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ABB LOW VOLTAGE AC DRIVES, WIND TURBINE CONVERTERS AND SOLAR INVERTERS

# **Converter modules with electrolytic DC capacitors in the DC link**

## Capacitor reforming instructions



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## **Further information**





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# Introduction

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## Contents of this chapter

This chapter describes the applicability, target audience and purpose of this manual and safety instructions.

## Applicability

This manual applies to converter modules which have electrolytic DC capacitors in the DC link. The subsections below list the converter module types and product series in more detail for each product area. All converter module types are referred to as converter or converter module in this manual.

**Note:** A drive module is used in all connection diagrams. The connection principle is the same for the other converter module types as well but the terminal markings can vary.

### ■ ABB low voltage AC drives

This manual applies to drive, inverter, IGBT supply and three-phase brake modules in product series ACS800, ACS850, ACQ810, ACSM1, ACS380, ACH480, ACS480, ACH580, ACQ580, ACS580 and ACS880, that is, the following module types:

- ACS800-01, -11, -31, -02, -04, -104 and -104LC
  - ACS850-04
  - ACQ810-04
  - ACSM1-04 and ACSM1-204
  - ACS380
  - ACH480
  - ACS480
  - ACH580-01, -04, -31 and 34
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- ACQ580-01, -04, -31 and -34
- ACS580-01 and -04
- ACS880-01, -04, -11, -31, -14, -34 and -104.

## ■ ABB wind turbine converters

This manual applies to line-side converter modules and generator-side converter modules in product series ACS800-67LC, ACS800-77LC, ACS800-87LC and ACS800N-87LC.

**Note:** ACS800-67 and ACS800-77 modules include film capacitors in the DC link instead of electrolytic capacitors. The film capacitors do not need to be reformed.

## ■ ABB solar inverters

This manual applies to solar inverter modules in product series PVS800-57 and PVS800-57B.

## Target audience

You are expected to know the standard electrical wiring practices, electronic components, and electrical schematic symbols.

## Purpose of the manual

The manual provides information needed for reforming the converter module capacitors.

## Safety instructions



**WARNING!** Obey the safety instructions delivered with the converter and given in this manual. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do electrical installation or maintenance work.

1. **Drives:** Never work on the converter, motor cable or motor when input power is applied. After you have disconnected the input power, always wait for 5 minutes to let the intermediate circuit capacitors to discharge before you start to work on the converter, the motor or motor cable.  
**Wind turbine converters:** Never work on the converter or generator when input power is applied. After you have disconnected the input power, always wait for 10 minutes to let the intermediate circuit capacitors discharge before you start to work on the converter, generator or generator cable.  
**Solar inverters:** Do not do work on the photovoltaic generator or the inverter or its input or output cables when the inverter is connected to an electrical power system or to the photovoltaic generator. After you have disconnected the inverter, always wait for 5 minutes to let the intermediate circuit capacitors discharge before you continue.
  2. Measure that the installation is de-energized.
    - Use a multimeter with an impedance of at least 1 Mohm.
    - Make sure that the voltage between the converter input power terminals (U1, V1 and W1) and the grounding terminal (PE) is close to 0 V.
    - Make sure that the voltage between the drive DC terminals (UDC+ and UDC-) and the grounding terminal (PE) is close to 0 V.
  3. Never switch on the converter power supply while the reforming circuit is connected. Lock the disconnecter (if any) to an open position.
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4. Make sure that the converter is clean and dry (no condensation) before you start the reforming.
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# Reforming the capacitors

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## Contents of this chapter

This chapter contains the instructions on how to reform the converter capacitors. It contains three alternative methods.

## Overview of the reforming

Electrolytic DC capacitors in the converter module DC link need to be reformed (re-aged) if the module has been non-operational for a year or more. The reforming time depends on how long the converter has been non-operational and on the converter module type. Without reforming, the capacitors can get damaged when the converter starts to operate.

If the converter has been non-operational for less than one year, the capacitors do not need reforming.

