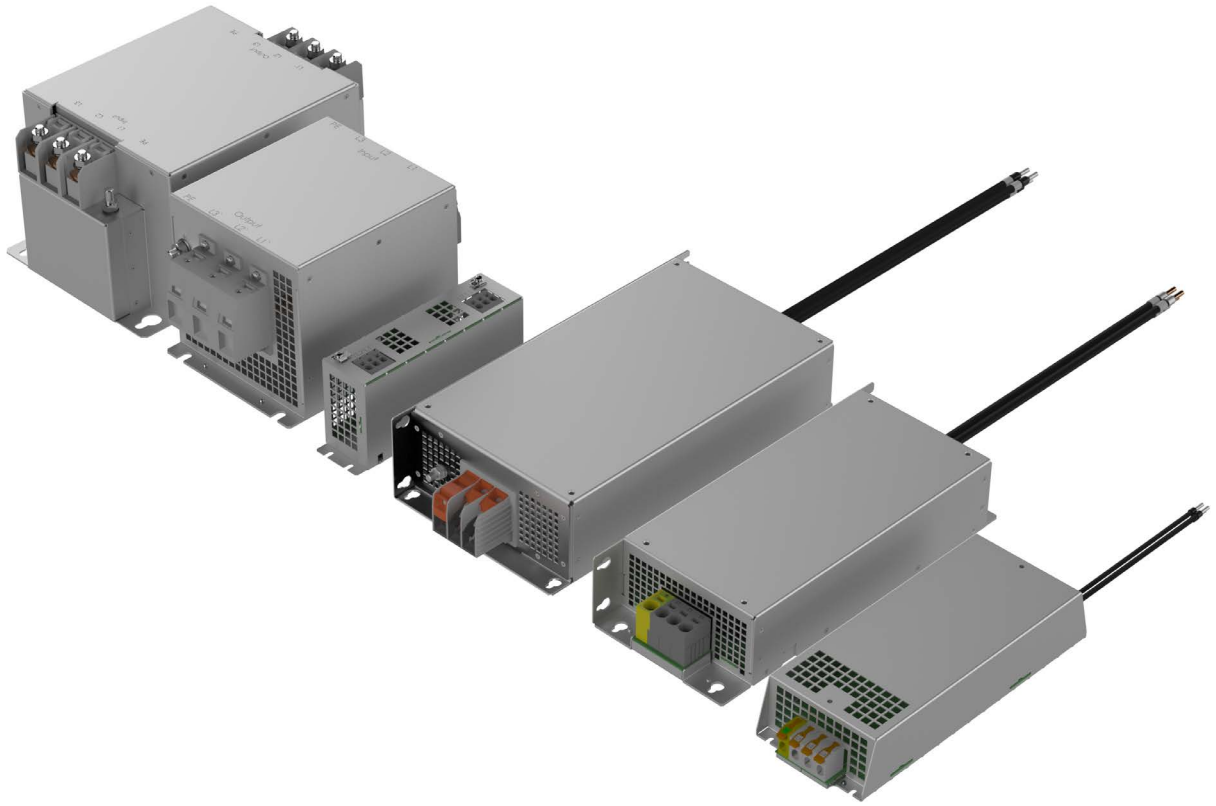

COMBILINE **E6**

INSTRUCTIONS FOR USE | **INSTALLATION EMC FILTER**

Translation of the original manual
Document 20165077 EN 02

Preface

The described hard- and software are developments of the KEB Automation KG. The enclosed documents correspond to conditions valid at printing. Misprint, mistakes and technical changes reserved.

Signal words and symbols

Certain operations can cause hazards during the installation, operation or thereafter. There are safety informations in the documentation in front of these operations. Security signs are located on the device or machine. A warning contains signal words which are explained in the following table:

⚠ DANGER	Dangerous situation, which will cause death or serious injury in case of non-observance of this safety instruction.
⚠ WARNING	Dangerous situation, which may cause death or serious injury in case of non-observance of this safety instruction.
⚠ CAUTION	Dangerous situation, which may cause minor injury in case of non-observance of this safety instruction.
NOTICE	Situation, which can cause damage to property in case of non-observance.

RESTRICTION

Is used when certain conditions must meet the validity of statements or the result is limited to a certain validity range.

Is used when the result will be better, more economic or trouble-free by following these procedures.

More symbols

►	This arrow starts an action step.
• / -	Enumerations are marked with dots or indents.
=>	Cross reference to another chapter or another page.

Note to further documentation.
www.keb.de/service/downloads

Laws and guidelines

KEB Automation KG confirms with the EC declaration of conformity and the CE mark on the device nameplate that it complies with the essential safety requirements.

The EC declaration of conformity can be downloaded on demand via our website. Further information is provided in chapter "Certification".

Warranty and liability

The warranty and liability on design, material or workmanship for the acquired device is given in the general sales conditions.

Here you will find our general sales conditions.
www.keb.de/terms-and-conditions

Further agreements or specifications require a written confirmation.

Support

Through multiple applications not every imaginable case has been taken into account. If you require further information or if problems occur which are not treated detailed in the documentation, you can request the necessary information via the local KEB Automation KG agency.

The use of our units in the target products is outside of our control and therefore lies exclusively in the area of responsibility of the customer.

The information contained in the technical documentation, as well as any user-specific advice in spoken and written and through tests, are made to best of our knowledge and information about the intended use. However, they are regarded as being only informal and changes are expressly reserved, in particular due to technical changes. This also applies to any violation of industrial property rights of a third-party. Selection of our units in view of their suitability for the intended use must be done generally by the user.

