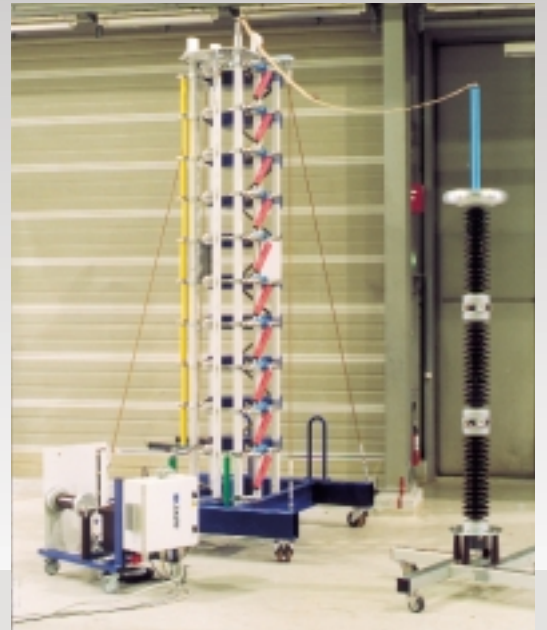


WHEN QUALITY IS AN ISSUE, THE CHOICE IS HAEFELY



SGSA

IMPULSE VOLTAGE TEST SYSTEM
SGSA
100-800 kV, 5-40 kJ

HAEFELY 
HIGH VOLTAGE TEST

IMPULSE VOLTAGE TEST SYSTEM

APPLICATION

SGSA impulse test systems can be used to generate impulse voltages from 10 kV to 750 kV simulating lightning strokes and switching surges. The total charging voltage range covers from 100 kV to 800 kV with a stage energy of 5 kJ.

The system is built on contains all experience acquired in impulse generator production since 1932.

Applications covered include testing according to IEC, ANSI/IEEE as well as other national standards.

The basic system can be upgraded in various ways for special tests and or greater ease of operation. A number of additional circuits and components allow to optimise the impulse test system for tests on:

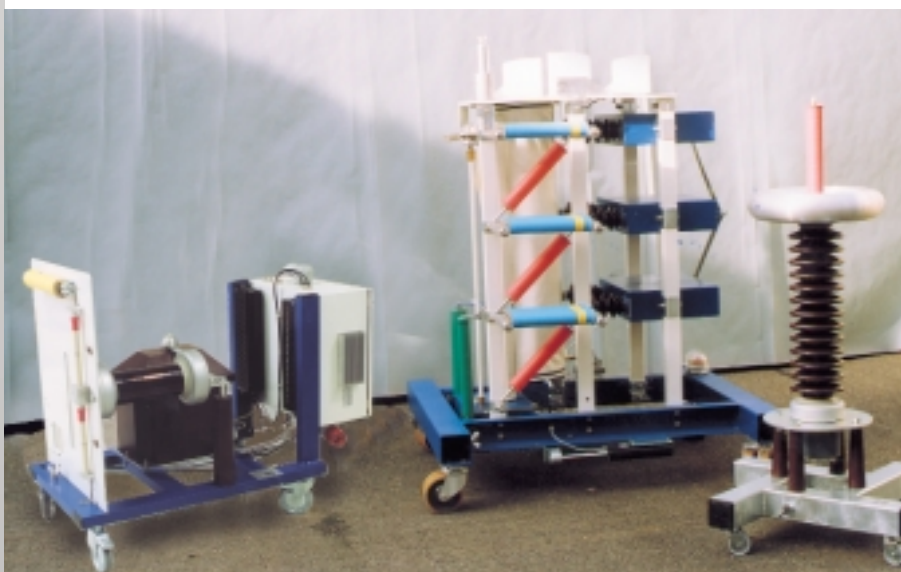
- distribution transformers
- small power transformers
- cables (type tests)
- arresters (impulse current tests)
- motor / generators
- insulators
- bushings
- GIS
- instrument transformers

The user-friendly control unit can also be controlled from a computer.

The SGSA systems can be equipped with hydraulic jacking system or mounted on a trailer for better transportability.

Main features of the SGS system are:

- total charging voltage from 100 kV up to 800 kV (optional up to 1200 kV)
- 5 kJ stage energy
- reliable and accurate triggering using improved Marx circuit
- easy operation with micro-processor control system
- equipped with resistors for performing lightning and switching impulse voltages (SI resistors are optional)
- unique protective grounding device
- ingenious extensions of load range
- short reconfiguration times (handy plug-in resistors and connections, special resistor support, external band resistor)
- series resistors can be interchanged with one another as can the parallel resistors
- different kind of base frames available
- liquid insulation used in the impulse capacitors is made of castor oil which offers optimal environmental compatibility (no PCB's)!
- special solutions for unique customer requirements.
- communication between measuring system and controls allows to determine the efficiency and to work with test voltages.



*Impulse Voltage Test System
SGSA 300-15, 300 kV, 15 kJ
with Charging Rectifier
LGR 100-20,
Impulse Generator SGS
300 kV, 15 kJ
CS Divider 300 kV*

QUALITY

USER BENEFITS

Quality

The electronic measurement and control components are designed and manufactured inhouse. Our many years of experience in dealing with electromagnetic compatibility of electronic devices in high voltage test bays provides the requisite expertise.

In designing and manufacturing our impulse test systems we take full advantage of our (nearly) seventy years of experience. As a result, trouble-free operation and a long service life are ensured.

Safety of Operation

The design of the test system and, in particular, the control system comply with VDE 0104.

Testing personnel benefit from enhanced protection against accidents. The grounding device with a switch and additional earthing band guarantees safe operation.

