

Recommendations for Storage, Testing and Maintenance of Vacuum Capacitors

Storage of Vacuum Capacitors

Vacuum capacitors should be stored in vertical position in a clean, dry place. It is recommended to keep the capacitor in the hermetically closed plastic bag with Silicagel during storage.

Periodic high voltage tests and, if necessary, high voltage processing (spot knocking) approximately every 4-6 months will maintain the voltage hold-off capability almost indefinitely.

If a water cooled capacitor has been in service before, water should be removed from the inside of the bellows (i.e. water course) **using a vacuum pump** (see Service Bulletin SB-31 Drying of Water Cooled Vacuum Capacitors). Hold-off voltage tests of water cooled capacitors should be made without filling the cooling system with water.

For shipment, variable capacitors must be set to minimum capacitance. When ever possible use original container.

Incoming Inspection Procedure

1. Short (discharge) the two electrodes carefully.
2. Set variable vacuum capacitor to maximum position and check for possible shorts by means of an Ohmmeter. If ok, proceed.
3. Perform HV AC hold off tests using high voltage test unit with a suitable voltage level and a limited current of 100mA maximum.
4. Prepare test set up in accordance with the steps indicated in the high voltage tester manual, using the AC continuous mode.
5. Test working (operating) voltage, i.e. 60 % of peak test voltage.
6. a) Increase the high voltage gradually from 0 to the 60 % point of the peak test voltage of the capacitor to be tested. The voltage increase should be such that the 60 % point is reached in approximately one (1) minute. This is necessary to avoid high sudden charge currents exceeding the capability of the tester, tripping the overload in the tester. During the voltage increase an occasional indication of an arc can be observed due to line surges (or transients). One such instability is acceptable and no cause for rejection.

b) After reaching the 60 % point hold for one (1) minute. In case an arc (discharge or breakdown) occurs, the capacitor is rejected.

7. Upon successful completion of step 6b increase the high voltage gradually (in approximately one (1) to two (2) minutes) to the rated peak test voltage. During this step instabilities (arcing) as well as small bursts (groups) of breakdowns are permissible.

After the peak test voltage of the capacitor is reached hold for one (1) minute. During this step, up to 10 discharges are permitted, after which the capacitor is to be operated for one (1) minute without any instability. If this is not possible the capacitor is rejected.

Periodic Evaluation Test Procedure

8. Every 4 to 6 months (or prior to installation) the capacitors held in stock should be subject to the incoming test procedure described above (see step 3 to 7) with the following modifications:
9. When testing at the operating voltage level (60 % of the peak test voltage see step 6b) one arc (instability) is permitted and the one (1) minute holding step is to be repeated. If the capacitor arcs during the second attempt, the capacitor is to be considered rejected, if still in the warranty period. It can possibly be reconditioned → step 11.
10. Upon successful completion of step 9 above, increase the voltage to the specified peak test value, as shown in step 7. Step 7b to be modified such that up to 15 discharges are permitted prior to obtaining a one (1) minute hold. If the one (1) minute operation cannot be obtained, the capacitor is rejected if still in the warranty period.
11. After one year from date of shipment if step 10 cannot be performed, the capacitor should be conditioned (high voltage processed) using the pulse mode of the HV test unit. This processing step has to be performed for up to 45 minutes if required. Then repeat step 9 and 10. If the unit fails again it is considered a reject.
12. Capacitors installed in a circuit which is in continuous use should not be removed for a periodic test. These units have to be tested only if circuit malfunctions and/or problems are experienced.

DC Evaluation Test

1. When desired or where it is indicated, a DC evaluation test should be performed. It is recommended to precede the DC test with the AC hold off test. If this cannot be done, check for possible shorts by means of an Ohmmeter.
2. The DC test can and should be performed with the DC+ and DC- mode. Using a DC source with a limited current of 100 μ A. **Never exceed** the peak working voltage for the capacitor type (i.e. **60 % of peak test voltage**). Increase the high voltage slowly from 0 to the peak working voltage. The leakage current for a new capacitor should be less than 10 μ A in both direction DC+ and DC-. The leakage current can be affected by dirt on the ceramic insulator and/or high humidity. After an extended time of operation or problems the leakage current can be more than 50 μ A.
3. If the leakage current is too high, use of the pulse mode operation (spot knocking) may, depending on the condition of the capacitor, have a beneficial effect. Make sure the ceramic insulator is clean before resorting to this step.

As a preventive measure it is recommended to replace capacitors with leakage currents of higher than 50 μ A (depending on the application it is indicated to re-place the capacitor already with leakage currents of more than 30 μ A).

Maintenance

Under normal operating conditions the capacitors do not need much maintenance. They should be cleaned periodically to remove dust and dirt accumulation. The unglazed ceramic envelope can easily be cleaned with a detergent and water.

Special grease for periodic lubrication of guide shaft and lead screw can be provided.

For maintenance of water cooled variable capacitors see Service Bulletin SB-21 "Maintenance/Repair of Water Chamber of Water Cooled Variable VCs".