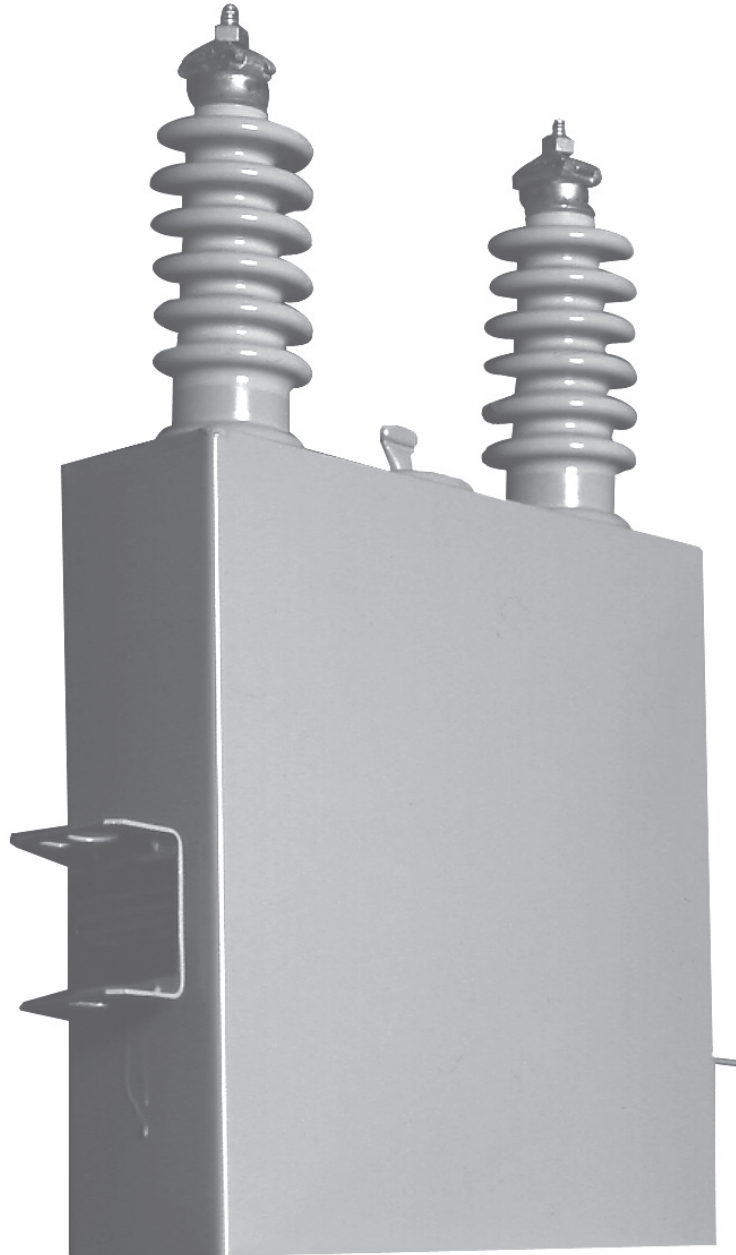


Medium-voltage, single-phase capacitor installation and maintenance instructions



EATON

Powering Business Worldwide

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Safety for life



Eaton's Cooper Power series products meet or exceed all applicable industry standards relating to product safety. We actively promote safe practices in the use and maintenance of our products through our service literature, instructional training programs, and the continuous efforts of all Eaton employees involved in product design, manufacture, marketing and service.

We strongly urge that you always follow all locally approved safety procedures and safety instructions when working around high-voltage lines and equipment and support our "Safety For Life" mission.

Safety information

The instructions in this manual are not intended as a substitute for proper training or adequate experience in the safe operation of the equipment described. Only competent technicians, who are familiar with this equipment should install, operate and service it.

A competent technician has these qualifications:

- Is thoroughly familiar with these instructions.
- Is trained in industry-accepted high- and low-voltage safe operating practices and procedures.
- Is trained and authorized to energize, de-energize, clear, and ground power distribution equipment.
- Is trained in the care and use of protective equipment such as flash clothing, safety glasses, face shield, hard hat, rubber gloves, clampstick, hotstick, etc.

Following is important safety information. For safe installation and operation of this equipment, be sure to read and understand all cautions and warnings.

Hazard Statement Definitions

This manual may contain four types of hazard statements:

DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

CAUTION

Indicates a hazardous situation which, if not avoided, could result in equipment damage only.

Safety instructions

Following are general caution and warning statements that apply to this equipment. Additional statements, related to specific tasks and procedures, are located throughout the manual.

DANGER

Hazardous voltage. Contact with hazardous voltage will cause death or severe personal injury. Follow all locally approved safety procedures when working around high- and low-voltage lines and equipment.

G103.3

WARNING

Before installing, operating, maintaining, or testing this equipment, carefully read and understand the contents of this manual. Improper operation, handling or maintenance can result in death, severe personal injury, and equipment damage.

