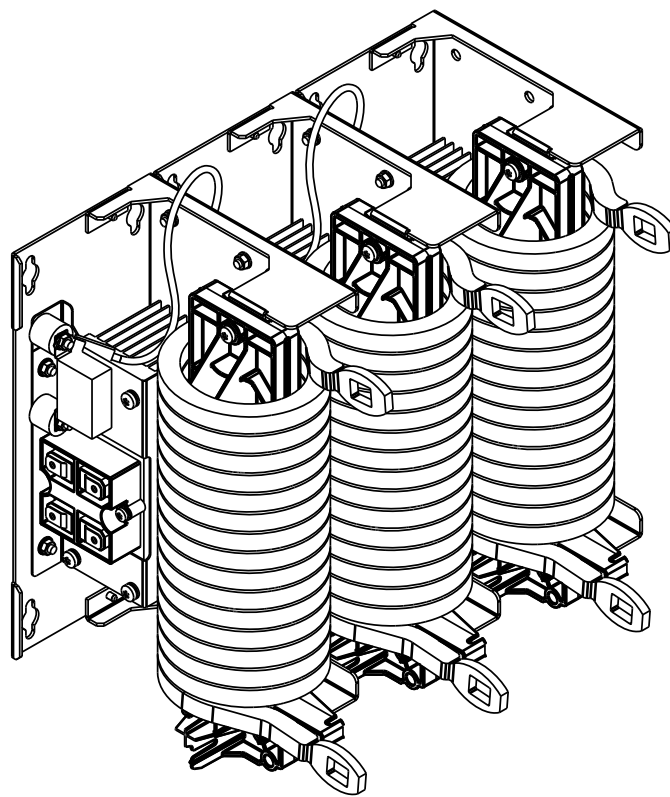


ABB drives

Hardware manual
du/dt filter
BOCH-0350A-7



du/dt filter
BOCH-0350A-7

Hardware manual

3AXD50000019720 Rev B
EN
EFFECTIVE: 2016-01-05

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About this manual

Contents of this chapter

The chapter describes the manual in short.

Applicability

This manual is applicable to BOCH-0350A-7 du/dt filters.

Target audience

The manual is intended for people who select, plan the installation, install, commission and use the du/dt filter. Read the manual before working on the filter. The reader is expected to know the fundamentals of electricity, wiring, electrical components and electrical schematic symbols.

Safety

Only qualified electricians are allowed to install, commission and maintain the du/dt filter.

The complete safety instructions for the drive/inverter are given in the drive hardware manual or separate safety instructions manual (*ACS880 multidrive and multidrive modules safety instructions* (3AUA0000102301 [English])). Read and follow the complete safety instructions before working on the drive/inverter.

The following instructions are intended for all who install and service the du/dt filter. Ignoring the following instructions can cause physical injury or death, or damage to the equipment.



WARNING!

- Ground the filter to the protective earth (PE) terminal of the cabinet. No separate grounding conductor is needed if there is proper galvanic connection through the filter fixing screws, conductive metallic fixing base and the PE busbar of the cabinet.
 - Beware of hot surfaces. The surface temperature of the du/dt filter can exceed 150 °C (302 °F) during operation. After the operation, let the filter cool off for two hours before working on it.
 - Ensure sufficient cooling. See chapter [Installation](#).
-

Operation principle

Contents of this chapter

The chapter describes the operation of the du/dt filter and the intended use.

Operation principle

The drive/inverter employs modern IGBT inverter technology. Regardless of the frequency, the drive/inverter output comprises pulses of approximately the drive/inverter DC bus voltage with a very short rise time. The pulse voltage can almost double at the motor terminals, depending on the attenuation and reflection properties of the motor cable and the terminals. This can cause additional stress on the motor and motor cable insulation.

Modern variable speed drives/inverters with their fast rising voltage pulses and high switching frequencies can generate current pulses that flow through the motor bearings, which can gradually erode the bearing races and rolling elements.

There are optional *common mode filters* and *du/dt filters* available for the ABB drives. The common mode filters mainly reduce bearing currents. The du/dt filters also protect the motor insulation system.

To avoid damage to motor bearings and insulation system:

- Select and install the cables according to the instructions given in the hardware manual.
- Check if the installation needs to be equipped with additional protection equipment, such as insulated N-end bearings in the motor, or drive/inverter output filters. The requirements are specified in the drive/inverter hardware manual and for ACS880, in *ACS880 multidrive cabinets and modules electrical planning instructions* (3AUA0000102324 [English]).

