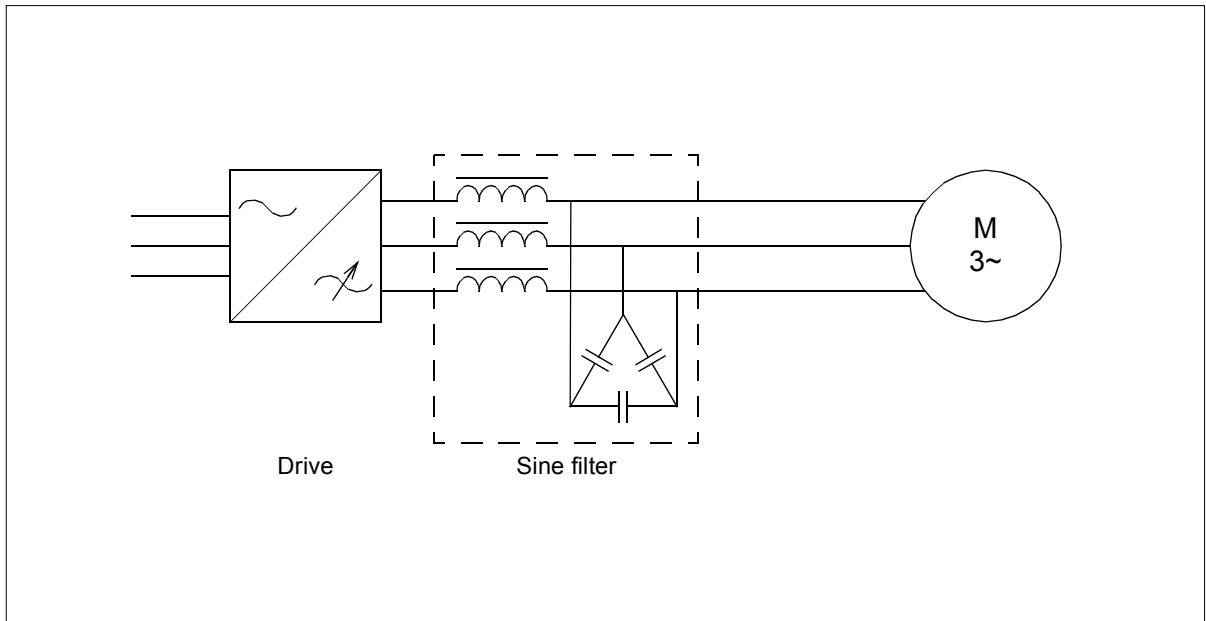


# Hardware manual

## Sine filters



## List of related manuals

- Drive hardware manuals
- Drive firmware manuals

You can find manuals and other product documents in PDF format on the Internet. See section [Document library on the Internet](#) on the inside of the back cover. For manuals not available in the Document library, contact your local ABB representative.

# Hardware manual

## Sine filters

Table of contents



Installation



Start-up





# Table of contents

---

## 1. Introduction to the manual

Contents of this chapter .....	7
Applicability .....	8
Compatibility .....	8
Safety instructions .....	8
Target audience .....	9
Quick reference guide .....	9
Epcos filters .....	9
NSIN filter kits by ABB .....	10

## 2. Hardware description

Contents of this chapter .....	11
Operation principle .....	11
Voltage drop .....	12
Output frequency .....	12
Peak voltage .....	12
Bearing currents .....	12
Selecting a filter for a drive .....	13
Construction of the Epcos filters .....	13
Degree of protection and housings of the filters .....	13
Layout drawing .....	14
Overview diagram .....	15
Construction of the NSIN filter kits by ABB .....	16
Contents of the filter kits .....	16
Layout drawing .....	16
Overview diagram .....	16

## 3. Installation

Contents of this chapter .....	17
Mechanical installation guidelines .....	17
General guidelines .....	17
Guidelines for Epcos filters .....	18
Guidelines for NSIN filter kits by ABB .....	18
Electrical installation guidelines .....	19
General guidelines .....	19
Temperature monitoring .....	19
Guidelines for Epcos filters .....	20
Guidelines for NSIN filter kits by ABB .....	20
Connection diagram – Epcos filters .....	21
Connection diagram – NSIN filter kits by ABB .....	21

## 4. Start-up

Contents of this chapter .....	25
Parameter settings .....	25

---



## 5. Maintenance

Contents of this chapter .....	27
Maintenance intervals of NSIN filter kits by ABB .....	27
Replacing cooling fan of NSIN0485-6 .....	28
Replacing cooling fan of NSIN0900-6 and NSIN1380-6 .....	28

## 6. Technical data

Contents of this chapter .....	29
Epcos filters .....	29
NSIN filter kits by ABB .....	29
Dimensions .....	30
Ambient conditions .....	30

## 7. Drawings

Contents of this chapter .....	31
Dimensions of Epcos filters .....	31
Dimensions of choke modules in ABB filter kits .....	32
Choke module NSUL0485-6 .....	32
Choke module NSUL0900-6 .....	33
Choke module NSUL1380-6 .....	34
Dimensions of AC capacitors in ABB filter kits .....	35
AC capacitor B32373A8606J050 .....	35
AC capacitor B32373A8826J050 .....	36
AC capacitor E62.R16-603C60 .....	37
AC capacitor E62.P24-803C60 .....	38
Dimensions of cooling fans in ABB filter kits .....	39
Cooling fan W2E200-HH38-06 .....	39
Cooling fan D4E225-CC01-56 .....	40
Layout drawing examples – NSIN filter kit installation .....	41
NSIN0485-6 installation example .....	41
NSIN0900-6 installation example .....	42
NSIN1380-6 installation example .....	43

## Further information

Product and service inquiries .....	45
Product training .....	45
Providing feedback on ABB Drives manuals .....	45
Document library on the Internet .....	45





# 1

## Introduction to the manual

---

### Contents of this chapter

This chapter describes the contents of the manual and gives some general information.

---

## Applicability

This manual is applicable to NSIN0485-6, NSIN0900-6 and NSIN1380-6 sine filter kits by ABB and the Epcos sine filters listed in the table when used with ABB low voltage AC drives.

Epcos sine filter	
B84143V0004R229	B84143V0040R230
B84143V0006R229	B84143V0056R230
B84143V0011R229	B84143V0092R230
B84143V0016R229	B84143V0130S230
B84143V0025R229	B84143V0207S230
B84143V0033R229	B84143V0006R231
B84143V0050R229	B84143V0007R231
B84143V0066R229	B84143V0012R231
B84143V0075R229	B84143V0038R231
B84143V0095R229	B84143V0043R231
B84143V0162S229	B84143V0064R231
B84143V0230S229	B84143V0077R231
B84143V0390S229	B84143V0091R231
B84143V0010R230	B84143V0145R231
B84143V0018R230	B84143V0209S231
B84143V0026R230	B84143V0249S231

## Compatibility

For compatibility of the filters and filter kits with drives and inverter units, see the applicable drive or inverter unit hardware manual.

## Safety instructions



**Warning!** Read the safety instructions for the drive, and obey them when you install the filter, do the start up or do work with an installed filter. See the drive hardware manual or the separate safety instructions manual. Ignoring the instructions can cause physical injury or death, or damage to the equipment



**Warning!** Before working on the filter: disconnect the drive and the filter from the power line.



- wait for 5 minutes to let the filter discharge.
- make sure by measuring that the filter is not powered and that the fan of the filter kit (NSIN by ABB) is switched off.
- let the filter cool down before starting any maintenance work. The filter (IP00) is hot when it is in operation. Ignoring the instructions can cause physical injury.



## Target audience

This manual is intended for people who plan sine filter installation, install it, or do the start up of a drive with a sine filter.

You are expected to know the fundamentals of electricity, wiring, electrical components and electrical schematic symbols.

The manual is written for readers worldwide.

## Quick reference guide

### ■ Epcos filters

This table shows where you can find information on the filters.

Task/Item	See ...
General information on the sine filters	<i>Hardware description</i> on page 11
Construction of the sine filters	<i>Construction of the Epcos filters</i> on page 13 Filter data sheets. (Go to <a href="http://en.tdk.eu/">http://en.tdk.eu/</a> .)
Selecting a sine filter for a drive	Drive or inverter unit hardware manual
Planning the installation of a sine filter	<i>Installation</i> on page 17 Filter data sheets. (Go to <a href="http://en.tdk.eu/">http://en.tdk.eu/</a> .)
Installing a sine filter	<i>Installation</i> on page 17 Filter data sheets. (Go to <a href="http://en.tdk.eu/">http://en.tdk.eu/</a> .)
Commissioning a drive with a sine filter	<i>Start-up</i> on page 25
Technical data for the drives with sine filters: <ul style="list-style-type: none"> <li>• ratings</li> <li>• losses</li> <li>• air flow</li> </ul>	Drive or inverter unit hardware manual
Technical data for the sine filters: <ul style="list-style-type: none"> <li>• dimensions</li> <li>• free space requirements</li> </ul>	Filter data sheets. (Go to <a href="http://en.tdk.eu/">http://en.tdk.eu/</a> .)
Technical data for the sine filters: <ul style="list-style-type: none"> <li>• Terminal data</li> </ul>	Filter data sheets. (Go to <a href="http://en.tdk.eu/">http://en.tdk.eu/</a> .)
Ambient conditions	Drive or inverter unit hardware manual

## ■ NSIN filter kits by ABB

This table shows where you can find information on the filter kits.

Task/Item	See ...
General information on the sine filters	<a href="#">Hardware description</a> on page 11
Construction of the sine filter kits	<a href="#">Construction of the NSIN filter kits by ABB</a> on page 16
Selecting a sine filter kit for a drive	Drive or inverter unit hardware manual
Planning the installation of a sine filter kit	<a href="#">Installation</a> on page 17
Installing a sine filter kit	<a href="#">Installation</a> on page 17
Commissioning a drive with a sine filter	<a href="#">Start-up</a> on page 25
Technical data for the drives with sine filters: <ul style="list-style-type: none"> <li>• ratings</li> <li>• losses</li> <li>• air flow</li> </ul>	Drive or inverter unit hardware manual
Technical data for the sine filter kits: <ul style="list-style-type: none"> <li>• dimensions</li> </ul>	<a href="#">Dimensions of choke modules in ABB filter kits</a> on page 32
Technical data for the sine filters: <ul style="list-style-type: none"> <li>• Terminal data</li> </ul>	<a href="#">Drawings</a>
Ambient conditions	Drive or inverter hardware manual

## 2

# Hardware description

---

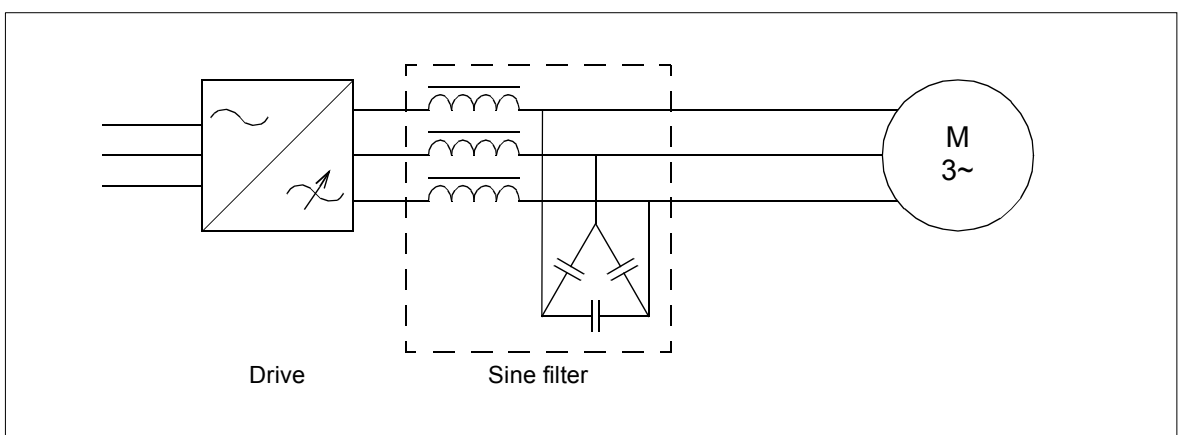
## Contents of this chapter

This chapter describes the operation principle and hardware of the filters and filter kits.

## Operation principle

Sine filters are low-pass filters that suppress the high frequency components of the drive output.

A sine filter consists of single- or three-phase reactors and delta- or star-connected capacitors. This overview diagram shows a drive system with a sine filter.



