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Instruction Book

For

TRV Capacitors

Type OCCF

Read this instruction book before assembling the unit.

******WARNING******

DE-ENERGIZED CAPACITORS MAY CONTAIN TRAPPED CHARGES

Read this instruction book **before** assembling the unit.

Never work on TRV capacitors or adjacent equipment without first having short-circuited and grounded all terminals and intermediate metallic flanges as the capacitors may have electric charges with voltage at the lethal level. In addition, a ground rod should stay on the line terminal as long as people work on the TRV capacitor stack.

In the event an electrical test is to be performed, the person supervising the test assumes the responsibility of performing the test in a safe manner under the local / federal regulation. After the test, the ground rod should be put back to the line terminal until the TRV capacitors are ready to be energized.

Note: To effectively discharge TRV capacitor stacks do the following:

(a) Put the ground rod onto the line terminal (Such action will short-circuit the entire stack and put the line terminal to the ground potential), and

(b) Use another ground rod to attach to the metallic bellow housing for duration of 10 –15 seconds to be certain that there is no residual electrical charge within the capacitor units.

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1.0 Description

1.1 Design

Ritz TRV capacitor units type OCCF are designed to improve the switching transient voltage for the circuit breaker operations. The capacitor insulation comprises polypropylene film and kraft paper. The electrodes of the capacitor element are aluminum foil. The capacitor elements are connected in series with tinned copper tabs adequately sized to carry the transient capacitive charging current due to the transient voltage. The capacitor stack is impregnated with capacitor synthetic oil. The capacitor assembly is housed in either porcelain or composite hollow insulators as specified by the customers.

Each capacitor unit is provided with its own stainless steel oil expansion bellow externally mounted on the insulator and protected with a cast aluminum housing.

The capacitor stack can be a multi-capacitor-unit assembly depending on the voltage rating. Customer should refer to the outline provided by Ritz.

More details may be found from the cross-sectional drawing of the unit assembly at the end of this book

1.2 Ambient Conditions

The Ritz TRV capacitor units are suitable for outdoor operation. The ambient conditions are:

(A) Range of temperature: -50° to 45°C
(B) Altitude: 1 000 m (3 300 ft) or less above sea level
(C) Wind velocity: 120 kmh or 200 mph or less
(D) Seismic force: 0.2 g or less

Any deviation from the above will be shown on the outline of the unit assembly.

1.3 Maximum Transport Mass

The maximum transport mass of the unit assembly is the mass of the unit with 20 percent extra for the packaging material and other accessories such as the high voltage shield for the primary connection.

2.0 Packing, Transport and Storage

The TRV capacitors are delivered in wood crates. The insulators are protected with either plastic wraps or hard paper tubes. For multi-unit assemblies, all the units for the assembly are in the same crate together with the connecting hardware. The top unit is with the primary terminal (if provided) or the top half of the bellow housing. If a high voltage shield is provided for the primary terminal connection, it should be included in the crate.

The TRV capacitors should be transported and handled as gently as possible, e.g. on well-sprung trucks, gentle lowering onto the floor with the crane and other precautionary measures. The marking “UP” on the packing case shows the correct position for transport.

NOTE: The capacitor centerline should remain vertical during transport and storage. Try to avoid tilting units by more than 30° from the vertical line.

The use of rope slings with a choker-type hitch arranged to bear on the upper metal flange is an effective way for lifting the capacitor units. Never lift up the unit with the rope around the shed of the insulators. In addition, do not flex the silicone rubber sheds for the composite insulators as they may be easily broken off. Care should be exercised to avoid jarring the load when starting to lift.
Crated units may be stored outdoor on level ground for a short time (3 months in fair weather). The top ends of the capacitors (if not protected by the top half of the bellow housing) should be protected against weather with the temporary covers. If damaged, these covers should be made good before putting them for extended period of outdoor storage.