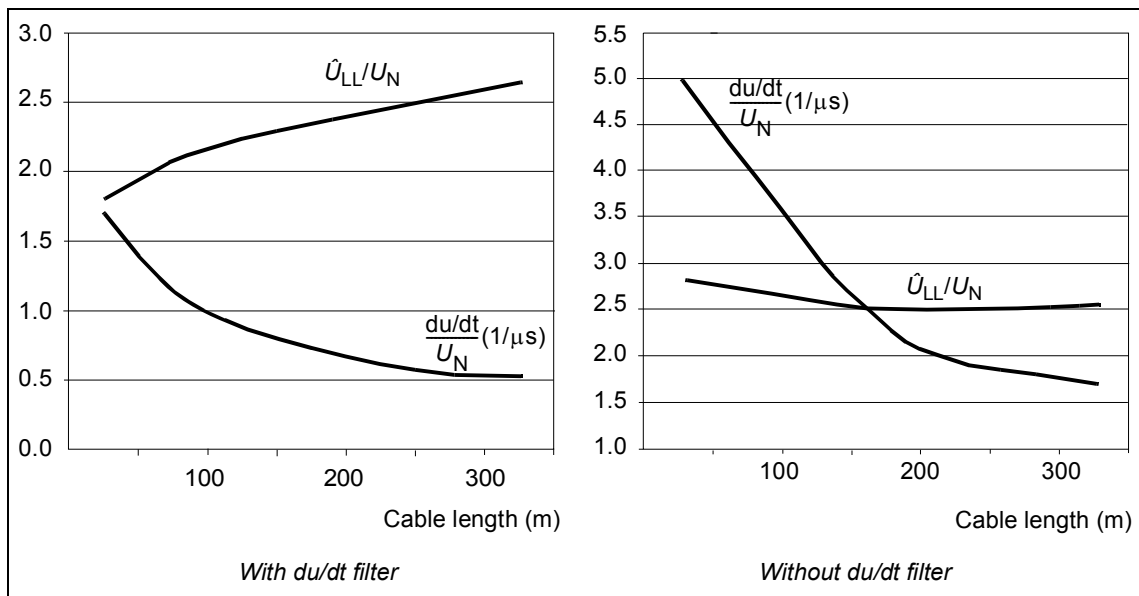
Graphs illustrating the effect of the du/dt filter

The graphs show the peak line-to-line voltage (\hat{U}_{LL}) and voltage change (du/dt) at the motor terminals as a function of the motor cable length. \hat{U}_{LL} and du/dt are scaled to the nominal line-to-line voltage (U_N). To calculate the actual peak voltage value in volts and du/dt value in volts per microsecond, multiply the values of the graph by the supply voltage (U_N).

The values in the first graph are measured with an ABB du/dt filter while the second graph shows a system without output filtering. The values in the second graph are only representative. The actual unfiltered du/dt values depend on the drive/inverter type, and are usually in the range of 1 to 5 kV/microsecond.

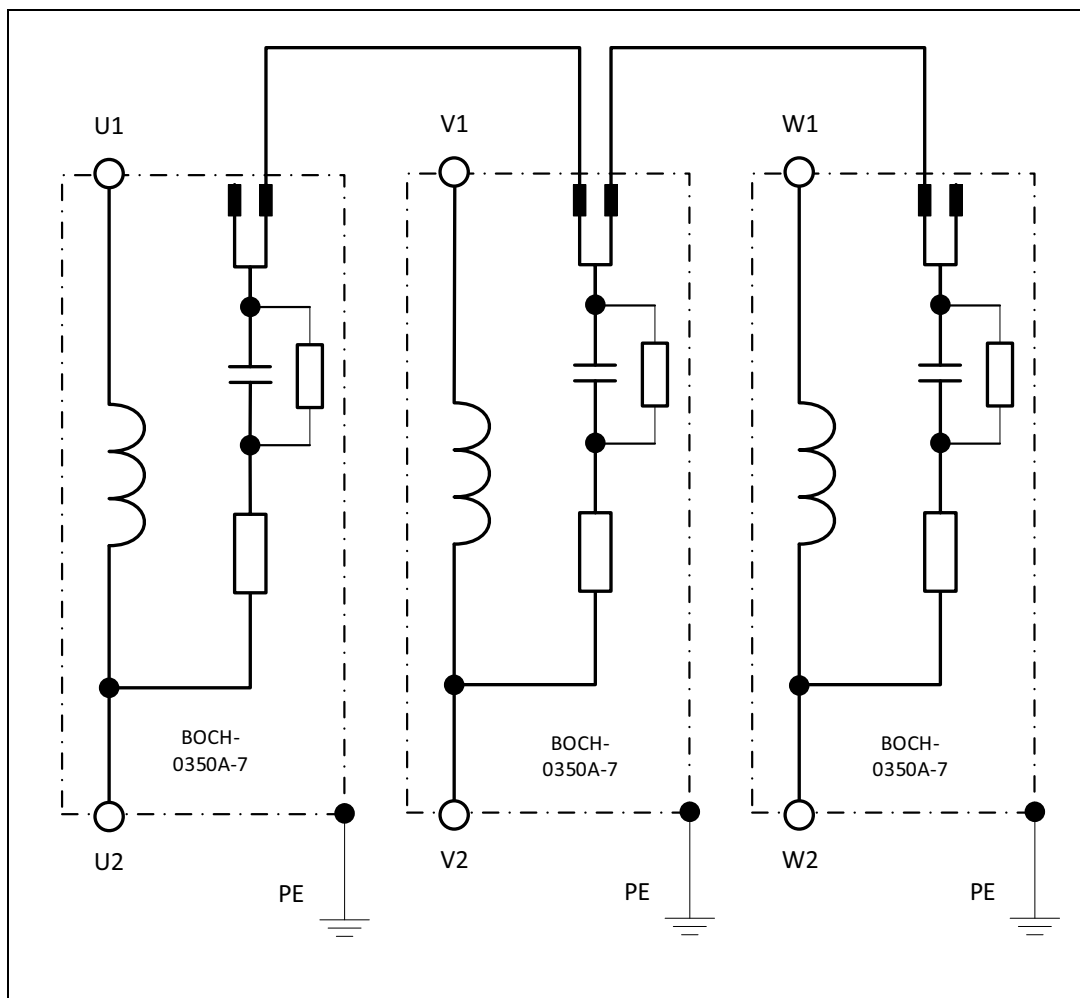
If the drives/inverters have an IGBT supply unit or resistor braking, the \hat{U}_{LL} and du/dt values are approximately 20% higher.