Tests can only be done within the intended end use of the product (application) by the customer. They must be repeated, even if only parts of hardware, software or the unit adjustment are modified.

Copyright

The customer may use the instructions for use as well as further documents or parts from it for internal purposes. Copyrights are with KEB Automation KG and remain valid in its entirety.

This KEB product or parts thereof may contain third-party software, including free and/or open source software. If applicable, the license terms of this software are contained in the instructions for use. The instructions for use are already available to you, can be downloaded free of charge from the KEB website or can be requested from the respective KEB contact person.

Other wordmarks or/and logos are trademarks (™) or registered trademarks (®) of their respective owners.

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Standards for EMC components

Product standards:

EN 55017	Methods of measurement of the suppression characteristics of passive EMC filtering devices (CISPR 17:2011); German version EN 55017:2011
EN 60939-1	Passive filter units for electromagnetic interference suppression - Part 1: Generic specification (IEC 60939-1:2010)
EN 61800-3	Speed-adjustable electrical drives. Part 3: EMC requirements and specific test methods (VDE 0160-103, IEC 61800-3)
EN 61800-5-1	Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy (IEC 61800-5-1); German version EN 61800-5-1
UL 61800-5-1	American version of the EN 61800-5-1 with „National Deviations“

Basic standards:

EN 60529	Degrees of protection provided by enclosures (IP Code) (IEC 60529)
EN 60664-1	Insulation coordination for equipment within low-voltage systems Part 1: Principles, requirements and tests (IEC 60664-1)
EN 60721-3-1	Classification of environmental conditions - Part 3-1: Classification of groups of environmental parameters and their severities - Section 1: Storage (IEC 60721-3-1); German version EN 60721-3-1
EN 60721-3-2	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 2: Transportation and handling (IEC 104/670/CD)
EN 60721-3-3	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities; section 3: Stationary use at weatherprotected locations; Amendment A2 (IEC 60721-3-3); German version EN 60721-3-3

General standards:

DGUV regulation 3	Electrical installations and equipment
DNVGL-CG-0339	Environmental test specification for electrical, electronic and programmable equipment and systems
DIN IEC 60364-5-54	Low-voltage electrical installations - Part 5-54: Selection and erection of electrical equipment - Earthing arrangements, protective conductors and protective bonding conductors (IEC 64/1610/CD)
EN 60204-1	Safety of machinery - electrical equipment of machines Part 1: General requirements (VDE 0113-1, IEC 44/709/CDV)
EN 61373	Railway applications - Rolling stock equipment - Shock and vibration tests (IEC 61373); German version EN 61373
ISO 4017	Fasteners - Hexagon head screws - Product grades A and B
ISO 4762	Hexagon socket head cap screws
ISO 7090	Plain washers, chamfered - Normal series - Product grade A
ISO 7092	Plain washers - Small series - Product grade A
ISO 7045	Pan head screws with type H or type Z cross recess - Product grade A

1 Basic Safety Instructions

The COMBIVERT is designed and constructed in accordance with state-of-the-art technology and the recognised safety rules and regulations However, the use of such devices may cause functional hazards for life and limb of the user or third parties, or damages to the system and other material property.

The following safety instructions have been created by the manufacturer for the area of electric drive technology. They can be supplemented by local, country- or application-specific safety instructions. This list is not exhaustive. Non-observance of the safety instructions by the customer, user or other third party leads to the loss of all resulting claims against the manufacturer.

NOTICE

Hazards and risks through ignorance.

► Read the instructions for use !

► Observe the safety and warning instructions !

► If anything is unclear, please contact KEB Automation KG !

1.1 Target group

This instruction manual is determined exclusively for electrical personnel. Electrical personnel for the purpose of this instruction manual must have the following qualifications:

- Knowledge and understanding of the safety instructions.
- Skills for installation and assembly.
- Start-up and operation of the product.
- Understanding of the function in the used machine.
- Detection of hazards and risks of the electrical drive technology.
- Knowledge of *DIN IEC 60364-5-54*.
- Knowledge of national safety regulations (e.g. *DGUV regulation 3*).

1.1 Transport, storage and proper use

The transport is carried out by qualified persons in accordance with the environmental conditions specified in this manual. The filters shall be protected against excessive strains.

Do not store the filters

- in the environment of aggressive and/or conductive liquids or gases.
- with direct sunlight.
- outside the specified environmental conditions.

1.2 Installation

⚠ DANGER

Do not operate in an explosive environment!

► The COMBIVERT is not intended for the use in potentially explosive environment.

⚠ CAUTION

Maximum design edges and high weight!

Contusions and bruises!

► Never stand under suspended loads.

► Wear safety shoes.

► Secure drive converter accordingly when using lifting gear.

- To prevent damages to the device:
- Make sure that no components are bent and/or isolation distances are changed.
- The device must not be put into operation in case of mechanical defects. Non-compliance with the applicable standards.
- Do not allow moisture or mist to penetrate the unit.
- Avoid dust permeating the device. Allow for sufficient heat dissipation if installed in a dust-proof housing.
- Note installation position and minimum distances to surrounding elements. Do not cover the ventilation openings.
- Mount the drive inverter according to the specified degree of protection.
- Make sure that no small parts fall into the COMBIVERT during assembly and wiring (drilling chips, screws etc.). This also applies to mechanical components, which can lose small parts during operation.
- Check the reliable fit of the device connections in order to avoid contact resistances and sparking.
- Do not walk-on drive converter.
- The safety instructions are to be kept!

1.3 Electrical connection

⚠ DANGER

Voltage at the terminals and in the device!

Danger to life due to electric shock!

