



# Assembly and Maintenance Instructions for AC and DC Power Capacitors

By Vishay ESTA Division

## INTRODUCTION

This document contains supplementary provisions for the assembly, operation, and maintenance of capacitors (“operating manual”). Read this operating manual carefully prior to any installation and commissioning work, and in addition to the applicable statutory provisions, observe the rules contained in this document or the rules of the documents referred to.

This operating manual is an integral part of the capacitor and must always be considered as such. Make sure that the operating manual can be accessed if needed and keep it carefully in a safe place to ensure that it is available during the entire life of the system. If the capacitor is resold, the operating manual must be added to the capacitor.

On receipt, the capacitors must be checked for damage (especially damage in transit) and must not be used until their harmlessness has been clarified or they have been repaired professionally.

Moreover, the “General Safety Recommendations for Power Capacitors” of the ZVEI, the German Electrical and Electronic Manufacturer’s Association, must be observed. They can be downloaded at [www.zvei.org](http://www.zvei.org).

## INTENDED USE

The capacitors may only be utilized for customary use and within the framework of the specifications agreed upon. Unless otherwise agreed upon, Vishay’s technical datasheets will apply.

For a safe operation of the capacitors, it must be ensured that all limit values (electrical, mechanical, and thermal) are complied with according to the technical datasheet, identification plate, warnings, and the technical standards listed, as well as the instructions mentioned in this document.

All work may only be carried out by qualified personnel, observing all applicable safety instructions!

## WARRANTY

With regard to warranty, the contract concluded between the parties will apply. The contractual warranty rights will not be extended by the statements and explanations in this operating manual.

## EXCLUSION OF LIABILITY

No liability will be assumed for damage that results from improper transport, storage, assembly, or operation outside the technical parameters specified by customers or third parties in the applicable datasheets (unless commissioned by Vishay).

## DECLARATION OF CONFORMITY

To the production and inspection of the capacitors, the standards (VDE [German Association for the Electrical, Electronic, and Information Technologies] and IEC provisions and requirements) that, unless otherwise explicitly agreed upon by the parties, are effective at the time of the order confirmation will apply.

## SAFETY INSTRUCTIONS

Signal words and their meaning:

**DANGER** DANGER indicates an immediate hazard with a high risk that will result in death or serious personal injury if not avoided.

**WARNING** WARNING indicates a possible hazard with a medium risk that will result in death or (serious) personal injury if not avoided.

**NOTICE** NOTICE refers to possible misuse that will result in damage to the product.

## Assembly and Maintenance Instructions for AC and DC Power Capacitors

### GENERAL SAFETY INSTRUCTIONS

The following general safety instructions and warnings must be observed:



#### DANGER TO LIFE CAUSED BY ELECTRIC VOLTAGE

- When carrying out work at the capacitors, there is danger to life.
- Before starting any work, make sure that the capacitor system is de-energized and secured against being switched on
- Wear the prescribed personal protective equipment
- When entering the safety zone, pay attention to any live parts in the environment of the system
- Do not touch any components when you are not sure if they may still be live
- Any work on capacitors may only be carried out in the de-energized state while observing the following safety precautions:
  1. Disconnecting
  2. Securing against being switched on
  3. Discharging with an adequate discharge device
  4. Earthing
  5. Short-circuiting
- ATTENTION: The presence of a discharge device integrated into the system is not a substitute for the safety instructions mentioned above!



#### EXPLOSION OR FIRE

Despite monitoring equipment and guards, the housing and / or bushings can be destroyed in the event of an overload or a substantial electrical defect. In addition to this, flammable components can ignite. When choosing the site of installation, the applicable fire safety regulations (adequate safety distances, ensuring of escape routes, etc.) must be taken into account.



#### LEAKAGE OF IMPREGNATING AGENTS

In the event of a fire, the impregnating agent may leak. If the impregnating agent has leaked, please observe the safety regulations that are adequate for the impregnating agent that is mentioned on the rating plate (see "Oil no. / designation"). More information in this respect can also be found in the corresponding safety datasheet.

Dry capacitors are marked on the rating plate with the designation "dry."

STORAGE		
CAPACITOR TYPE	STORAGE PERIOD < 3 MONTHS	STORAGE PERIOD > 3 MONTHS
Outdoor capacitor	Outdoors on a suitable surface; rain protection required	Storage in original packaging under a roof and / or in well-ventilated rooms; humidity < 90 %; temperature between -30 °C and +40 °C; stacking is not permissible
Indoor capacitor	Storage in a dry place at temperatures between -30 °C and +40 °C; humidity must be assessed so that there is no condensate formation. For better ventilation, the package must be opened. Stacking is not permissible	

### INSTALLATION AND COMMISSIONING



#### Short-circuiting connections (for discharge) must be removed prior to commissioning!

The regulations on the erection of high voltage systems (e.g. EN 50179 and / or VDE 0101) applicable at the site of installation must be observed. The nominal data on the rating plate, datasheet, or order, and the specified internal circuit must be checked for compliance with the intended application beforehand.