The voltage rise time can be calculated as follows: $\Delta t = 0.8 \cdot \hat{U}_{LL}/(\text{du/dt})$.



Overview diagram

This figure shows a circuit diagram of the BOCH-0350A-7 du/dt filter. The three-phase filter consists of identical single-phase parts that the installer must put together in the field: each part has a choke and a snubber circuit.



Selecting the du/dt filter

Contents of this chapter

The chapter instructs in selecting a du/dt filter for your drive/inverter.

Filter selection procedure

Step	What to do	More information
1.	Check whether a du/dt filter is needed in the installation.	The requirements are specified in a separate planning instructions or a drive/inverter hardware manual. ¹⁾
2.	Pre-select a filter according to the drive/inverter type.	Filter selection tables are in the drive/inverter hardware manual. The pre-selected filter is suitable for most applications.
3.	Check that the pre-selected filter is suitable for your application.	Use the pre-selected filter.

¹⁾ The data can be found either in an appropriate drive/inverter hardware manual, or in *ACS880 multidrive cabinets and modules electrical planning instructions* (3AUA0000102324 [English]). The PDF files are available on request.

Installation

Contents of this chapter

The chapter contains mechanical and electrical installation instructions.

Warnings and restrictions



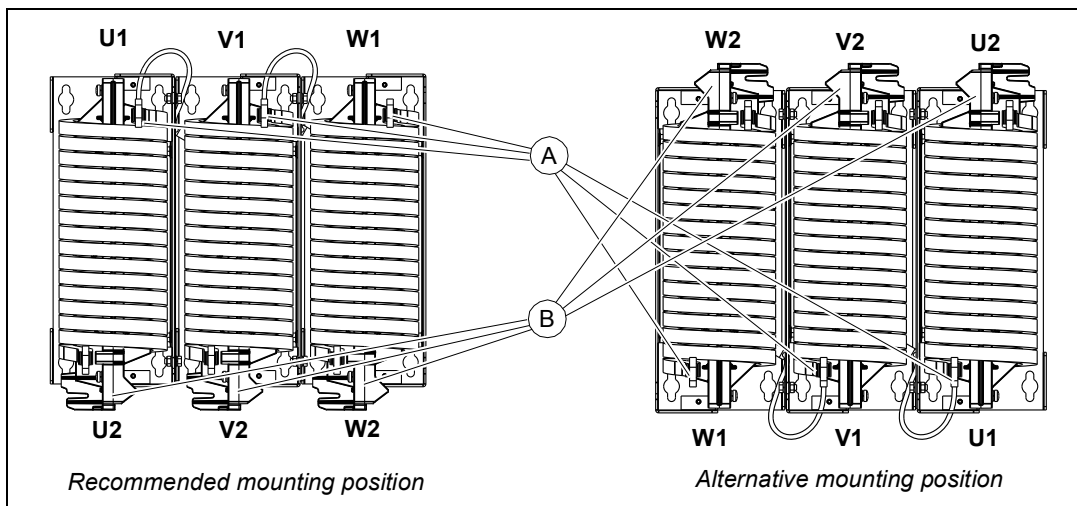
WARNING! Never work on the drive/inverter, motor cable or motor when main power is applied. After disconnecting the input power, always wait for 5 minutes to let the intermediate circuit capacitors discharge before you start working on the drive, motor or motor cable. Check with a multimeter that the drive/inverter is in fact discharged before beginning work.

- Encase the non-enclosed (IP00) filters to meet the safety requirements (for cabinet installation solely).
- Use a shielded cable between enclosures.
- Mount the filter on a mounting structure that is of non-flammable material and strong enough to carry the weight of the filter.

Planning the installation

See chapter *Technical data* for allowed ambient conditions, maximum cable length between the drive/inverter output and the filter, maximum motor cable length and other technical data.