- ► For any work on the unit switch off the supply voltage and secure it against switching on.
- ► The supplied drive converters and filters form a technical unit and must therefore not be disconnected from the mains independently of one another.
- ► Wait until the drive has stopped in order that no regenerative energy can be generated.
- ► Observe capacitor discharge time, if necessary measure DC voltage at the terminals.
- ► Never bridge upstream protective devices (also not for test purposes).

For a trouble-free and safe operation, please pay attention to the following instructions:

- The electrical installation shall be carried out in accordance with the relevant requirements.
- Cable cross-sections and fuses must be dimensioned according to the design of the machine manufacturer. Specified minimum / maximum values may not be fallen below /exceeded.
- With existing or newly wired circuits the person installing the units or machines must ensure the EN requirements are met.

1.4 Start-up and operation

⚠ CAUTION

High temperatures at heat sink and coolant!

Burning of the skin!

- ► Cover hot surfaces safe-to-touch.
- ► If necessary, attach warning signs on the system.
- ► Check surface and coolant lines before touching them.
- ► Before working let the unit cool down.

- During operation, all covers and control cabinet doors shall be kept closed.
- Only use accessories approved for the device.
- Never touch terminals, busbars or cable ends.

1.5 Repair

In case of malfunction, unusual noises or smells inform a person in charge!

⚠ DANGER

Unauthorized exchange, repair and modifications!

Unpredictable malfunctions!

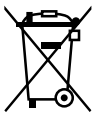
- ► Modification or repair is permitted only by authorized personnel by KEB Automation KG.
- ► Only use original manufacturer parts.
- ► Infringement will annul the liability for resulting consequences.

In case of failure, please contact the machine manufacturer. Only the machine manufacturer knows the components and can provide appropriate sqare parts or induce the maintenance.

1.6 Disposal

Electronic devices of the KEB Automation KG are exclusively professional devices for further industrial processing (so-called B2B devices).

Manufacturers of B2B devices are obliged to take back and recycle devices manufactured after 14.08.2018. These devices may not be disposed at the collection centres of public sector disposal organisations.



If no deviating agreement has been made between the customer and KEB or no deviating mandatory legal regulation exists, KEB products marked in this way can be returned. Company and keyword to the return point can be taken from the list below. Shipping costs are paid by the customer. Thereupon the devices will be professionally recycled and disposed.

The entry numbers are listed country-specific in the following table. The corresponding KEB return addresses can be found on our website.

Withdrawal by	WEEE-Reg.-No.	Keyword
Austria		
KEB Automation GmbH	ERA: 51976	Stichwort „Rücknahme WEEE“
France		
RÉCYLUM - Recycle point	ADEME: FR021806	Mots clés „KEB DEEE“
Germany		
KEB Automation KG	EAR: DE12653519	Stichwort „Rücknahme WEEE“
Italy		
COBAT	AEE: (IT) 19030000011216	Parola chiave „Ritiro RAEE“

The packaging must be feed to paper and cardboard recycling.

2 Product Description

The COMBILINE E6 series are EMC filters. They are used to comply with normative limit values of high-frequency conducted interference voltages in the mains input of the drive converter.

The filters consist of an LC network which has a particularly high damping in the entire frequency range. This also reduces the effective leakage current of the drive system.

The filters are universally applicable when selecting the possible switching frequencies.

The back mount filters are intended for direct mechanical attachment to the COMBIVERT F6 drive converters.

2.1 Specified application

COMBILINE filters are only suitable for use with drive converters. They are intended for the installation into electrical systems or machines.

Technical data and information for connection conditions shall be taken from the type plate and from the instruction manual and must be strictly observed.

2.2 Unintended use

The operation of our products outside the indicated limit values of the technical data leads to the loss of any liability claims.

2.3 Product features

This instructions for use describe the following filters:

Unit type:	Back mount filter and side mount filter
Series:	COMBILINE E6
Rated current	12...330 A
Back mount filter suitable for COMBIVERT F6 housing:	2, 3, 4

The COMBILINE E6 filters are characterized by the following features:

- Designed for interference suppression of individual devices
- Side mount and back mount filters are suitable for the use on TN, TT and IT systems
- Large rated voltage range
  - 0...528 V for TN, TT mains filter
  - 300...528 V for IT mains filter
- High saturation resistance, designed for shielded motor cable lengths up to 100 m
- Low leakage current
- Operation on AC-DC sensitive RCDs with low tripping threshold of 30 mA for personal protection and 300 mA for fire protection
- Increase of the interference immunity of the drive converters
- Compact design of the filters. Assembly of the back mount filter directly under the drive converter

2.4 Part code

x x	E 6	T 6 0	-	x	x	x	x		
								Version	0: Sequential numbering
								Mains type	0: TN, TT
									5: IT
								Limit class	0: C1
									1: C2
									2: C3
								Design / Voltage class	1: Back mount filter / 400 V / 3ph
									3: Side mount filter / 400 V / 3ph
								Version	T60: Complete filter incl. housing
								Series	E6: COMBILINE
								Unit size	12...27: COMBILINE E6 filter

Table 1: Part code

3 Technical Data

Unless otherwise indicated, all electrical data in the following chapter refer to a 3-phase AC mains.

