

Power Capacitors

Service Information

High-Voltage, Single-Phase Installation and Maintenance Instructions

S230-10-1

Service Information S230-10-1 covers instruction for installing and maintaining the Cooper Power Systems EX® line of high-voltage, single-phase capacitors (Figure 1). Where applicable, the requirements of federal, state, local codes and insurance underwriters must be fulfilled.

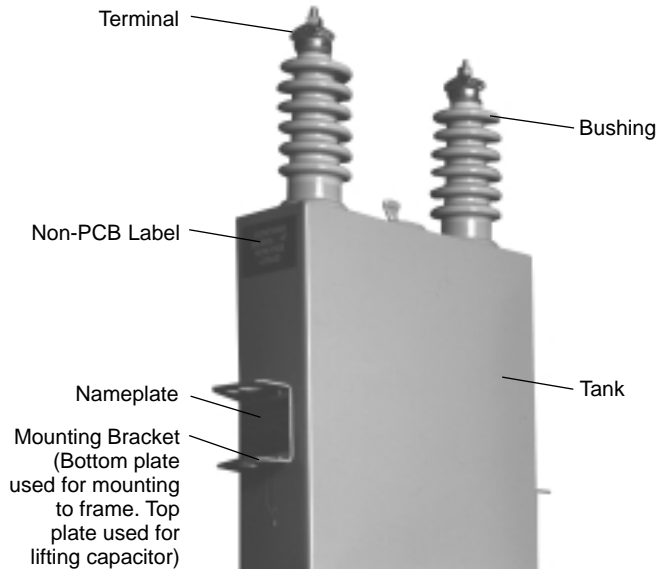


Figure 1.
EX-7 High-voltage, single-phase power capacitor.

Initial Inspection

CAUTION: Cooper Power Systems 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.

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 110% of the rated voltage shown on each capacitor nameplate.
 - 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 Cooper Power Systems representative.

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.

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

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 Cooper Power Systems 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).

Refer to page two of these instructions for the definitions of warning/danger and caution alerts. These instructions do not claim to cover all details or variations in the equipment, procedure, or process described, nor to provide directions for meeting every possible contingency during installation, operation or maintenance. When additional information is desired to satisfy a problem not covered sufficiently for the user's purpose, please contact your Cooper Power Systems representative.

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.
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. Make all electrical connections.
 8. Re-energize the circuit.

Maintenance

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


To perform maintenance work on power capacitors.

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

NOTE: If a leak is detected, the capacitor tank can be repaired on site. Contact your Cooper Power Systems representative about a tank repair kit.


5. 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 a capacitor results in a predictable increase in the capacitance level. This is the basis for the capacitances of partially failed capacitors listed in Table 1.

 **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 reenergization.

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

Handling a Failed Capacitor

 **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.

To remove a failed capacitor from an installation,


1. Short the failed capacitor and allow the capacitor to discharge for at least 5 minutes.
2. Remove the capacitor from the frame or rack.

Disposal of Capacitors

The impregnating fluid dielectric in Cooper Power Systems 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.

Hazard Statement Definitions

This manual contains two types of hazard statements:

 **WARNING/DANGER:** A warning/danger alert describes a hazardous situation that may cause death and/or personal injury and gives instruction on how to avoid death and/or personal injury..


 **CAUTION:** A caution alert describes a hazardous situation that may cause personal injury and/or property damage and gives instruction on how to avoid personal injury and/or property damage.