See chapter *Dimension drawings* for the dimensions. The filter can be mounted in an upright position with the output terminals down or up. Other mounting positions are possible with an extra fan.



A	Input terminals
B	Output terminals

Mounting plate

Make sure any cross-members or shelves on which components are mounted are properly grounded and the connecting surfaces left unpainted. The structure must be of non-flammable material and strong enough to carry the weight of the unit.

Encasing

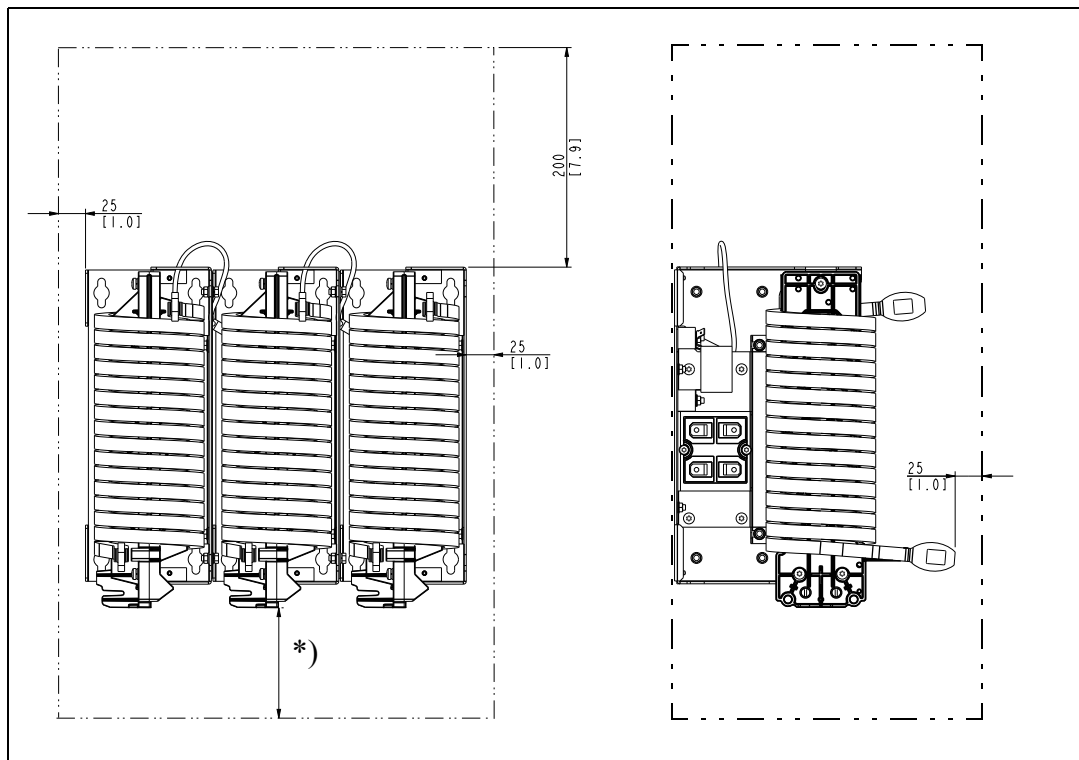
The unprotected (IP00) filter must be encased or placed in a cabinet.

Electrical connections

When the filter and drive module are in the same cabinet, we recommend busbars for connecting the drive/inverter output to the filters. If cables are used, they must be rated for at least 105 °C (221 °F). If the filter is not installed in the same cabinet as the drive/inverter, shielded symmetrical cable must be used between the drive/inverter cabinet and the filter enclosure.

Free space around the filter

Free space is required around the unit for natural convection cooling as shown. With forced cooling, less free space is required.



*) Space required for the cabling

Clearance distances from the input and output terminals and coil surfaces

Clearance distances from the input and output terminals and coil surfaces must be at least 15 mm (0.59 in.). Pay attention to the local regulations.

Note: Due to high temperature of the coil surfaces during operation, route the motor cables at least 50 mm (1.97 in.) away from the coil surfaces and secure them appropriately.

Cooling

The filter cools with no extra fan when you install it in the inlet cooling air flow of the drive/inverter module, that is, the filter is below the drive/inverter module in the same cabinet. If filters are located elsewhere, it is essential that equal airflow is arranged for filters. The rate of the airflow is 2 m/s (6.56 ft/s). The fans must be monitored. The space above the filter is hot (up to 70 °C [158 °F] depending on the installation and operating conditions). Take this into account in the cabinet design.

Tightening torques

The following table applies to grade 8.8 screws with or without joint compound.