The sine filter provides true sinusoidal voltage waveform at the drive output by suppressing the high frequency voltage components of the drive output. The high frequency voltage components cause:

- stress to motor insulation
- output transformer saturation (if any).

Suppression of the high frequency voltage components is needed, when extra long motor cables are used, there is a step-up transformer between the drive and a motor, or when a drive is installed to an old direct-on-line motor.

The sine filter:

- minimizes voltage reflections, bearing currents and harmonic distortion. Thus, you can use longer motor cables or install a drive to an old on-line motor.
- reduces the motor noise level in most cases.
- allows you to use an output transformer. With the transformer, you can use a low voltage drive with a medium voltage motor, for example.

**Note:** Some drive control programs change the motor control mode to scalar automatically when you take the sine filter in use by a parameter setting. This limits the motor control accuracy somewhat. For more information, see the firmware manual.

## Voltage drop

At 50 Hz drive output frequency and nominal output current, the voltage drop is 10 to 15 percent of the nominal output voltage typically. See the drive hardware manual for the voltage drop values.

A voltage drop over the sine filter causes an increase of the motor current when the power is kept at a constant level. You must take this into account when dimensioning the motor and the drive.

The voltage drop also decreases the maximum available torque of the motor. Avoid operation above the field weakening point (FWP) and with high overload.

**Note:** Product activation of the sine filter mode (parameter *95.15 bit 1*) will cause drive output current to derate. For more information see the drive hardware manual.

## Output frequency

The sine filter operates within the frequency range of 0.5 ... 100 Hz. However, with non-regenerative drives without a brake chopper in use, we recommend that the drive output frequency is less than  $1.1 \times \text{FWP}$  because of possible self-excitation of the motor. FWP = field weakening point, 50 or 60 Hz typically.

## Peak voltage

The peak phase-to-phase voltage of a drive with the sine filter is approximately  $1.5 \times U_N$ ; the peak phase-to-ground voltage is approximately  $2 \times U_N$ .  $U_N$  is the nominal voltage of the drive output.

## Bearing currents

The sine filter reduces circulating-type and shaft grounding-type motor bearing currents which increase the bearing life time.

---

## Selecting a filter for a drive

See drive or inverter unit hardware manual for a list of preselected filters.

## Construction of the Epcos filters

### ■ Degree of protection and housings of the filters

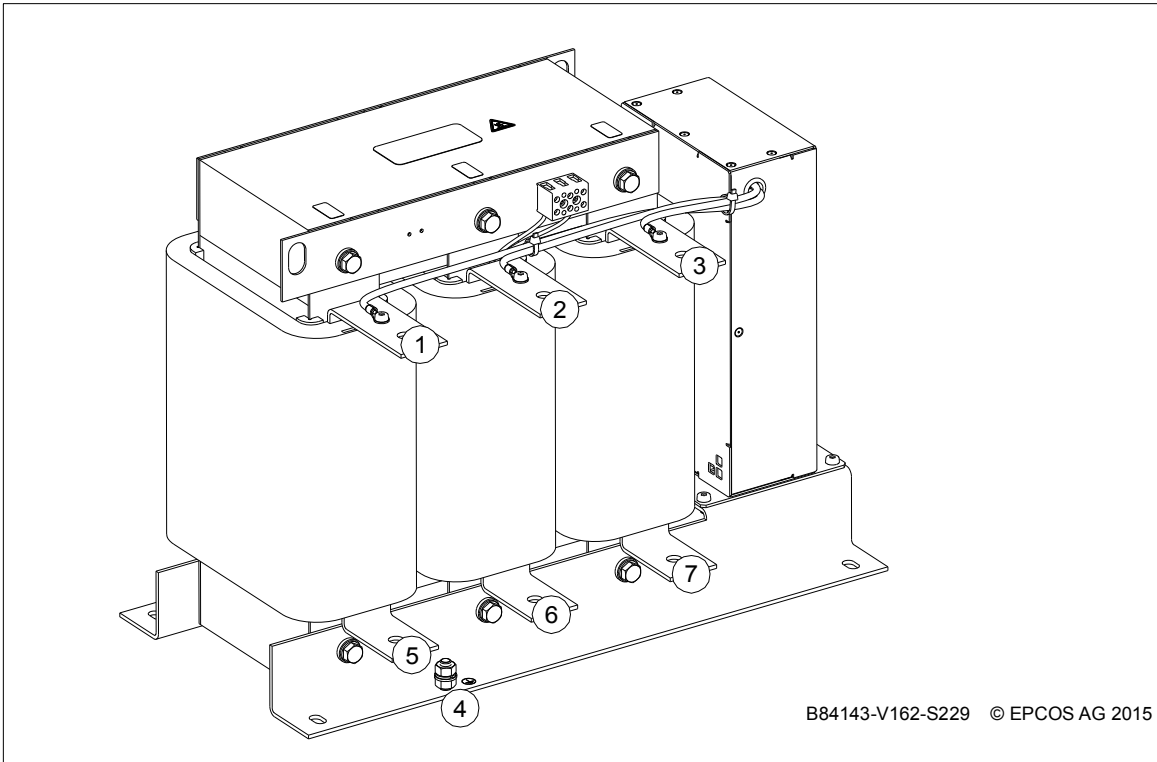
A filter includes all filter components in a ready-made unit except for the IP21 housing that has to be ordered separately.

The degree of protection of the filters is IP00 or IP21. The filter cools down by natural convection.

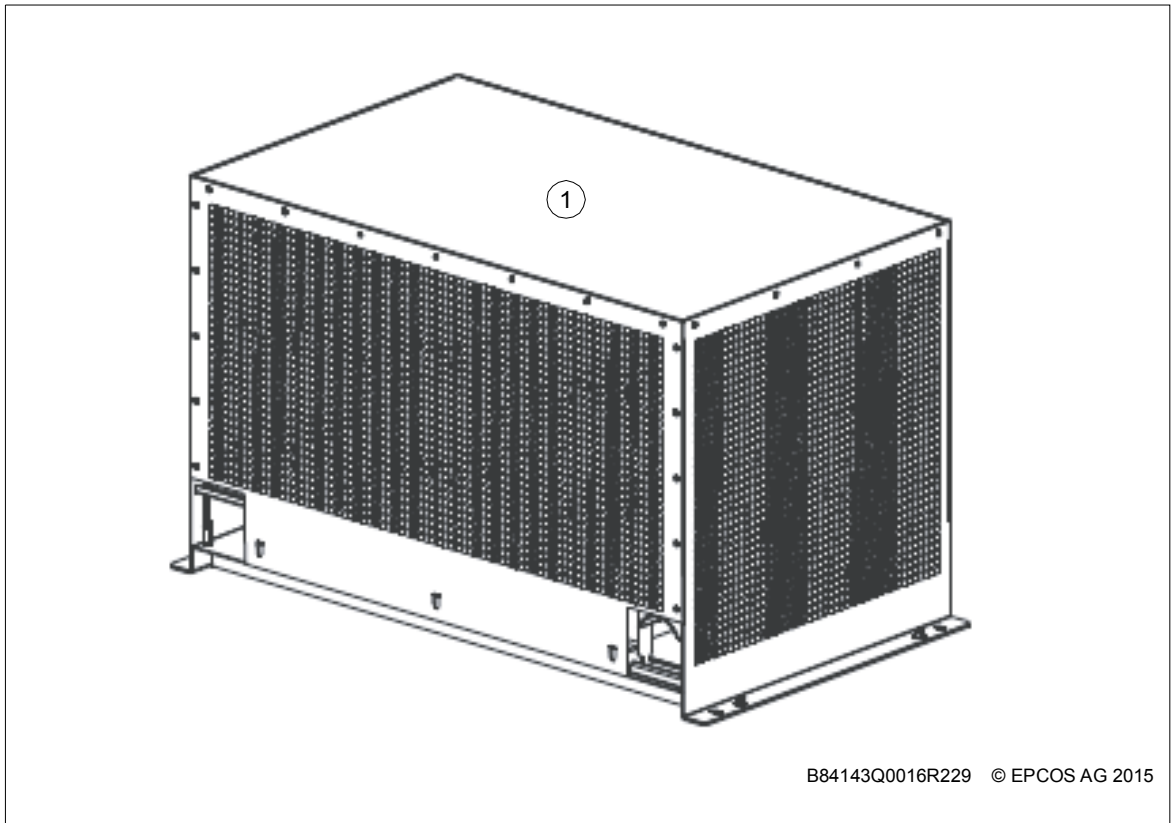
Epcos sine filter (IP00)	Housing (IP21)
B84143V0004R229	B84143Q0002R229
B84143V0006R229	B84143Q0002R229
B84143V0011R229	B84143Q0004R229
B84143V0016R229	B84143Q0006R229
B84143V0025R229	B84143Q0008R229
B84143V0033R229	B84143Q0008R229
B84143V0050R229	B84143Q0010R229
B84143V0066R229	B84143Q0010R229
B84143V0075R229	B84143Q0010R229
B84143V0095R229	B84143Q0012R229
B84143V0162S229	B84143Q0014R229
B84143V0230S229	B84143Q0016R229
B84143V0390S229	B84143Q0018R229
B84143V0010R230	B84143Q0008R229
B84143V0018R230	B84143Q0008R229
B84143V0026R230	B84143Q0008R229
B84143V0040R230	B84143Q0010R229
B84143V0056R230	B84143Q0010R229
B84143V0092R230	B84143Q0012R229
B84143V0130S230	B84143Q0020R229
B84143V0207S230	B84143Q0022R229

## Layout drawing

These figures show example layouts of Epcos filter and filter housing. The connections and components vary depending on the filter type. See the filter data sheet for more information. For the data sheets, see [Quick reference guide](#) on page 9.



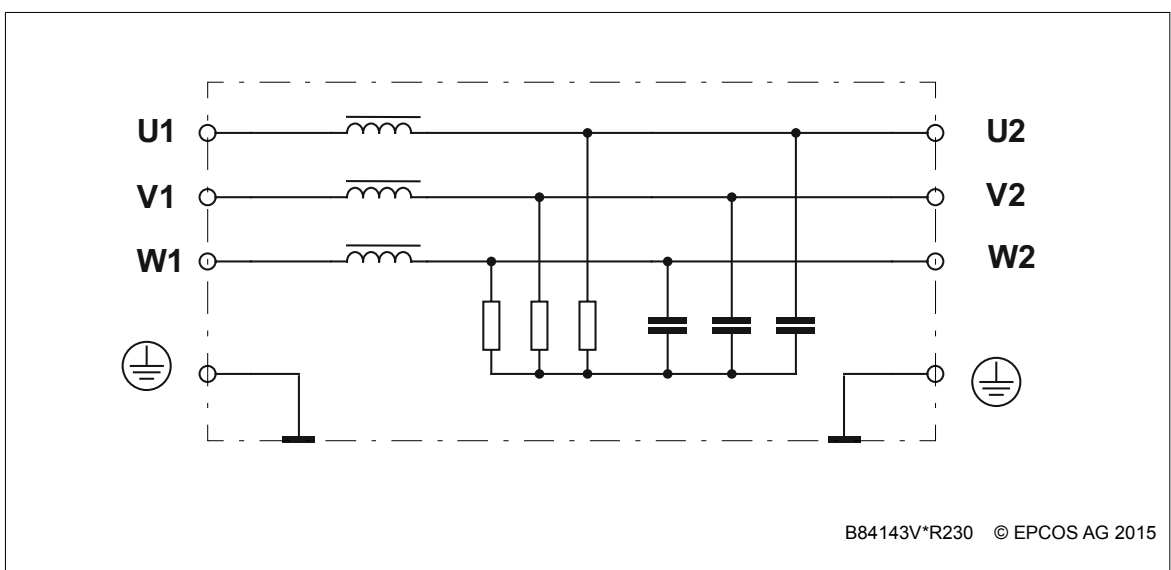
No.	Description	No.	Description
1	Output terminal U2	5	Input terminal U1
2	Output terminal V2	6	Input terminal V1
3	Output terminal W2	7	Input terminal W1
4	PE		



No.	Description
1	Sine filter housing

■ **Overview diagram**

This figure shows an example circuit diagram of an Epcos filter. The connections and components vary depending on the filter type. See the filter data sheet for more information. For the data sheets, see [Quick reference guide](#) on page 9.



## Construction of the NSIN filter kits by ABB

### ■ Contents of the filter kits

A filter kit includes a choke, capacitors and a cooling fan. The customer must install the kit components in an enclosure or cabinet to ensure safety and protection. For more information, see [Installation](#) on page 17.