Besides the reforming methods presented in this manual, ABB can supply you with ready-made reforming devices, such as FINERO FST-DCP 1500-05 and FUG HCK 800-2000. For more information, contact your local ABB representative.

## Reforming time

The intermediate circuit (DC link) of the converter is connected to its nominal voltage for the reforming time to “wake up” the capacitors. The diagram below shows the required reforming time.

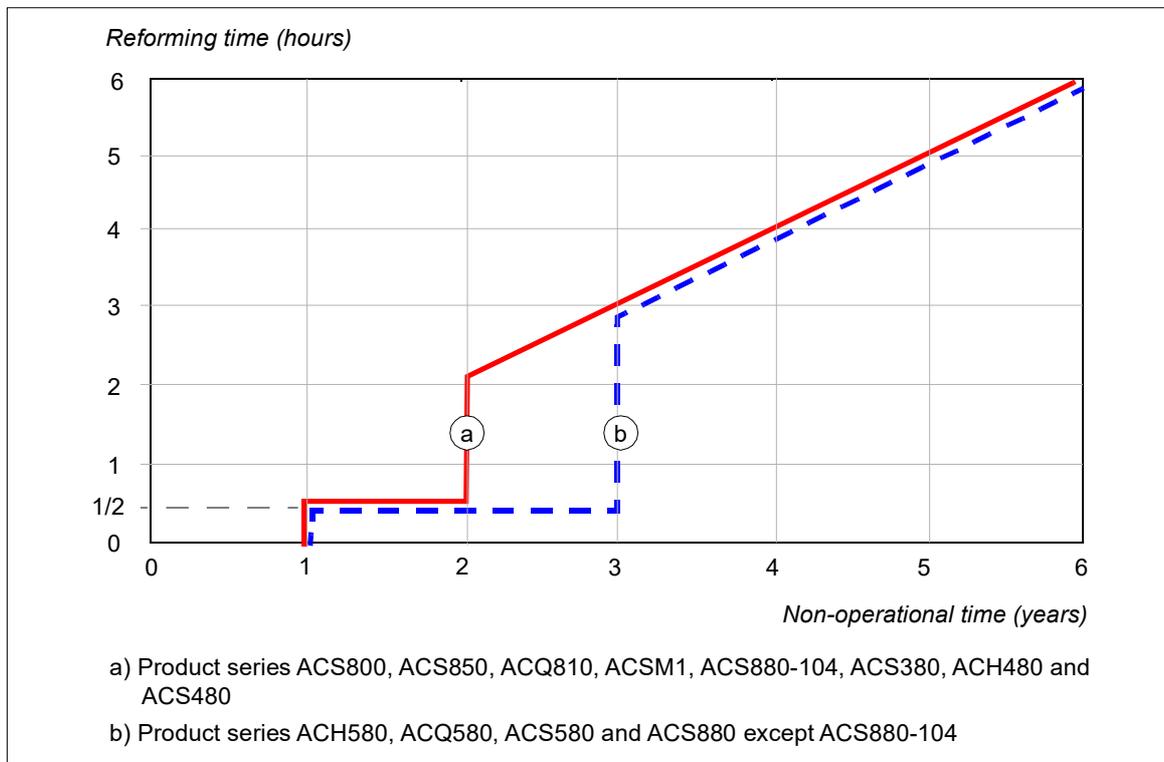
If the converter has been stocked (non-operational) for one to two years (graph a), it can be reformed with power on for 30 minutes method.

If the converter has been stocked (non-operational) for one to three years (graph b), it can be reformed with power on for 30 minutes method. See section [Reforming with power on for 30 minutes](#) on page 11.

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If the non-operational time has been more than two (graph a) or three (graph b) years, reform the converter using the method in section [Reforming with external DC power supply](#) on page 11 or [Reforming with external diode bridge](#) on page 13.