Safety in the operation of the test system does, however, require proper personnel training.

Ease of Operation with Modern Control System

The generator control systems allow very comfortable and flexible control of the SGSA impulse test system.

They are 100% our own design and manufacture.

Safety features are implemented in the hardware independent of software. All components of the control system are EMC tested.

Protection of Test Objects and Test Systems

The test system is shut down in case of overvoltage, overcurrent, and fast voltage transients.

The test system is continuously monitored during test operation.

Compact Design

Design of the impulse test system SGSA is light and flexible, for limited space and on-site purposes. For on-site tests it can be easily mounted on a trailer, specially when equipped with hydraulic jacking mechanisms.

Appearance

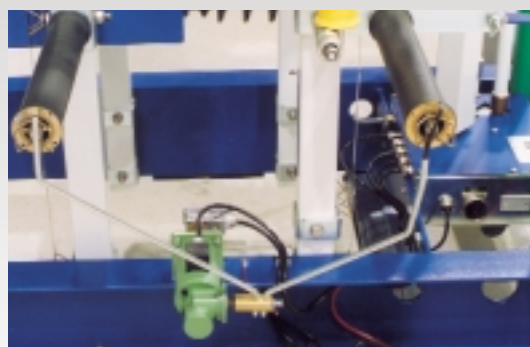
High voltage test bays form an important part of any manufacturing system that maintains the quality of a customers' products.

A well-equipped test bay with appropriate appearance is important. Haefely products are not only technically, but also aesthetically designed to complement the quality image of the customer's facilities.

Haefely Test AG
quality assurance
complies with
DIN ISO 9001.



Control Unit
GC 223



Grounding Device

GENERAL SYSTEM SPECIFICATIONS

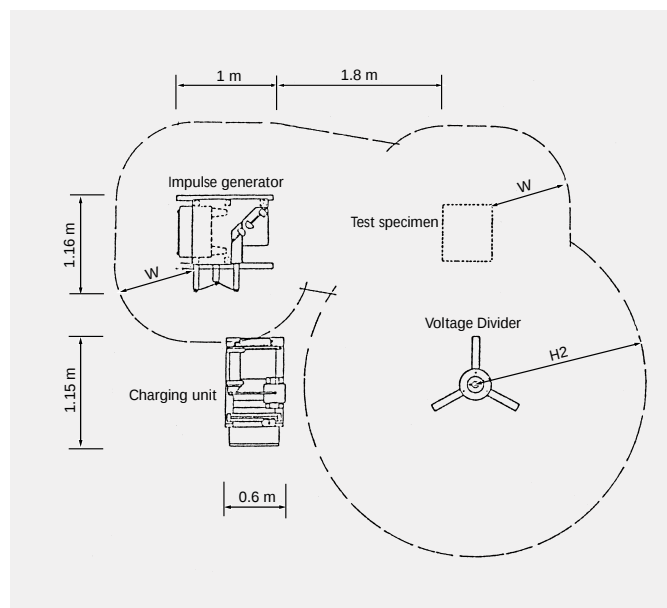
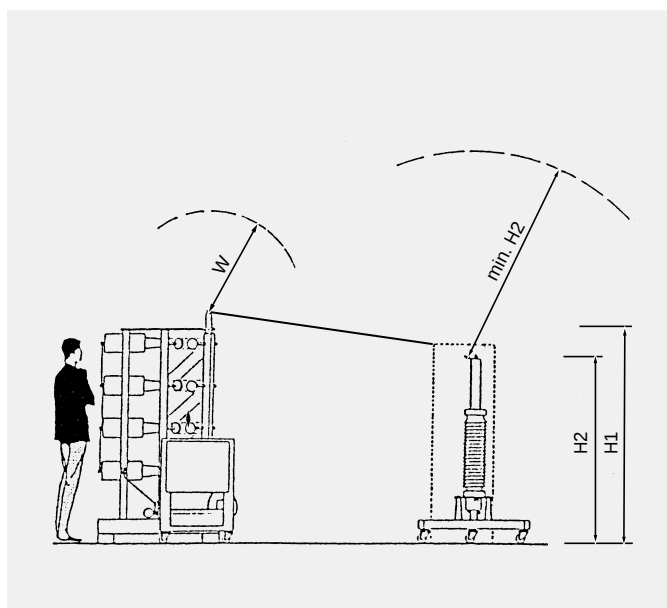
SGSA SYSTEM DATA

Code	Generator			lightning impulse 1.2/50		switching impulse 250/2500 (Option)		
	Max. charging voltage	Max energy	Impulse capaci- tance	Max. load	Max. output voltage at $C_{b \max}$ $\pm U_{\text{peak LI}}$	Max. load	Max. output voltage at $C_{b \max}$ $\pm U_{\text{peak SI}}$	Time between impulses at $U_{I \max}$ t
	$U_{I \max}$	W	C_s	$C_{b \max \text{ LI}}$	$\pm U_{\text{peak LI}}$	$C_{b \max \text{ SI}}$	$\pm U_{\text{peak SI}}$	
	kV	kJ	nF	nF	kV	nF	kV	s
SGSA 100-5	100	5	1000	16.0	90	2.7	80	40
SGSA 200-10	200	10	500	12.5	180	3.2	155	40
SGSA 300-15	300	15	333	10.0	270	3.3	230	40
SGSA 400-20	400	20	250	8.5	360	3.4	305	40
SGSA 500-25	500	25	200	7.0	445	1.7	380	40
SGSA 600-30	600	30	167	6.2	540	1.7	460	40
SGSA 700-35	700	35	143	5.6	630	1.7	535	50
SGSA 800-40	800	40	125	5.3	700	2.3	605	55



