



# LOW VOLTAGE CAPACITORS FOR POWER FACTOR CORRECTION

VOLTAGE RATING max. 1000 V

INSTRUCTIONS FOR INSTALLATION, USE AND SERVICE

**Grid Solutions Ltd.**

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Author: T. Rinne

Updated: T. Rinne

Acceptor: J. Kotiniitty

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Reg.no: KOSS OM00001

## Grid Solutions Ltd.

Kaapelikatu 3  
 P.O. Box 4  
 FI-33331 Tampere  
 Finland  
 Tel.: +358 3 3883 11  
 Fax: +358 3 3883 360  
 E-mails: name.surname@ge.com  
 www.ge.com

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## CAUTION

Before installing, using or servicing capacitors, read this manual through carefully.

The purpose of this manual is to ensure that Grid Solutions Ltd. low-voltage power capacitors for power factor correction are installed, used and serviced safely and correctly in the intended operating and ambient conditions.

## 1. CONSTRUCTION

Grid Solutions Ltd. low-voltage capacitors with voltage ratings ranging from 220V to 1000V are composed of dry, all-plastic (metallized polypropylene) elements. Capacitors feature a complex protection system provided by the self-healing design of capacitor elements, the internal protection of every individual element, and the dry, incombustible filling of the steel enclosures of capacitors (N-series is without filling).

Standard capacitors are equipped with internal discharge resistors connected between the capacitor terminals which decrease any residual DC charge (max.  $\sqrt{2}$  x rated voltage) to 75 V in three minutes after the capacitor has been switched off (according to standard IEC 60831-1). Automatically controlled capacitor bank without blocking reactors application requires shorter discharge time, 50V in 1 min, then external discharge resistor set or electronic discharge device must be added to the capacitor terminals.

Capacitors are constructed and tested in accordance with IEC 60831-1&2 (2014) and have CE marking.

## 2. MAIN FEATURES

Frequency rating 50 Hz or 60 Hz.

Indoor installation only.

Capacitor losses  $\leq 0,4$  W/kvar (with internal or external discharge resistors).

Operation temperature range is

-40..+50°C (category C) or -5..+55°C (category D), but the time of high temperature is limited according to IEC 60831-1 standard as follows:

	category C (L-series unit)	category D (N-series unit)
max. ambient-air temp.	+50°C	+55°C
24 hours mean max.	+40°C	+45°C
1 year mean max.	+30°C	+35°C

Higher temperature is harmful to the capacitor. If there are other conditions, contact the manufacturer.

### Capacitance tolerances:

-5 to +10 % for units and banks up to 100 kvar

-5 to +5 % for units and banks above 100 kvar

### Maximum permissible voltages:

Capacitor units are suitable for operation at voltage levels

1,1×Un continuously

1,2×Un max 5 min

1,3×Un max 1 min

### Maximum permissible currents:

Capacitor units are suitable for operation at a r.m.s. current of 1,3×rated current continuously.

## 3. AMBIENT CONDITIONS

Capacitors shall be placed so that there is adequate dissipation by convection and radiation of the heat produced by the capacitor losses. Overheating shortens the capacitor service life, so it is important that the capacitors operate as cool as possible.

In networks where harmonics are generated, do not use capacitor units without de-tuning or filter reactors. Capacitors may amplify the current and voltage harmonics, which may result in damages to the capacitors or the whole system, or possibly even in bodily injury.

Harmonics are generated e.g. by DC drives, inverter drives, UPS equipment, arc furnaces, electric filters, different discharge lamps and arc welding equipment.

Improper use of capacitors may cause the warranty to drop. Grid Solutions Ltd. provides detailed instructions for capacitor use on request.

## 4. INSTALLATION

Check that no damage was caused to the capacitors during transport.

When installing individual capacitors, make sure to handle with care the external discharge resistors (if any) and terminal assembly. After installation, check the condition of the external discharge resistors and their distance from voltage-carrying and earthed parts.

Connection to the terminal can be done by (recommendation):

- Cable lugs (N-series, please refer to figure 1. on p. 7)
- Cable lugs (L-series, please refer to figure 2. on p. 7)
- Flat bus bars

In all connections avoid excessive mechanical stress to the terminal assembly.

Tighten the terminal nuts with a torque of:

- Bolt M6: 5 Nm (N-series)
- Bolt M8: 12-14 Nm (L-series)
- Bolt M12: 15-18 Nm (L-series, special terminal models)

If no torque wrench is available, tighten the nut until the spring washer straightens out. A too high torque will cause damage to the terminal assembly.

The capacitor enclosure must always be earthed. When earthing is made by means of the mounting lugs, always use paint-breaking contact washers under retaining screws and nuts to ensure earthing.

Check all connections and protections before energising of capacitors.

## 4.1 Fuses and connection cables

### Notice local safety codes and instructions.

When dimensioning the connection cable and protective fuses, consider the following facts:

For fixed capacitor banks (except detuned models) the rated value of main fuse shall be at least  $1,7 \times$  rated current of the bank to carry the high inrush current

For automatically controlled capacitor banks (except de-tuned models) the rated value of main fuse shall be at least  $1.5 \times I_n$  rated current of the bank. One step banks are dimensioned as fixed banks

In de-tuned capacitor banks the iron core reactors are reducing the switching peak currents and thus lower over dimensioning factor can be used than above

The connection cable of the capacitor shall be dimensioned to correspond the fuse values, taking into account the national rules/electrical codes.

In filter capacitor banks the connection cable and fuse shall always be dimensioned case by case.

