

## Watercooled Power RF-Capacitors

### 1. PRODUCT DESCRIPTION

Watercooled power RF-capacitors are designed for use in the tank circuit of high power RF equipment. Vishay Draloric's TWX, TWXFZ and TWIF pot-styled capacitors dissipate the heat produced under load by means of water flow around the capacitor elements. In order to provide protection from influences of the chemical/physical characteristics of the coolant, a glass passivation layer is applied over the cooled noble metal electrode.

The electrical terminations are made directly to the noble metal electrodes either utilizing special soldering techniques or special clamping fittings. This method of attachment provides a strong, rigid connection of unsurpassed reliability. The TWX model is made with a contoured, glazed insulation rim designed for use in a relatively clean, dry environment. The TWXF, TWXFZ and TWIF models feature an umbrella shaped insulation rim made from silicone rubber to minimize the adverse effects of moisture, dust and other impurities in the working environment.

All watercooled pot capacitors are supplied with the necessary screws/nuts and contact plates to make the connection to the electrode terminals. Ferrules and sleeve nuts for the water supply connections are also included.

### 2. ELECTRICAL DATA AND GUIDELINES

- 2.1. Listed in the tables on the datasheets are the general physical and electrical characteristics of the ceramic dielectric materials used.
- 2.2. The continuous limit values of voltage, current and power given in the derating diagrams must be observed.
- 2.3. The rated voltage given in the tables is the peak value of the sinusoidal a.c. voltage or the sum of the d.c. and peak a.c. voltages for which the capacitor is rated under continuous operation.
- 2.4. The rated current in the tables is the effective value of the sinusoidal current for which the current paths of the capacitor are designed.
- 2.5. If several capacitors are connected in parallel, care should be taken to mount the top electrodes of the capacitor away from the RF-buss bar to minimize the effects of stray electromagnetic fields. Under no circumstances should the inner electrode terminal exceed a temperature of 100°C.
- 2.6. The electrical connection to the inner electrode must be flexible in order to prevent the generation of physical forces which could damage the capacitor elements. Such forces are often generated by the dimensional differences resulting from the normal physical tolerances of the capacitors. The capacitor's inner electrode connector must not be used as a mechanical support for other devices or components.

### 3. INSTALLATION

Watercooled pot capacitors are designed to be installed in a vertical, umbrella-up position (TWX, TWXF, TWIF model) or a vertical, umbrella-down position (TWXFZ model). Other positions may be allowed as shown on the appropriate datasheets. For large generators requiring multiple capacitors connected in parallel, we recommend a circular mounting pattern for optimum circuit performance.

### 4. COOLING

- 4.1. The cooling system is designed to operate at a maximum water pressure of 4 bars (58 psi).
- 4.2. The water outlet of the capacitor must always be located higher than the water inlet in a vertical installation. This allows any air to escape from the unit. Horizontal installations require that both water connections be at the top side of the unit. To preserve the capacitors from frost damages during the transport, we can supply special models with outlet screws for emptying the cooling water from the unit.
- 4.3. The minimum flow rates specified in the tables must be observed. When using antifreeze mixtures, increase the minimum rates given by at least 20%.
- 4.4. The cooling system is designed to have a water temperature increase of < 10°C (Water inlet to water outlet) when the capacitor is operated at full rated power and at the minimum water flow rate.

A water intake temperature of ≤ 30°C is recommended.

If the cooling system for several capacitors is connected in series, the intake temperature of the coolant must not exceed 50°C for any of the capacitors.

The pressure drop in a series connected cooling system is small. The table below illustrates the effects upon water flow rates as a function of the number of series connected TWXF 135285 capacitors in the system with a constant intake water pressure of 3 bars (43.5 psi)

3 bars (43.5 psi) intake water pressure, cooling systems in series		1	2	3	4	5
Water flow rate	[Liters/Minute]	13.0	10.5	8.5	7.3	6.0
	[US-gal./Minute]	3.43	2.77	2.24	1.92	1.58



- 4.5. Intake water temperature fluctuations in excess of 3°C/sec. must be avoided to prevent damage to the capacitor elements.
- 4.6. A coolant temperature rate monitor must provide a fail-safe on/off power control for the RF equipment.
- 4.7. Normal tap water or de-mineralized water may be used for cooling. The water must be reasonably free of Ca CO<sub>3</sub> and clear of foreign particles or milkyness. The pH-value of the coolant should be between 6 and 8.

### 5. ELECTRICAL AND MECHANICAL SCREENING TESTS

All capacitors are subjected to the following tests prior to shipment:

- Capacitance value (0.1MHz, 20V<sub>RMS</sub>, 25 ± 5°C)
- Dissipation factor (0.3 or 1,0MHz, 10V<sub>RMS</sub>, 25 ± 5°C)
- Insulation resistance (100 V<sub>DC</sub>, 25 ± 5°C)
- Dielectric strength (200% rated voltage [peak value], 50Hz, 5 Minutes)
- RF-power test (130% rated power for 10 Minutes in a test generator circuit)
- Pressure test (Standard: 6 bars [87 psi] for 1 Minute, 25± 5°C)
- Control of the cooling system for water flow resistance

### 6. WARRANTY STIPULATION FOR WATERCOOLED CERAMIC POWER RF-CAPACITORS

- 6.1. Unless otherwise provided for hereinafter, warranty shall be governed by General Terms of Sale and Delivery.
- 6.2. Warranty is assumed for capacitors which fail to operate owing to faults in material or production, and within the warranty period for capacitors.  
Excluded from warranty are capacitors prematurely rendered unserviceable owing to improper treatment, overloading, circuit errors, as well as capacitors operated without observing the data given in our catalogue. Warranty is also excluded in cases where faults can no longer be recognized on the capacitor owing to third party interferences.  
Warranty is only effectively assumed when meeting the requirements referred to hereinafter.
- 6.3. For claiming warranty, the defective capacitor should be returned to us, if possible in its original packing, within 14 days following the date of failure, being accompanied by the COMPLETELY filled-in and signed Original Guarantee Certificate. The risks of transportation, as well as any shipping costs and other charges shall in any case be borne by the sender.
- 6.4. Warranty can only become effective if the defective capacitor is received by us in the same condition as it was when it happened to fail.
- 6.5. We have the right to inspect any records proving the use of the capacitor.
- 6.6. The decision as to whether we are obliged to assume warranty for the capacitor shall exclusively rest with us.
- 6.7. When acknowledging the warranty claim, any non-repairable capacitor shall remain our property. When refusing a warranty claim the defective capacitor will be returned at the customer's expense only if demanded so explicitly when asserting the warranty claim. In case examination required disassembly of the capacitor no claims for damage can be derived therefrom.
- 6.8. The customer gives us the right to have the system checked in which the capacitor was operated.
- 6.9. When acknowledging a warranty claim, restitution is made by supplying either a repaired and newly tested capacitor, or by supplying a new one.
- 6.10. Warranty shall only extend to the capacitor itself. Any further claims for damages are excluded.

### 7. CONDITIONS OF GUARANTEE

**Persuant to the foregoing stipulations we assume warranty for these watercooled pot capacitors up to a period of 5000 hours of operating service. Any claims for warranty, however will extinguish 24 months following the date of delivery.**