3.1 Operating conditions

3.1.1 Climatic ambient conditions

Storage	**Standard**	**Class**	**Notes**
Surrounding temperature	*EN 60721-3-1*	1K4	-25…55 °C
Relative humidity	*EN 60721-3-1*	1K3	5…95 % (without condensation)
Storage height	–	–	max. 3000 m above sea level
Transport	**Standard**	**Class**	**Notes**
Surrounding temperature	*EN 60721-3-2*	2K3	-25…70 °C
Relative humidity	*EN 60721-3-2*	2K3	95 % at 40 °C (without condensation)
Operation	**Standard**	**Class**	**Notes**
Surrounding temperature	*EN 60721-3-3*	3K3	5…40 °C (extended to -10…45 °C)
Air inlet temperature	–	–	5…40 °C (-10…45 °C)
Relative humidity	*EN 60721-3-3*	3K3	5…85 % (without condensation)
Version and degree of protection	*EN 60529*	IP20	Protection against foreign material > ø12.5 mm No protection against water Non-conductive pollution, occasional condensation when PDS is out of service.
Site altitude	–	–	max. 2000 m above sea level • With site altitudes over 1000 m a derating of 1 % per 100 m must be taken into consideration.

Table 2: Climatic ambient conditions

3.1.2 Mechanical ambient conditions

Storage	Standard	Class	Notes
Vibration limits	*EN 60721-3-1*	1M1	Vibration amplitude 0.3 mm (2…9 Hz) Acceleration amplitude 1 m/s² (9…200 Hz)
Shock limit values	*EN 60721-3-1*	1M1	40 m/s²; 22 ms
Transport	**Standard**	**Class**	**Notes**
Vibration limits	*EN 60721-3-2*	2M1	Vibration amplitude 3.5 mm (2…9 Hz) Acceleration amplitude 10 m/s² (9…200 Hz) (Acceleration amplitude 15 m/s² (200…500 Hz))*
Shock limit values	*EN 60721-3-2*	2M1	100 m/s²; 11 ms
Operation	**Standard**	**Class**	**Notes**
Vibration limits	*EN 60721-3-3*	3M4	Vibration amplitude 3.0 mm (2…9 Hz) Acceleration amplitude 10 m/s² (9…200 Hz)
	EN 61800-5-1	–	Vibration amplitude 0.075 mm (10…57 Hz) Acceleration amplitude 10 m/s² (57…150 Hz)
Shock limit values	*EN 60721-3-3*	3M4	100 m/s²; 11 ms

Table 3: Mechanical ambient conditions

**Not tested*

3.1.3 Chemical/mechanical active substances

Storage		Standard	Class	Notes
Contamination	Gases	*EN 60721-3-1*	1C2	–
	Solids		1S2	–
Transport		**Standard**	**Class**	**Notes**
Contamination	Gases	*EN 60721-3-2*	2C2	–
	Solids		2S2	–
Operation		**Standard**	**Class**	**Notes**
Contamination	Gases	*EN 60721-3-3*	3C2	–
	Solids		3S2	–

Table 4: Chemical/mechanical active substances

3.1.4 Electrical operating conditions

3.1.4.1 Equipment classification

Requirement	Standard	Class	Notes
Overvoltage category	*EN 61800-5-1*	III	–
	EN 60664-1		–
Pollution degree	*EN 60664-1*	2	Non-conductive pollution, occasional condensation when PDS is out of service.

Table 5: Device classification

3.2 Electrical data

3.2.1 Electrical data back mount filter unit sizes 14, 16 (F6 housing 2)

Filter type			14E6T60-1050	16E6T60-1050
Rated voltage		U_N / V	400 (UL: 480)	
Voltage range	2)	U_{in} / V	300...528	
Phases			3	
Rated frequency		f_N / Hz	50/60±2	
Leakage current		I_{leak} / mA	2.1	2.1
Rated current @ U_N = 400 V		I_N / A	21	43
Rated current @ U_N = 480 V		I_{N_UL} / A	18	35
Rated overload (60s)	1)	I_{60s} / %	150	
Power dissipation		P_D / W	22	31

Table 6: Electrical data back mount filter F6 housing 2

1) *The values refer in % to the rated current I_N.*

2) *Up to 550 V for max. 1min/h*

3.2.2 Electrical data back mount filter unit sizes 18, 20 (F6 housing 3)

Filter type			18E6T60-1050	20E6T60-1050
Rated voltage		U_N / V	400 (UL: 480)	
Voltage range	2)	U_{in} / V	300...528	
Phases			3	
Rated frequency		f_N / Hz	50/60±2	
Leakage current		I_{leak} / mA	2.1	2.1
Rated current @ U_N = 400 V		I_N / A	59	82
Rated current @ U_N = 480 V		I_{N_UL} / A	48	72
Rated overload (60s)	1)	I_{60s} / %	150	
Power dissipation		P_D / W	40	82

Table 7: Electrical data back mount filter F6 housing 3

1) *The values refer in % to the rated current I_N.*

2) *Up to 550 V for max. 1min/h*

3.2.3 Electrical data back mount filter unit size 22 (F6 housing 4)

Filter type			22E6T60-1050
Rated voltage		U_N / V	400 (UL: 480)
Voltage range	2)	U_{in} / V	300...528
Phases			3
Rated frequency		f_N / Hz	50 / 60 ± 2
Leakage current		I_{leak} / mA	2.1
Rated current @ U_N = 400 V		I_N / A	126
Rated current @ U_N = 480 V		I_{N_UL} / A	105
Rated overload (60s)	1)	I_{60s} / %	150
Power dissipation		P_D / W	109