All power connections must be designed with sufficient cross-sections and suitable material.

**The tightening torque for live connections must be designed according to the marking on the product.**

Screw connections must be greased with a lubricant suitable for the application.

The connections must be secured so that they do not become loose.

Damage to the paint (even on the bottom) must be repaired immediately (only use an approved repair kit) in order to avoid subsurface corrosion. In the event of strong mechanical vibrations of the site of installation, the capacitor must be decoupled mechanically.

## Assembly and Maintenance Instructions for AC and DC Power Capacitors

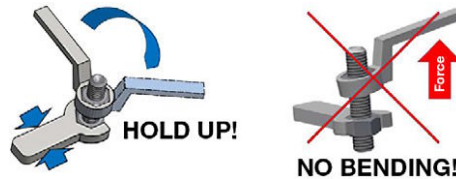
**NOTICE**

**DAMAGE TO THE CAPACITOR BUSHINGS**

- Avoid applying direct force (tension / pressure / bending) to the capacitor bushings



- If possible, always use a suitable tool as a counter part when performing screwing work:



**COOLING**

**AIR-COOLED CAPACITORS**

A distance of > 35 mm between the short ends of the housing or to the adjacent housing parts must be complied with.



**Note**

- Capacitors that fail because the permissible ambient temperature has been exceeded are not subject to warranty and / or guarantee if granted. Temperature classes according to IEC 60871-1

**WATER COOLED CAPACITORS**

- The specifications on the rating plate must be complied with
- The cooling medium must be chosen and prepared according to the intended purpose
- Neither the cooling medium nor the pipe system may contain copper-corrosive components
- There may be impregnating agent residues in the cooling system when it is delivered. Leakages are not involved
- Live waterways that are brought out in an insulated manner require hose lines of a sufficient length without any metal reinforcement. Their length must be assessed according to the electrical conductance of the water and the voltage to earth

**EARTHING AND DISCHARGE**

- The housings must be earthed in the correspondingly marked place 
- Capacitors with installed discharge resistors are marked with “EW,” “R = yes,” “R = WERT > MOhm,” or as follows: 
- Re-connection work may only be carried out after the residual voltage has dropped to less than 10 % of the nominal voltage
- For systems, the minimum period of time for re-connection can be found on the bank rang plate

**DANGER**

**MONITORING EQUIPMENT**

To ensure the safe operation of the capacitors, suitable monitoring equipment must be provided. In this respect, please refer to IEC 60871-3, IEEE 1036, and ZVEI’s “General Safety Recommendations for Power Capacitors.”

**OPERATION AND MAINTENANCE**

The operating company must determine adequate cleaning intervals, which, among other factors, depend on the respective environmental conditions. If no shorter intervals are required due to the environmental conditions, however, Vishay recommends the following:

- Regular visual inspection for leakage and overheating must be carried out every six months
- The bushings must be checked every six months for soiling and cleaned if necessary
- The torque of live connections must be checked after the first four weeks and every 24 months afterwards, and re-tightened to the target torque if necessary
- Water cooled capacitors must be checked at regular intervals for proper functioning of the cooling equipment
- If recommended / available, monitoring equipment (thermostat, pressure control device, pressure switch) must be subjected to a function control every 24 months



## Assembly and Maintenance Instructions for AC and DC Power Capacitors

### TROUBLESHOOTING

If monitoring equipment has been triggered, switching equipment, clamping units, and the capacitor housing must be inspected externally by complying with the safety instructions (see section "Safety Instructions"). If no external changes can be detected, it is necessary to detect defective units by means of a capacity measurement.



### RECONNECTION

Reconnecting a capacitor battery after the monitoring equipment has been triggered without any clarification and professional rectification of the cause is not permissible, and can result in substantial consequential damage and / or hazards for people!

### DECOMMISSIONING / SHUTDOWN



**Capacitors that are decommissioned must be equipped permanently with a jumper over the housing and bushing!**

### DISPOSAL

Depending on their respective type, capacitors contain a liquid or a solid filling material. Information as to which filling material is used can be found on the respective name plate, as well as on the datasheet.

For disposal, locally applicable regulations must be observed. Where necessary, a safety datasheet for the respective filling material can be made available.

#### Notes

- Any leaked filling agent must be collected and absorbed according to the locally applicable regulations using suitable binding agents and also be disposed of adequately
- Be careful when handling capacitors with triggered guards. These capacitors can have a residual charge even over a longer period of time short-circuit after discharge). This information must also be provided to the responsible disposal company

### RETURN DELIVERY OF CAPACITORS

Leaking capacitors must be packaged and marked adequately.

The capacitor must be equipped with a jumper (bushings and housing)!