Min. safe clearance to wall	Height	Weight (net)	Divider					Shipping volume/ weight (whole system)
			Code	Capaci- tance	Damping resistor	Height	Weight (net)	
				C	R	H2		
				pF	Ω	m	kg	
W	H1	kg						m ³ /kg
m	m							
0.2	0.9	210	CS 100-1000	1000	130	1.5	60	5/500
0.4	1.2	250	CS 200-1000	1000	130	1.5	60	6/650
0.6	1.6	308	CS 300-1000	1000	130	1.5	60	7/700
0.8	1.9	370	CS 400-1000	1000	130	1.5	60	10/800
1.0	2.3	432	CS 500-500	500	270	2.3	100	11/1000
1.2	2.6	494	CS 600-500	500	270	2.3	100	12/1100
1.4	3.0	556	CS 700-500	500	270	2.4	110	14/1250
1.6	3.3	618	CS 800-670	670	230	3.2	150	15/1350

Impulse Voltage Test System, proposed layout

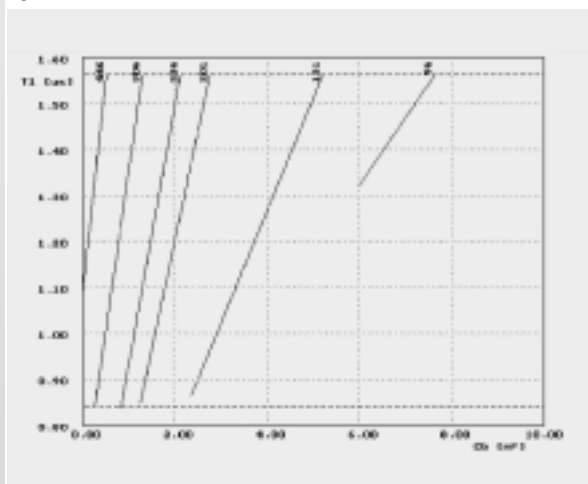


GENERAL SYSTEM SPECIFICATIONS

Operating Range

The minimum output voltage is 10 kV independent of polarity. This is obtained with only one stage. The other stages are shorted or connected in parallel.

The maximum output voltage can be read from the table. It depends on the load and the waveform.



Ambient Conditions

The impulse generator can be operated at ambient temperatures between 0°C and 45°C and relative humidity (R.H.) ≤ 95% (no condensed moisture).

The control and measurement equipment is designed for operation at ambient temperatures of 0°C to 45°C and R.H. values between 35% and 80%.

The permissible temperature and R.H. ranges for shipping and storage of all parts are -20°C to 60°C and ≤ 95% R.H. (no condensed moisture).

The voltage values stated in the documentation are for standard conditions, that is, T = 20°C, b = 1013 mbar and R.H. = 80%.

These values apply for operation of the system up to 1000 m above sea level. Above this elevation, the voltage is reduced by 1% for each 100 m.

Impulse Intervals

At maximum charging voltage, minimum time between impulses is given in the table SGSA system data. This interval is dictated by the maximum charging current thermal limitation of parallel resistors and the maximum energy of the impulse capacitors in the impulse generator.

If the charging voltage is reduced, the interval between impulses can be reduced.

Special solutions for shorter impulse intervals are available on request.

Immunity to Electromagnetic Interference

Electromagnetic interference is unavoidable in impulse testing. The SGSA test system is designed especially to decrease the influence of interference fields for a correct function of the control and measuring electronic instruments.

The measurement and control lines are properly shielded and grounded. Inputs and outputs are protected against overvoltages.

The system components are grounded with a suitable material such as copper braid or foil to keep the ground potentials at a safe level.

The measurement signal from the high voltage divider is in the range of 100 V to 1600 V in order to ensure a high signal/noise ratio.

THE IMPULSE VOLTAGE GENERATOR

FUNCTION OF THE IMPULSE TEST SYSTEM

The test system comprises the following main components:

- charging rectifier
- impulse generator
- control system
- divider

Accessories for additional measurements, tests or analyses of the wave shape are:

- shunt
- chopping gap
- measuring system

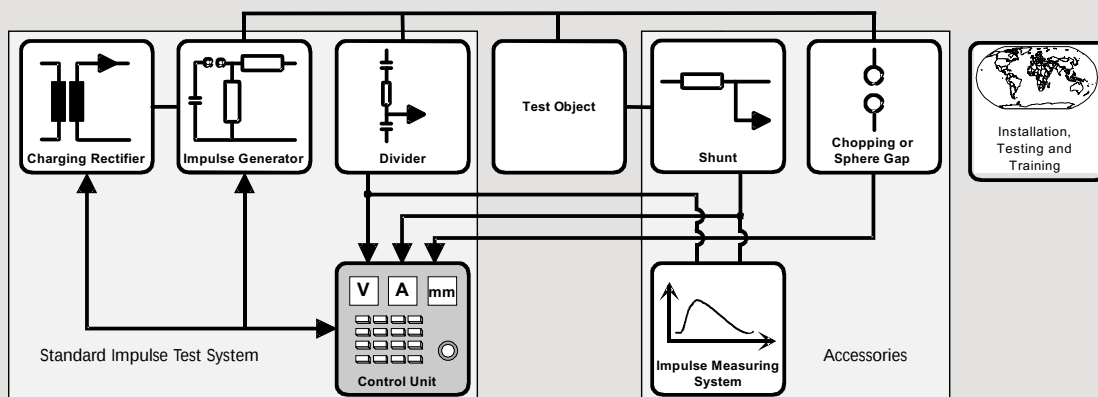
The block diagram below demonstrates the basic functions of the system.

