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Data Sheet 3.13/3

Impulse Voltage Generators

500 kV up to 2400 KV – Series M

Brief Description

The impulse voltage generators / series M are the main component of impulse voltage test systems, series M (see Data Sheet 3.10), ranging from 500 kV to 2400 kV cumulative charging voltage.

They are designed for testing high-voltage equipment of power systems with lightning impulses (LI: 1.2/50 μ s) and switching impulses (SI 250/2500 μ s) according to the IEC standard 60060-1 (IEEE St.4). The maximum charging voltage is 100 kV per stage with a maximum energy of 10 kJ per stage. With 24 stages, maximum output voltages of 2300 kV (LI) and 1800 kV (SI) can be generated in the no-load case.

The impulse voltage 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 as in laboratories for research and education.

The circuit of the impulse voltage generators is a Marx multiplier circuit. The impulse capacitors, arranged in the stages of the impulse voltage generator, are charged in parallel with DC voltages up to 100 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.

All components of the impulse voltage generator are supported by four insulating columns made of glass-fiber reinforced plastic. The switching spark gaps of all generator stages are commonly housed inside a fifth insulating column with slight air overpressure to guarantee clean air for a safe triggering. For safe operation, the test generator is equipped with one earthing switch and a motor-driven earthing rope, 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.



Figure 1: Impulse voltage test generator IG 90/1800 M

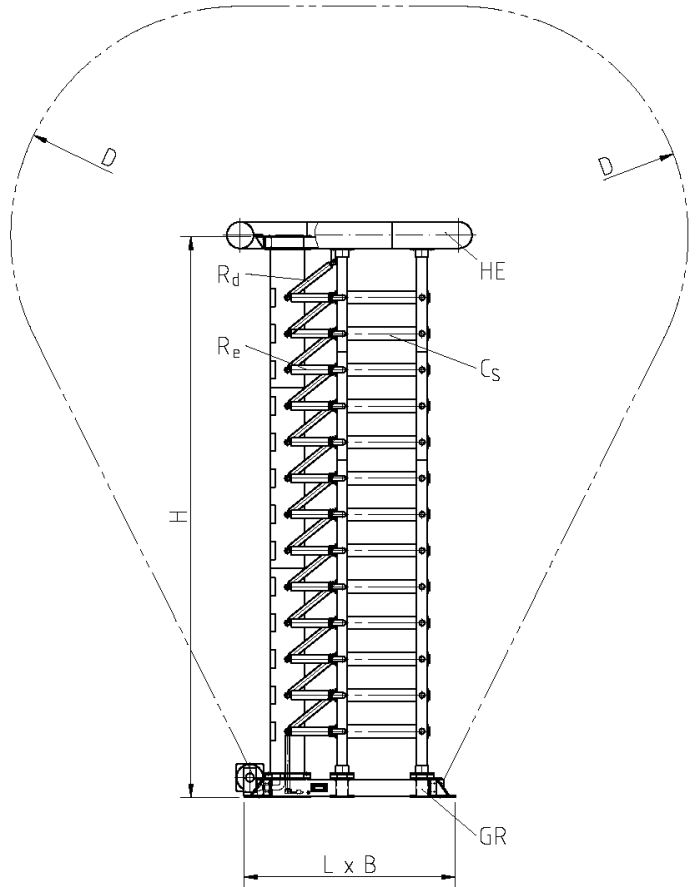


Figure 2: Dimensional drawing

Table 1: Electrical main parameters

Stage energy ¹⁾		5 kJ		10 kJ	
Total charging voltage	Number of stages	Total charging energy	Impulse capacitance	Total charging energy	Impulse capacitance
kV		kJ	nF	kJ	nF
500	5	25	200	50	400
600	6	30	167	60	333
700	7	35	143	70	286
800	8	40	125	80	250
900	9	45	111	90	222
1000	10	50	100	100	200
1100	11	55	91	110	182
1200	12	60	83	120	167
1300	13	65	77	130	154
1400	14	70	71	140	143
1500	15	75	67	150	133
1600	16	80	63	160	125
1700	17	85	59	170	118
1800	18	90	56	180	111
1900	19	95	53	190	105
2000	20	100	50	200	100
2100	21	105	48	--	--
2200	22	110	45	--	--
2300	23	115	43	--	--
2400	24	120	42	--	--
Min. time difference between impulses, 1 to 16 stages ¹⁾		40 s		80 s	
Min. time difference between impulses, 17 to 24 stages ¹⁾		60 s		120 s	
Capacitors per generator stage		1 x 1 μF/100 kV		1 x 2 μF/100 kV	

¹⁾ Other stage energies resp. other min. time difference between impulses on request.

Main parameters

total charging voltage:	500 to 2400 kV
total charging energy:	25 to 200 kJ
stage charging voltage:	100 kV
stage energy:	5.0 and 10 kJ
Number of stages:	5 to 24

Table 2: Dimensions, weights

Total charging voltage	Number of stages	Height H (stationary) for 5 kJ installation *	Height H (stationary) for 10 kJ installation *	Base frame Length x Width L x B mm		Weight ²⁾ kg	
				Stage energy 5 kJ	Stage energy 10 kJ	Stage energy 5 kJ	Stage energy 10 kJ
kV		mm	mm				
500	5	2560	2915	1980 x 1450	2120 x 1450	1263	1595
600	6	2900	3325			1377	1771
700	7	3240	3735			1490	1947
800	8	3580	4145			1604	2123
900	9	3920	4555			1717	2299
1000	10	4260	4965			1831	2475
1100	11	4600	5375			1945	2651
1200	12	4940	5785			2058	2827
1300	13	5280	6195			2172	3003
1400	14	5620	6605			2285	3179
1500	15	5960	7015			2399	3355
1600	16	6300	7425			2513	3531
1700	17	6640	7835			2626	3707
1800	18	6980	8245			2740	3883
1900	19	7320	8655			2853	4059
2000	20	7660	9065			2967	4235
2100	21	8000	--			3081	--
2200	22	8340	--			3194	--
2300	23	8680	--			3308	--
2400	24	9020	--			3421	--

* without top electrode

²⁾ with resistor set for LI 1.2/50 μ s but without HV top electrode

Safety clearance D (see dimensional drawing)

D is approximately height H / 2.

Please note:

D depends on wave shape (LI, SI,..), dimension of top electrode and dimension of test hall.

Mobility

As an option, impulse voltage generators with stage energies of 5 kJ and 10 kJ are moveable up to 1600 kV.

Accessories on special request

- Set of resistors for switching impulse test of transformers
- Air cushions for the impulse voltage generator up to 1600 kV to move it on smooth horizontal floor
- Rollers for the impulse voltage generator, in order to move it by hand (up to 1600 kV)
- Additional resistors and inductances (Glaniger Extension, Data Sheet 3.32) for the lightning impulse voltage test of transformers
- Reactors for the generation of oscillating lightning and oscillating switching impulses, e.g. for the on-site testing of SF6-switchgear
- Reactors for the generation of impulse currents, e.g. for the testing of surge arresters and components of lightning protection or for the generation of impulse magnetic fields
- Weather-protecting hood for a temporary outdoor installation of the generator (up to 1200 kV)
- Top electrode for adaptation to existing laboratory walls at switching impulse voltages

Type designation

IGF or IGL a/b M

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

Without F or L = stationary

F = mobile (on rollers)

L = mobile (on air cushions)

M = series M (medium)