This table lists the contents of the filter kits.

Filter kit type	Part designation	Qty	Name	Type
NSIN0485-6	R13	1	3-phase choke module	NSUL0485-6
	C41-43.1	3	AC capacitor	B32373A8606J050
				OR*
				E62.R16-603C60
G13	1	Cooling fan	W2E200-HH38-06	
NSIN0900-6	R13	1	3-phase choke module	NSUL0900-6
	C41-43.1	3	AC capacitor	B32373A8826J050
				OR*
				E62.P24-803C60
G13	1	Cooling fan	D4E225-CC01-56	
NSIN1380-6	R13	1	3-phase choke module	NSUL1380-6
	C41-43.1-2	6	AC capacitor	B32373A8606J050
				OR*
				E62.R16-603C60
G13	1	Cooling fan	D4E225-CC01-56	

3AXD10000044776.XLS

**\*Note:** ABB uses both AC capacitor types in the sine filter kits. However, all capacitors in one filter kit are always of the same type (and must be). For more information, consult ABB.

### ■ Layout drawing

For examples of the filter kit installations, see [Layout drawing examples – NSIN filter kit installation](#) on page 41.

### ■ Overview diagram

For the filter connection diagrams, see [Electrical installation guidelines](#) on page 19.



## 3

# Installation

---



## Contents of this chapter

This chapter includes general installation guidelines for the filters and filter kits.

## Mechanical installation guidelines

### ■ General guidelines

**Note:** Consider the weight. Large filters and filter components are heavy.

Consider the degree of protection for the filter (IP class).

Install the bare (IP00) filter or filter kit in an enclosure or a cabinet with a sufficient protection. Make sure that the hot air can freely escape the filter enclosure or cabinet, in other words, the cabinet has an air inlet and outlet.

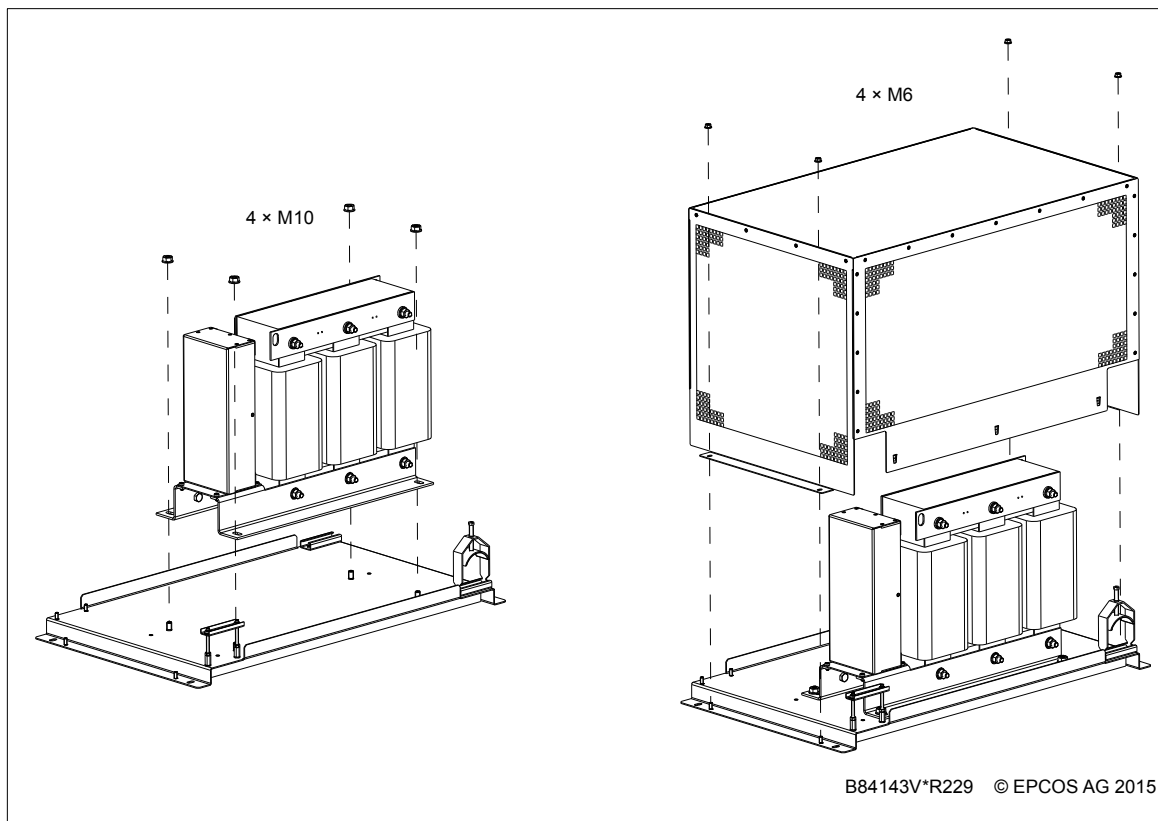
Make sure that there is enough cooling air available to transfer away the filter losses. See the drive hardware manual for the losses.

Consider the free space requirements for the filter. Always attach the filter or the filter kit components on a firm and non-flammable base.

---

### ■ Guidelines for Epcos filters

This figure shows an example of installing an Epcos B84143V\*\*R229 filter and IP21 B84143Q\*\*R229 housing. See the filter data sheet for more information. For the data sheets, see [Quick reference guide](#) on page 9.



### ■ Guidelines for NSIN filter kits by ABB

Do not install the capacitors in the hot region above the choke module. However, the capacitors do not need to be in the cooling air flow of the fan.

Leave sufficient space above the terminals of the capacitors. The overpressure disconnecter can extend the capacitor by 8 mm.

Direct the cooling fan airflow through the choke unit. Prevent recirculation inside the cabinet, for example, with an air baffle.

For example layouts, see [Layout drawing examples – NSIN filter kit installation](#) on page 41.

## Electrical installation guidelines

### ■ General guidelines

Provide the cooling fan with a 230 V AC power supply. For current consumption, see [Epcos filters](#) on page 29.

The maximum cable length between the drive and the filter is 5 meters. The cable length between the filter and the motor is not limited. Obey the motor cable selection rules of the drive hardware manual. For other cabling requirements, see the drive hardware manual.

### Temperature monitoring

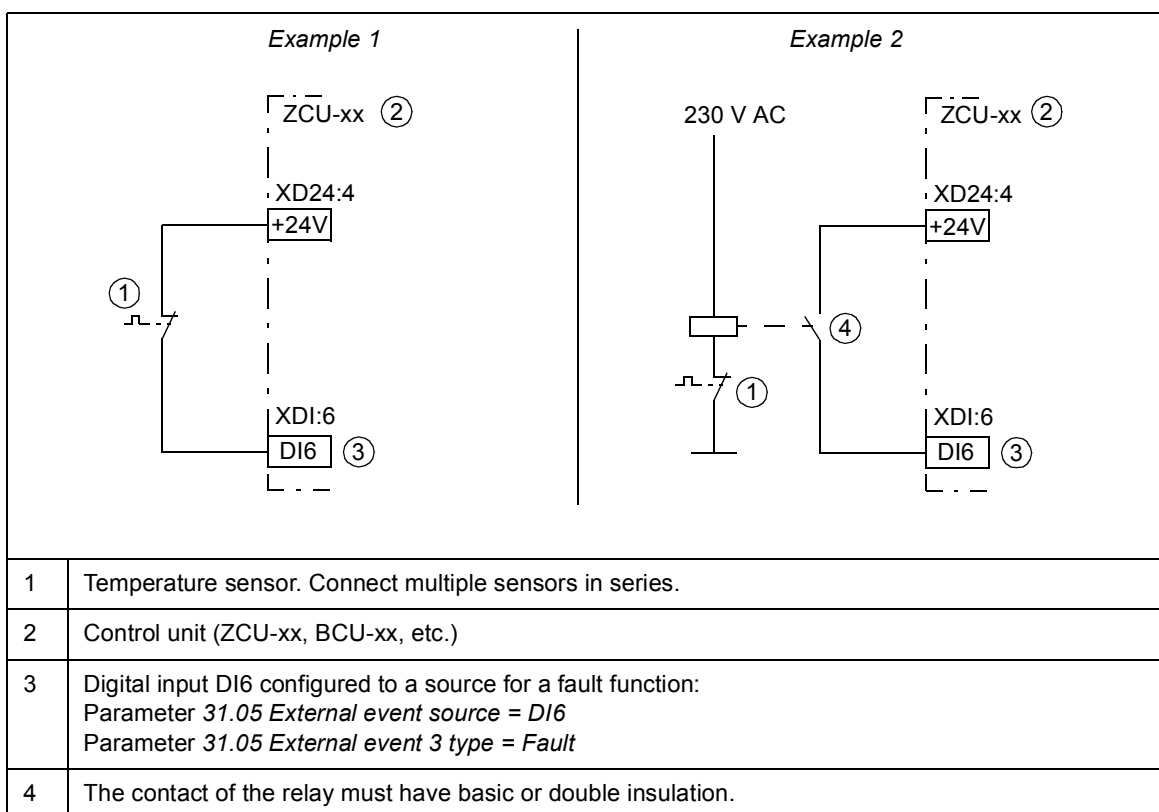
Each sine filter has temperature sensor(s) for an overtemperature indication. We recommend that you connect the sensor(s) to the drive, and configure the drive to monitor the temperature and cut off the load current in case of filter overtemperature.

In the table below, there are two implementation examples for the temperature monitoring:

- Example 1 is applicable with sine filters used in 400 or 500 V drive systems.
- Example 2 is applicable with sine filters used in 400, 500 or 690 V drive systems.



**Warning!** If you have a 690 V drive system, do not connect the filter temperature sensor(s) directly to the terminals of the drive control unit: the insulation level between the sensor and the filter main circuit (690 V) does not meet the requirements for a double insulation (IEC/EN 60664)



### ■ Guidelines for Epcos filters

For the terminal cross section and cable length, go to the filter data sheet at <http://en.tdk.eu/>.

### ■ Guidelines for NSIN filter kits by ABB

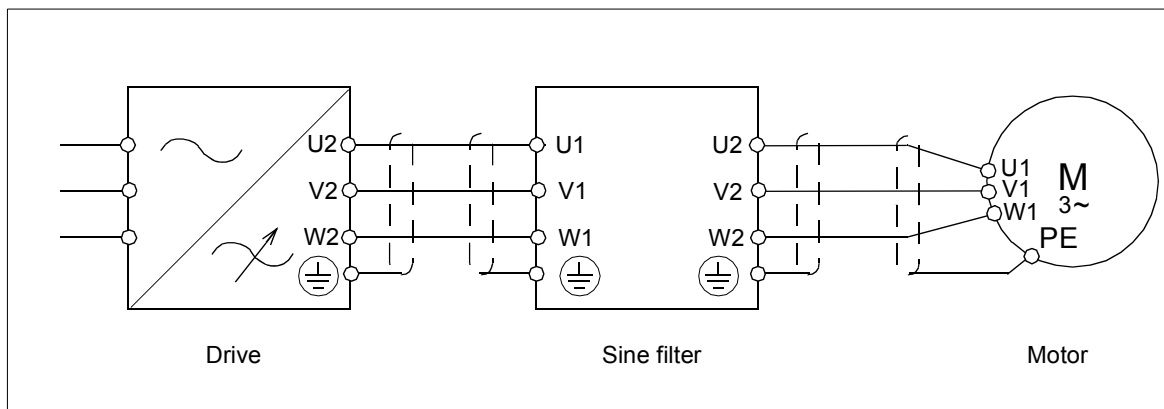
Make sure that you use adequately sized capacitor wiring. The minimum cross-sectional area for copper conductors is:

Filter kit type	Wire size (mm <sup>2</sup> )
NSIN0485-6	35
NSIN0900-6	50
NSIN1380-6	50



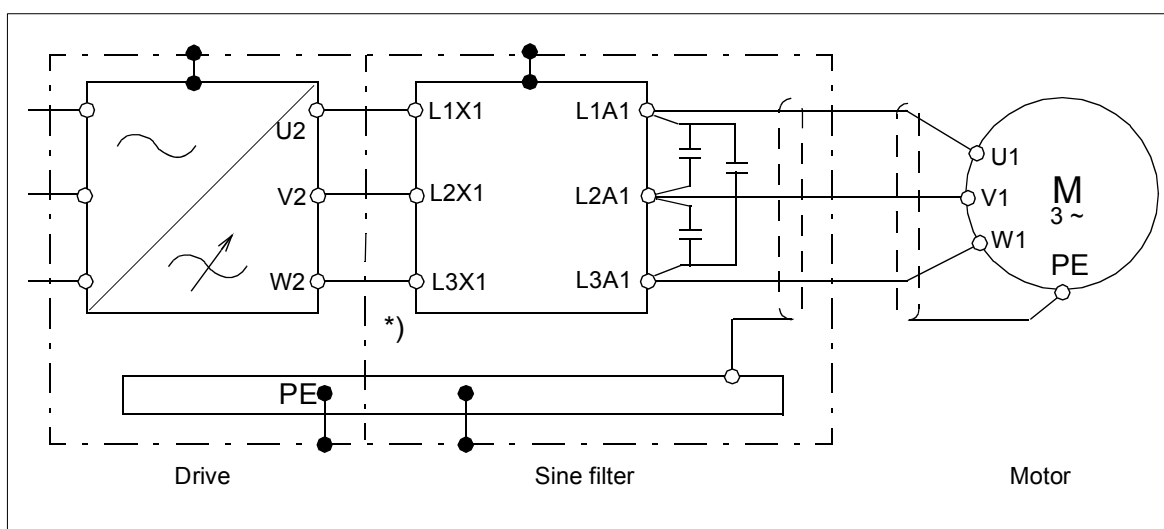
### ■ Connection diagram – Epcos filters

This simplified figure shows the connections of a filter kit with the drive system. For tightening torques, see the data sheets at <http://en.tdk.eu/>.