The impulse test system operates under a control system which charges the impulse generator through the charging unit. This is achieved as the stages in the impulse generator are connected in parallel via the charging resistors. Charging time and charging voltage can be selected.

Once the selected charging voltage has been reached, a trigger pulse initiates firing of the first spark-gap of the impulse generator. The resulting overvoltage triggers the successive stages. As all the spark-gaps fire, the stages which are connected in series, multiply the charging voltage to reach the test voltage.

An impulse voltage divider reduces the impulse voltage to a value that the measuring and recording instruments can use.

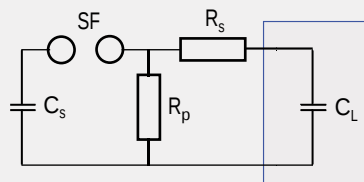
Impulse Test System



THE IMPULSE VOLTAGE GENERATOR

The Impulse Voltage Generator is the main part of an impulse voltage test system. An impulse voltage generator SGS consists of a number of capacitors charged in parallel up to a maximum voltage of 100 kV. When the desired charging voltage has been reached, a set of sphere gaps connect the capacitors in series and the output voltage is delivered via some pulse forming elements.

The figure shows an equivalent circuit diagram for a single stage impulse generator (it is possible to simplify a multi stage impulse generator into this circuit).



C_s Impulse Capacitance
SF Spark Gap
 R_p Parallel Resistance
 R_s Serie Resistance
 C_L Load Test Objekt

Design

Like all Haefely impulse generators the SGS generator is based on the MARX multiplier circuit.

Standard Impulse generators type SGS are fitted with castors to increase mobility.

The sophisticated design of this impulse test system takes into account requirements in conjunction with impulse voltage tests as imposed by industry (HV- Cable, HV- Power- Transformers, etc.), universities and utilities.

The design is light and flexible, ideal for limited space and on-site purposes.

The inherent strength of the construction makes it possible to transport the assembled generator in either vertical or horizontal positions.

In order to increase the impulse capacitance, generator stages can be connected in parallel and the groups so formed can be further connected in series. The total charging voltage being the product of the stage charging voltage and the number of groups.

Spark-gap drive, safety ground switch and triggering unit are built into the base frame.

Impulse capacitors

Each impulse capacitor consists of flat elements built into a steel housing and impregnated with castor oil. The housing walls are flexible so that the impregnating oil can expand. Years of experience with castor oil as impregnant guarantee the long capacitor life.

Castor oil offers optimal environmental compatibility (no PCB's).

Handy plug-in resistor



Resistors

Resistors built into the impulse circuit are wire wound on a tube and protected with heat shrink sleeve against mechanical damage. Each resistor value has a specific colour for easy identification.

These resistors have a plug-in connection for quick and easy reconfiguration.

The external series resistor consists of an insulating textile tape with a meandering resistor wire woven into it. Thus this external resistor also has a low inductance. Taps on the external series resistor permit matching to various specimen capacitances.

The basic system includes a set of resistors for lightning impulse voltages.

Earthing System

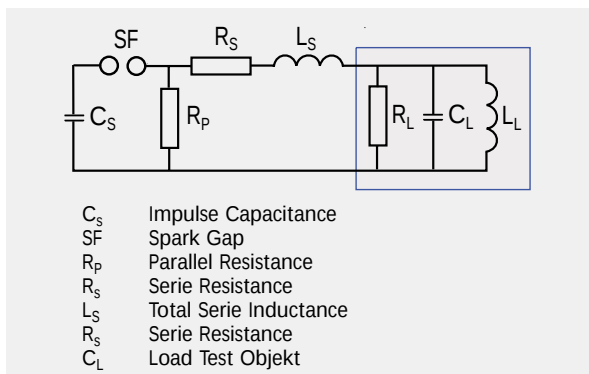
A switch mounted in the base frame of the generator carries out earthing of the generator at the lowest stage.

Due to the discharge time constant of the generator an additional earthing band is moved into all stages which grounds all capacitors.

OVERSHOOT COMPENSATION

Overshoot

The most important difference between the simplified equivalent circuit and a more accurate equivalent circuit is the consideration of additional energy storage elements.

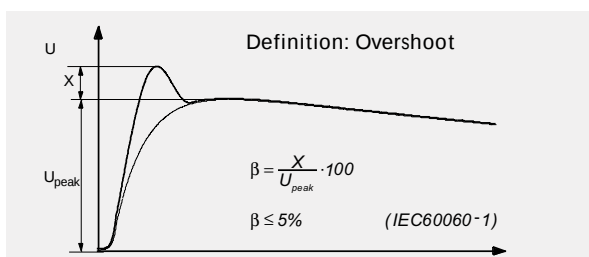


The consequence of these additional elements is important. Discharge of the impulse capacitor can produce oscillations.

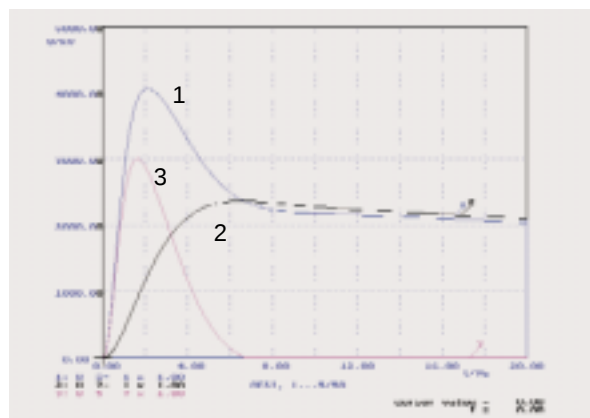
If the impulse test circuit forms a resonance circuit an overshoot will be generated. According to IEC 60-1 LI is acceptable if the overshoot is less than 5%.