Screw size	Torque	
	N·m	lbf·ft
M5	3.5	2.6
M6	9	6.6
M8	20	14.8
M10	40	29.5
M12	70	51.6
M16	180	132.8

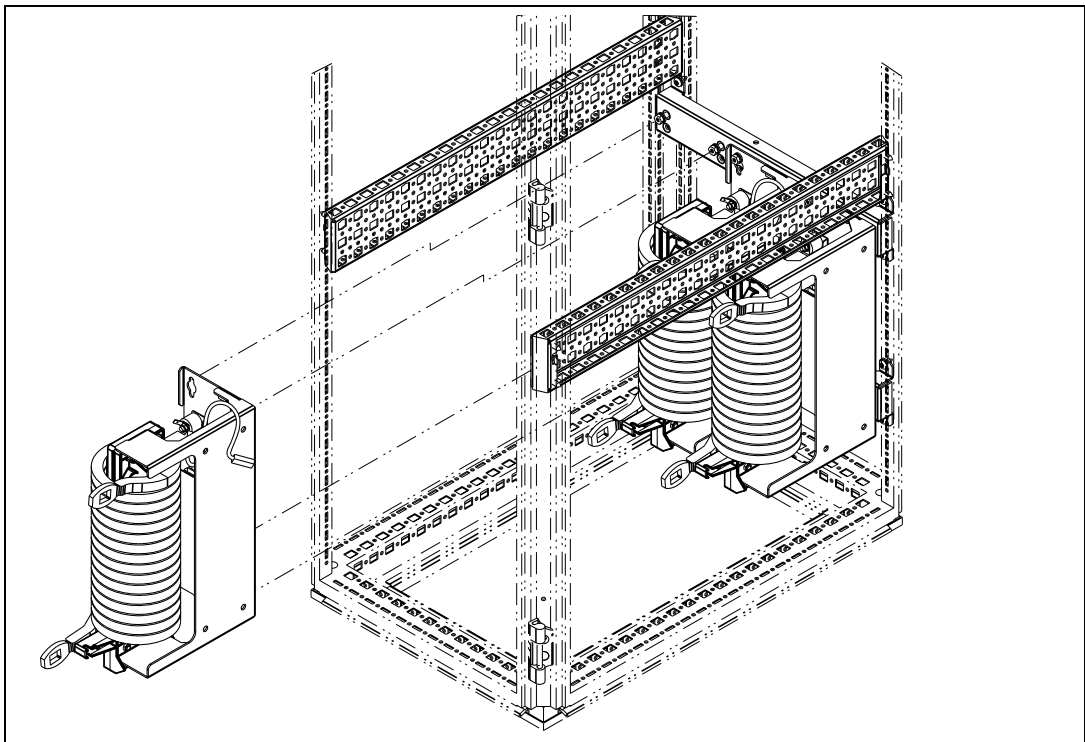
Mechanical installation



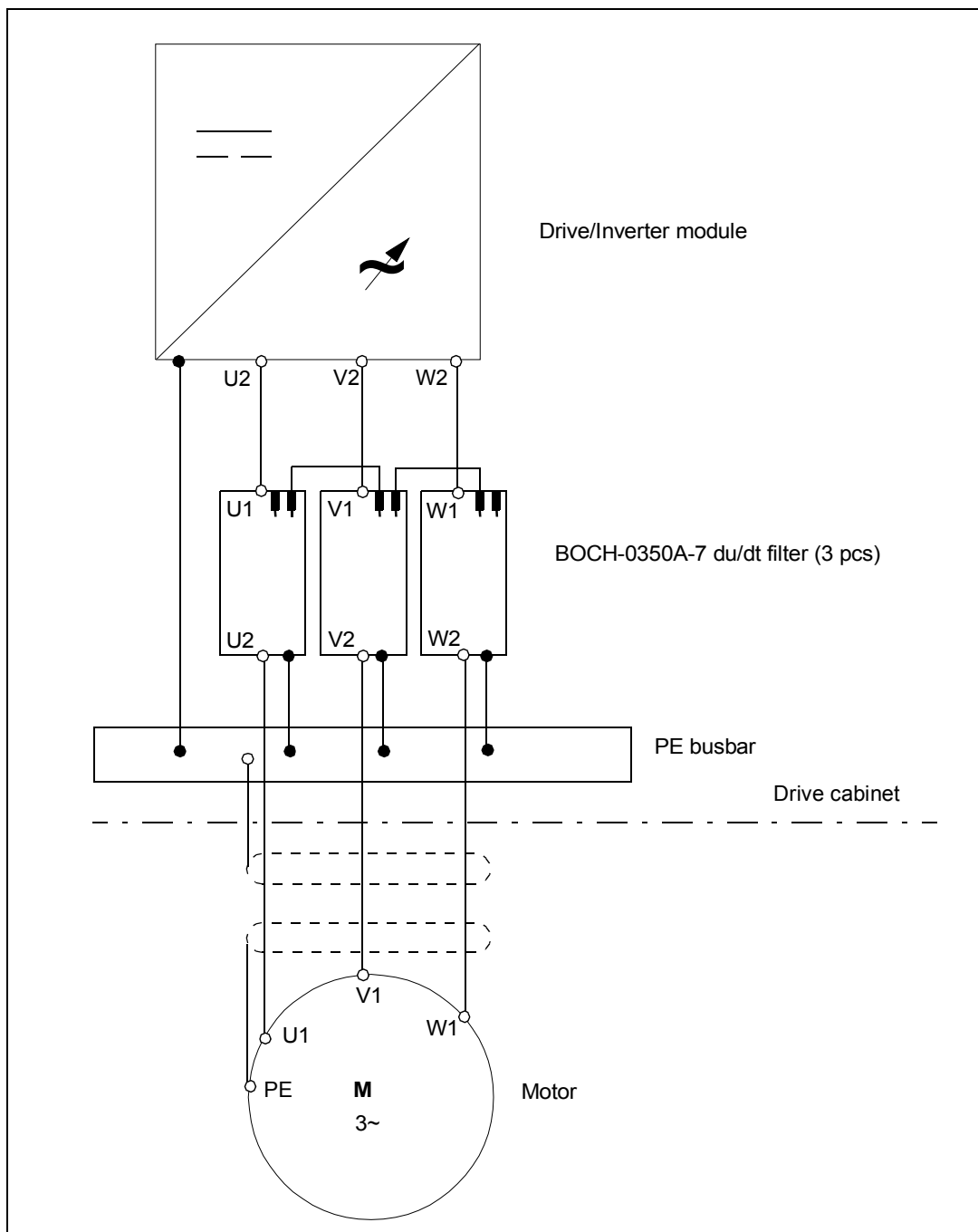
WARNING! Never work on the drive/inverter, motor cable or motor when main power is applied. After disconnecting the input power, always wait for 5 minutes to let the intermediate circuit capacitors discharge before you start working on the drive, motor or motor cable. Check with a multimeter that the drive/inverter is in fact discharged before beginning work.

