

MODULAR HVDC TEST SYSTEM

- DC voltage tests on components for HVDC transmission:
 - Cables
 - Transformers
 - Bushings
 - Thyristor valves



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Fig. 1 Modular HVDC test system, type GPM 40/400



Fig. 2 Modular HVDC test system, type GPM 30/800

FACTS IN BRIEF

HVDC modules are applied to generate high-voltage direct voltage for routine, type, and development tests on components used in HVDC transmission systems. Several HVDC modules can be easily combined in series operation to attain a higher DC test voltage. The modules are suitable for indoor operation in high-voltage test bays, either in stationary or mobile applications using a system of air cushions.

The modular HVDC test system is available for indoor or on-site application.

The test system is designed to generate HVDC test voltages according to IEC 60060-1 (2010-09). The voltage measurement fulfills the requirements according to IEC 60060-2 (2010-11).

The modular HVDC test system allows polarity reversal tests according to relevant standards. This system features a reliable electrical and robust mechanical design. The state-of-the-art control system supports the operator during automatic test procedures.

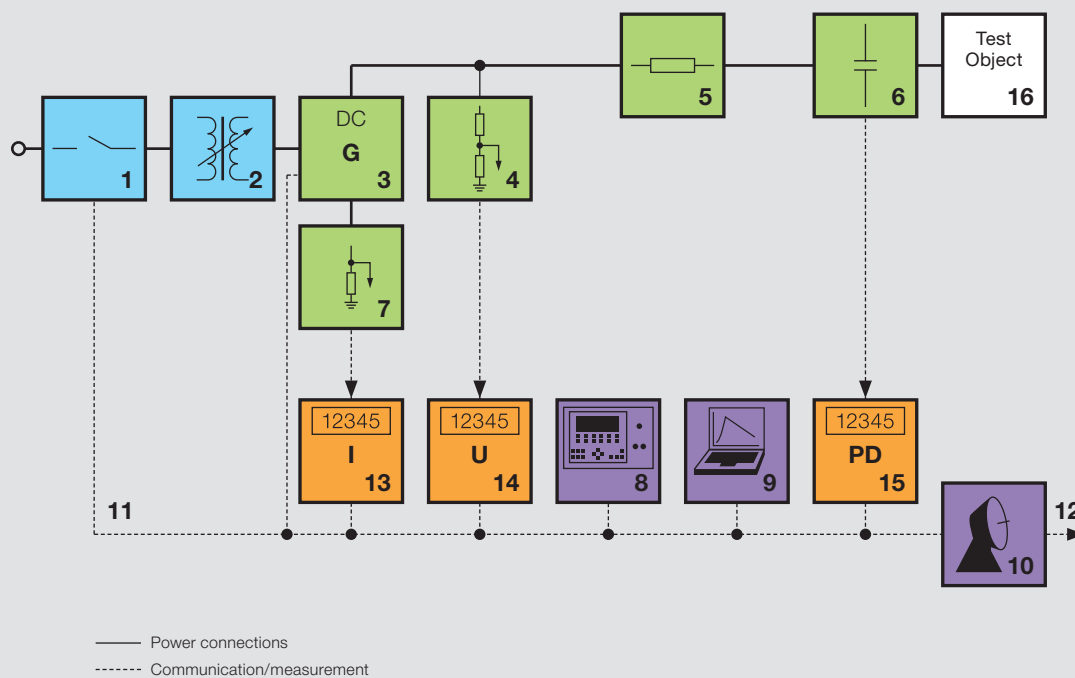
The following features are available to meet the customer's requirements:

- Internal voltage divider that is part of the DC module
- Air-cushions for easy positioning
- High-voltage filter/coupling capacitor for PD measurement

BENEFITS

- LOW PD-LEVEL
- LOW RIPPLE (< 3 % ACC. TO IEC)
- INTERNAL VOLTAGE DIVIDER TO SAVE SPACE
- SAVES TIME THANKS TO FAST POLARITY REVERSAL TESTS

- EASY TRANSPORTATION ON STANDARD TRAILERS
- MODULAR DESIGN FOR SIMPLE EXTENSION TO HIGHER VOLTAGES
- FULFILLS LATEST SAFETY REQUIREMENTS FOR PERSONNEL



Power supply

- 1 Switching cubicle
- 2 Regulating transformer

HV circuit

- 3 DC generator
- 4 Voltage divider
- 5 Damping resistor
- 6 HV filter/coupling capacitor
- 7 Current shunt

Control system

- 8 HiCOS Basic
- 9 HiCOS Advanced
- 10 Remote access module
- 11 PROFIBUS/Ethernet
- 12 LAN, Internet

Measuring systems

- 13 Current meter
- 14 Peak voltmeter
- 15 PD measuring device
- 16 Cables, transformers, bushings, thyristor valves

Fig. 3 Block diagram of a modular HVDC test system

APPLICATION

HIGHVOLT offers modular HVDC test systems with a rated current from 10 mA to 40 mA and rated voltage up to 1600 kV that are adapted to the following test applications.