The inductance of the test circuit can not be reduced (that's physics), but an additional circuit, the Haefely patented Overshoot Compensation can be include. The resistor R_C (including L_C) and the capacitance of the test object C_L form a low pass filter. Higher frequencies (the oscillation) will be attenuated more than lower frequencies (the impulse itself) by a low pass filter.

The last figure of this chapter shows the voltages between two different points of the test circuit. Across the series connection of load and Overshoot Compensation an impulse voltage with overshoot is generated. If the voltage drop across the Overshoot Compensation is added to this voltage the result will be according to the standards.

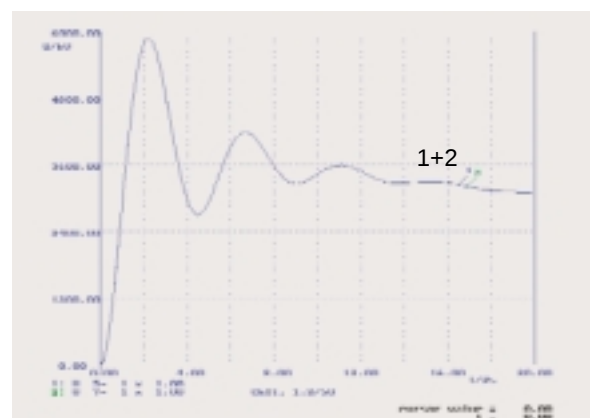


External Overshoot
Compensation



Wave shape calculation (with Overshoot Compensation)

1 voltage at point before OC
2 voltage over test object
3 voltage over OC



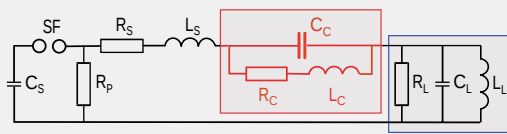
Wave shape calculation (without Overshoot Compensation)

1 + 2 voltage over test object

GLANINGER CIRCUIT

Realisation of Overshoot Compensation

Realisation of Overshoot Compensation for impulse generators of type SGS is an external additional arrangement of components. This solution can also be used for "Non-Haefely-Generators".



C_S	Impulse Capacitance
SF	Spark Gap
R_P	Parallel Resistance
R_S, L_S	Series Resistance/Inductance
C_C, R_C, L_C	Overshoot Compensation
R_L, C_L, L_L	Test Object, Divider, MAFS (Load)

Advantage of a Haefely Overshoot Compensation

The advantage of an impulse generator with Overshoot Compensation is the extended load range for impulse voltages. If the standard generator produces unacceptable oscillations Overshoot Compensation may be able to keep the shape within the 5% limits. For the generation of steep front impulses (because the front resistor is very low) the Overshoot Compensation can be very helpful.

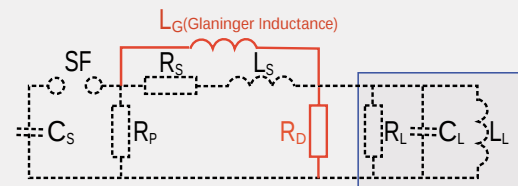
Main application for Overshoot Compensation

As already discussed Overshoot Compensation permits extension of the capacitive load range. If a customer wants to test large capacitors the Overshoot Compensation is of help (Attention: cable tests use a special shape). For tests with steep front impulses the Overshoot Compensation can also be used.

Main applications for the Overshoot Compensation are manufactures of:

1. Switchgears / GIS (high capacitances)
2. Distribution- / power transformers (high capacitances)
3. Motors / generators (steep front)
4. Bushings (high capacitances)
5. Universities, institutes and laboratories

The Glaninger Circuit (see figure below) can be used for testing very small inductances, such as the low-voltage windings of transformers. The Glaninger inductance (L_G) is connected in parallel to the series resistor. The inductance has a high impedance (Z_L) during the rapid rise at the impulse front. This means only the series resistors effective during impulse risetime. During slow decay of the impulse the inductance has a low impedance, that means the impedance of the parallel connection of L_G and R_S is determined by the impedance of the Glaninger inductance. The result is less damping in the resonant circuit (impulse capacitance / Glaninger inductance / test inductance) and hence an increased time to half value.



C_S	Impulse Capacitance
SF	Spark Gap
R_P	Parallel Resistance
R_S, L_S	Series Resistance/Inductance
L_G	Glaninger Inductance
R_D	Damping Resistor (only if $L_S < 10 \cdot L_G$)
R_L, C_L, L_L	Test Object, Divider, MAFS (Load)

CHARGING UNIT

LGR 100

Charging rectifiers type LGR 100 are used to charge the capacitive energy storage elements of impulse generators with stages voltages up to 100 kV such as the type SGS.

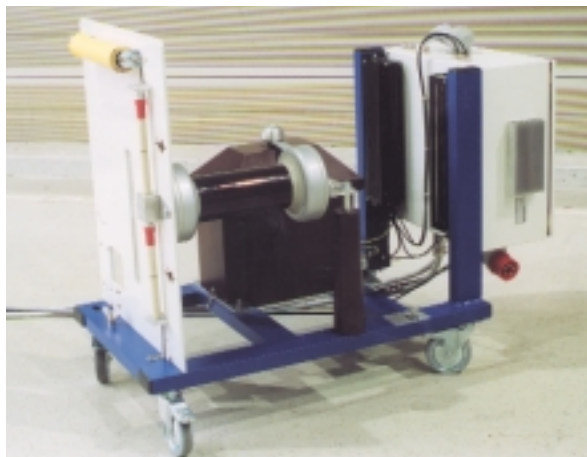
It is usually located close to the base frame of the impulse generator. Connection is with an aluminium tube. The high voltage transformer is resin or oil insulated, rectifier elements and measuring resistors are air insulated.