### ■ Connection diagram – NSIN filter kits by ABB

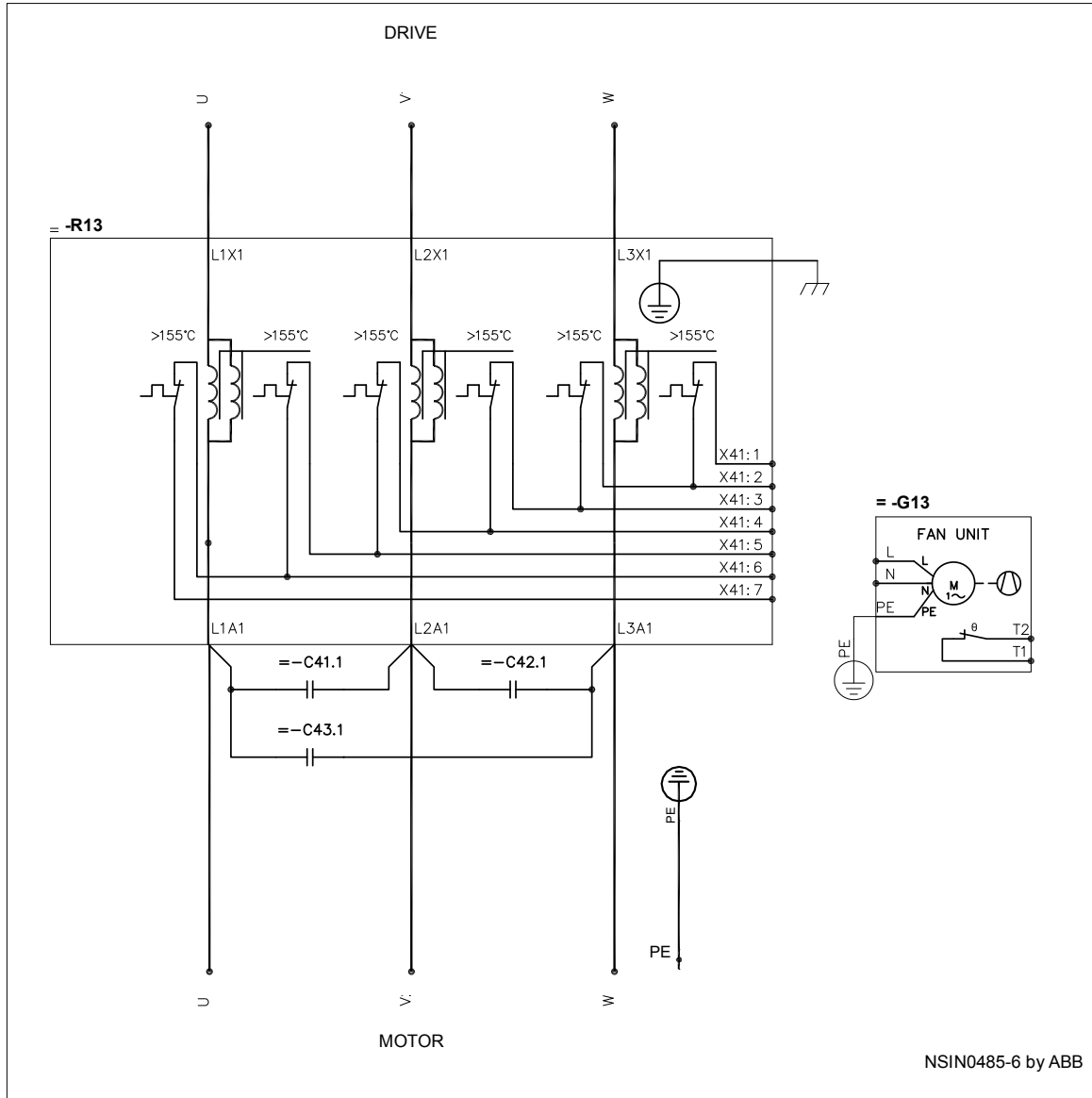
This simplified figure shows the connections of a filter kit with the drive system. For tightening torques, see [Dimensions of choke modules in ABB filter kits](#).

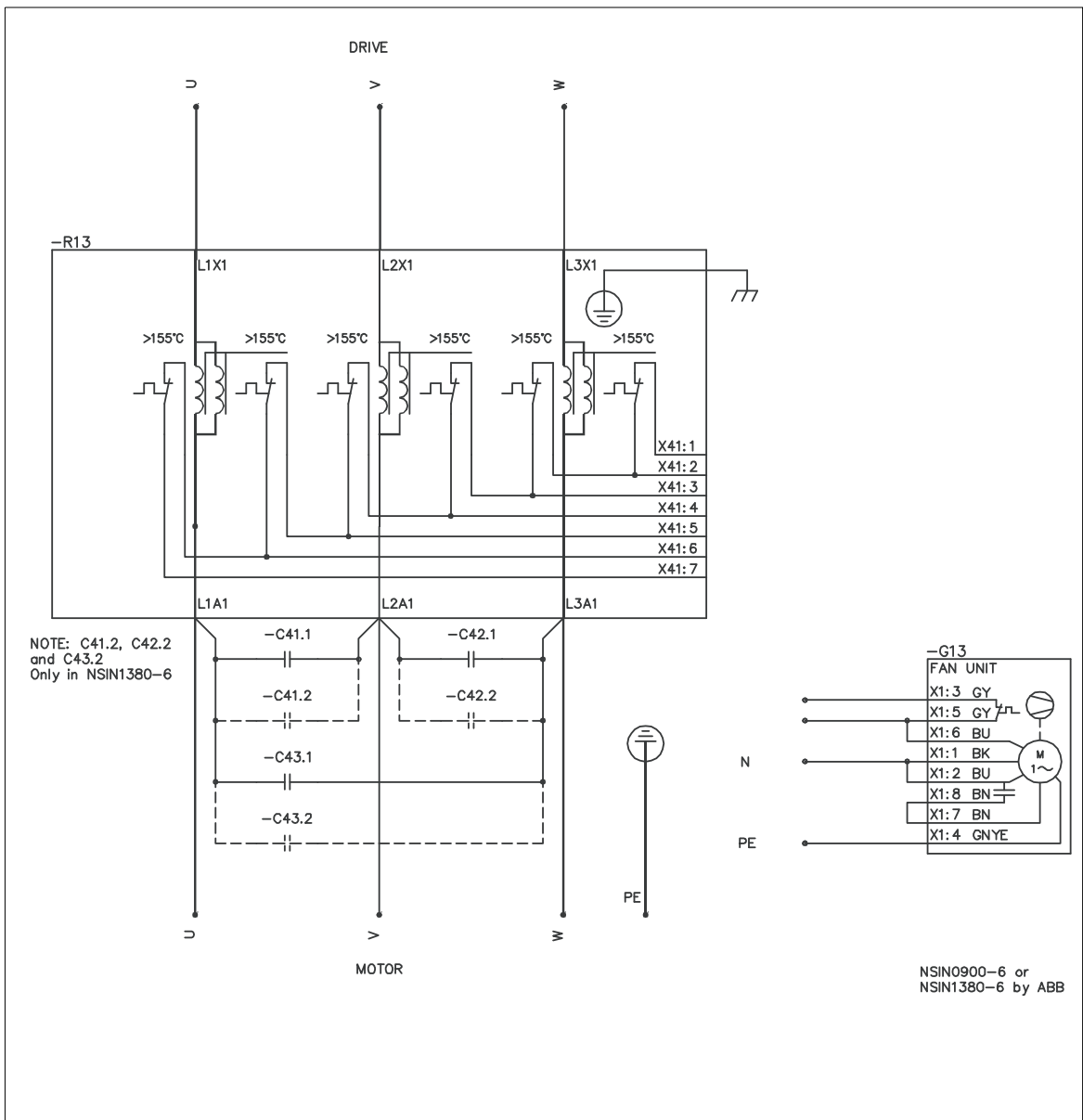


\*) Also the cable between the filter and the drive must be shielded if you do not run it inside a metal enclosure (cabinet). Ground the cable shield to the cabinet PE busbar.

## 22 Installation

These figures show the circuit diagrams of filter kits. The connections and components vary depending on the filter type.









# 4

## Start-up

---

### Contents of this chapter

This section describes the start-up settings of a drive with a sine filter. The settings are valid for the ACS880 primary control program, ACS580 standard control program, ACH580 HVAC control program and ACHQ580 pump control program.



### Parameter settings

Make the following drive parameter settings before starting up a drive equipped with a sine filter:

1. When you use the filter types given in this manual, set parameter *95.15 Special HW settings* to *ABB Sine filter*. Some control programs force the drive to use scalar motor control mode, and limits the switching and output frequencies.
  2. If you use a brake chopper and the maximum output frequency exceeds  $1.1 \times \text{FWP}$  (field weakening point), you must set parameter *43.06 Brake chopper function* to *Overvoltage peak protection*.
-





# 5

## Maintenance

---

### Contents of this chapter

This chapter contains maintenance instructions. The information is valid for NSIN filter kits by ABB when used with ABB low voltage AC drives. For Epcos sine filters, contact the seller or the producer of the equipment.

### Maintenance intervals of NSIN filter kits by ABB

The table shows the intervals for the preventive maintenance tasks for ABB's NSIN filter kits allowed for the customer.

Maintenance task/object	Years from start-up						
	3	6	9	12	15	18	21
Cooling fan of NSIN filter kit			R			R	
Capacitors of NSIN filter kit <sup>*)</sup>			R			R	

#### Symbols

R Replacement

\*) For information on replacing the capacitor contact ABB service ([www.abb.com/drivesservices](http://www.abb.com/drivesservices))

**Note:** Recommended maintenance intervals and component replacements are based on operation in specified ambient conditions.

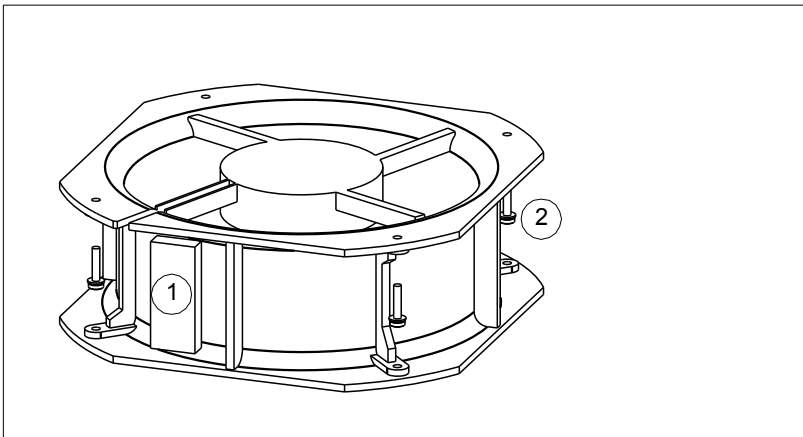
---



**WARNING!** Obey the instructions in [Safety instructions](#) on page 8. If you ignore them, injury or death, or damage to the equipment can occur.