## 5. SERVICE

Correctly installed capacitors are practically service-free; only periodical checks are required. The first check shall take place 2 to 3 months after commissioning, e.g. re-tensioning of cable joints. After that the capacitors shall be checked at intervals of about one year, e.g. during other periodical service.

After switching off the capacitors, wait at least five minutes to allow the capacitor to discharge through the discharge resistors. Then short-circuit the capacitor terminals with an isolated tool and connect the capacitors to earth. Capacitors must always be earthed when there is somebody working in their immediate vicinity. When working on an individual capacitor, make sure the capacitor terminals are short-circuited and connected to the enclosure. This is especially important if the capacitor is damaged.

### To be checked

Check all wire and bus bar connections.  
Check terminal plastic parts and clean if necessary.  
Check the condition of the external discharge resistors (if any) and their distance from voltage-carrying parts.

Measure capacitor capacitances with a capacitance meter if possible. It is also advisable to record the results of every periodical measurement.

Make a visual inspection to the capacitors. Should a capacitor enclosure show mechanical damages, signs of overheating, etc. indicating an electrical fault inside, replace the capacitor.

After the capacitors have been switched off and earthed, feel about the capacitor enclosures to determine their surface temperature. A very warm enclosure may be a sign of:

- Overload of capacitor caused by harmonics, overvoltage, etc.
- Electrical damage and consequent increase in capacitor loss

**In case of overheating always find out the cause.**

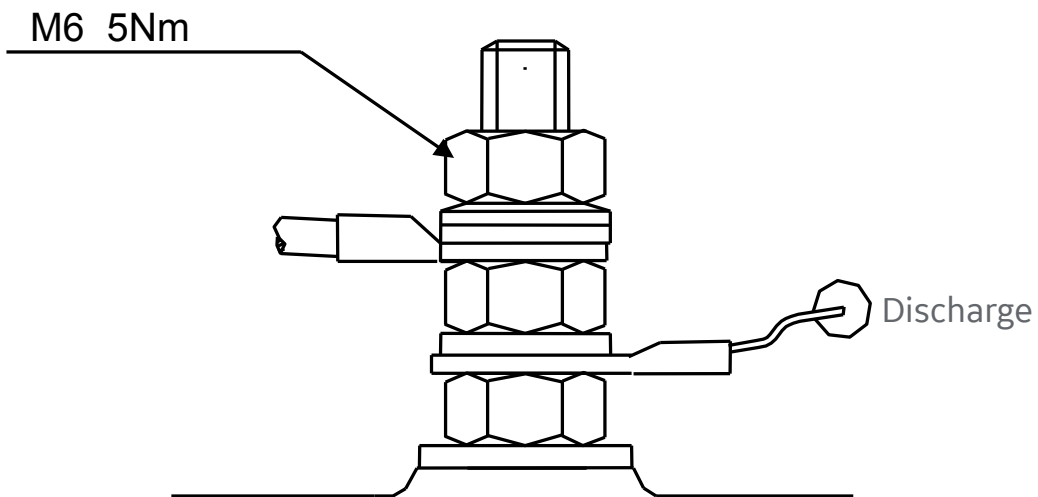
## 6. ENVIRONMENT AND RECYCLING

**Product package:** Wooden palette, cardboard box and package plastic (04 PE-LD) can be reused or burnt to gain energy.

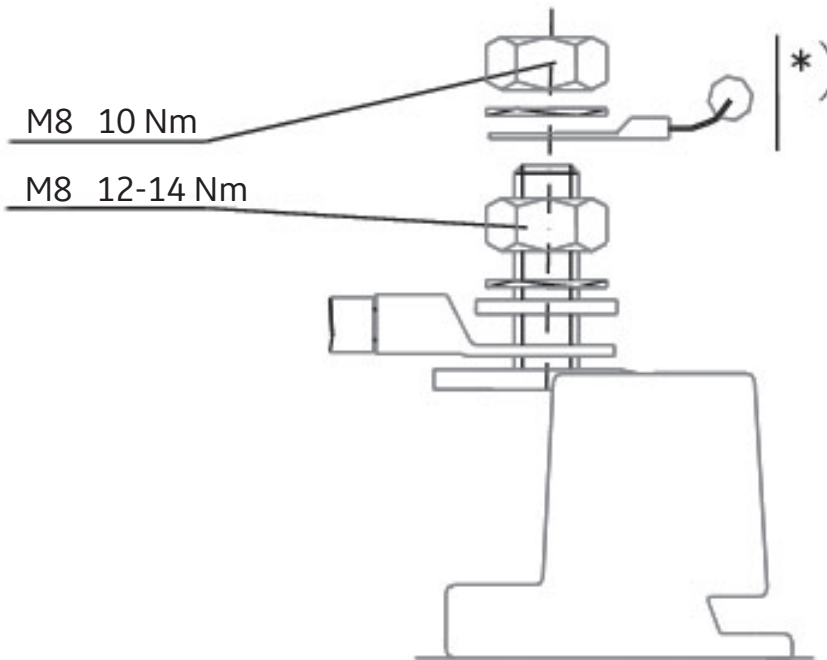
**Product disposal:** Dry, all-plastic low voltage capacitors do not contain any impregnating liquids and can hence be disposed of according to the local regulations.

Metal parts can be sorted out and recycled.

## Connection to the terminal:



**Figure 1.** Terminal nut torque for N-series capacitor units.



**Figure 2.** Terminal assembly and nut torques for L-series capacitor units.

\*) If external discharge resistors are used, remove resistors while connecting cables.

### CAUTION

Handle discharge resistors with care while removing and fixing them.