Table 8: Electrical data back mount filter F6 housing 4

1) *The values refer in % to the rated current I_N.*

2) *Up to 550 V for max. 1min / h*

3.2.4 Electrical data side mount filter unit sizes 12, 14, 16

Filter type			12E6T60-3xxx	14E6T60-3xxx	16E6T60-3xxx
Rated voltage		U_N / V	400 (UL: 240)	400 (UL: 480)	
Voltage range for xxE6T60-3000	2)	U_{in} / V	0...528		
Voltage range for xxE6T60-3050	2)	U_{in} / V	300...528		
Phases			3		
Rated frequency		f_N / Hz	50 / 60 ± 2		
Leakage current		I_{leak} / mA	1.85	1.92	1.27
Rated current @ U_N = 400 V		I_N / A	12	22	43
Rated current @ U_N = 240 V		I_{N_UL} / A	10.6	-	-
Rated current @ U_N = 480 V		I_{N_UL} / A	-	19.6	35
Rated overload (60s)	1)	I_{60s} / %	180		
Power dissipation		P_D / W	8	13.5	17.5

Table 9: Electrical data side mount filter sizes 12, 14, 16

1) *The values refer in % to the rated current I_N.*

2) *Up to 550 V for max. 1min / h*

3.2.5 Electrical data side mount filter unit sizes 18, 20

Filter type			18E6T60-3xxx	20E6T60-3xxx
Rated voltage		U_N / V	400 (UL: 480)	
Voltage range for xxE6T60-3000	2)	U_{in} / V	0...528	
Voltage range for xxE6T60-3050	2)	U_{in} / V	300...528	
Phases			3	
Rated frequency		f_N / Hz	50 / 60 ± 2	
Leakage current		I_{leak} / mA	1.57	2.02
Rated current @ U_N = 400 V		I_N / A	65	100
Rated current @ U_N = 480 V		I_{N_UL} / A	52	72
Rated overload (60s)	1)	I_{60s} / %	150	
Power dissipation		P_D / W	27	54

Table 10: Electrical data side mount filter sizes 18, 20

1) *The values refer in % to the rated current I_N.*

2) *Up to 550 V for max. 1min / h*

3.2.6 Electrical data side mount filter unit sizes 22, 24

Filter type			22E6T60-3xxx	24E6T60-3xxx
Rated voltage		U_N / V	400 (UL: 480)	
Voltage range for xxE6T60-3000	2)	U_{in} / V	0...528	
Voltage range for xxE6T60-3050	2)	U_{in} / V	300...528	
Phases			3	
Rated frequency		f_N / Hz	50 / 60 ± 2	
Leakage current		I_{leak} / mA	2.02	2.67
Rated current @ U_N = 400 V		I_N / A	150	200
Rated current @ U_N = 480 V		I_{N_UL} / A	105	169
Rated overload (60s)	1)	I_{60s} / %	150	
Power dissipation		P_D / W	80	100

Table 11: Electrical data side mount filter sizes 22, 24

1) *The values refer in % to the rated current I_N.*

2) *Up to 550 V for max. 1min / h*

3.2.7 Electrical data side mount filter unit size 27

Filter type			27E6T60-3xxx
Power dissipation		P_D / W	160
Rated voltage		U_N / V	400 (UL: 480)
Voltage range for xxE6T60-3000	2)	U_{in} / V	0...528
Voltage range for xxE6T60-3050	2)	U_{in} / V	300...528
Phases			3
Rated frequency		f_N / Hz	50 / 60 ± 2
Leakage current		I_{leak} / mA	3.54
Rated current @ U_N = 400 V		I_N / A	330
Rated current @ U_N = 480 V		I_{N_UL} / A	-
Rated overload (60s)	1)	I_{60s} / %	150
Power dissipation		P_D / W	160

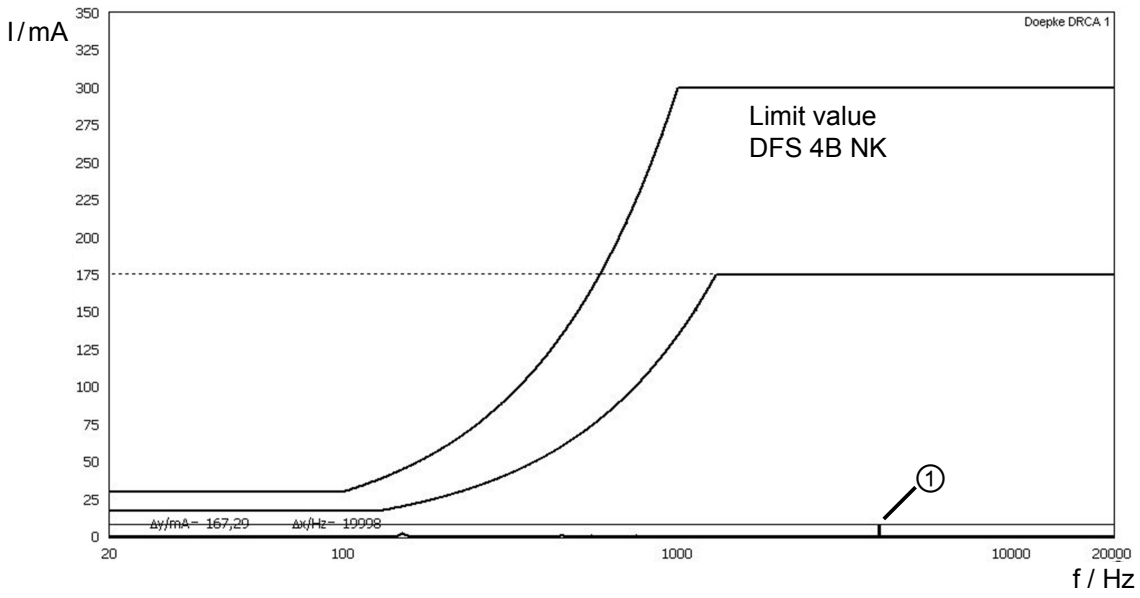
Table 12: Electrical data side mount filter unit size 27