## Checking the converter age

The converter serial number defines the week when the converter was manufactured:

- 7 digits: For example, in 3260034, 3 denotes manufacturing year (2003), 26 manufacturing week and 0034 running manufacturing number.
- 8 digits: For example, in 14250125, 1 denotes manufacturing country (1 = Finland), 4 manufacturing year (2004), 25 manufacturing week and 0125 running manufacturing number.
- 10 digits: For example, in 1173200725, 1 denotes manufacturing country, 17 manufacturing year (2017), 32 manufacturing week and 00725 running manufacturing number.

## Reforming with power on for 30 minutes

This method can be used for capacitor reforming if the converter has been stocked (non-operational) for one to two years (product series ACS800, ACS850, ACQ810, ACSM1, ACS880-104, ACS380, ACH480 and ACS480) or for one to three years (product series ACH580, ACQ580, ACS580 and ACS880 except ACS880-104).

1. Switch the power on to the converter for 30 minutes.
2. Do not load the converter while the reforming is ongoing.

The converter “wakes up” its capacitors on its own, after which it is ready for use.

## Reforming with external DC power supply

This method can be used for capacitor reforming if the converter has been stocked (non-operational) for two years or longer (product series ACS800, ACS850, ACQ810, ACSM1, ACS880-104, ACS380, ACH480 and ACS480) or for three years or longer (product series ACH580, ACQ580, ACS580 and ACS880 except ACS880-104).



**WARNING!** Obey the safety instructions in section [Safety instructions](#) on page 6.

If you ignore them, injury or death, or damage to the equipment can occur. Never switch on the converter power supply while the reforming circuit is connected.

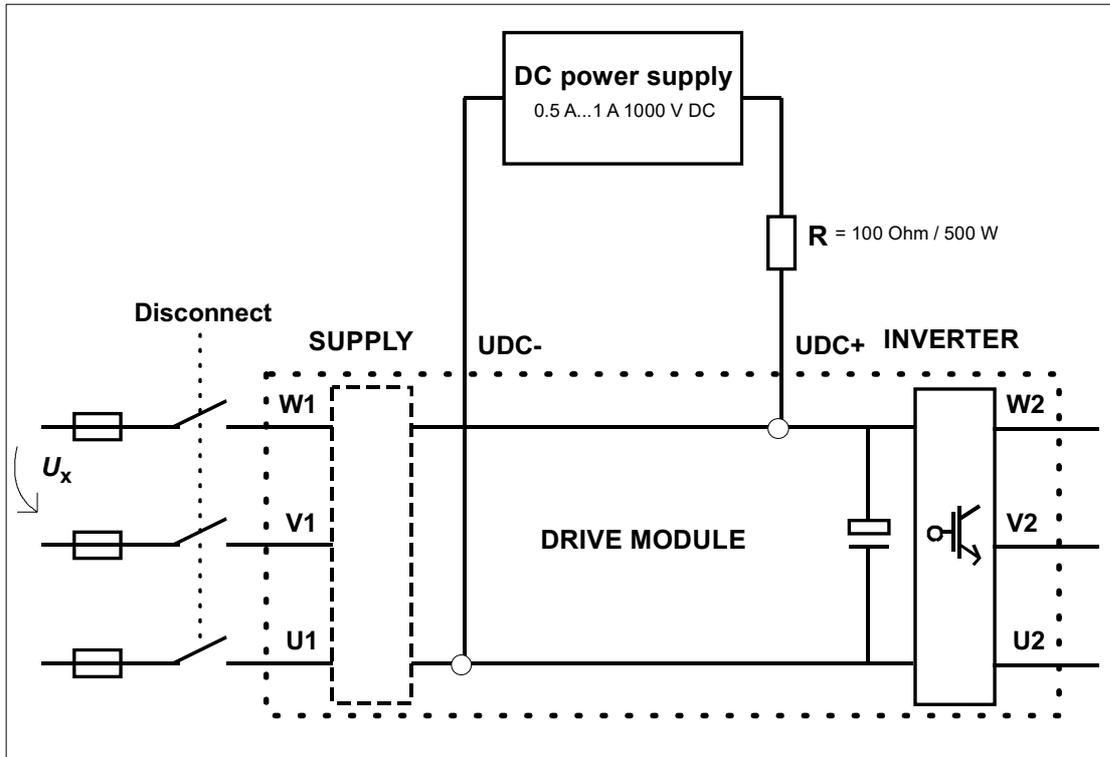
Lock the disconnecter (if any) to an open position.