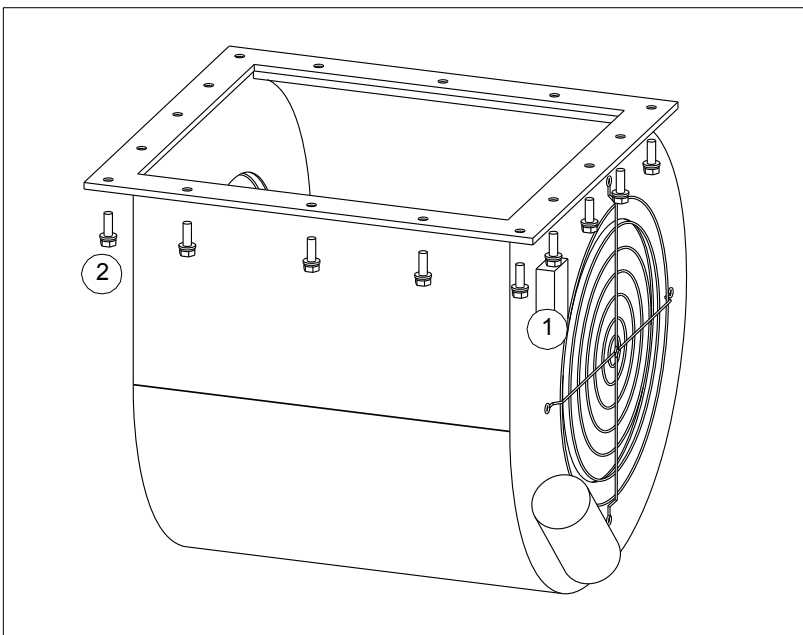
### ■ Replacing cooling fan of NSIN0485-6

1. Disconnect the fan power cable.
2. Undo the screws that fasten the fan.
3. Install the new fan in reverse order.



### ■ Replacing cooling fan of NSIN0900-6 and NSIN1380-6

1. Unplug the wiring of the fan.
2. Undo the screws that fasten the fan.
3. Install the new fan in reverse order.



# 6

## Technical data

---

### Contents of this chapter

This chapter contains technical data.

### Epcos filters

For the technical data of the filters, go to the filter data sheet at <http://en.tdk.eu/>.

### NSIN filter kits by ABB

This section contains technical data of the filter kits. [Quick reference guide](#) on page 9 lists the technical data you can find in the drive hardware manual.

Filter kit type	Qty	Name	Type	Filter kit ratings
NSIN0485-6	3	AC capacitor	B32373A8606J050	60 µF
			E62.R16-603C60	60 µF
	1	Cooling fan	W2E200-HH38-06	230 V AC, 50/60 Hz, 0.3/0.4 A
NSIN0900-6	3	AC capacitor	B32373A8826J050	82 µF
			E62.P24-803C60	80 µF
	1	Cooling fan	D4E225-CC01-56	230 V AC, 50/60 Hz, 2.8/3.4 A
NSIN1380-6	6	AC capacitor	B32373A8606J050	60 µF
			E62.R16-603C60	60 µF
	1	Cooling fan	D4E225-CC01-56	230 V AC, 50/60 Hz, 2.8/3.4 A

3AXD10000044776.XLS

---

## ■ Dimensions

<b>Choke module</b>	<b>Height mm</b>	<b>Width mm</b>	<b>Depth mm</b>	<b>Weight kg</b>
NSUL0485-6	1249.0	386.0	216.0	160.0
NSUL0900-6	633.5	754.0	430.0	aprox. 370.0
NSUL1380-6	847.5	755.0	430.0	aprox. 490.0

<b>Capacitor</b>	<b>Diameter mm</b>	<b>Height of can mm</b>	<b>Height including terminals mm</b>	<b>Weight kg</b>
B32373A8606J050	96.0	195.0	234.3	1.7
B32373A8826J050	116.0	175.0	214.3	2.1
E62.R16-603C60	116.0	167.0	204.0	1.8
E62.P24-803C60	95.0	245.0	286.0	1.8

<b>Fan</b>	<b>Height mm</b>	<b>Width mm</b>	<b>Depth mm</b>	<b>Weight kg</b>
W2E200-HH38-06	80.0	260.0	260.0	2.0
D4E225-CC01-56	328.0	341.0	397.0	14.0

## Ambient conditions

See the drive hardware manual.



# Drawings

---

## Contents of this chapter

This chapter contains links to the dimension drawings of the Epcos filters and the dimension drawings of the NSIN filter kits by ABB.

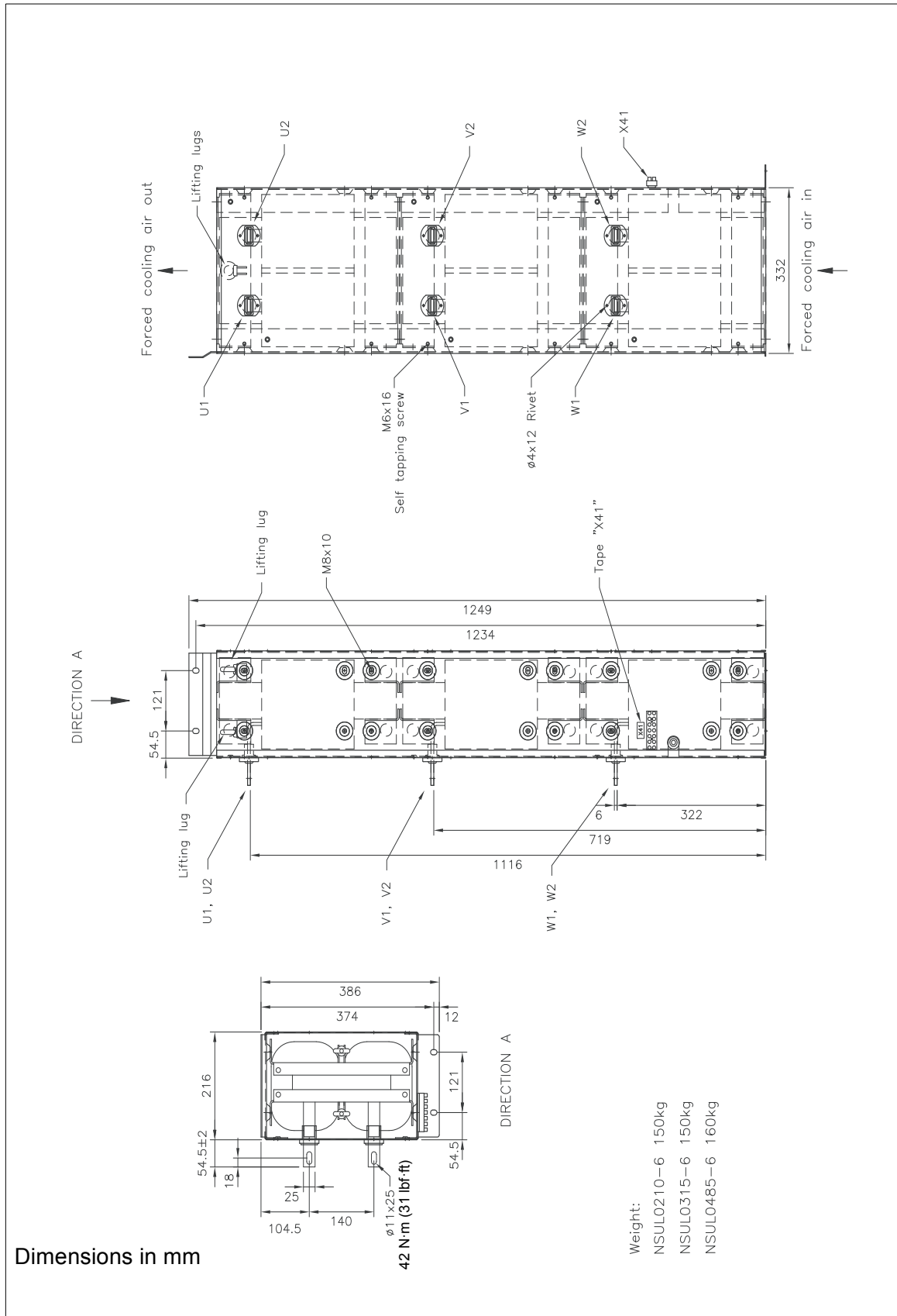
## Dimensions of Epcos filters

For the dimensions of the filters, go to the filter data sheet at <http://en.tdk.eu/>.

---

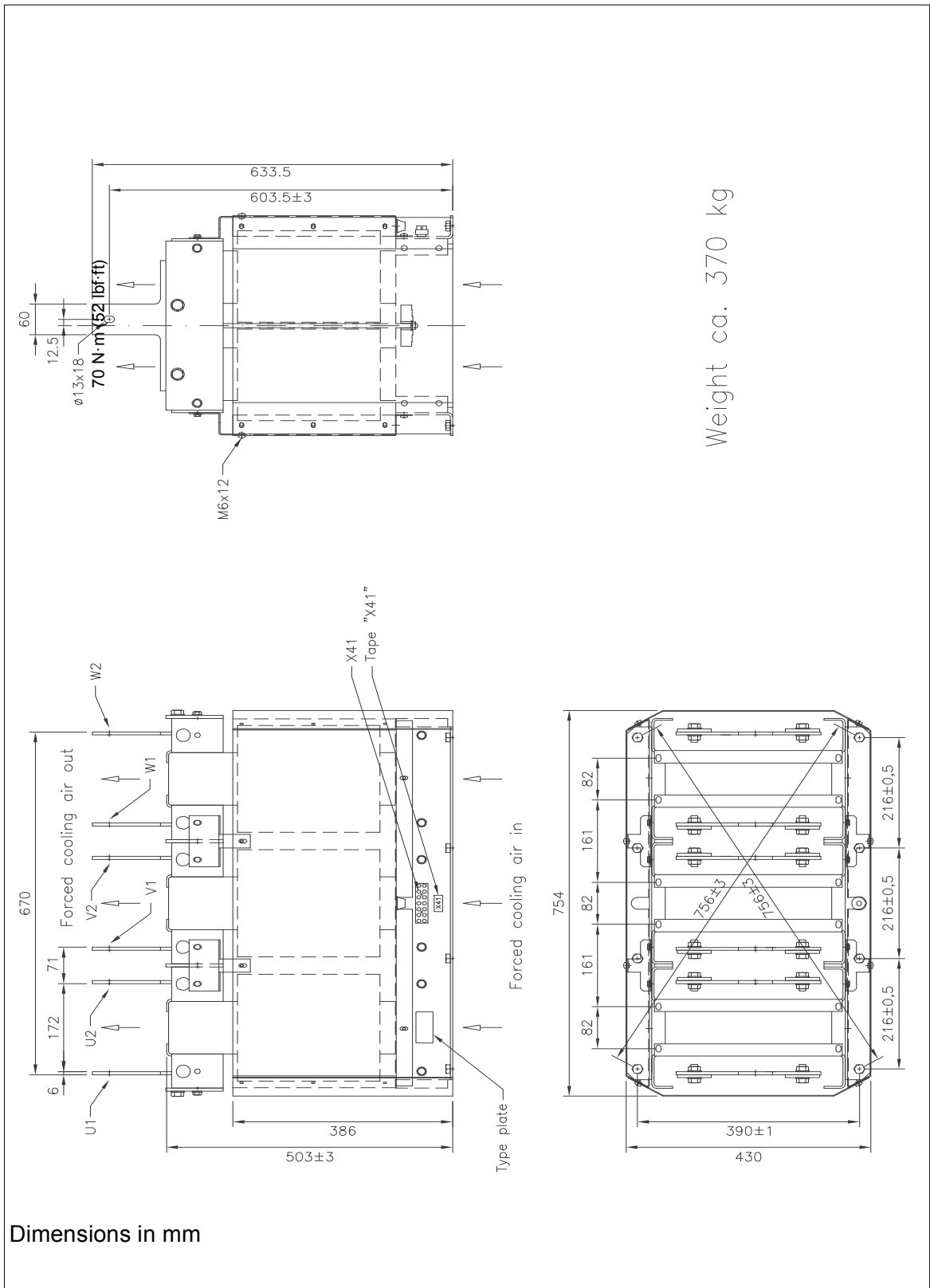
## Dimensions of choke modules in ABB filter kits

