

Data Sheet no. 3.12/4

## Impulse Voltage Generators

### 1000 kV up to 6000 kV – Series G

#### Brief Description

The impulse voltage generators / series G are the main component of impulse voltage test systems, series G (s. Data Sheet 3.10), ranging from 1000 kV up to 6000 kV cumulative charging voltage. On request generators up to 10000 kV cumulative charging voltage can be supplied.

They are designed for testing high voltage equipment of power systems with lightning (LI: 1.2/50  $\mu$ s) and switching (SI 250/2500  $\mu$ s) impulses according to the IEC standard 60060-1 (IEEE St.4). The maximum charging voltage is 200 kV per stage with a maximum energy of 30 kJ. With 30 stages, maximum output voltages of 5700 kV (+/-LI) and 4500 kV (-SI) can be generated in the no-load case.

The generators can be modified for carrying out a variety of special tests, e.g. on transformers, impulse current testing of surge arresters and even components of wind generators or air planes as well as EMP tests of electrical equipment. The chosen modular system enables a very variable application in industries as well in laboratories for research and education.

The circuit of the impulse generators is a modified Marx multiplier circuit. The impulse capacitors, arranged in the stages of the generator, are charged with positive and negative DC voltages up to 100 kV each against earth 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 approximately double-exponential impulses, the generator stages comprise appropriate front resistors and tail resistors. Special care is given for a short loop in each stage in order to have a low internal inductance which results in low superimposed oscillations and low overshoot of the impulse.

All components of the impulse generator are supported by four insulating columns made of glass-fiber reinforced plastic. A stable construction is achieved by rectangular frames in each generator stage. In each third stage there is a folding platform that can be entered for a convenient changing-over of the resistors. These platforms are accessible without risk via an insulating ladder throughout all generator stages. The switching spark gaps of all stages are commonly housed inside a fifth insulating column with a slight air overpressure to guarantee clean air for a safe triggering. For safe operation, the test generator is equipped with two earthing switches and two motor driven earthing ropes, which additionally short-circuits all impulse capacitors after the generator is switched off.

The four insulating columns are placed on a common sectional steel base which can be designed either as stationary or as a mobile type, the latter having rollers or receptacles for air cushions. The frame carries also the DC generator including the cubicle for the thyristor controller.

## Electrical main parameters

Stage energy <sup>1)</sup>		20 kJ		30 kJ	
Total charging voltage	Number of stages	Total charging energy	Impulse capacitance	Total charging energy	Impulse capacitance
kV		kJ	nF	kJ	nF
1000	5	100	200.0	150	300.0
1200	6	120	167.0	180	250.0
1400	7	140	143.0	210	214.3
1600	8	160	125.0	240	187.5
1800	9	180	111.0	270	166.7
2000	10	200	100.0	300	150.0
2200	11	220	90.9	330	136.4
2400	12	240	83.3	360	125.0
2600	13	260	76.9	390	115.4
2800	14	280	71.4	420	107.1
3000	15	300	66.7	450	100.0
3200	16	320	62.5	480	93.8
3400	17	340	58.8	510	88.2
3600	18	360	55.6	540	83.3
3800	19	380	52.6	570	78.9
4000	20	400	50.0	600	75.0
4200	21	420	47.6	630	71.4
4400	22	440	45.5	660	68.2
4600	23	460	43.5	690	65.2
4800	24	480	41.7	720	62.5
5000	25	500	40.0	750	60.0
5200	26	520	38.5	780	57.7
5400	27	540	37.0	810	55.6
5600	28	560	35.7	840	53.6
5800	29	580	34.5	870	51.7
6000	30	600	33.3	900	50.0
Min. time difference between impulses		40 s		60 s	
Capacitors per generator stage		2 x 2 µF/100 kV		2 x 3.0 µF/100 kV	

<sup>1)</sup> Other stage energies resp. other min. time difference between impulses on request

### Type designation

IG a/b G

a = total charging energy in kJ  
 = stage energy in kJ x number of stages  
 b = total charging voltage in kV

Example: IG 420/4200 G  
 Impulse generator  
 420 kJ, 4200 kV, series G

### Main parameters

total charging voltage: 1000 to 6000 kV  
 total charging energy: 100 to 900 kJ  
 stage charging voltage: 200 kV  
 stage energy: 20, 30 kJ  
 Number of stages: 5 to 30

