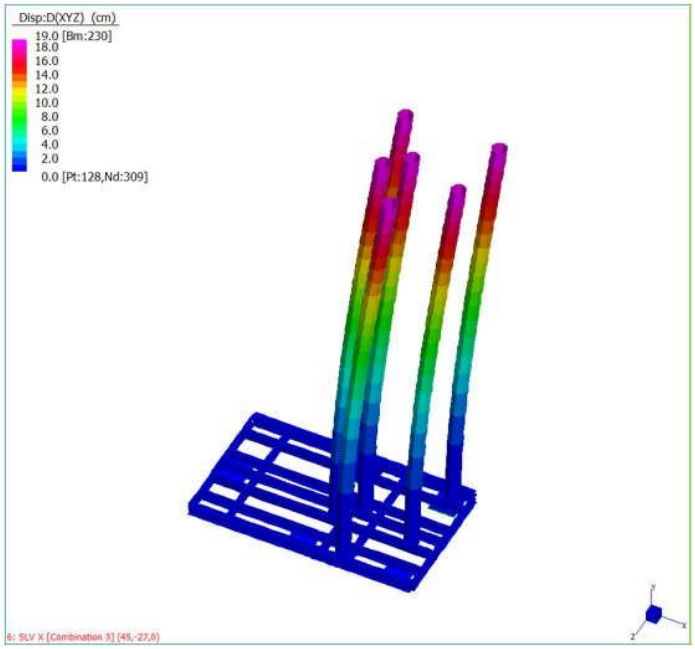
The basement carries also the 200 kV_{DC} power supply.

For the safety of the operator, our impulse generators are equipped with 3 points pneumatic earthing system to place to the earth the HV terminal of each capacitor and its tank. With this solution each capacitor is short-circuited and connected to the earth.

The earthing system will act automatically, when the operator will turn off the impulse generator system or in case of failure or emergency.

To ensure a perfect working in all conditions, the pneumatic system is equipped with air pressure reserve to ensure a safety earthing procedure of the impulse generator also in case the air pipe will be damaged or removed.

All our impulse generators are specifically designed to withstand disasters such as earthquakes.



All our impulse generators are equipped as standard with:

- Predisposition for air cushions system
- Spark-gaps contained in insulating pipe with purification area system
- Locking blocks after the movement of the impulse generator.
- Pneumatic earthing system (3 points) that will ensure the short circuit of all impulse capacitors after that the generator is switched off.