TABLE 1
Capacitance Values for Cooper Power Systems Capacitors*

Capacitor Voltage (volts)	50-kvar Capacitor		100-kvar Capacitor		150-kvar Capacitor		200-kvar Capacitor		300-kvar Capacitor		400-kvar Capacitor		500-kvar Capacitor	
	Normal Range (μf)	Partially Failed Units (μf)	Normal Range (μf)	Partially Failed Units (μf)	Normal Range (μf)	Partially Failed Units (μf)	Normal Range (μf)	Partially Failed Units (μf)	Normal Range (μf)	Partially Failed Units (μf)	Normal Range (μf)	Partially Failed Units (μf)	Normal Range (μf)	Partially Failed Units (μf)
2400	23.00–26.45	> 46.04	46.04–52.95	> 92.08	69.06–79.42	> 138.12	92.08–105.89	> 184.16	—	—	—	—	—	—
2770	17.28–19.87	> 34.56	34.56–39.74	> 69.12	51.84–59.62	> 103.68	69.12–79.49	> 138.24	—	—	—	—	—	—
4160	7.65–8.80	> 15.30	15.32–17.62	> 30.64	22.98–26.43	> 45.96	30.64–35.24	> 61.28	—	—	—	—	—	—
4800	5.75–6.61	> 11.50	11.51–13.24	> 23.02	19.26–19.85	> 34.52	23.02–26.47	> 46.04	—	—	—	—	—	—
6640	3.00–3.45	> 4.50	6.01–6.91	> 9.02	9.02–10.37	> 13.53	12.03–13.83	> 18.05	18.04–20.75	> 27.06	24.06–27.67	> 36.09	30.08–34.59	> 40.00
7200	2.55–2.93	> 3.40	5.11–5.88	> 6.81	7.67–8.82	> 10.22	10.23–11.76	> 13.64	15.34–17.64	> 20.45	20.46–23.53	> 27.28	25.58–29.42	> 34.02
7620	2.28–2.62	> 3.04	4.57–5.26	> 6.09	6.85–7.88	> 9.13	9.13–10.50	> 12.17	13.70–15.76	> 18.27	18.27–21.01	> 24.36	22.84–26.27	> 30.38
7960	2.09–2.40	> 2.79	4.18–4.81	> 5.57	6.28–7.22	> 8.37	8.37–9.62	> 11.16	12.55–14.43	> 16.73	16.74–19.25	> 22.32	20.93–24.07	> 27.84
8320	1.92–2.20	> 2.40	3.88–4.41	> 4.79	5.75–6.61	> 7.19	7.66–8.81	> 9.58	11.50–13.22	> 14.38	15.33–17.63	> 19.16	19.16–22.03	> 23.95
9540	1.46–1.68	> 1.83	2.91–3.35	> 3.64	4.37–5.03	> 5.46	5.83–6.70	> 7.29	8.74–10.06	> 10.93	11.66–13.41	> 14.58	14.57–16.76	> 18.21
9960	1.33–1.53	> 1.66	2.67–3.07	> 3.33	4.01–4.61	> 5.01	5.34–6.14	> 6.67	8.02–9.22	> 10.02	10.69–12.29	> 13.36	13.37–15.38	> 16.71
11400	1.02–1.17	> 1.22	2.04–2.35	> 2.45	3.06–3.52	> 3.67	4.08–4.69	> 4.90	6.12–7.04	> 7.34	8.16–9.39	> 9.79	10.21–11.74	> 12.25
12470	0.85–0.98	> 1.02	1.70–1.96	> 2.04	2.55–2.93	> 3.06	3.41–3.92	> 4.09	5.11–5.88	> 6.13	6.82–7.83	> 8.18	8.53–9.81	> 9.98
13280	0.75–0.86	> 0.87	1.50–1.73	> 1.75	2.25–2.59	> 2.62	3.00–3.45	> 3.50	4.51–5.19	> 5.26	6.01–6.91	> 7.01	7.52–8.65	> 8.80
13800	0.69–0.79	> 0.80	1.39–1.60	> 1.62	2.03–2.39	> 2.42	2.78–3.20	> 3.24	4.17–4.80	> 4.86	5.57–6.41	> 6.50	6.96–7.66	> 8.12
14400	0.63–0.72	> 0.735	1.27–1.46	> 1.48	1.91–2.20	> 2.23	2.55–2.93	> 2.98	3.83–4.40	> 4.47	5.11–5.88	> 5.96	6.40–7.36	> 7.49
15125	—	—	1.16–1.32	> 1.33	1.74–1.98	> 1.99	2.32–2.64	> 2.65	3.48–3.97	> 3.98	4.64–5.29	> 5.30	5.80–6.62	> 6.63
19920	—	—	0.66–0.72	> 0.73	1.00–1.10	> 1.11	1.33–1.47	> 1.48	2.00–2.21	> 2.22	2.67–2.96	> 2.97	3.34–3.70	> 3.71
20800	—	—	0.61–0.66	> 0.77	0.92–1.00	> 1.01	1.23–1.34	> 1.35	1.84–2.01	> 2.02	2.45–2.69	> 2.70	3.07–3.37	> 3.38
21600	—	—	0.57–0.62	> 0.63	0.85–0.93	> 0.94	1.14–1.24	> 1.25	1.70–2.93	> 1.87	2.27–2.49	> 2.50	2.84–3.11	> 3.12
22130	—	—	0.54–0.58	> 0.59	0.81–0.87	> 0.88	1.08–1.17	> 1.18	1.62–1.76	> 1.77	2.17–2.36	> 2.37	2.71–2.36	> 2.96
22800	—	—	0.51–0.54	> 0.56	0.77–0.83	> 0.84	1.02–1.10	> 1.11	1.53–1.66	> 1.67	2.04–2.22	> 2.23	2.55–2.77	> 2.78
23800	—	—	—	—	—	—	0.94–1.02	> 1.03	1.40–1.52	> 1.53	1.87–2.03	> 2.04	2.34–2.54	> 2.55
24940	—	—	—	—	—	—	0.85–0.91	> 0.92	1.28–1.38	> 1.39	2.71–1.84	> 1.85	2.13–2.30	> 2.31

* Normal capacitance ranges are based on a –0 to +15% manufacturing tolerance.

The minimum capacitance value of partially failed capacitors may vary somewhat for earlier capacitor designs. A capacitance meter or a low-voltage bridge can be used to measure the capacitance of all-film capacitors to determine whether or not they have partially failed. The voltage used to test the capacitors with this type of equipment is only a few volts. A failure in an all-film capacitor has a very low impedance even to these low voltages, and as a result, partial failure in an all-film capacitor can be easily identified.