## Dimensions, Weights

Total charging voltage	Number of stages	Height H (stationary) installation*	Base frame Length x Width L x B mm		Weight <sup>3)</sup> kg	
			20	30	20	30
kV		mm	Stage energy kJ		Stage energy kJ	
1000	5	4440			3680	4450
1200	6	5095			4360	5300
1400	7	5750			4850	5940
1600	8	6405			5330	6580
1800	9	7060			5870	7270
2000	10	7715			6350	7910
2200	11	8370			6840	8550
2400	12	9025	3200	3200	7370	9240
2600	13	9680	x	x	7860	9880
2800	14	10335	2650	2650	8340	10520
3000	15	10990			8880	11210
3200	16	11645			9360	11850
3400	17	12300			9850	12490
3600	18	12955			10380	13180
3800	19	13610			10870	13820
4000	20	14265			11350	14460
4200	21	14920			11890	15150
4400	22	15575			12370	15790
4600	23	16230			12860	16430
4800	24	16885			13390	17120
5000	25	17540			13880	17760
5200	26	18195			14360	18400
5400	27	18850			14900	19090
5600	28	19505			15380	19730
5800	29	20160			15870	20370
6000	30	20815			16400	21060

\* without top electrode

### Safety clearance D (see Fig. 2):

D is approximately height H / 2, but the precise value D depends on wave shape (LI, SI,..), dimension of top electrode and dimension of test hall

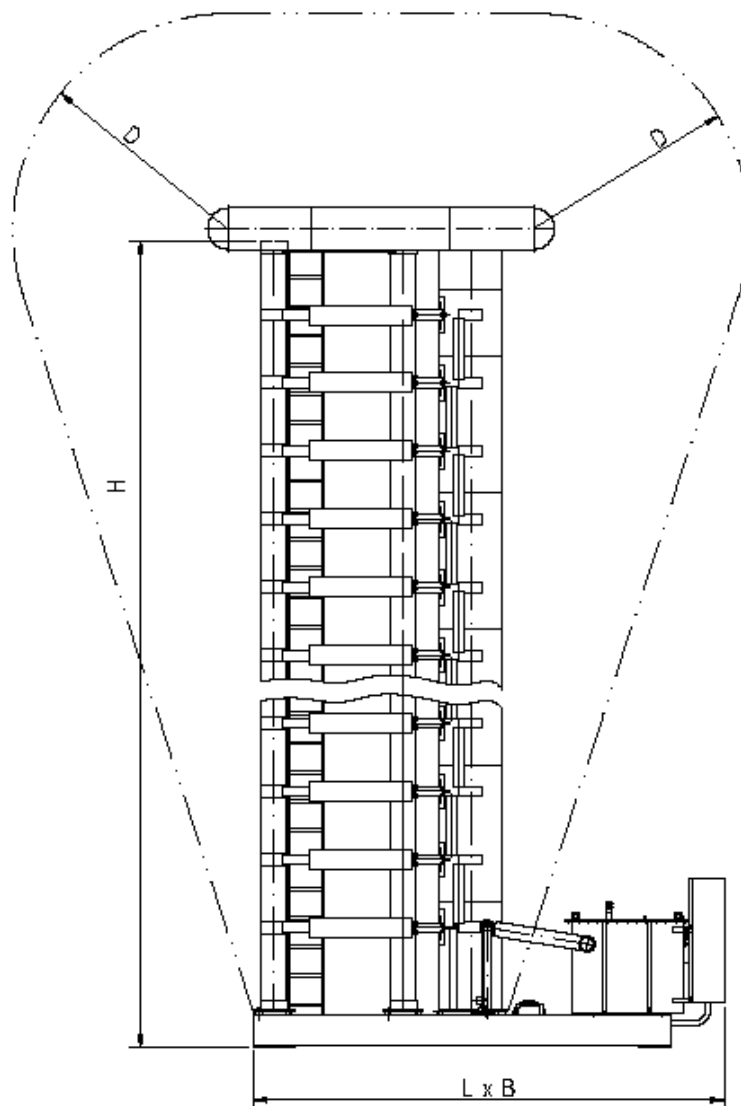
### Accessories on special request:

- set of resistors for switching impulse test of transformers;
- air cushions for the impulse generator up to 4000 kV to move it on smooth horizontal floor (especially for larger types);
- wheels for the impulse generator
- additional resistors and inductances (Glaniger coils, Data Sheet 3.32) for lightning impulse voltage test of transformers;
- reactors for the generation of impulse currents, e.g. for the testing of surge diverters and components of lightning arresters or for the generation of impulse magnetic fields;
- weather-protecting towers for a installation of the generator outdoors;
- top electrode for adaptation to existing laboratory walls at switching impulse voltages;



Fig. 1: Impulse voltage test generator IG 200/2000 G

**Dimensional drawing**



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