3.0 Assembly of the Capacitor Stack

The assembly should be done in reference to the outline drawing. For multi-porcelain-unit, pay special attention to the mounting base and the top terminal to avoid interference with the circuit breaker connection. In addition, if the assembly is to be mounted with an angle to the vertical axis, make sure the weep hole of the bellow housing is the lowest point in order to have proper water drainage. For the latest design[1], please refer to Figure 1.

3.1 Pre-assembly Checks

Packing-material remnants should be cleaned off all components, especially underneath the sheds of the insulators and flanges.
Check the ground lead at the mounting base (refer to the outline for detail) making sure it is not broken.
Check if there are signs of oil leakage around the oil expansion bellow and both the top and bottom seal areas. Inspect the capacitors if there is damage to the units. The cause of the leakage must be established. Ritz should be notified immediately of any defects found, quoting the serial number of the unit and providing an accurate description of the defect.

3.2 Procedure of Setting up the Capacitor Stack

After uncrating, the bottom capacitor unit should be brought into position on the circuit breaker or structure with the crane. Secure the unit with the mounting hardware (customer should provide his own). If it is a multi-unit stack, use the crane to bring the upper unit right to approximately 30 mm (1.25 in) above the bottom unit. Insert the joining bolts provided into the bottom end of the upper capacitor unit. Rotate the upper unit so that the capacitor unit nameplates for both capacitors are aligned. Lower the upper capacitor until it settle on top of the bottom capacitor. Assemble them with the nuts and washers provided. Torque the joining hardware to the standard value. Repeat the same process for any other uppermost units provided. There is no electrical connection between the capacitors to be physically made, as the mechanical coupling will provide the electrical connection at the same time.
The primary terminal, if provided, is normally assembled with the uppermost capacitor unit. However, customer should assemble the high voltage shield, if provided, with the hardware provided. Purpose of such shield is to have an improved electrical field at the primary terminal so

[1] For the earlier design, the user should check the location of the weep hole on the lower side of the bellow housing.

that the impulse voltage withstand capability is better and radio influence voltage of the assembly is reduced.

4.0 Electrical Connections

Connect the ground terminal/connector to the ground of the circuit breaker or the structure, which should be connected to the station ground grid.
Connect the primary terminal with the cable and the connector (customer provides his own), making sure that the cable does not cause unnecessary cantilever stress to the unit assembly.

5.0 Field Electrical Tests

Customer is recommended, before putting the unit into service, to do an electrical test on the TRV capacitor units. The Doble test should provide useful data for future reference. It should be noted the capacitance value stamped on the nameplate is rounded off to the hundreds of pico-farads, which is determined at rated voltage. If the Doble reading is a close match, then the capacitance value is satisfactory.
Since the Doble test is performed with a maximum voltage of 10 kV, the power factor may be different from the factory test data (dissipation factor). However, Ritz considers, for brand-new units, any value of the power factor below 0.3% is acceptable.
The commission test data, the ambient conditions and test set serial number should be kept as a reference for future comparison.
For capacitors, which have been in service for some time, if the customer decides to check the power factor, Ritz recommends the user should perform the measurement within 48 hours after removal from service. If he performs the measurement of power factor after a waiting time of more than 3 days, the power factor can be as high as 1.0% due to the following phenomena:

i) Ionic concentration in the system[2], [because of the oil circulation within the capacitor in service, has brought the concentration to a uniform and complete level than that at manufacturing].

ii) The ions distribute more uniformly within the thin oil film between the capacitor elements than the time when Ritz manufactured the unit.

6.0 Maintenance

Ritz TRV capacitors do not require any programmed maintenance. However, visual inspection for oil leakage on the unit assembly while the customer is doing regular maintenance on the circuit breaker is recommended.
If desired, a Doble test should be repeated every five year (preferably the same test set is used) to see if there is any increase in capacitance or power factor. The test data should be corrected to the same temperature as at the time of the commission test.