1) *The values refer in % to the rated current I_N.*

2) *Up to 550 V for max. 1min / h*

3.2.8 Leakage current measurements

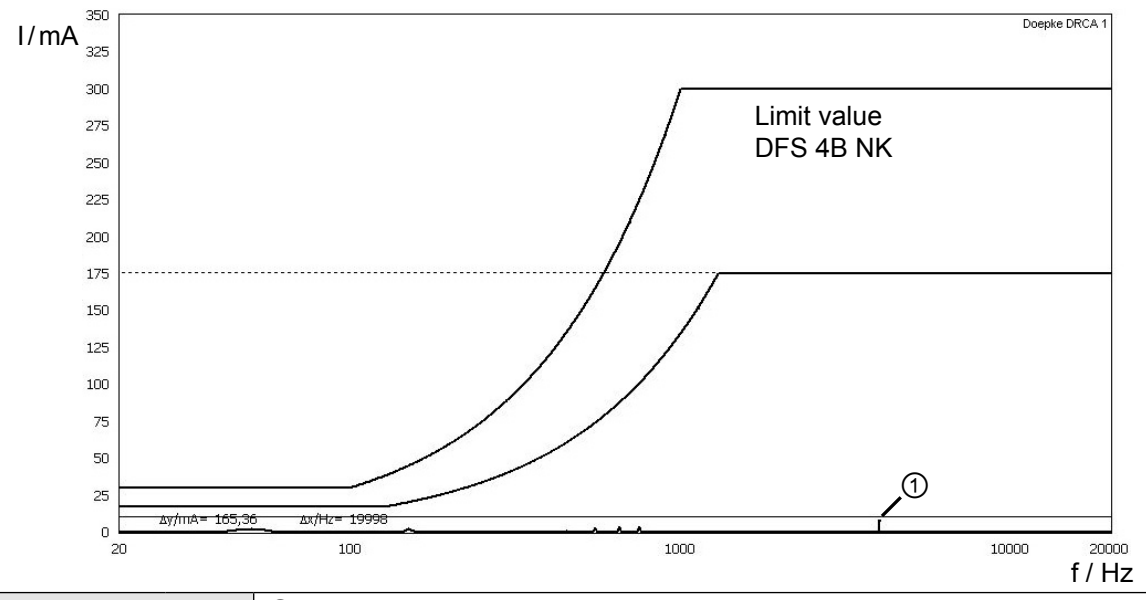
3.2.8.1 Leakage current measurement 12E6T60-3xxx



Measuring point		①
Current	*I* / mA	8.5
Frequency	*f* / Hz	4000

Figure 1: Leakage current measurement 12E6T60-3xxx

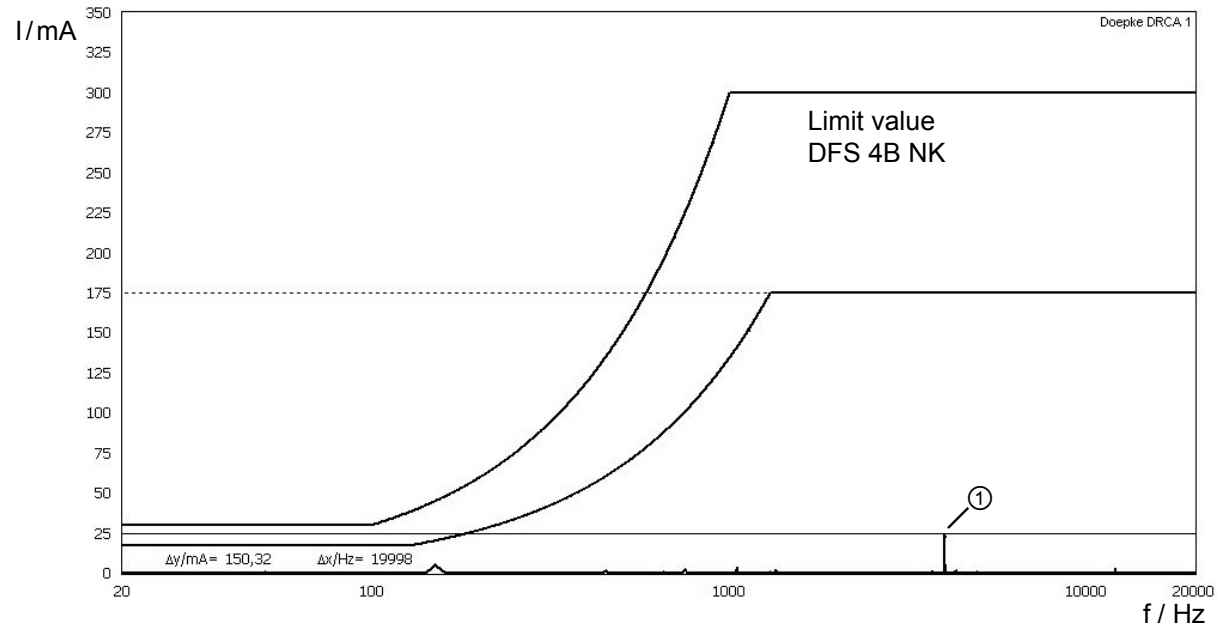
3.2.8.2 Leakage current measurement 14E6T60-xxxx