### Choke module NSUL0485-6

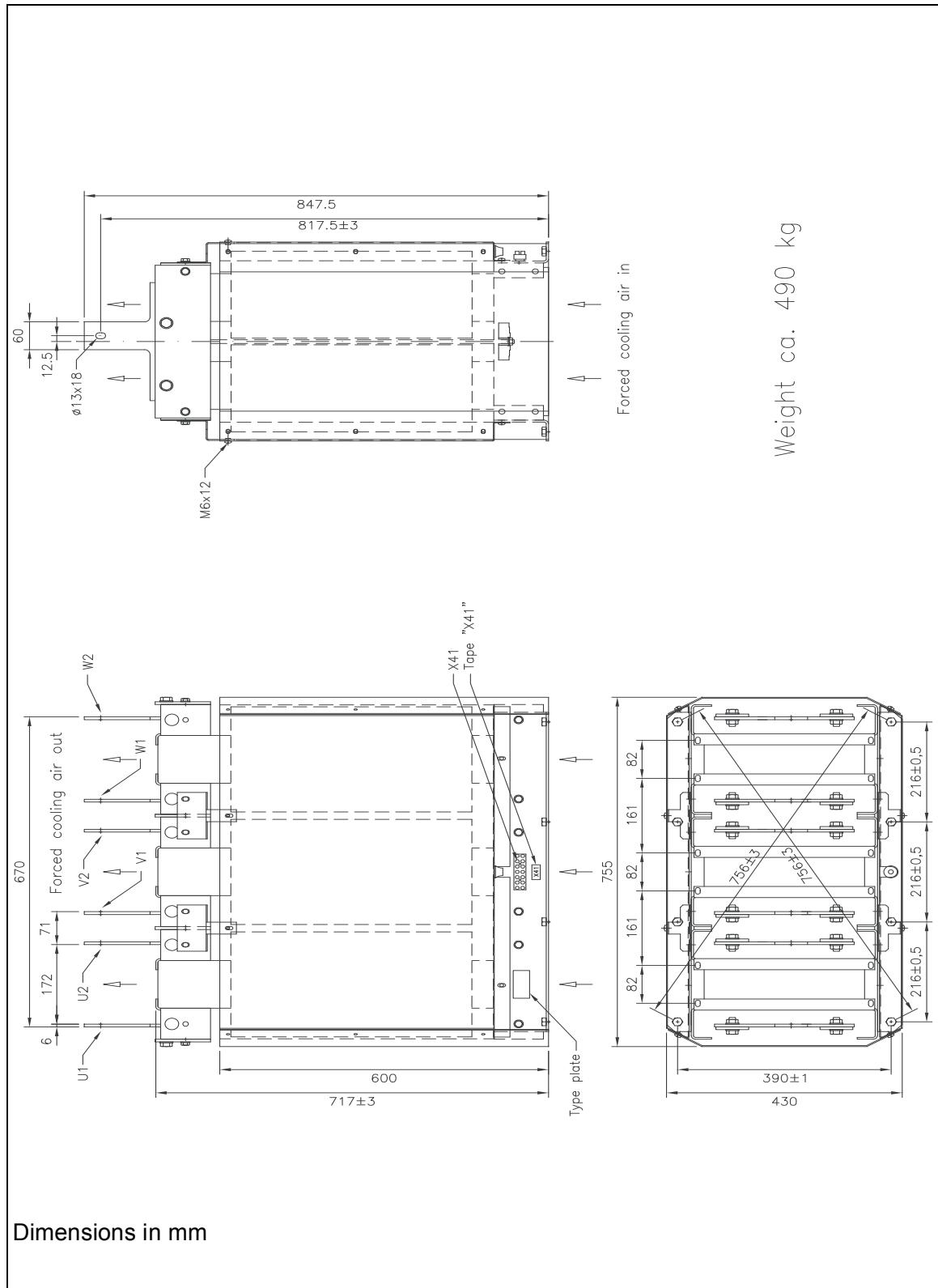




■ Choke module NSUL0900-6



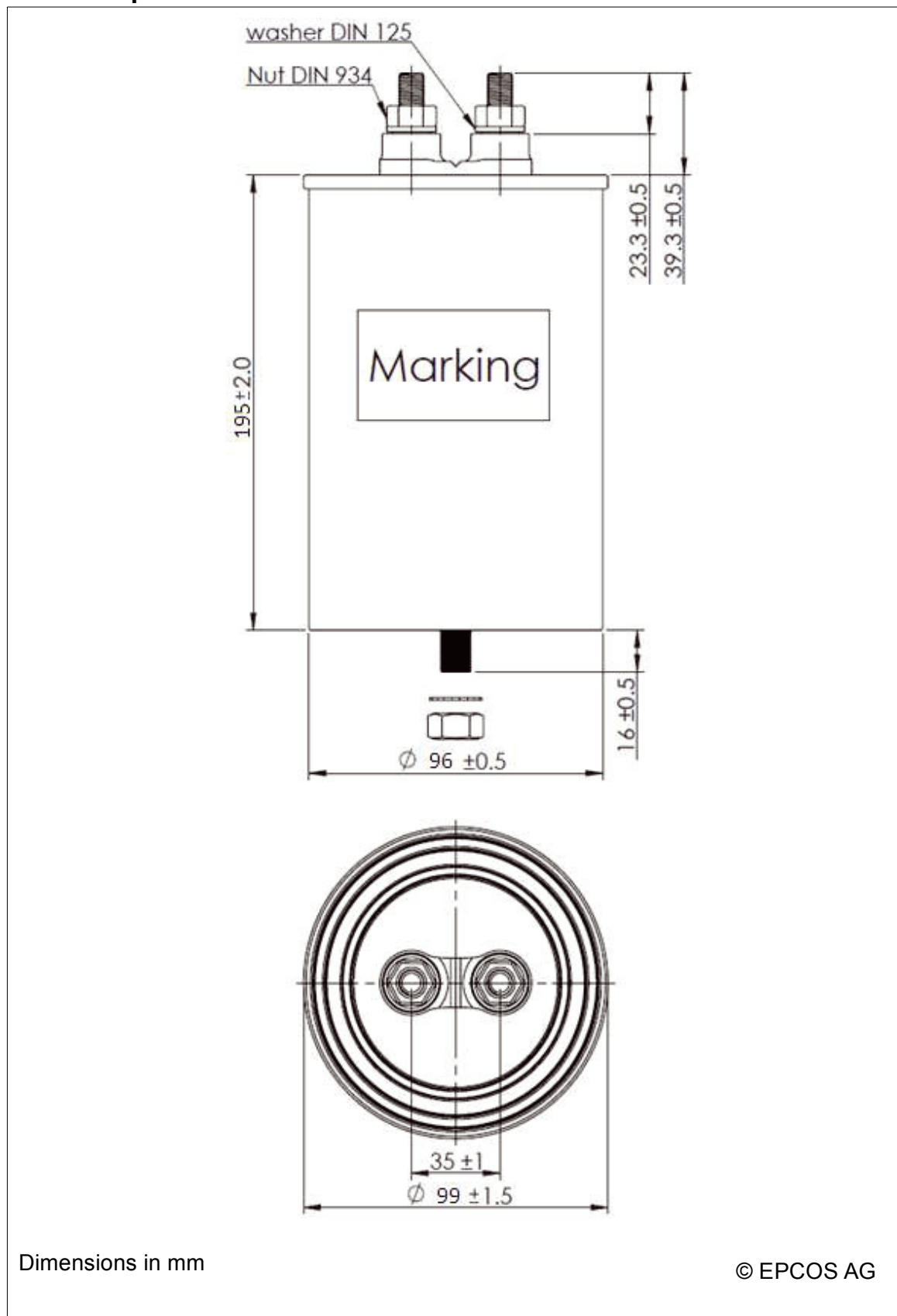
■ Choke module NSUL1380-6



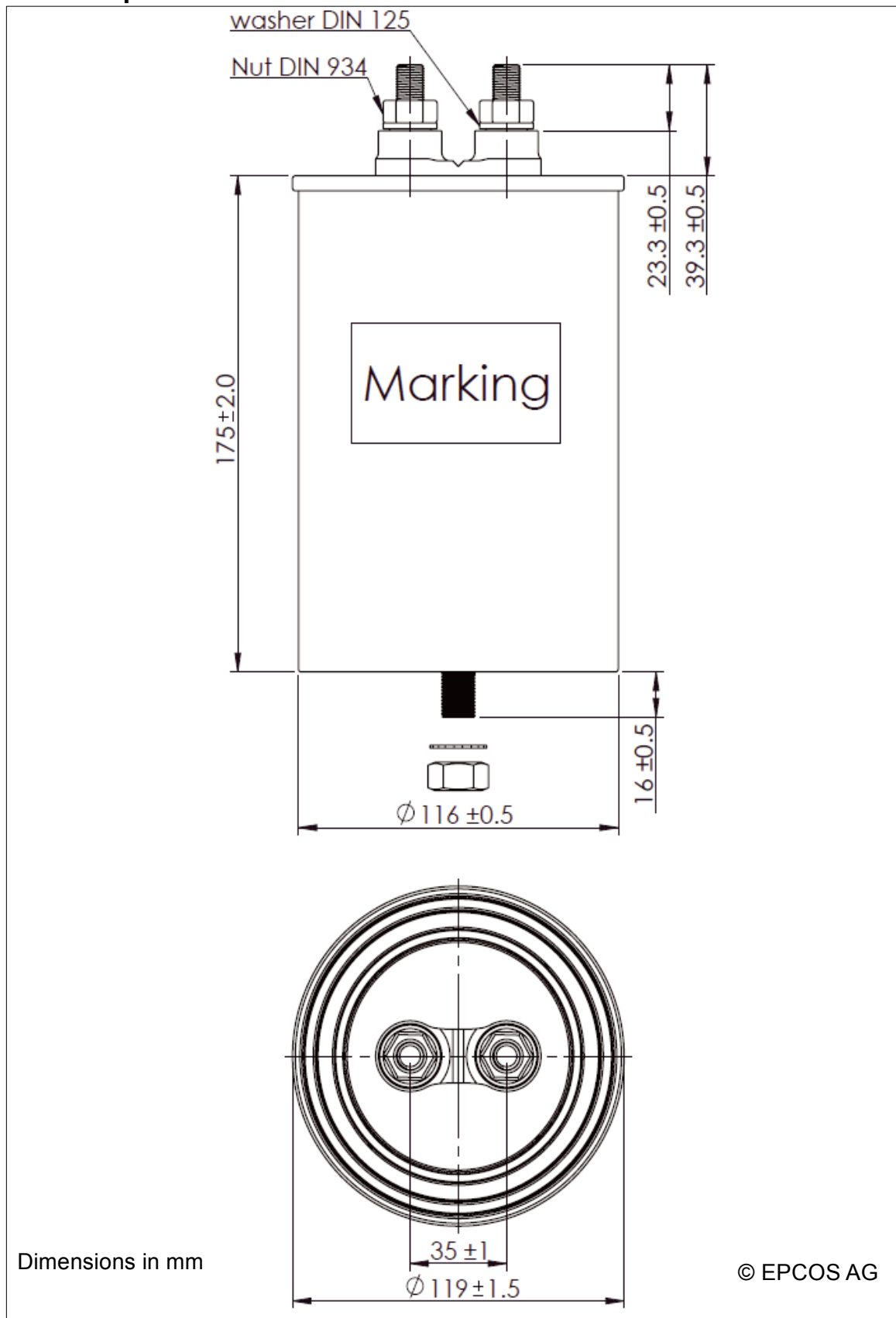
Dimensions in mm

## Dimensions of AC capacitors in ABB filter kits

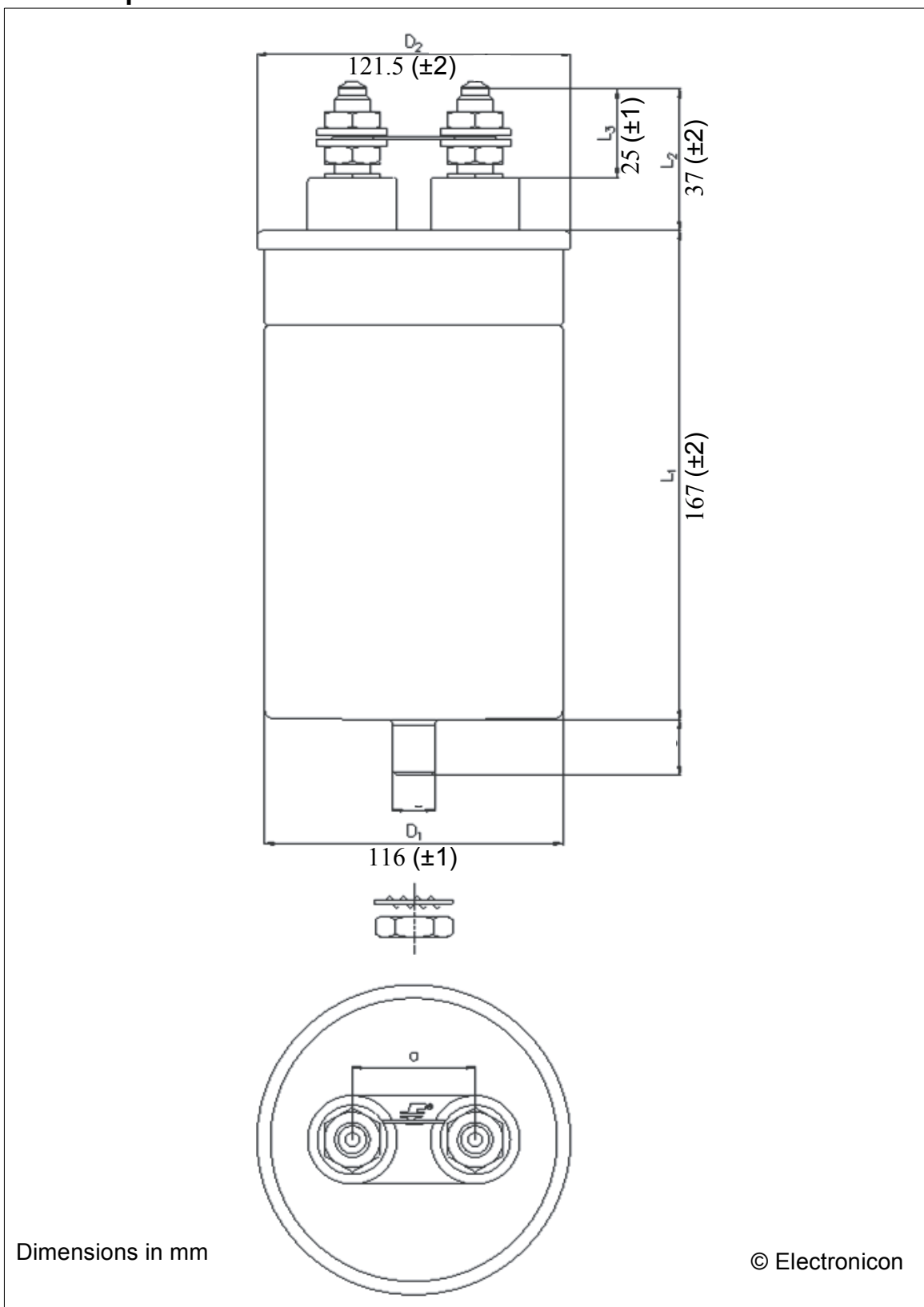
### ■ AC capacitor B32373A8606J050



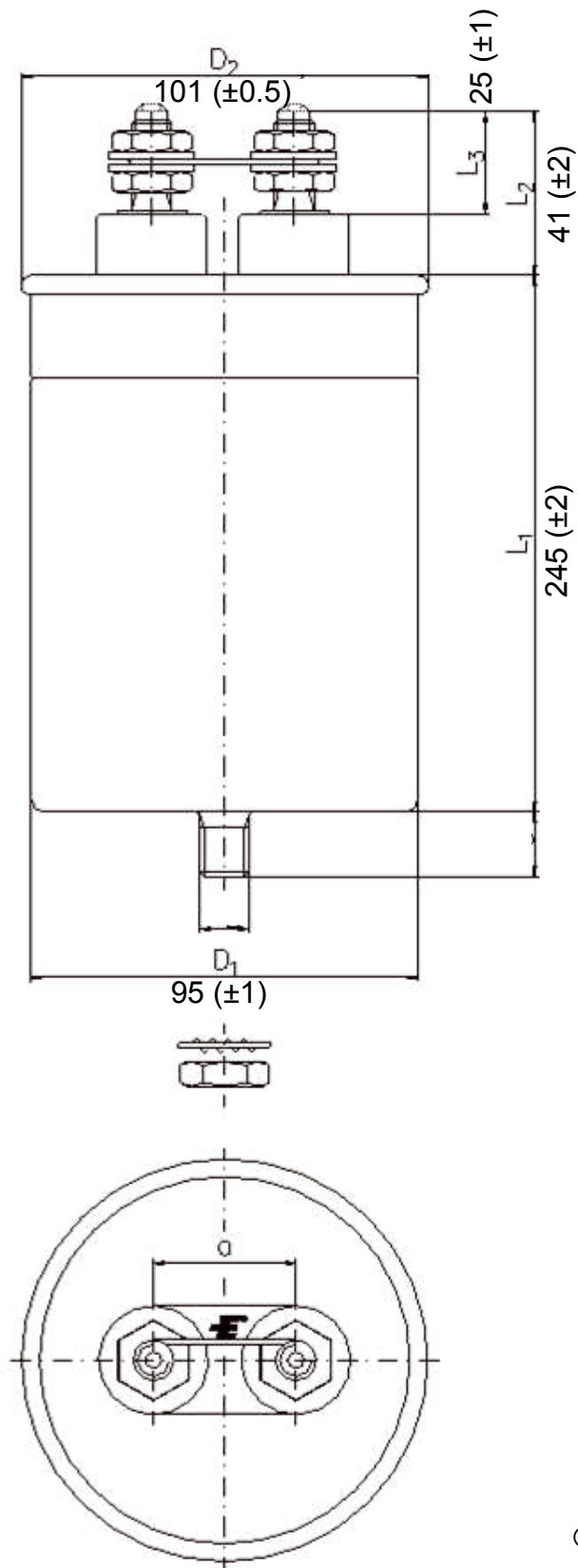
■ AC capacitor B32373A8826J050



■ AC capacitor E62.R16-603C60



■ AC capacitor E62.P24-803C60

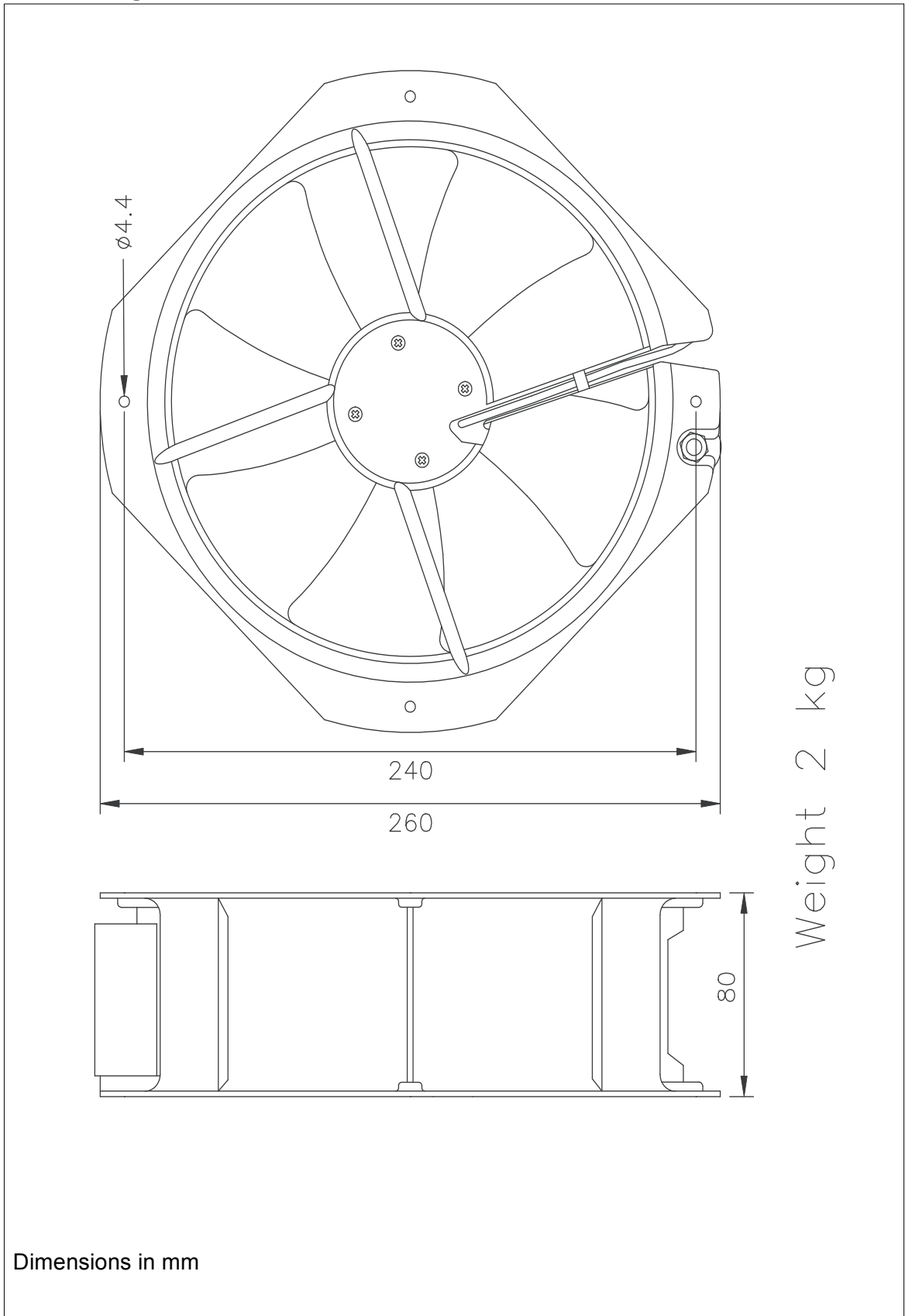


Dimensions in mm

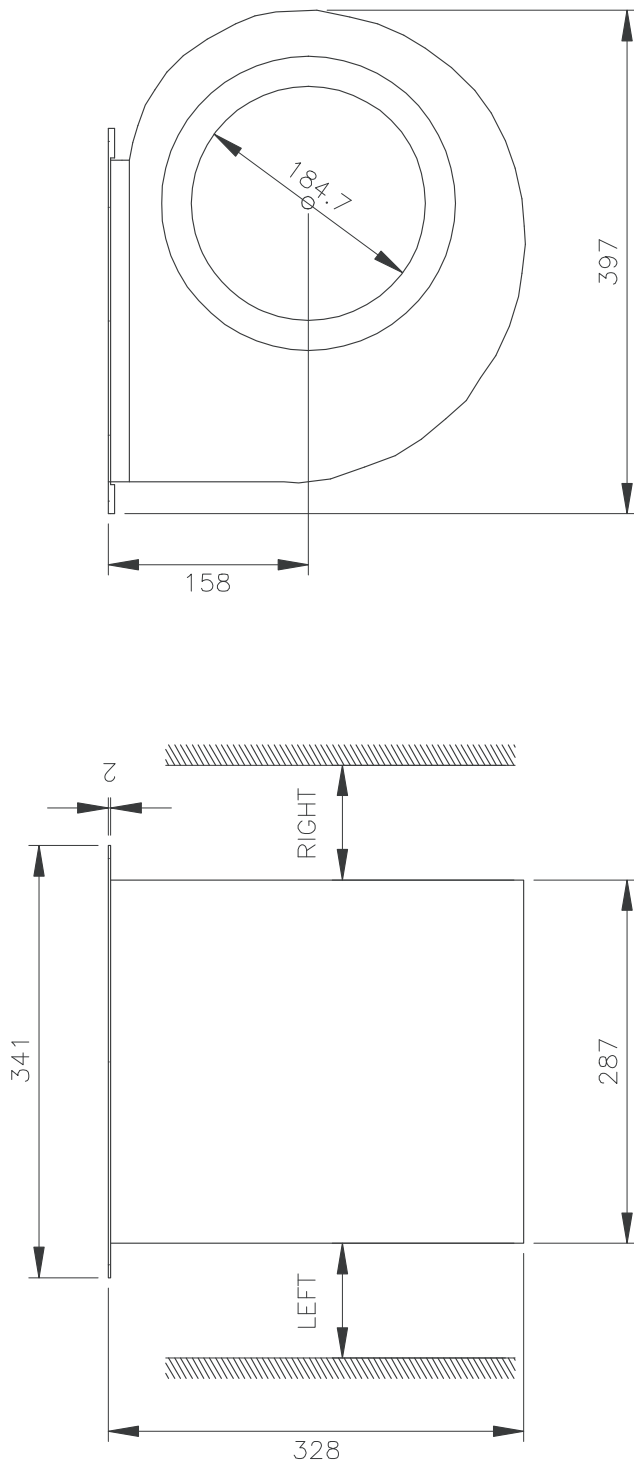
© Electronicon

## Dimensions of cooling fans in ABB filter kits

### ■ Cooling fan W2E200-HH38-06



■ Cooling fan D4E225-CC01-56



Dimensions in mm

WEIGHT 14 kg