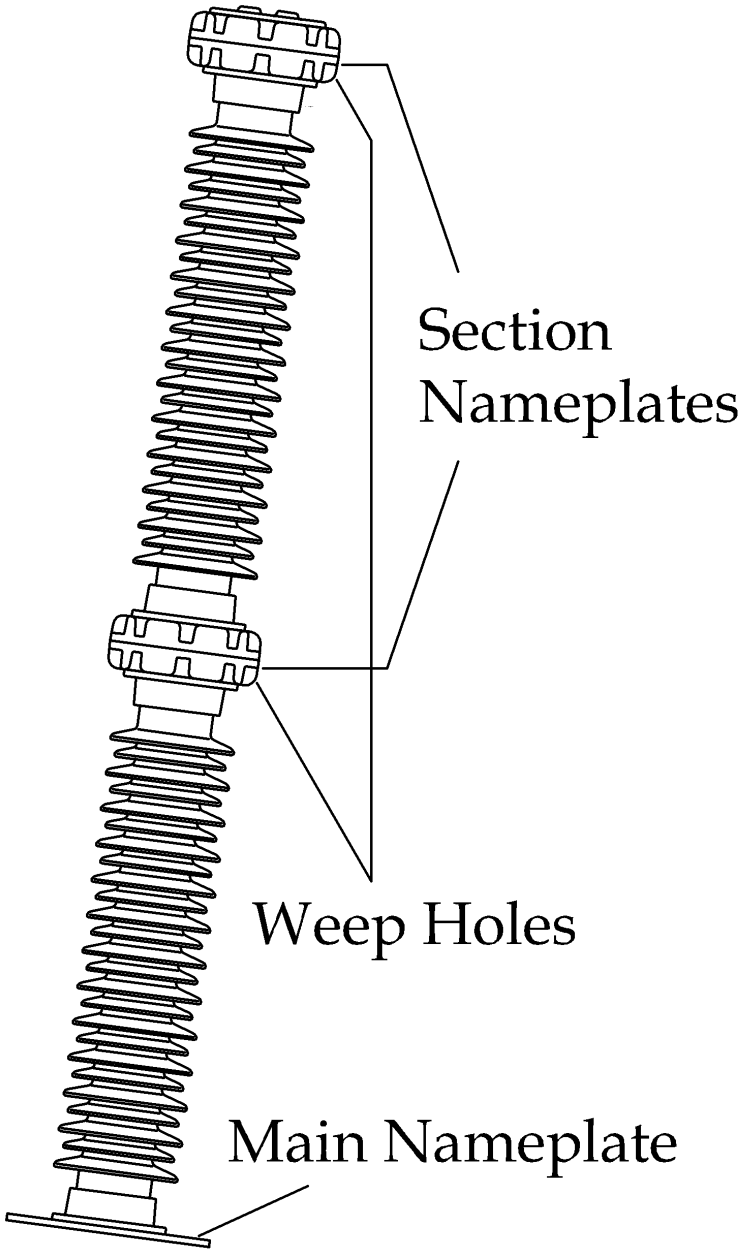
[2] Because the oil used for the capacitors is a powerful solvent and any surface dir or grease will dissolve in the oil forming ions. We call he phenomenon of high power factor at reduced voltage Garton Effect.