G101.0

WARNING

This equipment is not intended to protect human life. Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply can result in death, severe personal injury and equipment damage.

G102.1

WARNING

Power distribution and transmission equipment must be properly selected for the intended application. It must be installed and serviced by competent personnel who have been trained and understand proper safety procedures. These instructions are written for such personnel and are not a substitute for adequate training and experience in safety procedures. Failure to properly select, install or maintain power distribution and transmission equipment can result in death, severe personal injury, and equipment damage.

G122.3

Medium-voltage, single-phase capacitor installation and maintenance instructions

⚠ IMPORTANT

This instruction literature applies to both internally-fused capacitors and unfused capacitors. An unfused capacitor unit does not have internal fuses. An internally-fused capacitor unit includes internal fuses for each element.

Product information

Introduction

Service Information MN230002EN covers instruction for installing and maintaining the Eaton's Cooper Power series line of medium-voltage, single-phase capacitors (Figure 1). Where applicable, the requirements of federal, state, local codes and insurance underwriters must be fulfilled.

Read this manual first

Read and understand the contents of this manual and follow all locally approved procedures and safety practices before installing or operating this equipment.

Additional information

These instructions cannot cover all details or variations in the equipment, procedures, or processes described nor provide directions for meeting every possible contingency during installation, operation, or maintenance. For additional information, contact your Eaton's Cooper Power series product representative.

Handling and storage

Be careful during handling and storage of the capacitor to minimize the possibility of damage. If the capacitor is to be stored for any length of time prior to installation, provide a clean, dry storage area.

⚠ CAUTION

Eaton's Cooper Power series power capacitors are housed in hermetically sealed tanks that contain all-film solid dielectric packs impregnated with a non-PCB fluid dielectric. Do not drop, jar, or otherwise handle a capacitor in a manner that would violate the integrity of the hermetic seal.

Standards

ISO 9001 Certified Quality Management System

Initial inspection

Immediately upon receipt of a capacitor shipment:

1. Check each capacitor nameplate to make sure the voltage rating is correct for the system on which the capacitor is to be applied.

- A. Power capacitors must be connected only to systems on which the terminal-to-terminal voltage does not exceed rated voltage shown on each capacitor nameplate.

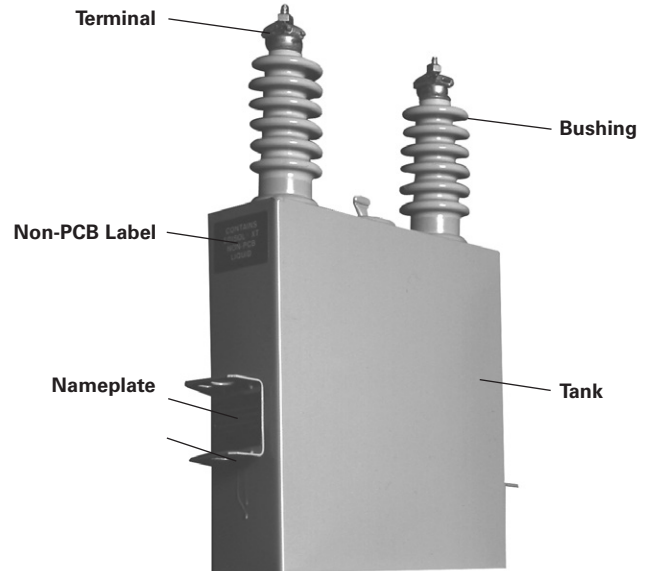


Figure 1. Medium-voltage, single-phase power capacitor

- B. Capacitors to be connected in delta must be rated at the line-to-line system voltage.
- C. Capacitors to be connected in wye must be rated at the line-to-neutral system voltage.
2. Check each capacitor tank and bushing for signs of rough handling or damage in transit.
 - If a capacitor bushing is damaged or a capacitor tank has dents, bulges, and/or leaks, set the capacitor aside and file a claim with the carrier and notify your Eaton's Cooper Power series product representative.

⚠ CAUTION

Operation at an ambient temperature higher than 55 °C (131 °F) will shorten the service life of a power capacitor.

Pre-installation preparations

1. Make sure that branch circuit conductors have a current-carrying capacity at least 135% of the operating current of the capacitor installation.
2. Make sure the ambient temperatures in which the capacitor installation is to operate is between -50 °C and 55 °C (-58 °F and 131 °F).
3. Make sure the capacitor installation is protected by a correctly rated fuse. (Contact your local Eaton's Cooper Power series product representative for fusing application guidelines.)

Installation

1. De-energize the circuit.
2. Install the rack or frame in which the capacitors are to be mounted.
3. Hoist each capacitor into position in the rack or frame using the capacitor's hanger brackets.

CAUTION

Never use a bushing as a handle when lifting or moving a power capacitor; use only the hanger brackets.

