

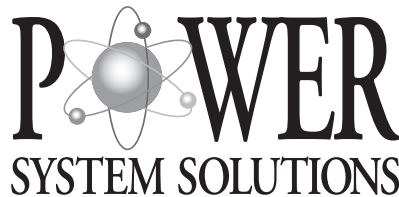
POWER › QUALITY › SOLUTIONS

AUTOMATICALLY SWITCHED  
**Low Voltage Capacitor and  
Harmonic Filterbank Assemblies**

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**Installation, Operating  
and Maintenance Manual**

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**WARNING** Installation, operation and maintenance of this equipment should only be performed under the supervision of a qualified electrical engineer.



**WARNING** Incoming power should be disconnected and the capacitor bank de-energized before making any wiring connections or modifications.

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## **Introduction**

This manual is intended as a general guide for the installation and maintenance of PSS automatically switched low-voltage harmonic filters and capacitor banks.

Outline drawings accompany this manual for installation purposes.

## **Transportation and handling**

Equipment must always be transported in the upright position. The assembly is bolted to a pallet inside a wooden crate for shipping. If a fork lift is used to move the unit, the assembly should be lifted from the rear of the crate.

Lifting eyes are provided on the top of the equipment enclosure, so the assembly may be lifted with a hoist.

The assembly is wrapped with a plastic protector and is reinforced around the controller. Preserve the packaging until the bank is installed.

Upon delivery, check for obvious damage to crating and PSS PF equipment assembly. Check packing list for all components. Any damage or missing items should be filed immediately with the carrier.

If assembly is not installed immediately it should be stored without removing the packaging. Crates should be stored on a level surface in a clean, non-corrosive atmosphere. If the assembly is stored outdoors, the packing should be checked periodically for degradation.

## **Installation and storage**

Perforations in the base of the enclosure allow the equipment to be secured to the floor. Removable lifting eyes are provided on the top of the assembly for carrying and handling the assembly with a crane.

Place the equipment so:

- Natural airflow is not impeded.
- Ambient temperature does not exceed 40°C (104°F).
- Spacing is in compliance with the requirements of 2008 National Electrical Code and all applicable codes.

PSS Capacitors/Harmonic Filters are provided with lugs to receive feeders and grounding conductors. When applying the conductors, the lugs should be checked for proper phase rotation and torque. The equipment should be grounded before handling to assure a charge is not trapped, causing electrical shock to installer.

Conduit, tray and cable size must adhere to 2008 National Electrical Code and local applicable codes.

Capacitor bank and detuned harmonic filterbank enclosures are provided with top, side, or bottom cable entry ports (see Figure 1).




Figure 1

Once unit is in place, make sure the circuit breaker is in the off position. Verify the torque on all electrical connections, and connect the ground to the ground terminals in the assembly.

Verify phase sequence to determine the phases are proper with A, B, and C or 1, 2 and 3. The correct phase sequence is critical for proper operation of Power Factor Correction equipment.

Verify that the current rating of the current transformer can handle the maximum current calculated for the feeder. The transformer should be installed with polarity (P1) toward (facing) the source. The transformer is to be placed on Phase A of the main feeder and physically located between the source and PF correction equipment.

The secondary wires of the current transformer (S1 and S2) are connected to terminals “K” and “L” on the furnished terminal board. Connect the transformer as shown in Figure 2.

 **WARNING** Current transformer terminals must always be shorted during installation or any time the transformer is to be open circuited. To short the current transformer circuit at the shorting block terminals, withdraw the yellow plastic tab and slide the orange toggle lever “K” up.

Connect the incoming cables to the circuit breaker. For proper arrangement and CT placement, see Figure 2.