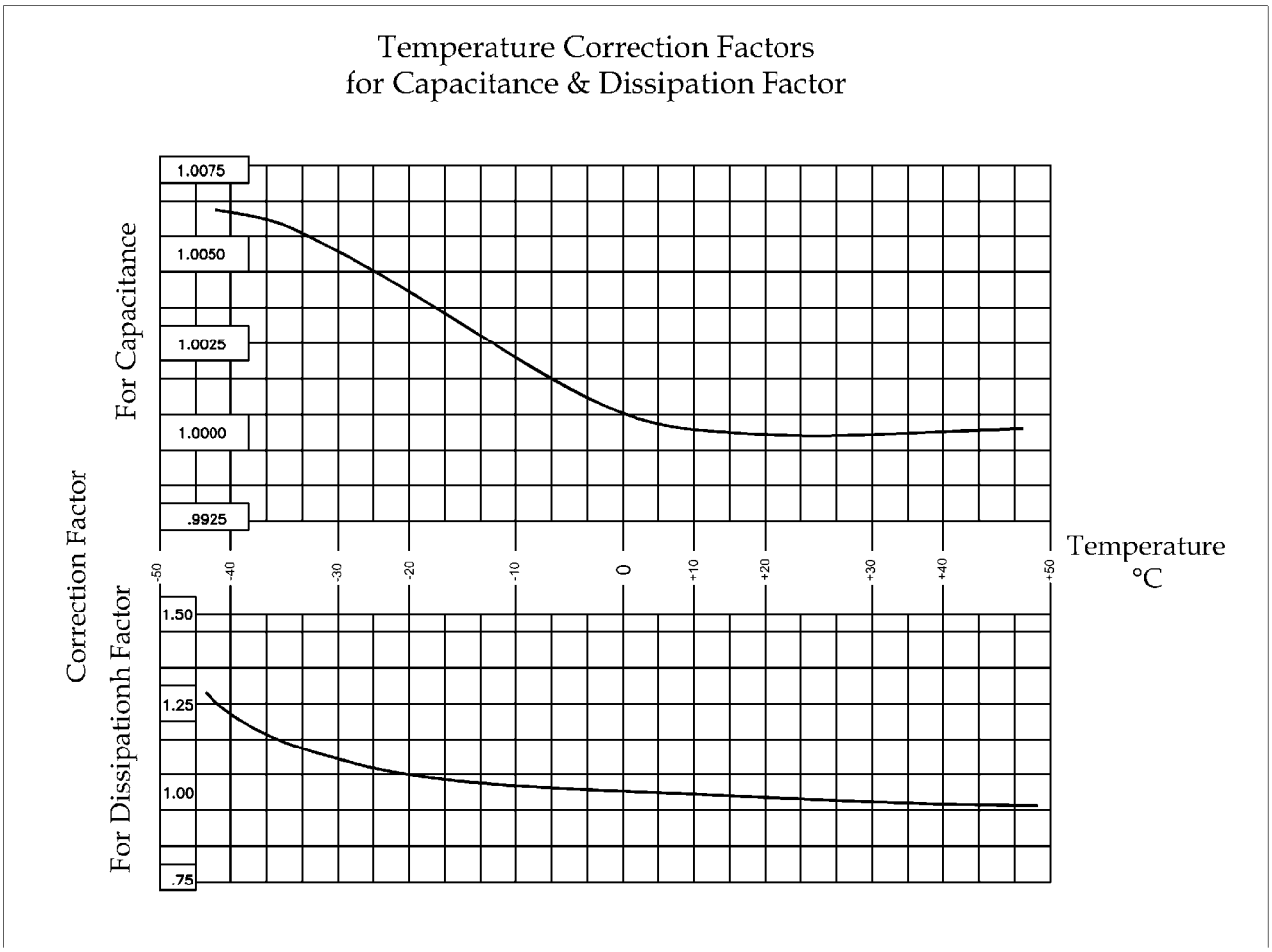
In general, an increase of capacitance of 1% is a concern. Customer should report the results to the factory and ask assistance to determine whether the unit is in satisfactory conditions.

7.0 Miscellaneous Technical Information

Refer to the following pages for the information for the correction factor used for capacitance and that for the dissipation factor or power factor for the capacitor units.

Fig 1: Location of the Weep Holes




Temperature Correction Factors
for Capacitance & Dissipation Factor
Correction Factor
For Capacitance
1.0075
1.0050
1.0025
1.0000
.9925
For Dissipationh Factor
1.50
1.25
1.00
.75
-50
-40
-30
-20
-10
0
+10
+20
+30
+40
+50
Temperature
°C