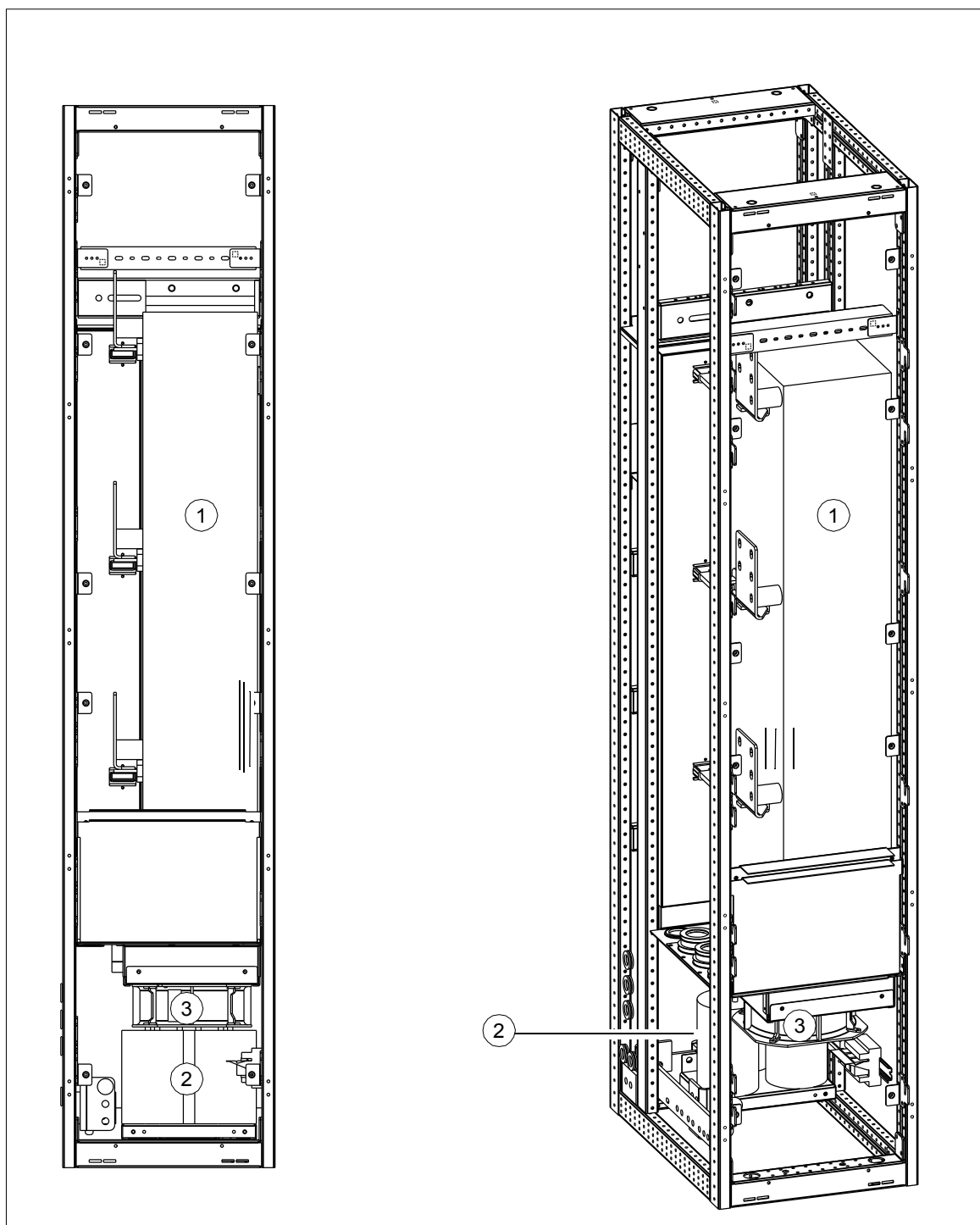
NOTE) Left and right clearance depend on each module i



## Layout drawing examples – NSIN filter kit installation

### ■ NSIN0485-6 installation example

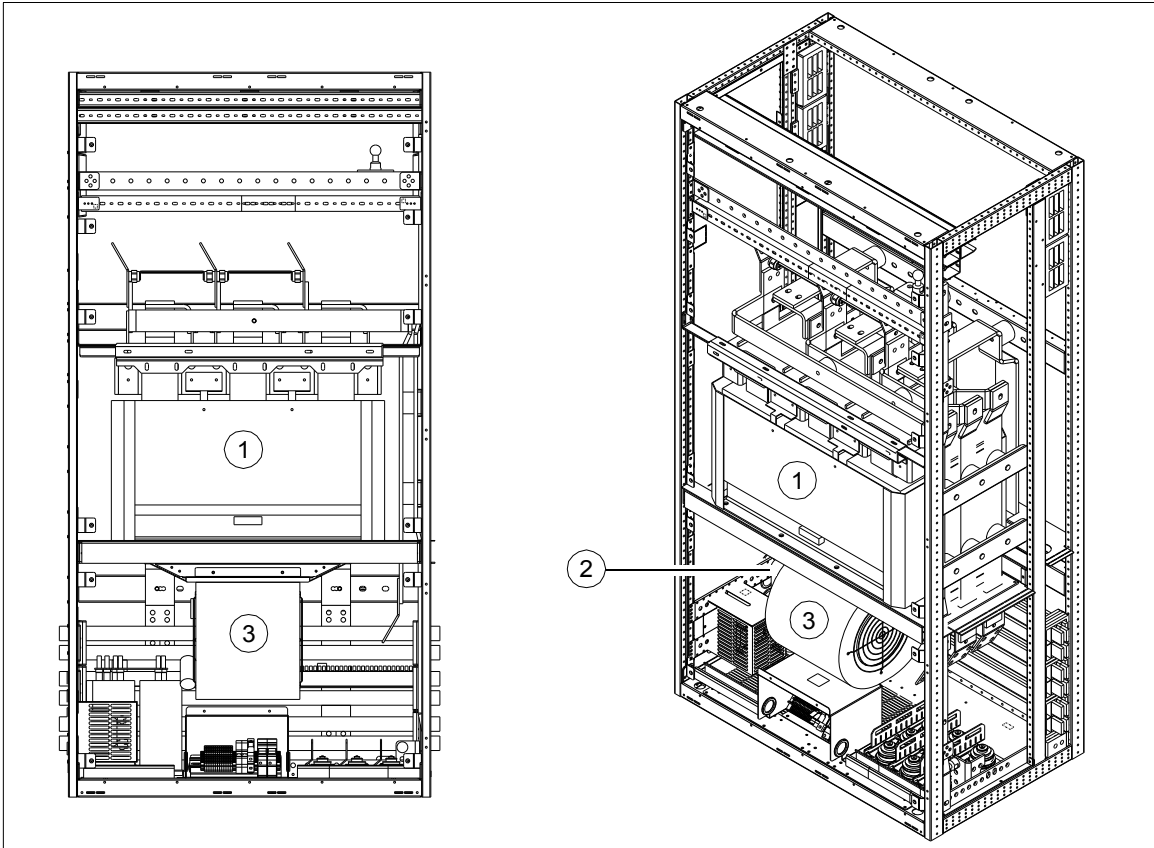
This figure shows an example of a filter kit installation of NSIN0485-6 (by ABB).



No	Description
1	Choke module
2	AC capacitor (3 pcs)
3	Cooling fan

■ **NSIN0900-6 installation example**

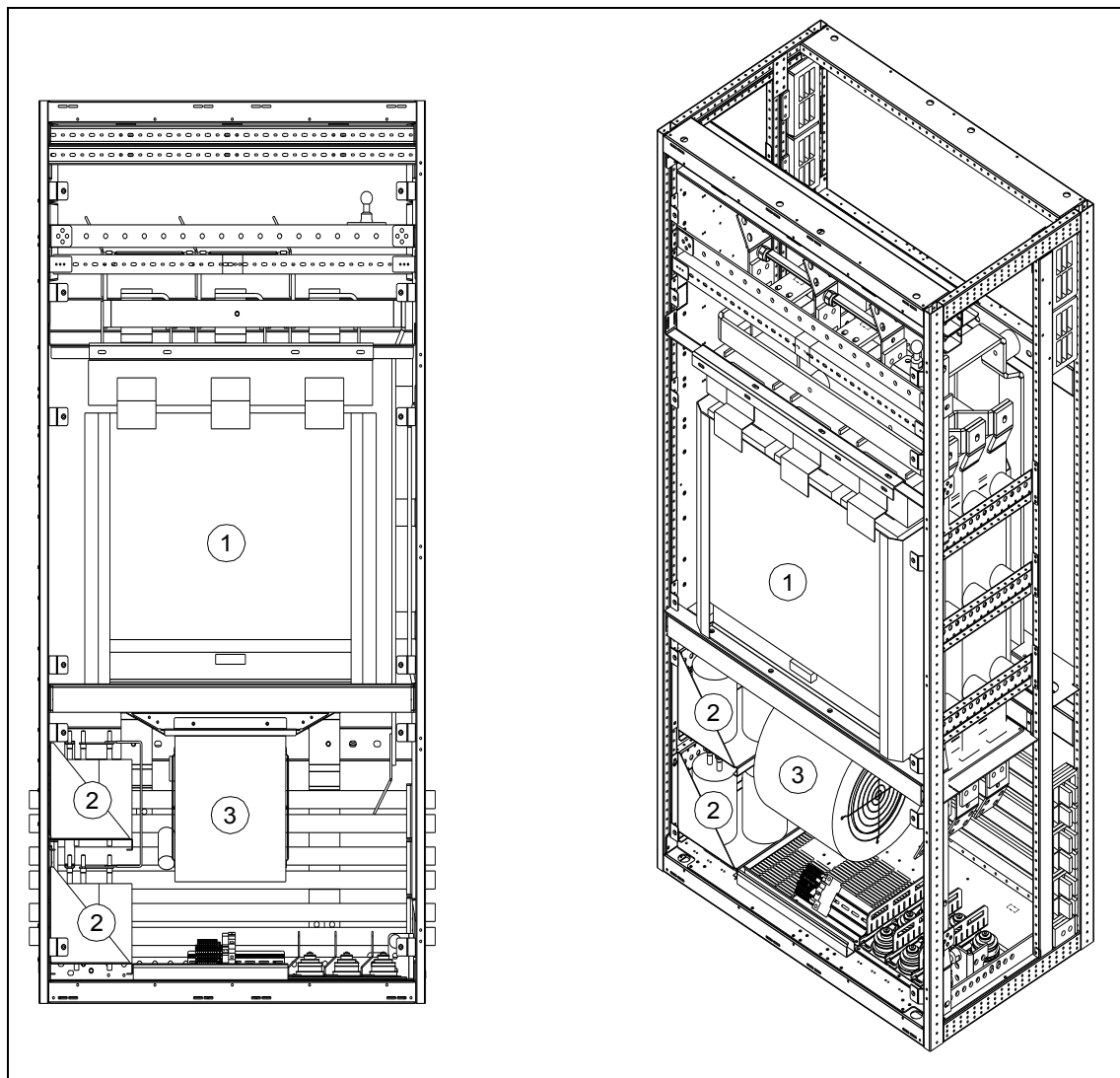
This figure shows an example of a filter kit installation of NSIN0900-6 (by ABB).



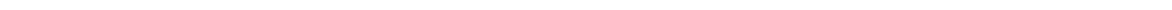
No.	Description
1	Choke module
2	AC capacitor (3 pcs)
3	Cooling fan

■ **NSIN1380-6 installation example**

This figure shows an example of a filter kit installation of NSIN1380-6 (by ABB).



No.	Description
1	Choke module
2	AC capacitor (6 pcs)
3	Cooling fan



## 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](http://www.abb.com/searchchannels).

### Product training

For information on ABB product training, navigate to [new.abb.com/service/training](http://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](http://new.abb.com/drives/manuals-feedback-form).

### Document library on the Internet

You can find manuals and other product documents in PDF format on the Internet at [www.abb.com/drives/documents](http://www.abb.com/drives/documents).

# Contact us

[www.abb.com/drives](http://www.abb.com/drives)

[www.abb.com/drivespartners](http://www.abb.com/drivespartners)

3AXD50000016814 Rev C (EN) 2017-11-09