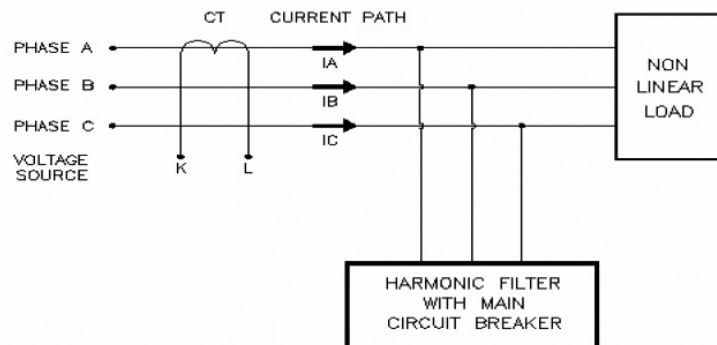


Figure 2

**FUSE DISCONNECTS** The fuse disconnect should be at least 165% of the rated capacitor current.

**CIRCUIT BREAKER** The circuit breaker should be sized at least 135% of the rated capacitor bank current.

**CONDUCTOR AMPACITY** NEC Article 460 specifies that the ampacity of capacitor conductors are to be rated at least 135% of rated capacitor current; 90°C (194°F) cable should be used at its 75°C (167°F) ampacity to serve the Harmonic Filter. The ampacity should be derated as necessary for ambient temperature (See NEC Table 31016).

Verify torque of all terminals (breaker, fuses, contactors, etc.) to make sure they have not loosened during shipment. See the table below.

Bolt Diameter	TPI	ASTM A193 GR B7, B8, B16, B8M bolting and K-500 monel with a bolt stress of 60,000 PSI
1/4	20	14
5/16	18	21
3/8	16	30
7/16	14	45
1/2	13	65
9/16	12	95
5/8	11	135
3/4	10	230
7/8	9	360
1	8	535
1 1/8	8	815
1 1/4	8	1,125
1 3/8	8	1,525
1 1/2	8	1,900
1 5/8	8	2,540
1 3/4	8	3,240
1 7/8	8	4,075
2	8	4,990
2 1/4	8	6,665
2 1/2	8	8,525
2 5/8	8	9,525
2 3/4	8	10,525
3	8	13,760

## **Start up**

To energize the PF correction equipment control circuit, place the control circuit breaker in the “On” position. When the breaker is in this position, all control devices (fans, indication lamps, power factor relay, etc.) will be energized.

The power factor relay will start displaying actual power factor (PF), but will not immediately start connecting capacitance steps. The electrical parameters can be configured within the power factor relay.

To start connecting the capacitor steps, change the power factor relay “Off” mode to “Auto” mode. See the PFR portion of this manual to perform this step.

Power factor relay parameters, such as minimum and maximum power factor and time delays, are preprogrammed at the factory. All parameters can be changed in the field as needed.

The power factor relay has control contacts to activate or deactivate alarms. Check manual to use contact option. For input sensing, the relay accepts a signal from field current transformers with a 5-amp secondary.



## **Maintenance**

Power factor correction equipment requires occasional maintenance. Contact PSS Field Services for annual preventative maintenance assistance. Current measurements should be taken on incoming phases to verify the equipment has not lost any capacitance and/or does not have any blown fuses.

There will be some effects from increased heating or dust getting into the unit. Regular inspection is recommended.

- Check regularly for blown fuses and replace the blown fuse immediately with identical or equivalent parts.
- Check the cooling fans regularly for proper operation.
- Clean the dust filters and clean dust off the equipment in the unit.

## Troubleshooting

Stepped capacitance will not follow facility loading curves under the following conditions:

- The power factor relay is in the “Off” position instead of “Auto.”
- Power factor relay adjustments are not correct. Verify the power factor and number of steps.
- The current transformer is not connected properly. Check the polarity, proper phase placement and confirm current transformer is installed on the line side of the capacitor bank.

If the power factor relay indicates there are disconnected or skipped steps:


- The relay may not be detecting the step. Verify the contactor is functioning and the fuses and capacitors are not blown.
- Check the wiring to the contactor.

If the equipment is found without control power:

- Check the primary control fuses and secondary fuses.
- Check disconnect or circuit breaker.

If alarm function activates although everything seems to be functioning properly:

- A high reactive power demand will activate the alarm circuit until this condition is corrected.
- Check the primary control fuses.
- The target power factor is set higher than the harmonic filter/ capacitor bank was designed to achieve.



If the equipment shows all steps are on but the power factor does not change:

- The current transformer has been installed on the load side of the capacitor bank. The transformer must be placed on the line side of the capacitor bank.

If the power factor relay doesn't turn on:

- Check the control circuit breaker and fuses for proper functioning.

### **Fuse Blowing**

Harmonic filterbank/capacitor bank fuses may blow for many reasons. Switching spikes, lightning strikes or other electrical disturbances may cause fuse failures. However, frequent fuse blowing indicates a more serious problem. Your system's harmonics may cause frequent fuse and capacitor failure. Please contact PSS field services (501) 327-6456 for assistance if this occurs.