



## Re-forming of DC-bus Electrolytic Capacitors Following Extended Storage

Application Guide AP04014006E

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### Capacitors

Cutler-Hammer® brand adjustable frequency drives from Eaton's electrical business utilize large aluminum (Al) electrolytic capacitors in their DC section. Aluminum electrolytic capacitors are commonly used due to the fact that they have very good capacitance values relative to their canister volume. They also have a high ripple current capacity.

In normal operation, the leakage current of the capacitors is low due to a dielectric aluminum oxide layer (forming) on the aluminum foil. If capacitors are stored for a long period of time without an applied voltage, the aluminum oxide layer loses its homogenous nature. As a result, when a voltage is applied, a high leakage current can result that can damage the capacitor. This is a typical feature of all aluminum oxide type capacitors and is not dependant on the manufacturer. With Cutler-Hammer adjustable frequency drives, this means that the capacitors, charging resistors, rectifiers, etc., could be damaged if the unit is powered without proper forming of the capacitors.

### Re-forming of the Capacitor Following a Long Storage Period

#### A) Capacitors installed in adjustable frequency drives

Often, adjustable frequency drives are stored for extended periods of time without being powered, for example, distributor stock or customer spares. **The re-forming of the capacitors in these units should be done at least once a year.** This can be done by applying the required voltage to the unit and keeping it applied for a minimum of one hour.

If more than one year has elapsed since the unit was last energized, the re-forming of the capacitors must be done in a manner that limits the possibility of a high leakage current passing through the capacitors. The best solution to re-form the capacitors is to use a DC power supply with an adjustable current limitation. The current limit, for example, can be set for 300 to 500 mA. The DC power supply is connected directly to the +/- terminals of the DC bus or directly to the terminals of capacitors. For SV9000 compact models that have no DC bus terminal connections, due to their built-in chopper circuit, a different procedure is recommended. For compact frame size M3, the DC supply is connected between two of the input phases. For compact frame sizes M4b and M5b, the DC supply is connected to the +/- terminals located on the power board. The power board is located under the control board. These terminals should be accessible without having to remove the control board.

The DC voltage is adjusted up to the nominal DC voltage level of the unit ( $1.35 \cdot U_n$  ac) and should be maintained for at least 1 (one) hour.

If a DC power supply is not available and the unit has been stored de-energized for longer than one year, consult your Eaton sales representative before connecting the power.

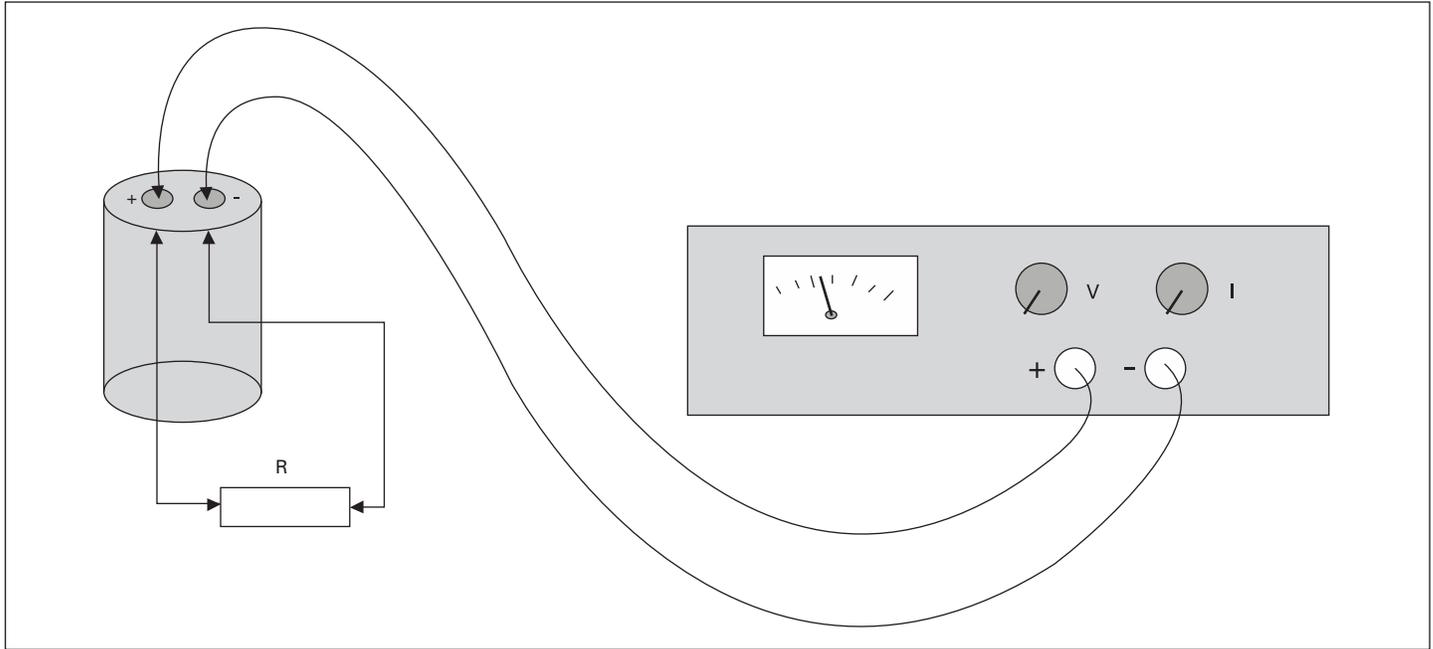
## B) Loose spare capacitors

A loose, spare capacitor that is known to have been sitting de-energized for over one year is best re-formed prior to installation in the adjustable frequency drive. For loose capacitors, the DC supply current limit is set between 50 and 100 mA. The DC voltage is set to the rated value for the capacitor. Progress of the capacitor's re-forming can be monitored using the current meter on the DC power supply. Even though the leakage current may stabilize sooner, it is still recommended to keep the capacitor energized for at least one hour.

### Warning

**Due to high leakage resistance, a dangerous voltage can remain in the capacitors for a long period of time. For safety reasons, discharge the capacitors after re-forming them by using a resistor.**

If re-forming of a capacitor is not done prior to their installation in an adjustable frequency drive, then refer to Section A of this document for the proper re-forming procedure.



**FIGURE 1. RE-FORMING OF LOOSE CAPACITOR USING AN ADJUSTABLE DC-SUPPLY**

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