Application: Iso Phase Bus and Switchgear Testing

Application Description

Testing **Iso Phase Bus (IPB)** or the bus work within **Switchgear (SG)** cabinets, often many in parallel, is normally an **AC Withstand** test, where the test voltage is applied from bus to ground and held for 60 seconds. The insulators holding the bus off of ground are either good or defective. If the test voltage holds for 60 seconds with no arcing, the bus duct and its insulators are deemed to be good. IEEE and other standards exist that define the test voltages required and the maintenance manuals from product vendors list the test voltages based on the nameplate voltage rating of the gear. AC field tests after installation and into the future are usually performed at 75% of the factory test voltage. For standard voltage classes, the test voltages shown in the tables below are typical.

DC voltage testing is sometimes used but is not the technically proper way to test bus insulators nor is it preferred by their vendors, except as a last resort if no AC method is available. DC fails to stress the bus similarly to in-service AC voltage conditions, tends to over read surface resistance of dirty or moist insulators, and is influenced by always changing environmental conditions. Also, there are no accepted standards for DC leakage current measurements indicating the health of bus insulators. Generally, DC leakage current readings when testing IPB and SG are not meaningful and can indicate false failures. AC voltage is used by most.

Iso Phase Bus Withstand Test Voltages

Test voltages at 75% of Factory for 60 seconds

IPB Voltage Rating kVac rms	Field Test Voltage kVac rms
15.5	37.5
25.8	45.0
38.0	60.0

Selecting an AC Dielectric Tester

The test voltage required should be known. What is often not known is how much AC current will be needed, which is a factor of the capacitance of the load. The charging current must be either calculated from the known pico-farads of the load, or check the current draw at a lower voltage and scale it up to the test voltage, or get a copy of the vendor's test report of the bus spec indicating the capacitance. Do you need 1 kVA, 10 kVA, or 100 kVA?

To calculate the current, use the following: Amps = 2πfCV

f = freq. (Hz) C = load capacitance (farads) V = test voltage (volts)

Switchgear Withstand Test Voltages

Table from NETA Acceptance Testing Manual

Type of Switchgear	Rated Maximum Voltage (kV) (rms)	Maximum Test Voltage kV	
		AC	DC
Low-Voltage Power Circuit Breaker Switchgear	.254/.508/.635	1.6	2.3
Metal-Clad Switchgear	4.76	14	20
	8.25	27	37
	15.0	27	37
	27.0	45	†
	38.0	60	†
Station-Type Cubicle Switchgear	15.5	37	†
	38.0	60	†
	72.5	120	†
Metal Enclosed Interrupter Switchgear	4.76	14	20
	8.25	19	27
	15.0	27	37
	15.5	37	52
	25.8	45	†
	38.0	60	†

t - Consult manufacturer. DC voltage testing is not recommended.

HVI Product Solutions

HVI produces many AC hipots from **3 kVac – 300 kVac** with power ratings from **1 kVA to 40 kVA**. Many of these are portable for field use and many are designed for lab or factory use. Some are low in Partial Discharge output to be used for **Tan Delta/Power Factor and Partial Discharge** testing. Numerous control features are available from simple manual controls to full computer interface to a front panel mounted PLC controller. HVI also produces a full line of high voltage DC hipots. Below are various AC testers from several product lines, but all can be used to AC Withstand test apparatus and some are suitable for TD & PD testing.

---------- ***PFT Series*** of Portable Hipots ----------

30 kVac @ 1 kVA

50 kVac @ 3 kVA

100 kVac @ 3 kVA

------ ***HPA Series*** of AC Dielectric Test Sets ------

60 kVac @ 7 kVA, Corona < 5 pc

50 kVac @ 5 kVA

FPA Series

6/12 kVac @ 6 kVA

ALT Series

60/120 kVac @ 7 kVA