Lift the filter by the lifting holes to the installation position. Fasten each filter with four screws according to the assembly instructions. Make sure that a proper galvanic connection is achieved by removing paint from support mechanics and the cabinet frame if necessary. See also the inverter HW manual.

The figure shows an installation example of the filter in the Rittal TS 8 enclosure.



Electrical installation



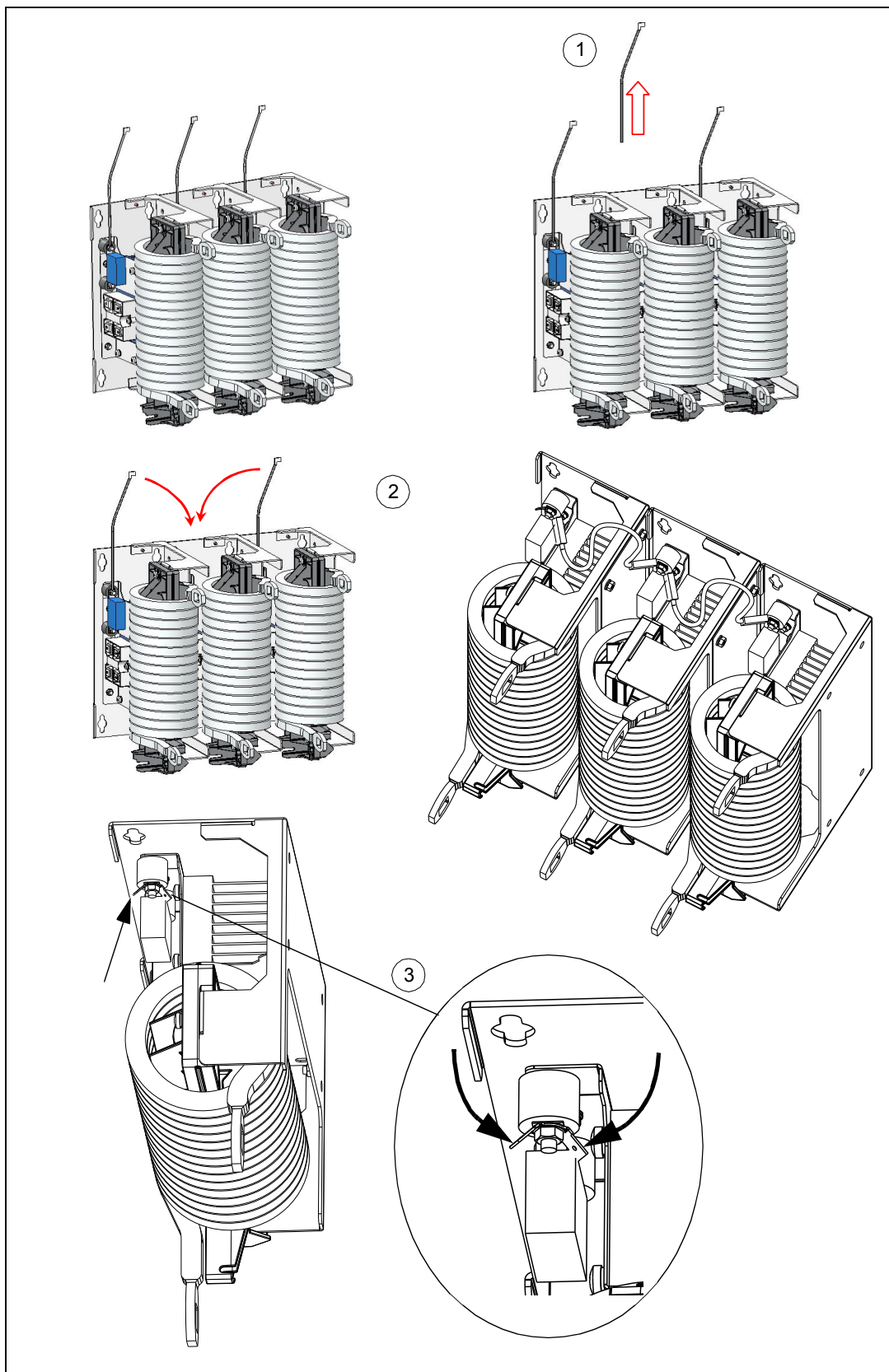
Grounding



WARNING! The filter is grounded through the four fastening screws to its mounting base. Ensure that the mounting base has a proper connection to the nearest grounding (PE) busbar/terminal. If that is not the case, use a separate grounding conductor between the filter frame and the PE busbar/terminal.

Wiring the snubber circuit

1. Remove the wire from the filter in the middle.
2. Connect snubber circuit wires of the first and last filter to the filter in the middle.
3. Make sure that the connector receptacles do not touch the frame of the next filter. If needed bend the blades of the connectors inwards.



Connecting input terminals U1, V1, W1 and output terminals U2, V2, W2

The input terminals (U1, V1, W1) and output terminals (U2, V2, W2) of the filter are made of aluminum. Use cable lugs suitable for aluminum busbars and joint grease to avoid corrosion and to ensure good electrical connection. The oxide layer must be scrubbed off from the contact surfaces before applying the grease. It is recommended

- to use the screws included in the delivery
- to retighten the connections 30 minutes after their installation.

Strain relief of cables

Secure the cables mechanically.

Start-up

Contents of this chapter

This section describes the start-up settings of a drive with a du/dt filter. The settings are valid for the ACS880 primary control program.

Parameter settings

Make the following drive parameter settings before starting up a drive equipped with a du/dt filter:

1. Set parameter 95.20 HW options word 1, bit 13 (du/dt filter activation) to Active (1). The setting forces the drive fan to full speed, and limits the maximum switching frequency.

Technical data

Contents of this chapter

This chapter contains the technical specifications of the du/dt filter and its installation.

Ratings

Input voltage (U_1): 380 ... 500 VAC 3-phase $\pm 10\%$, 380 ... 690 VAC 3-phase $\pm 10\%$.

Ratings, weights and maximum cable sizes:

Filter type	BOCH-0350A-7
Ordering code	3AXD50000018892 (includes three filters with mounting accessories and instructions)
U_N (V)	690
I_N (A)	350
Power loss (W)	550 (maximum power loss at I_N)
Weight (kg, lb)	16 (35)
Maximum motor cable size in mm²	3x240
Output connection size	M12
Input connection size	M12

3AXD000000601909

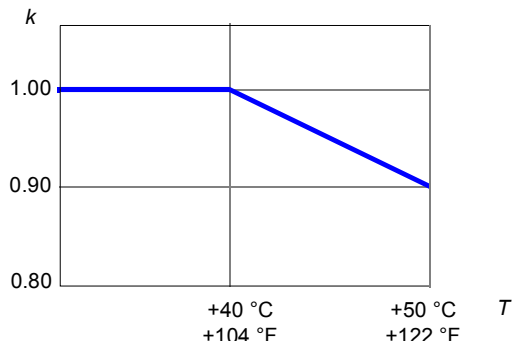
Note: Values are for three single-phase filters

Derating

The load capacity (current and power) decreases if the installation site altitude exceeds 1000 metres (3281 ft), or if the ambient temperature exceeds 40 °C (104 °F).

Temperature derating

In the temperature range +40 °C (+104 °F) to +50 °C (+122 °F), the rated output current is derated 1% for every added 1 °C (1.8 °F). The output current is calculated by multiplying the current given in the rating table by the derating factor.



Example If the ambient temperature is 50 °C (+122 °F), the derating factor is $100\% - 1 \frac{\%}{^{\circ}\text{C}} \cdot 10^{\circ}\text{C} = 90\%$ or 0.90. The output current is then $0.90 \cdot I_{\text{thmax}}$. For I_{thmax} .

Altitude derating

For altitude derating, see the drive/inverter hardware manual.

Connection data

Maximum drive/inverter output frequency: 200 Hz

Maximum allowed average switching frequency:

4.5 kHz (converter units with supply voltage < 500 V) or

3 kHz (converter units with supply voltage > 500 V)

Change the switching frequency with a drive/inverter parameter. For the ACS880 drive, set parameter 95.20 (13) Du/dt filter activation to value 1. **Note:** These switching frequency values are valid from ACS880 primary control program version 2.3x.