Measuring point		①
Current	*I* / mA	6.7
Frequency	*f* / Hz	4000

Figure 2: Leakage current measurement 14E6T60-xxxx

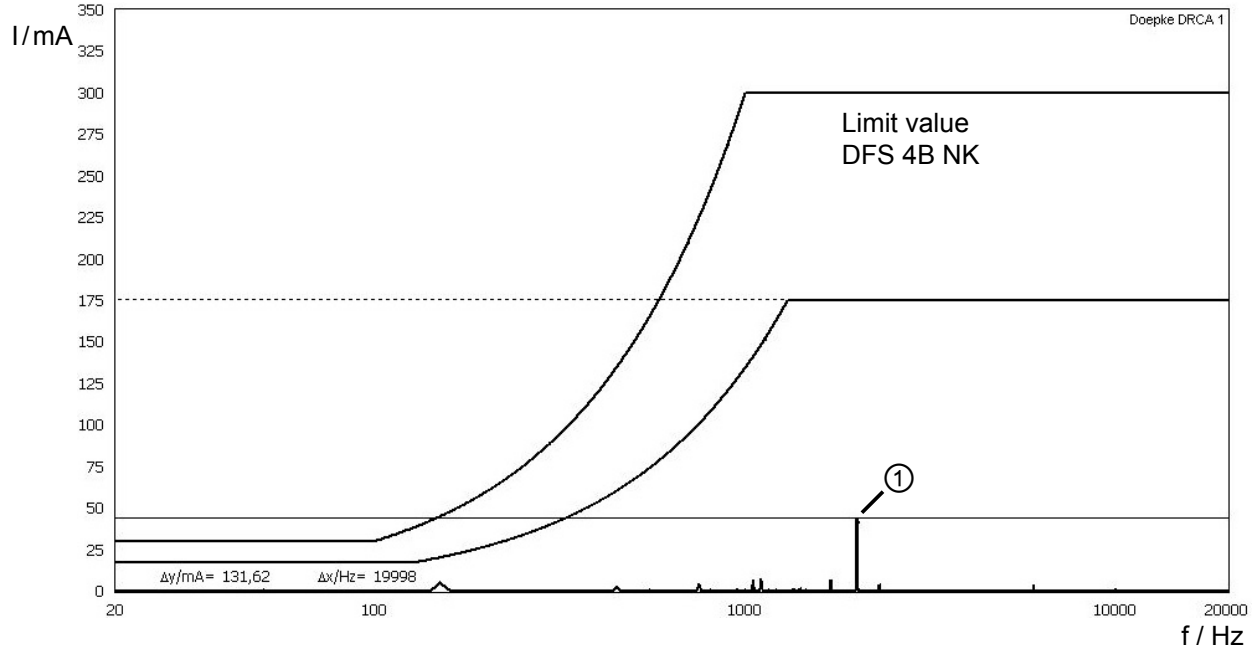
3.2.8.3 Leakage current measurement 16E6T60-xxxx



Measuring point		①
Current	*I* / mA	24.7
Frequency	*f* / Hz	4000

Figure 3: Leakage current measurement 16E6T60-xxxx

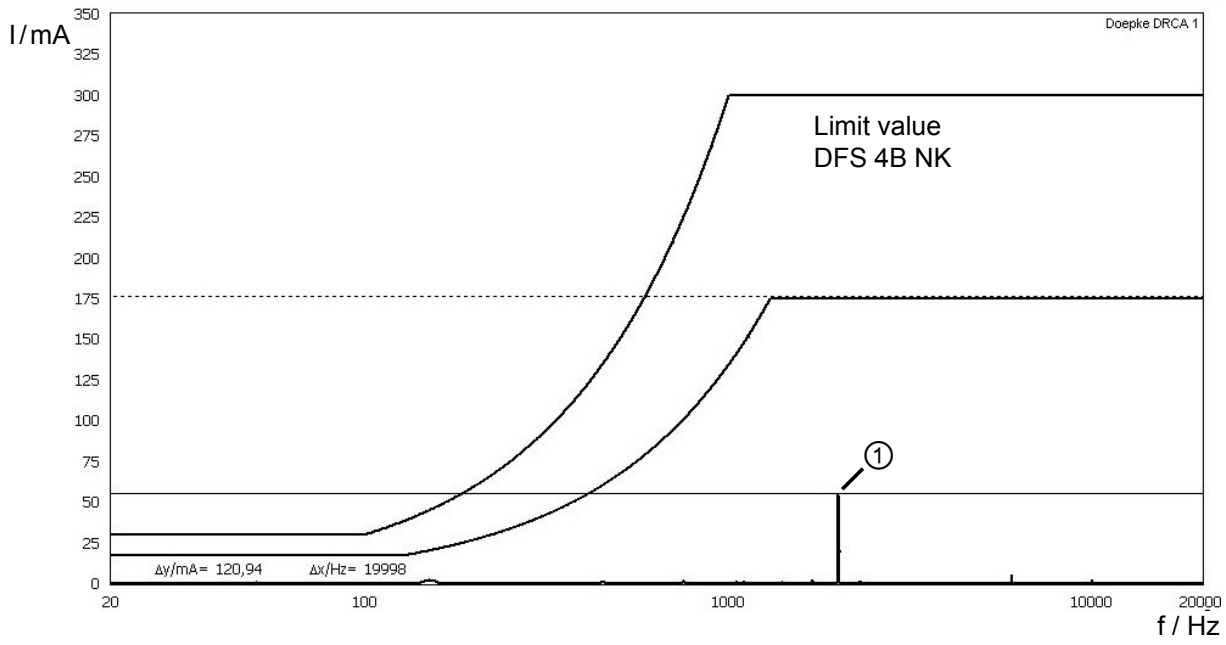
3.2.8.4 Leakage current measurement 18E6T60-xxxx