Charging rectifiers of this type are built with castors for greater mobility.

Standard charging rectifier type LGR 100 has a rated voltage of 100 kV and a current of 20 mA or 40 mA (type LGR 100-20 or LGR 100-40).

Main features of the LGR 100 are:

- compact design
- short circuit protected
- standard automatic motor-driver polarity reversal for LGR 100-40
- optional automatic motor-driven polarity reversal for LGR 100-20



LGR 100-20



LGR 100-40

	LGR 100-20	LGR 100-40
Rated voltage U_n , both polarities	100 kV	100 kV
Rated current for U_n , continuous	20 mA	40 mA
Circuit	voltage doubling circuit	single-phase one-way circuit
Reversal time for motor drive	approx. 30 s	approx. 30 s
Test voltage, 5 minutes, both polarities	110 kV	110 kV
Ambient temperature	0°C...+45 °C	0°C...+45 °C
Measuring resistor	100 kV, approx. 200 MΩ	100 kV, approx. 200 MΩ
Supply voltage (standard) 3P + N	3x400 V, 50/60 Hz	3x400 V, 50/60 Hz
Power consumption	4 kVA	10 kVA
Input power three phase (also valid for matching transformer design)	10 kVA	22 kVA
Weight (approx.) net	165 kg	540 kg
gross	240 kg	700 kg
Shipping volume	1.5 m ³	2.5 m ³

DIVIDERS

CS - DAMPED CAPACITIVE IMPULSE VOLTAGE DIVIDER

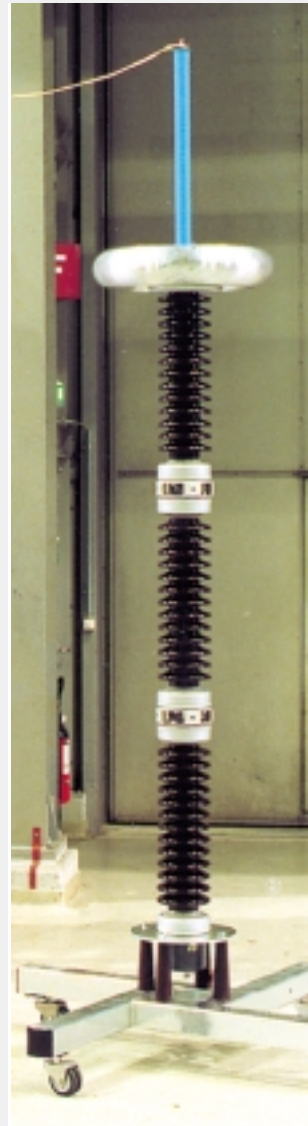
Damped capacitive impulse voltage dividers are used to measure high voltage full and tail chopped lightning and full switching impulses. Provided with an adequate additional secondary part they can also be used for alternating voltage measurements.

Dividers type CS can also be used as load capacitance for the impulse generator.

Oil-filled insulating cylinders accommodate oil paper capacitor packs. Damping resistance for divider type CS is placed externally on top of the uppermost capacitor.

Main features:

- response of system meets the requirements of IEC 60-2 (1994)
- stable mobile base frame
- indoor and outdoor types available
- different top-electrodes available



CS 1000-670

CONTROLS

Two systems different in sophistication/ technical data are available from Haefely. The well established GC 223 and the fully computerised GC 96.

Both control systems for the SGSA test system enable a fully automatic test sequence to be performed. Programming of the control system is user-friendly and easy. A manual mode is also available. Data communication between other Haefely equipment (impulse measuring system) is fully supported. Remote control from a host computer is also available. The control system can be designed as a desk, a mini rack or an integrated version. Haefely control systems run on a specially developed PCI (state of the art computer). No additional measures such as optical link or IR communication are necessary.

Impulse Generator Control GC 223

- comfortable and flexible control of an impulse system
- safety actions implemented in hardware, independent of any software
- manual and automatic mode available
- digital measuring system (eg HiAS 743) can be easily integrated
- stand alone or 19" rack insert available
- dust and dirt protected
- RS-232 Interface
- automatic correction for atmospheric conditions
- EMC shielded and proofed
- execution of automatic test sequences (optional)
- remote control for all functions (optional)
- control of external chopping gap (optional)

Advanced Impulse Generator Control GC 96 IMP

Basic functions are the same as in the GC 223, but the GC 96 IMP offers more operating and upgrade capabilities.

- sophisticated sequence programs
- user-friendly software
- equipped with a VGA colour monitor. The operator is prompted by the software.
- easy and clear indication and graphical display of several features, like: trip levels, system status, failure conditions, flashovers, etc.
- desk or console version available

- permits free programming and storage of complex test cycles. Any number of test cycles can be stored on floppy disks.
- includes interfaces for remote control and transfer of measurement.
- fully automatic operation mode for customised test sequences with individual parameters (optional)
- can be upgraded with integrated measurement and control functions as required.

Safety and Protection Functions

The control unit has a safety circuit and warning lamp connections. Actuation complies with VDE 0104. A lockable emergency switch is built into a separate box. The switch can be placed as needed so that it can be operated quickly in case of emergency. All safety functions are directly wired to the input circuit breaker i.e. they do not pass through the microprocessor control system.

