RESEARCH - DEVELOPMENT AND TESTING NATIONAL INSTITUTE FOR ELECTRICAL ENGINEERING
I C M E T CRAIOVA

200746 CRAIOVA - ROMANIA , B-dul Decebal, Nr. 118A
TEL : +403251 404 888; 403251 404 889; FAX: +40 251 415 482; 40 351 404 890 ; ; e-mail: market@icmet.ro; icmet@ icmet.ro

AC high voltage Power Supply for dielectric test benches

1.Scope.Description

AC high voltage power supply is intended to perform high voltage tests of insulation of some current paths against the mass to determine dielectric strength of high-voltage electrical switchgear and controlgear.

Power supply can be configured at request for:

- range of output voltages: 50 400 kV
- range of continuous duty powers: 2,5 30 kVA
- nominal supply voltage:
  - single-phase 230 V

  or
  - two-phase 400 V
- endowment with high voltage transformer in accordance with the mounting type:
  - outdoor

  or
  - indoor

High Voltage Power Supply, type SI - IT - 03

Technical characteristics of High Voltage Power Supply:

- Rated supply voltage: 230 V
- Rated frequency: 50 Hz
- Continuous duty high voltage power: 2.5 kVA
- Periodic intermittent duty high voltage power S3 type with DA = 25%: cca. 3.5 kVA
- Control of test voltage in the range: 0 - 264 kV
- voltage rate-of-rise: 0 - 264 kV/60 sec, ~ 4,4 kV/sec

High Voltage Power Supply is composed by:

a) High voltage step-up transformer

b) Control board (which contains autotransformer for supplying the high voltage step-up transformer, low voltage, control, protection, measure and signalization switchgear and controlgear)

2. Technical characteristics

The technical characteristics of components of SI-IT-03 type power supply are the following:

a) High voltage step-up transformer, TMU 0,22/264 kV type

The transformer is carried out from identical transformer unit disposed in cascade.

Characteristic				
S.N.	Denomination	Symbol	UM	Value
1.	Primary rated voltage (LV)	U_{PN}	V_{ef}	220
2.	Secondary rated voltage (HV)	U_{SN}	kV_{ef}	264
3.	Frequency	f	Hz	50
4.	Long-duration power (at U_{SN})	S_N	kVA	2,5
5.	Rated transformer ratio	$U_P / U_S = 1/K_n$	-	1/1200
6.	Accuracy in U_S measurement $U_S = U_P \cdot k_n$ ±3%	-	%	±3
7.	Induced withstand voltage -40s-150Hz	$U_{IT\sim150Hz}$	kV_{ef}	300
8.	Applied withstand voltage 1min 50Hz (at the verification of the insulation of LV windings and neutral terminal of HV windings)	$U_{JT\sim50Hz}$	kV_{ef}	2,5
9.	Rated secondary current at $U_S = U_{SN}$	I_{Sn}	A	0,010
10.	Short-circuit voltage	u_K	%	<10
11.	No-load current	I_0	A	< 4
12.	Losses: - no-load at 75 ^{0}C	P_0	W	<1200
13.	Losses: - on-load at 100 ^{0}C	P_K	W	<380
14.	Electromagnetic Compatibility (at U_{SN})	RIV	µV	<2500
15.	Level of partial discharges (at 150kV)	DP	pC	<50
16.	Resistance of primary windind at 20^{0}C ±10%	R_P	Ω	0,205
17	Resistance of secondary winding at 20^{0}C ±10%	R_S	Ω	7x5400
18.	Maximum allowable over-temperature of the winding (insulation class A).	θ_{Cu}	^{0}C	65

b) Control board

Single-phase autotransformer:

- rated power: 4.5 kVA
- rated supply voltage: 230 V
- rated frequency: 50 Hz
- output voltage (range of step value): 0 - 264 V
- step of minimum control voltage: 3 kV
- maximum output current: 15 A
- minimum time for reaching the maximum output voltage: 60 sec.

Measurement system for alternating voltages and currents

The measurement system for voltages and currents is foreseen with apparatus for:

- the measurement of input current in the step-up transformer
- the measurement of voltages: - the supply voltage of the step-up transformer;
  - the high, output voltage from the step-up transformer
- the measurement of the current in the high voltage circuit, applied to the product to be tested
- the measurement of triggering current of current protection in the high voltage circuit

The control circuits ensure the carrying out of sequences of application of test voltage, specific to the tested electrical apparatus.

The protection switchgear and controlgear ensures:

- the protection of the autotransformer against the overload by performing a proper control of thermal protection of Q1 circuit-breaker
- the protection of high voltage transformer and electrical apparatus which are tested by means of an electronic relay connected in the secondary of current transformer.

3.Operating mode of the test installation

The test voltage of the insulation of some current paths against the mass, for determining the dielectric strength is specified in the technical norms or the standards of each product, specified by the designer of the product.

The test voltage does not suddenly apply, because the big slop of voltage wave front favours the insulation breakdown or it is possible to arise overvoltages in the transformer.

The test voltage increases from the minimum value (0 V) to the maximum value, respectively it decreases from the maximum value to zero, uniformly in an interval of 60 seconds. The increasing/decreasing controls of the voltage are performed from two buttons located on the front of the board.

During the period of increasing and decreasing of the voltage it permanently follows the test voltage and the high voltage current. These quantities increase/decrease uniformly during the whole period of the test.

If the insulation of the object to be tested did not withstand to the test and it brokedown, the voltage of transformer to be tested reduces from the value at which it arrived to zero after the source disconnection.

The current in the test circuit is permanently surveyed by a protection relay with continuous control. The value of current at which the electronic protection relay gives the disconnection command is regulated for each test, the maximum short duration value of the current in the circuit of high voltage being of maximum 30 mA.

If at the test of the insulation of current path against the mass, this one was brokendown, it is necessary to determine also the place where the breakdown took place. The localization of insulation breakdown is done by repeated application of voltage and by the observation of appearance of sparks, smoke release or noise production because of the sparks which cannot be seen. If the place of breakdown is not visible (for example at the current paths protected by dry insulation or oil), this one is checked by the division of electric circuit in more and more lower parts, by the detachment of some connections if it is possible and by the separation of healthy parts of the injured one.

The test installation is so conceived that the signaling lamps light before the connection of the source of test voltage. The safeguard is a blocking electric system, connected in the control circuit of the source so that at the opening of the door of this enclosure the connection to the mains is not possible.