Encapsulated Test System Insulated with SF6

M. Gamlin
R. Gleyvod
P. Mohaupt
G. Voigt

ISH 97

HAEFELY
HIGH VOLTAGE TEST

Encapsulated Test Systems insulated with SF6

M. Gamlin, R. Gleyvod, P. Mohaupt, G. Voigt
Haefely Trench AG, Basel
Switzerland

Introduction

In recent years the demand for completely encapsulated test systems has markedly increased. These systems have several properties, which are, under certain circumstances, very advantageous. Compared to air insulated high voltage systems, with their large distances to surrounding walls, they require much less room and due to there complete encapsulation with grounded containers, provide complete protection against electric shock hazards. To perform partial discharge measurements on open, air insulated high voltage systems requires that they are erected within a shielded room to avoid disturbances by outside electromagnetic interference. Such shielded rooms add considerably to the cost of a high voltage laboratory. The SF6 gas is chemically inert, non toxic and shows no ageing. Nonetheless it should be remembered that SF6 is a potent green house gas and any leakage to the surroundings should be avoided.

Applications

The encapsulated test systems are often used to test SF6-insulated switchgear and substation equipment, where the test object can be directly coupled to the encapsulated test voltage source. In addition long duration testing of cables and other high voltage equipment is also often done with encapsulated systems, as the security measures to be taken are minimal.
Recently demand was high for AC transformer systems and resonance reactors with variable frequency. But it is also possible to build impulse or DC systems. Impulse systems are used for testing SF6-systems or for tests where space is very limited. In addition, when the capacitance of the test object is large, the inductance of an air insulated generator is too large to achieve rise times of the pulses within the tolerances required by international standards. With the more compact design of a SF6-insulated impulse generator, the inductance of the generator can be considerably reduced

Examples

Two AC test systems with high voltage transformers for testing of SF6 insulated components have recently been realised with the following basic data.

	System1	System 2
Nominal output voltage	700 kV	920 kV
Nominal output current	3 A	1 A
Partial discharge level	≤ 3 pC	≤ 5 pC

Fig. 1

AC test system 700 kV, 3 A (ACSK 700-3)
consisting of the following main components:

Low voltage side:	**High voltage side:**
Regulating transformer	HV-Test Transformer
Power Line Filter	Damping resistor
Compensating Reactor	Coupling / Measuring Capacito
Low Voltage Protection Device (Thyristor Switch	Switching chamber with SF6/Air bushing and SF6 termination

Fig. 2

AC test system 920 kV, 1 A (ACSK 920-1)
consisting of the following main components.

Low voltage side:	**High voltage side:**
Regulating transformer	HV-Test Transformer
Power Line Filter	Damping resistor
Compensating Reactor	Coupling / Measuring Capacitor
Low Voltage Protection	

Fig. 3

Encapsulated series resonant test system for routine testing of gas insulated switchgear units. Rated voltage 400 kV, PD level ‹ 2 pC, max. output current 0.8 A, frequency range 45 to 65 Hz. In this case the high voltage reactor is a gas insulated and coreless one, consisting of disk windings to enable further reduction of the harmonics for the PD measurement. No window technique is used for the PD measurement. The picture shows the complete test system without conrol unit.

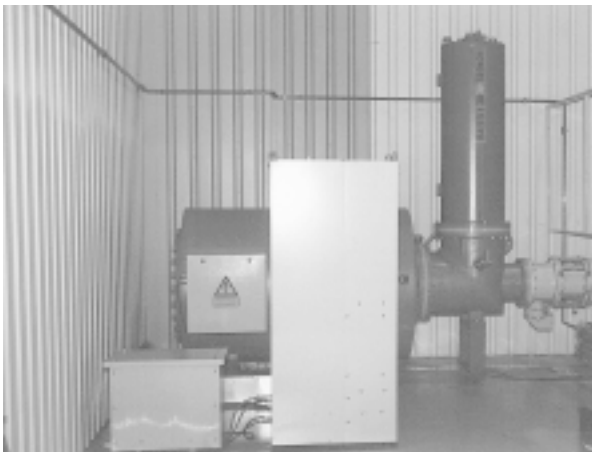
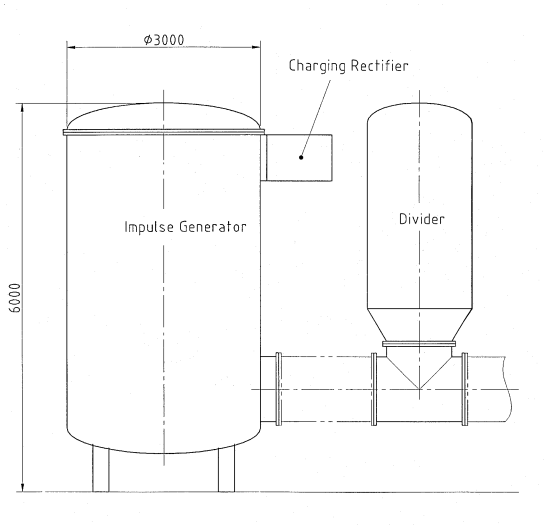


Fig. 4

Impulse test system 3000 kV with the following technical data:

Maximum charging voltage	3000 kV
Number of stages	10
Load range	10...15 nF
Maximum lightning impulse output voltage	2500 kV
Maximum switching impulse output voltage	1800 kV



Conclusion

SF6-insulated test systems have several important advantages compared to air insulated systems, so that their characteristics should be carefully evaluated, when considering to erect a new high voltage laboratory or to select new high voltage test equipment. It might influence the size of the testing hall and the kind of building construction and therefore the construction costs.

Haefely Test AG
High Voltage Test Division
CH-4028 Basel/Switzerland
Phone +41.61.373 41 11
Fax +41.61.373 49 12
www.haefely.com
e-mail: sales@haefely.com

HAEFELY
HIGH VOLTAGE TEST