OPTIONS

Control Desk

The control unit GC 96 IMP can be mounted in desk or console versions. The unoccupied space in the control desk can be used for other measurement instruments, such as the Haefely HIAS, RIC or DMI.

GC 96 IMP Interface

With a GC 96 IMP serial interface, the test system can be controlled by a more powerful computer. The interface is optically isolated, so that electromagnetic compatibility standards (IEC 1000-4-2) are completely fulfilled.

GC 96 IMP and HiAS 743



SPECIAL SOLUTIONS

Mobility

A large base frame improves stability of mobile generators with more than four stages. Castors make it easy to move the generator in a high-voltage test facility.

On-site Testing

Our specially designed mobile on-site impulse voltage test system can be transported in a horizontal position. The system is erected automatically by a hydraulic tilting mechanism. No additional assembling is necessary. Only connections to control and charging unit, test object and measuring system have to be performed. The total erection procedure takes only 2–3 minutes. Systems of this type have been operating successfully for more than 4 years.

Impulse Current

Theoretically only different resistors and a wave shaping inductance are necessary for generating impulse currents with an impulse voltage generator.

In practice it is necessary to know exactly which wave shape is required according to which standard over the maximal load capacitance and with which residual voltage. Using this information it is possible to calculate if it's possible to upgrade the impulse voltage generator to be an impulse current generator.

For lightning impulse current 8/20 μ s according to IEC 60-1 an extension is usually possible.



Mobile on-site impulse voltage test system for charging voltages of 800 kV. The automatic hydraulic erection system allows a very fast assembling and disassembling. Suitable for testing large Power Transformers.

Test System for Oscillating Lightning and Switching Impulses, SGSA-L

IEC 517 requires that gas-insulated switchgear (GIS) must be tested once on-site installation is completed. The following tests are recommended:

- Oscillating lightning impulse (OLI), max. rise time 15 μ s
- Oscillating switching impulse (OSI), rise time 150 μ s to 10 μ s

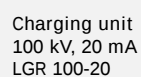
SGSA-L impulse test system is supplied with the following:

- Resistor set for switching impulse
- Inductance modules for generation of OLI
- Inductance modules for generation of OSI
- Special divider type CSL

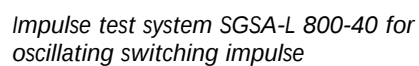
The oscillation frequency is determined by inductance in the generator and capacitance of the test specimen. In addition to the voltage divider, a capacitive load of 2 nF is required for operation of the test system.

The inductances are made of modules to suit the rated voltage of the generator. Each module consists of a coil wound on an insulating tube. The voltage distribution is capacitively graded. The inductances are arranged horizontally between generator and divider.

An advantage over resonant impulse generators is that a smaller and thus lighter impulse generator can be employed to produce the same peak value (i.e. a 600 kV- generator can produce oscillating switching impulses of approx. 1000 kV peak). Because the impulse generator can be shipped in a fully assembled form, set-up times are short, especially with the additional hydraulic tilting mechanism.



		Oscillating lightning impulse-OLI					Oscillating switching impulse -OSI					Divider	Dimension of test location		
Code	Load without divider nF	Number of inductance modules	Peak value (kV)		Rise time T1 (µs)		Number of inductance modules	Peak value (kV)		Peak time Td (µs)					
			2nF	20nF	2nF	20nF		2nF	20nF	2nF	20nF		L	W	H
SGSA L-600-30	2-20	3	1000	800	5	12	3	950	750	140	350	CSL 1200	11	8	7
SGSA-L-800-40	2-20	4	1400	1150	5	13	4	1350	1000	150	360	CSL 1500	14	11	9



OPTIONS

RESISTORS

Resistor Set for Switching Impulse

Resistor sets are available to generate the 250/2500 μ s switching impulse defined in IEC 60-1 and IEEE Std. 4. Resistor sets are also available to meet IEC 76-3 and ANSI/IEEE C57.12 special switching impulses for transformer testing.

Parallel Resistors

In order to compensate for the shorter decay time with small inductances, an additional set of parallel resistors can be supplied. It consists of three resistors for each stage.

Enclosed Spark Gap

A protective enclosure surrounds the spark gaps to keep suspended particles and dust away from the hemispherical caps and thus insure proper firing even in a dust-laden atmosphere.

The enclosure also damps much of the discharge noise.

Rain Hood for Outdoor Operation

A plastic hood to cover the generator and charging unit is available for temporary protection against rain during on-site service. The hood is rolled up when the system is in operation.

Shunts

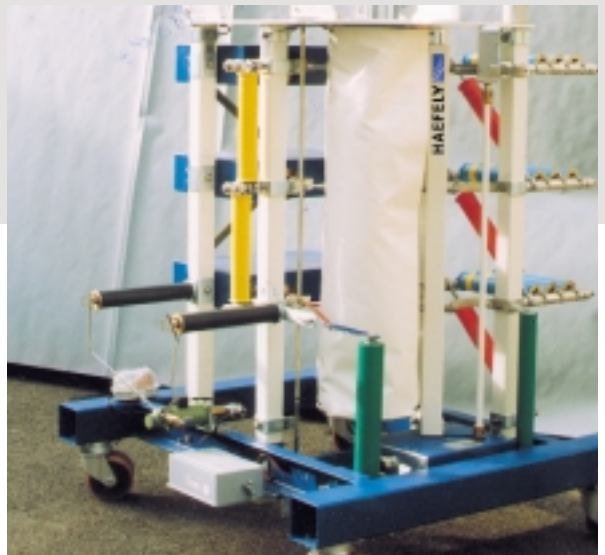
Haefely shunts can be used for the measurement of impulse currents. They consist of a metal cylinder with coupling flanges and coaxial measuring connector.