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1. Make sure that the converter module is disconnected from all possible power sources (all AC and DC inputs/outputs are disconnected).
  2. Measure that the installation is de-energized:
    - Use a multimeter with an impedance of at least 1 Mohm.
    - Make sure that the voltage between the converter input power terminals (U1, V1 and W1) and the grounding terminal (PE) is close to 0 V.
    - Make sure that the voltage between the converter DC terminals (UDC+ and UDC-) and the grounding terminal (PE) is close to 0 V.
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3. Make this reforming circuit and connect it to the DC terminals of the converter module. An external resistor is not needed if the DC power supply has an adjustable current limiter.



4. Switch on the reforming circuit for the time defined in section [Reforming time](#) on page 9.

**Note:** Limit the reforming current to max. 500 mA. If the DC power supply does not have an adjustable current limiter, increase the voltage gradually from 0 to the full scale value. Regulated DC power with active current limiting:

- Output current: 0.5...1 A DC, max. 500 mA during reforming
- Output voltage: adjustable 0...1000 V DC. An appropriate voltage during reforming is  $1.35 \dots 1.45 \cdot U_x$ .  $U_x$  denotes the nominal AC voltage of the converter.



**WARNING!** The capacitors can get damaged if you use excessive DC voltage during the reforming.

5. Switch off the reforming circuit.
6. Wait for 5 minutes (10 minutes for wind turbine converters) to let the converter DC capacitors discharge.
7. Measure that the voltage of the DC terminals of the converter is close to 0 V.
8. Disconnect the reforming circuit from the converter.

## Reforming with external diode bridge

This method can be used for capacitor reforming if the converter has been stocked (non-operational) for two years or longer (product series ACS800, ACS850, ACQ810, ACSM1, ACS880-104, ACS380, ACH480 and ACS480) or for three years or longer (product series ACH580, ACQ580, ACS580 and ACS880 except ACS880-104).



**WARNING!** Obey the safety instructions in section [Safety instructions](#) on page 6. If you ignore them, injury or death, or damage to the equipment can occur. Never switch on the converter power supply while the reforming circuit is connected.