Impulse generator parameters

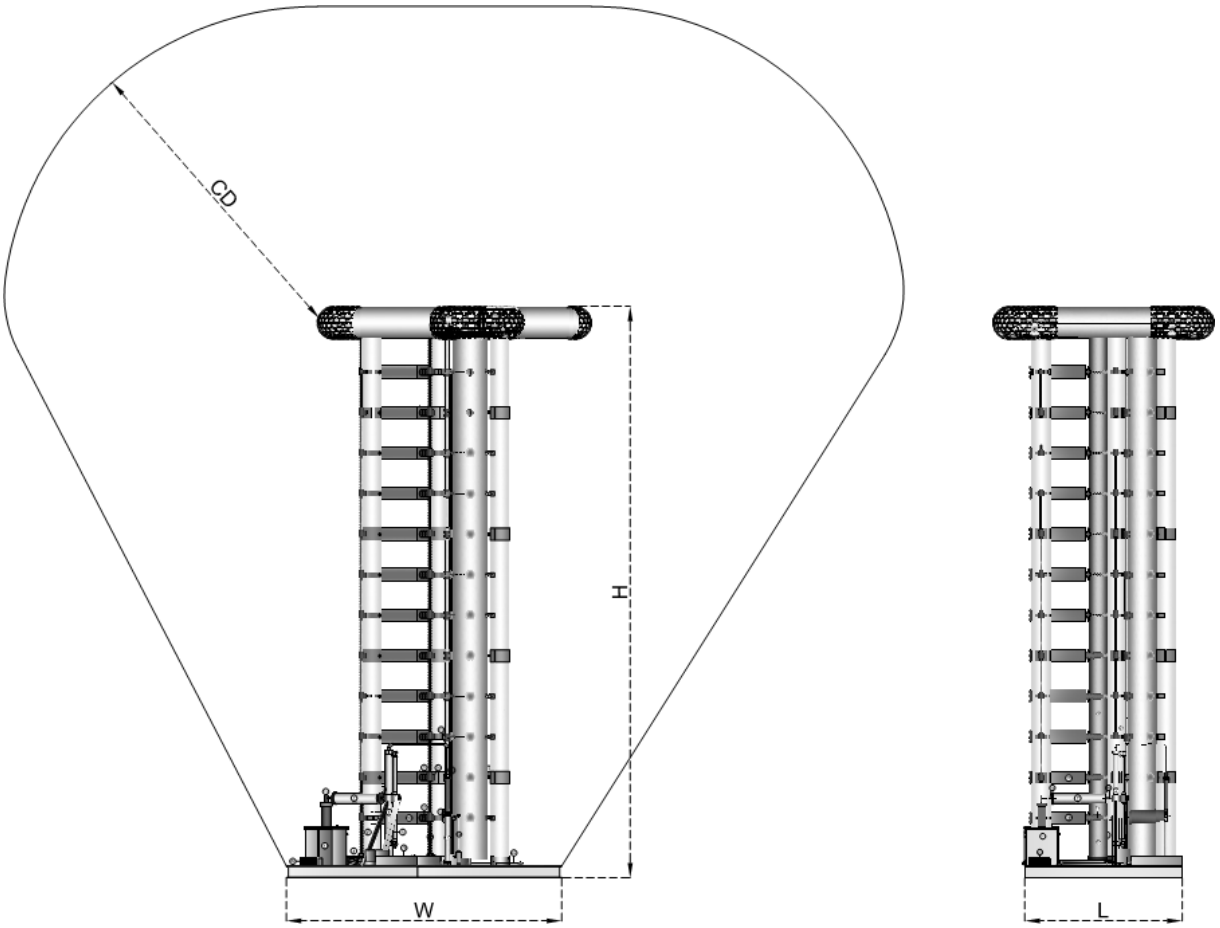
Stage energy		5kJ		10kJ		20kJ		30kJ	
Charging voltage kV	Number of stages	Total energy kJ	Total Capacit. nF	Total energy kJ	Total Capacit. nF	Total energy kJ	Total Capacit. nF	Total energy kJ	Total Capacit. nF
400	2	10	125	20	250	40	500	60	750
600	3	15	83	30	167	60	333	90	500
800	4	20	62.5	40	125	80	250	120	375
1000	5	25	50	50	100	100	200	150	300
1200	6	30	41.6	60	83.3	120	166.7	180	250
1400	7	35	35.7	70	71.4	140	142.9	210	214.3
1600	8	40	31.2	80	62.5	160	125	240	187.5
1800	9	45	27.8	90	55.6	180	111.1	270	166.7
2000	10	50	25	100	50	200	100	300	150
2200	11	55	22.7	110	45.5	220	90.9	330	136.4
2400	12	60	20.8	120	41.7	240	83.3	360	125
2600	13	65	19.2	130	38.5	260	76.9	390	115.4
2800	14	70	17.8	140	35.7	280	71.4	420	107.1
3000	15	75	16.7	150	33.3	300	66.7	450	100
3200	16	80	15.6	160	31.3	320	62.5	480	93.8
3400	17	85	14.7	170	29.4	340	58.8	510	88.2
3600	18	90	13.9	180	27.8	360	55.6	540	83.3
3800	19	95	13.2	190	26.3	380	52.6	570	78.9
4000	20	100	12.5	200	25	400	50	600	75
4200	21	105	11.9	210	23.8	420	47.6	630	71.4
4400	22	110	11.4	220	22.7	440	45.5	660	68.2
4600	23	115	10.9	230	21.7	460	43.5	690	65.2
4800	24	120	10.4	240	20.8	480	41.7	720	62.5

Overall dimensions and weight

Charging voltage	Number of stages	Height (H)	Safety clearence (CD)*	Basement L x W	Weight Kg			
kV		mm	mm	mm	5kJ	10kJ	20kJ	30kJ
400	2	2350	1293	2500 x 4550	2070	2300	2740	2900
600	3	3020	1661		2255	2600	3250	3490
800	4	3690	2030		2440	2900	3760	4080
1000	5	4360	2398		2625	3200	4270	4670
1200	6	5030	2767		2810	3500	4780	5260
1400	7	5700	3135		2995	3800	5290	5850
1600	8	6370	3504		3180	4100	5800	6440
1800	9	7040	3872		3365	4400	6310	7030
2000	10	7710	4241		3550	4700	6820	7620
2200	11	8380	4609		3735	5000	7330	8210
2400	12	9050	4978		3920	5300	7840	8800
2600	13	9720	5346		4105	5600	8350	9390
2800	14	10390	5715		4290	5900	8860	9980
3000	15	11060	6083		4475	6200	9370	10570
3200	16	11730	6452		4660	6500	9880	11160
3400	17	12400	6820		4845	6800	10390	11750
3600	18	13070	7189		5030	7100	10900	12340
3800	19	13740	7557		5215	7400	11410	12930
4000	20	14410	7926		5400	7700	11920	13520
4200	21	15080	8294		5585	8000	12430	14110
4400	22	15750	8663		5770	8300	12940	14700
4600	23	16420	9031		5955	8600	13450	15290
4800	24	17090	9400		6140	8900	13960	15880

*The safety clearance indicated is for LI impulse shape. The safety clearance distance depends from the impulse shape (LI or SI), dimensions of the top electrode and from the dimensions and geometry of the test room.

Dimensional drawing



Accessories on request:

- set of resistors for switching impulse test of transformers;
- air cushions for the impulse generator to move it on smooth horizontal;
- additional resistors for the lightning impulse voltage test of transformers;
- Glaninger circuit to perform lightning impulse test on transformer with low voltage
- Reactors for the generation of impulse currents