Sleeve Shunts, SH-H

Sleeve shunts can be used for the measurement of impulse currents of nearly any wave shape up to a maximum of 500 A. Also they can be operated up to a voltage drop of 1000 V (for double current). The repetition rate however has to be reduced. The ohmic value of the shunt can be changed easily by opening the housing and replacing the active element. The resistor-sleeves have low-inductance, are interchangeable and mounted into a stainless steel cylinder. Typical ratings for standard wave shape (8/20 μ s) are 50 A, 100 A and 250 A.

Cage Shunts, SH-Q

Cage shunts can be used for the measurement of impulse currents of nearly any wave shape up to a



maximum of 10 kA. They can also be operated up to a voltage drop of 1600 V (for increased current by a factor 3). The repetition rate however has to be reduced.

The resistors are mounted in a stainless steel cylinder filled with special sand which improves thermal behaviour.

Typical ratings for standard wave shape (8/20 μ s) are 500 A, 1000 A and 5000 A.

Tubular Coaxial Shunts, SH-R

Tubular coaxial shunts can be used for the measurement of impulse currents with front times less than 1 μ s up to a maximum of 100 kA. They can also be operated up to a voltage drop of 1000 V (for double current). The repetition rate however has to be reduced.

The tubular shunt is a metallic tube which shapes the resistor itself.

Typical ratings for standard wave shape (8/20 μ s) are 25 kA, 50 kA and 100 kA.

Set of Shunts for Transformers, SHT

This set of shunts provides everything needed for the measurement of impulse current during transformer testing.





SERVICES

Technical Services

A high level of customer service is essential in view of the complexity of high voltage test systems and the high reliability demanded by the customer.

The full warranty of the impulse voltage test system is conditional on the performance of the following Haefely services being performed:

- Expert installation and on-site testing of the system
- Training of the operating personnel
- Maintenance of the test system throughout its service life, but for a period of at least 10 years
- Availability of spare parts at least for 10 years

Installation and Testing On Site

The user is responsible for preparation of the test station and the power supply. The installation and connections for the voltage transformers must be prepared.

The warranty of an impulse test system requires that the system must be installed and tested on site under the supervision of Haefely specialists.

Haefely performs fine tuning on the control and measurement electronics.

A system test is then performed under no load conditions.

Acceptance testing is performed in co-operation with the purchaser. If possible, the customer furnishes a test object. It is understood that Haefely does not assume any liability for the test object which might be damaged during the acceptance test.

A standard acceptance test includes the following points:

- Tests of all functions
- Calibration of controls
- Impulse tests

Training of Operating Personnel

After acceptance testing, the personnel assigned to operate the impulse voltage test system will be trained.

Installation and operator training are conducted by Haefely customer service personnel and are adapted to suit the particular test facility and test specimen. This is an important contribution to reliable operation of the test system.

10 Years Maintenance Guarantee

Because of the high degree of vertical integration with respect to high-voltage components and electronic equipment, Haefely is virtually independent of the product policies of suppliers. A large stock of replacement parts is held for maintenance purposes. This makes it possible for Haefely to ensure maintenance for 10 years from the purchase date.

On-Site Calibration Service

Simple and unified calibration methods which apply to complete measuring systems give high-voltage test equipment manufacturers, users and customers the assurance of comparable quality requirements and tests involving such equipment.

Haefely performs following services:

- Calibration of divider
- Calibration of measuring unit
- Calibration of entire system

Other Services

Haefely offers a maintenance agreement tailored to the customer's special needs. In this way, the value of the test system can be preserved over a long period of time.

Further services are offered for support in integration tasks or during operation.

SCOPE OF SUPPLY

SGSA

SGSA

- 1 Impulse generator 1.2/50 μ s, including:
 - Mobile base frame
 - Enclosed spark gaps
 - Motor driven safety grounding system
- 1 Set resistors for lightning impulse
- 1 Charging rectifier, 100 kV, 20 mA with manual polarity change or 40 mA with automatic polarity change
- 1 Control unit GC 223
 - 2 Control cables, each 20 m
- 1 Impulse voltage divider CS ____
 - 1 Secondary unit
 - 1 Measuring cable, 20 m
- 1 Automatic safety grounding device
- 1 Grounding rod
 - with grounding wire, 5 m
- 1 Copper grounding band, 30 m
- 2 Set of operating instructions with test report (in English or German)
- 1 Technical service (upon request)
 - Installation and testing on site
 - Training of operating personnel

SGSA-L same as above, plus:

- 1 Impulse voltage divider CSL ____ or CR ____ (instead of CS)
- 1 Set resistors for switching impulse
- 1 Inductance for OLI
- 1 Inductance for OSI

Options

- Sphere gap KFS
- Multiple chopping gap MAFS
- Set resistors for switching impulse SGSA SW
- Set resistors for testing of small inductance SGSA RP
- Glaninger circuit for very small inductance SGSA WI
- Set of terminal resistors for winding transformers tests SGSA TERM
- Charging rectifier 100 kV, 40 mA LGR 100-40
- Motor drive for polarity reversal LGR POL (for 20 mA LGR)
- Insulating and matching transformer SGSA TRANS
- Overshoot Compensation for high capacitive loads SGSA OC
- Set of spare parts SGSA ERS



*Impulse Voltage Test System SGSA, 600 kV, 30 kJ
including MAFS and KFS*

E113.12

Subject to change
without prior notice
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