Never use the hanger brackets of the capacitor when lifting a complete capacitor installation. Never walk on an installed capacitor unit or its bushing(s).

4. Install each capacitor in the rack or frame so that heat from other equipment is minimal and air can circulate freely around each capacitor in the installation.
 - The capacitor terminals accept single-conductor sizes from no. 12 to no. 1 solid or stranded or two-conductor sizes from no. 8 to no. 2 stranded.

CAUTION

It is important to use a properly sized conductor with the connector to assure good electrical contact without arcing.

- The recommended torque on a terminal clamp nut is 16–19 ft-lb. (21.7 to 25.8 N-m)
5. If switches are to be installed, hoist them into position on the rack or frame.
 6. Ground the mounting frame and ground each capacitor tank to the frame or to the ground.
 7. If shorting wires were used for storage/transportation of the capacitor unit, verify that they are removed prior to energization.
 8. Make all electrical connections.
 9. Re-energize the circuit.

Maintenance

Periodic inspections and maintenance are recommended to check capacitance, bushing contamination, or fuse operations.

1. De-energize the capacitors.
2. Clean all bushings.
3. Make sure all electrical connections are tight.
4. Inspect all capacitor tanks for leaks.

WARNING/DANGER

Do not re-energize a capacitor that has experienced a fuse operation without first making sure that the capacitor has not failed. All-film capacitors may fail without being severely bulged and may rupture on re-energization.

Checking the capacitance of a capacitor is the best way to determine if the capacitor is sound or has completely or partially failed.

5. If applicable, inspect all fuse cutouts, and if a fuse cutout has operated—or if the capacitors have been subjected to unusual operating conditions—use a low-voltage capacitance meter to check the condition of all capacitors.

Note: Shorting one internal series group in an unfused capacitor results in a predictable increase in the capacitance level. Shorting an internal element (with a corresponding fuse operation) in an internally-fused capacitor results in a reduction in the capacitance level. See Handling a Partially-failed Capacitor Unit section below for the formula to verify if internal elements within the capacitor have failed.

Note: Not applicable to internally fused capacitors.

WARNING/DANGER

Proper skin, eye, and respiratory protection must be worn and the work area must be properly ventilated when handling a ruptured (failed) capacitor tank. Be extremely careful in removing a ruptured tank from a frame or rack and while transporting the tank to a disposal site.

If fluid dielectric spills or splashes onto the skin, immediately wipe the liquid from the skin, then wash the affected skin area thoroughly with soap and water.

If fluid dielectric splashes into the eyes, immediately flush the eyes with large amounts of clear water. Call a physician immediately.

If fluid dielectric is ingested, administer 2 to 4 oz. of vegetable or olive oil and 1 to 2 oz. of activated charcoal. DO NOT INDUCE VOMITING. Call a physician immediately.

Medium-voltage, single-phase capacitor installation and maintenance instructions

Handling a failed capacitor

1. Ensure power is removed from the capacitor.
2. Allow the capacitor to discharge before shorting.
For units containing discharge resistors designed to discharge the capacitor unit from peak rated voltage to less than 50 V in 5 minutes, allow five minutes before grounding. For units containing discharge resistors designed to discharge the capacitor unit from peak rated voltage to less than 75 V in 10 minutes, allow ten minutes before grounding. In the absence of design information, wait ten minutes before grounding.
3. Remove the capacitor from the frame or rack.

Handling a partially-failed capacitor unit

Use the following formula for detecting partially failed **unfused** capacitor unit:

1. Measure capacitance of the unit with a capacitance meter. This is the $C_{measured}$ value.
2. If $C_{measured} > C_{rated} \left[\frac{S}{S-1} \right]$, then the capacitor is partially-failed and should be removed from the circuit, where S is the number of series groups inside a single capacitor.

Use the following formula for detecting partially failed **internally-fused** capacitor unit:

1. Measure capacitance of the unit with a capacitance meter. This is the $C_{measured}$ value.
2. If $C_{measured} < C_{rated} \left[\frac{S \times (P - F)}{(S - 1) \times (P - F) + P} \right]$, then the capacitor is partially failed and should be removed from the circuit, where S is the number of series groups inside a single capacitor, P is the number of parallel elements, and F is the number of operated internal fuses. (Internally-fused units can have one or more operated internal element fuses and not change the measured capacitance beyond the tolerance allowed for the rated capacitance by the standards.)

Disposal of capacitors

The impregnating fluid dielectric in Eaton's Cooper Power series power capacitors is a non-PCB biodegradable, Class IIIB, combustible liquid. Disposal of these capacitors by incineration or other means must be in accordance with all applicable federal, state, and local regulations.



Eaton
1000 Eaton Boulevard
Cleveland, OH 44122
United States
Eaton.com

Eaton's Power Systems Division
2300 Badger Drive
Waukesha, WI 53188
United States
Eaton.com/cooperpowerseries

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For Eaton's Cooper Power series product
information
call 1-877-277-4636 or visit:
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