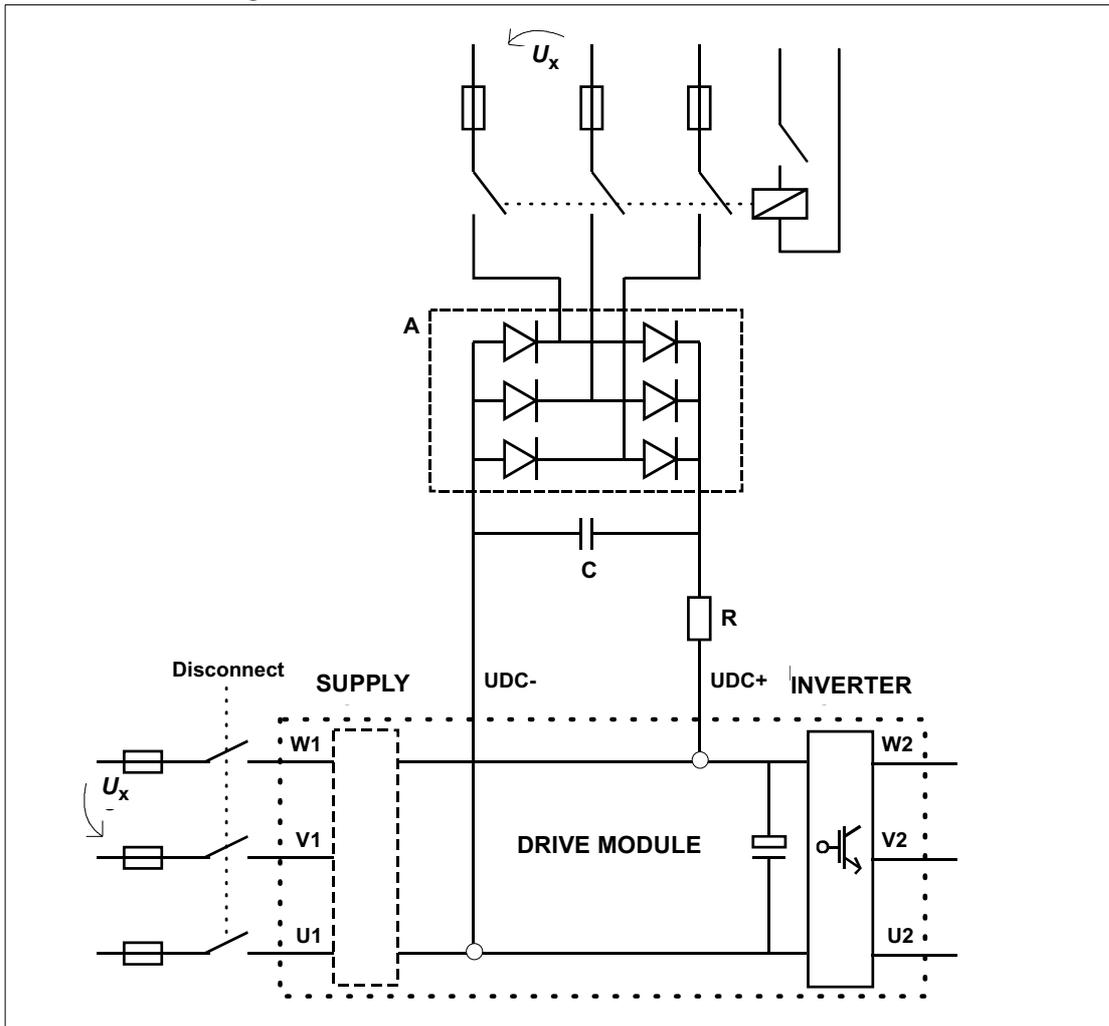
Lock the disconnecter (if any) to an open position.

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1. Make sure that the converter module is disconnected from all possible power sources (all AC and DC inputs/outputs are disconnected).
  2. Measure that the installation is de-energized:
    - Use a multimeter with an impedance of at least 1 Mohm.
    - Make sure that the voltage between the converter input power terminals (U1, V1 and W1) and the grounding terminal (PE) is close to 0 V.
    - Make sure that the voltage between the converter DC terminals (UDC+ and UDC-) and the grounding terminal (PE) is close to 0 V.
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3. Make this reforming circuit and connect it to the DC terminals of the converter module.



Voltage	Recommended components		
	A	R	C
$200\text{ V} < U_x < 240\text{ V}$	SKD 82/16	220 Ohm / 700 W	22 nF / 2000 V
$380\text{ V} < U_x < 415\text{ V}$	SKD 82/16	220 Ohm / 700 W	22 nF / 2000 V
$380\text{ V} < U_x < 500\text{ V}$	SKD 82/16	470 Ohm / 1200 W	22 nF / 2000 V
$525\text{ V} < U_x < 690\text{ V}$	SKD 82/16	680 Ohm / 1700 W	22 nF / 2000 V

4. Switch on the AC power supply of the reforming circuit for the time defined in section [Reforming time](#) on page 9.
5. Switch off and disconnect the AC power supply of the reforming circuit.
6. Wait for 5 minutes (10 minutes for wind turbine converters) to let the converter DC capacitors discharge.
7. Measure that the voltage of the DC terminals of the converter is close to 0 V.
8. Disconnect the reforming circuit from the converter.

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# Further information

## **Product and service inquiries**

Address any inquiries about the product to your local ABB representative, quoting the type designation and serial number of the unit in question. A listing of ABB sales, support and service contacts can be found by navigating to [abb.com/searchchannels](http://abb.com/searchchannels).

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