Main applications for HVDC test systems are:

- Factory and on-site testing on HVDC cables according to CIGRÉ 496
- Factory and on-site testing of converter transformers according to IEC 61378-2
- Testing on DC bushings according to IEC 62199
- Research, development, and education

- MAINTENANCE-FREE
- LOW LIFECYCLE COSTS
- SAVES TIME THANKS TO AUTOMATIC TESTING PROCEDURES

SYSTEM AND COMPONENTS

The HVDC test system is supplied with power via a switching cubicle (1) [see fig. 3]. The regulating transformer (2) adjusts the generated test voltage and feeds the DC generator (3) with the appropriate level of high voltage.

The DC generator together with its rectifiers and capacitors generates the DC test voltage by means of an appropriate electric circuit. For higher test voltages several stackable modules can be cascaded within the DC generator.

An internal resistive voltage divider (3) and a peak voltmeter (14) make up the voltage measuring system. A current shunt (7) and a current meter (13) are used to display the DC test current. The test object is connected via an external damping resistor (5). This damping resistor protects the DC generator against transient overvoltage occurring following a potential breakdown of the test object.

The control system HiCOS is available in order to control the modular HVDC test system and to record, manage, evaluate, and report the measuring data.

HiCOS Basic (8) contains all modules required to control the modular HVDC test system. It consists of HiCO Basic (hardware) and iCOS Basic (software), in addition to the safety measures and housing.

HiCOS Advanced (9) adds a computer control to HiCOS Basic. It consists of HiCO Advanced (hardware) and iCOS Advanced (software), in addition to the safety measures and the housing. HiCOS Advanced can also be connected to the user's LAN and via the INTERNET (12) to HIGHVOLT Customer Service for technical support, software updates, and any other assistance. Furthermore, the modular design of the HiCOS control system allows additional expansions of the range of functions.

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TECHNICAL PARAMETERS

The modular DC test system is designed to generate HVDC test voltages according to IEC 60060-1 (2010-09). The voltage measurement fulfills the requirements according to IEC 60060-2 (2010-11). The test system [see *figs. 1 and 2*] is applied to withstand or polarity reversal tests on components for HVDC transmission. For technical parameters of standard modular HVDC test systems, see *tables 1 and 2*.

Table 1 Standard modular HVDC test systems

| Test System | Rated current* [mA] | Rated voltage [kV] | Rated power [kW] | Ripple [%] |
|-------------|------------------------|-----------------------|---------------------|---------------|
| GPM 40/400 | 40 | 400 | 16 | <3 |
| GPM 30/800 | 30 | 800 | 24 | <3 |
| GPM 20/1200 | 20 | 1200 | 24 | <3 |
| GPM 10/1600 | 10 | 1600 | 16 | <3 |

*Note: The rated values refer to continuous operation. Test systems can also be overloaded for short periods of time.

Table 2 Operating conditions of standard modular HVDC test system

| | |
|--------------------------|------------|
| Frequency | 50/60 Hz |
| Temperature range | 5...40 °C |
| Daily mean temperature | ≤ 30 °C |
| Relative humidity | ≤ 90 % |
| Altitude above sea level | ≤ 1000 m |
| Duty cycle | continuous |

Resistive discharge device, type ERE

The automatic discharge device is designed for fast, safe and controlled discharge of a capacitive load.

The device itself consists of special bleeding resistors installed in glass fiber reinforced tubes which can be switched between high-ohmic and low-ohmic position for testing and discharging purpose. Thus the discharge device forms part of the high voltage testing circuit during test and can discharge the test object during low-ohmic operation mode. The discharging process can be automatically controlled via the control and measuring system.

Technical parameters are available on request.



Fig. 4 Discharge device type ERE integrated in high voltage test circuit

Water discharge resistor, type R-WAT

The water discharge resistor is designed for the safe, fast and controlled discharge process of stored energies in high capacitive test objects. Endangerment of the testing personnel and mechanical hazard is significantly reduced. Moreover, additional dielectric stresses on the insulation of the device under test caused by slow discharge processes are prevented.

The water discharge resistor consists of coaxial arranged tubes made of highly insulated material. The circulating water flow inside the water discharge resistor can be either low ohmic or high ohmic which allows full integration into the high voltage test circuit. In case of low ohmic mode of operation, the discharge device is active.

For discharge process, the resistor uses the physical and chemical characteristics of water like the high thermal capacity or the variable conductivity whereas the same is controlled via a separate water conditioning unit. The latter being also responsible for the heat dissipation caused by the discharge process.

Technical parameters are available on request.

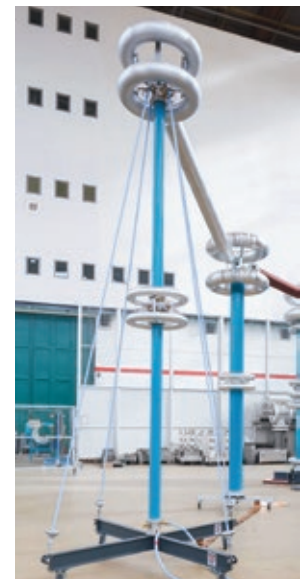


Fig. 5 Water discharge resistor type R800/80k-100M

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