Maximum cable length between the drive/inverter output and the filter: 3 m (9.84 ft)

Maximum motor cable length: 300 m (984.25 ft).

Protection classes

Degree of protection: IP00

Applicable standards and markings

EN 60204-1, EN 60529, EN 61800-3, EN 50178, CE marking, UL approved insulation system, cUL approval pending.

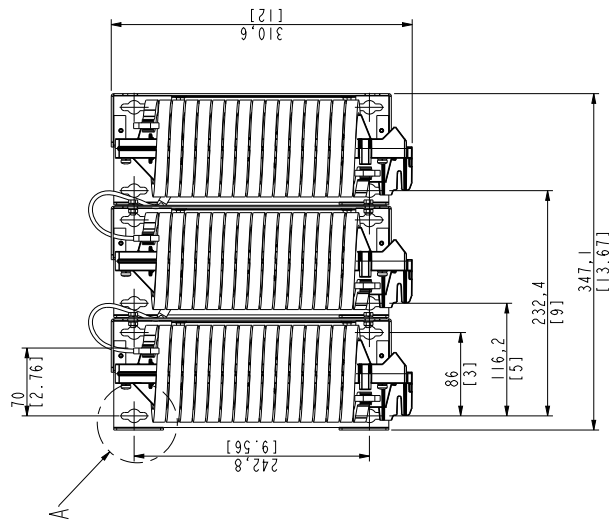
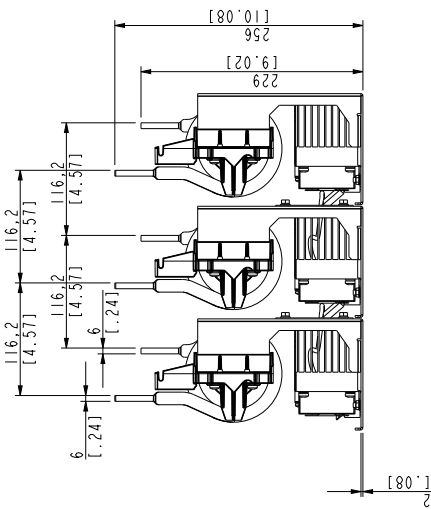
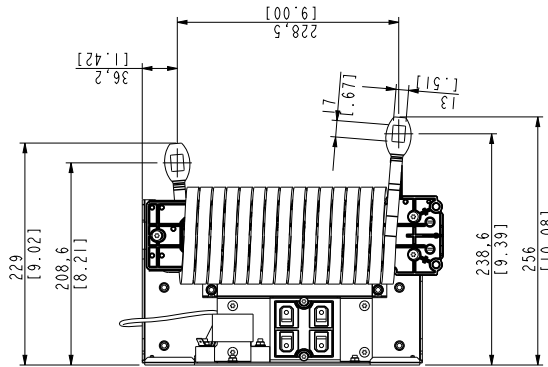
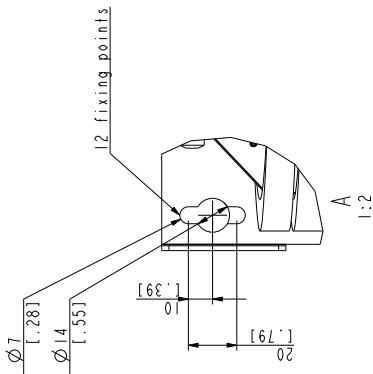
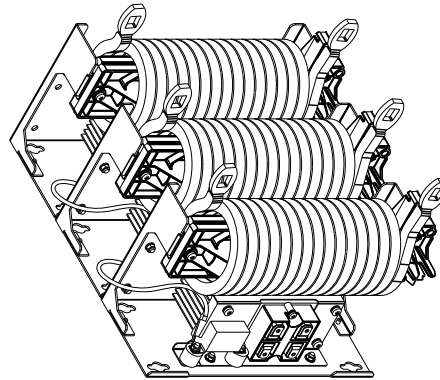
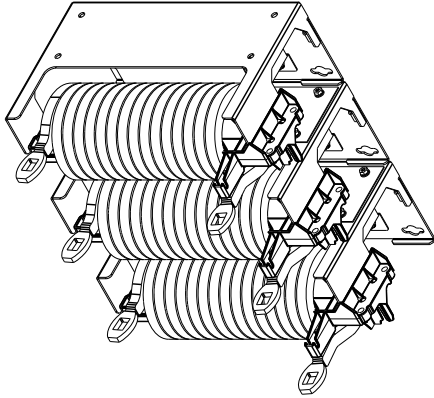
Ambient conditions

See the drive/inverter HW manual.

Dimension drawings

The dimensions are given in millimetres and [inches] below.

BOCH-0350A-7



3AXD5000019556

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 www.abb.com/searchchannels.

Product training

For information on ABB product training, navigate to new.abb.com/service/training.

Providing feedback on ABB Drives manuals

Your comments on our manuals are welcome. Navigate to new.abb.com/drives/manuals-feedback-form.

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