HVAC TEST SYSTEMS BASED ON TRANSFORMERS

- AC HV withstand tests on insulators
- Suitable for dry, wet and pollution tests
- AC HV withstand tests on GIS cable samples
- Multi-purpose test system for R&D and education
HV TEST SYSTEMS BASED ON TRANSFORMERS

FACTS IN BRIEF

HV test systems are intended to generate a continuously variable AC test voltage at power frequency. They are designed for testing all types of electrical insulations up to the highest voltages, preferably of electrical apparatus used in power transmission and distribution systems. When the test object is a pure capacitance (e.g. cable, GIS) the HVAC can also be generated by a resonant test system (HIGHVOLT types WR, WRM, WRV). When a resistive current must also be supplied (e.g. due to heavy partial discharges or leakage currents) a test system based on an HV transformer cascade including a base frame (e.g. for air cushion) is necessary. In the case of a breakdown, the energy flow and the overvoltage are limited by the fast switch-off unit (B). The control and measuring system includes the operator device (12) and/or an industrial PC (13) as well as the measuring instruments for voltage (14), partial discharge (15) and C/tan δ (16). The communication links (Profibus or Ethernet) between these components as well as with the programmable logic controllers (PLC) in the feeding components are realized by optic links (18).

APPLICATION

Test systems based on HV transformers are used in a wide application range due to their capability to supply not only reactive (capacitive) power but also active power. Generally they are therefore suited for HV tests under dry, wet, and polluted conditions not only in industry, but also for research, development and student training. Transformer test systems are also well suited for combined and composite HV tests e.g. on HV disconnectors.

Some applications are:
- HV withstand tests on insulators (dry, wet, polluted)
- Applied voltage test on power transformers
- HV withstand and PD tests on GIS and GIS/GIL components
- Type and prequalification tests on cable samples
- Various HV tests on power switches and disconnectors
- HV tests on current and voltage transformers
- Different HV tests including PD and C/tan δ measurement

In addition to the voltage divider (8) an HV filter including blocking impedance (9) and a coupling capacitor (10) are applied when sensitive PD are measured. For C/tan δ measurement, a compressed gas standard capacitor (11) is necessary. In the case of a breakdown, the energy flow and the overvoltage are limited by the fast switch-off unit (5).

SYSTEM AND COMPONENTS

The main component of an HVAC test system is the HV generator (7) (see fig. 2) consisting of a single test transformer or a transformer cascade including a base frame (e.g. for air cushion transportation) and top electrode. The HV generator is fed via the switchgear cubicle (1) and the voltage regulator (2) which can be combined with a booster transformer. To reduce the mainly capacitive load currents, compensation reactors on the LV side (3) (in special cases also on the HV side) can be applied. To guarantee the sinusoidal voltage shape, filters for harmonics (4) are arranged on the LV side (for cascades also on the intermediate HV stages). When the system shall be used for PD measurement the application of a low-pass filter (6) for suppressing noise signals from the mains is useful.

BENEFITS

- SINUSOIDAL OUTPUT VOLTAGE
- LOW CONTENT OF HARMONICS
- THD < 5 %
- SUITED FOR DRY, WET, AND POLLUTION TESTS
- ADAPTED DESIGNS FOR SHORT TERM AND CONTINUOUS OPERATION
- HIGH OUTPUT VOLTAGE STABILITY
- LOW INTERNAL PD NOISE LEVEL

Fig. 1 HVAC cascade based on insulating case transformers type WP 1000/1000

Fig. 2 Block diagram of HVAC test systems
TECHNICAL PARAMETERS

HIGHVOLT offers two different designs of HV transformers

**Insulating case transformer**
(HIGHVOLT type PEOI)

*Fig. 3 Insulating case transformer cascade type WP 1000/1000*

Test systems with metal tank transformer are a very space-saving solution. Thanks to the grounded metal tank, the test system can be set up close to the wall within the test field. If the positioning is outside, the high-voltage bushing of the transformer is routed through the wall, thus establishing a connection to the test field. The transformers can be operated in parallel or in a series connection as a high-voltage cascade. In the case of the series connection, the additional transformers are installed on insulated frames. Metal tank transformers are better suited for higher test powers and higher test loads than insulating case transformers, which are required e.g. for pollution tests. Their design and construction allows them to be operated under difficult ambient conditions, e.g. in open air test fields or under humid or tropical climatic conditions.

<table>
<thead>
<tr>
<th>Test system with</th>
<th>Insulating case transformer</th>
<th>Metal tank transformer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>100 to 500 kV</td>
<td>50 to 800 kV</td>
</tr>
<tr>
<td>Single transformer</td>
<td>600 to 1000 kV</td>
<td>1000 to 1800 kV</td>
</tr>
<tr>
<td>Cascade</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated current</td>
<td>up to 2 A</td>
<td>up to 10 A</td>
</tr>
<tr>
<td>Duty cycle</td>
<td>short term operation (interval operation)</td>
<td>continuous operation</td>
</tr>
<tr>
<td>Installation</td>
<td>indoor (outdoor under fair weather)</td>
<td>indoor and outdoor</td>
</tr>
<tr>
<td>Building/shielded room</td>
<td>clearance to walls required</td>
<td>no clearance between tank and wall required</td>
</tr>
<tr>
<td>Mobility</td>
<td>wheels or air cushion</td>
<td>wheels or air cushion</td>
</tr>
<tr>
<td>Special design</td>
<td></td>
<td>oil-SF₆-bushing for GIS/GIL testing</td>
</tr>
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