Measuring point		①
Current	*I* / mA	44.1
Frequency	*f* / Hz	2000

Figure 4: Leakage current measurement 18E6T60-xxxx

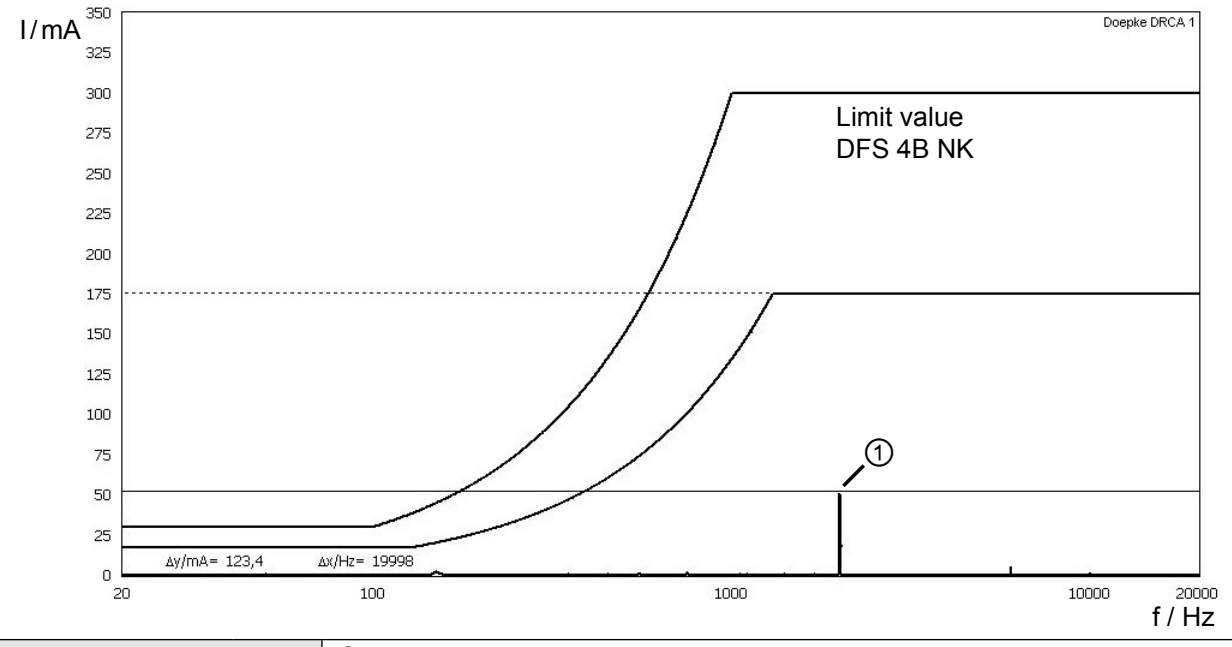
3.2.8.5 Leakage current measurement 20E6T60-xxxx



Measuring point		①
Current	*I* / mA	55.6
Frequency	*f* / Hz	2000

Figure 5: Leakage current measurement 20E6T60-xxxx

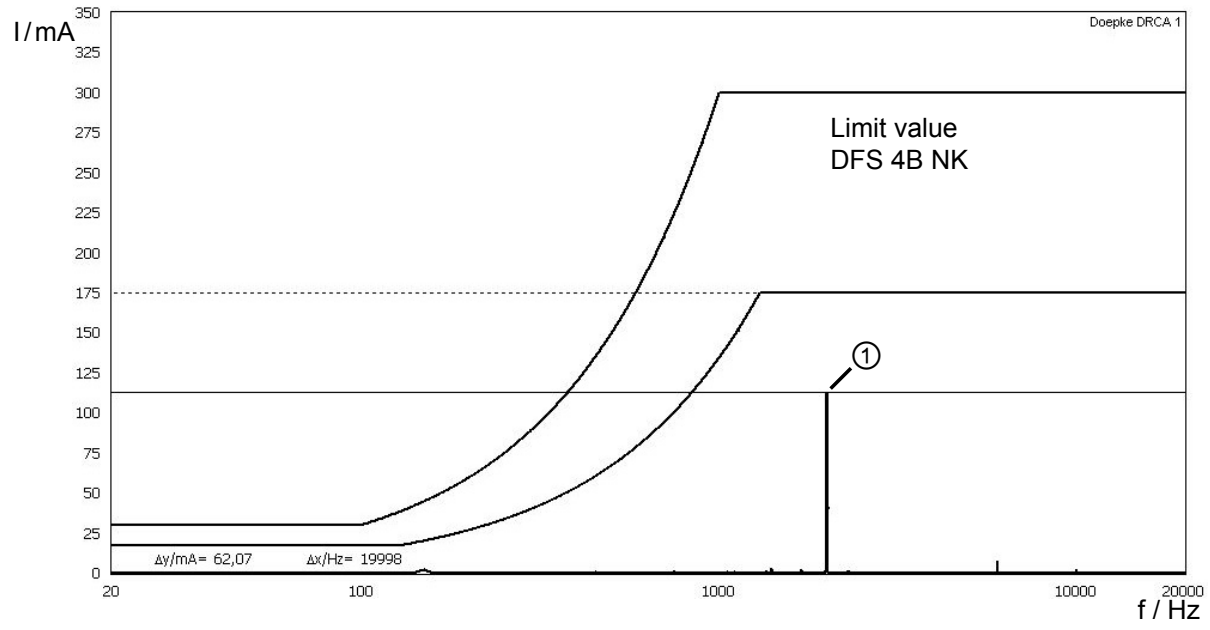
3.2.8.6 Leakage current measurement 22E6T60-xxxx



Measuring point		①
Current	*I* / mA	52.4
Frequency	*f* / Hz	2000

Figure 6: Leakage current measurement 22E6T60-xxxx

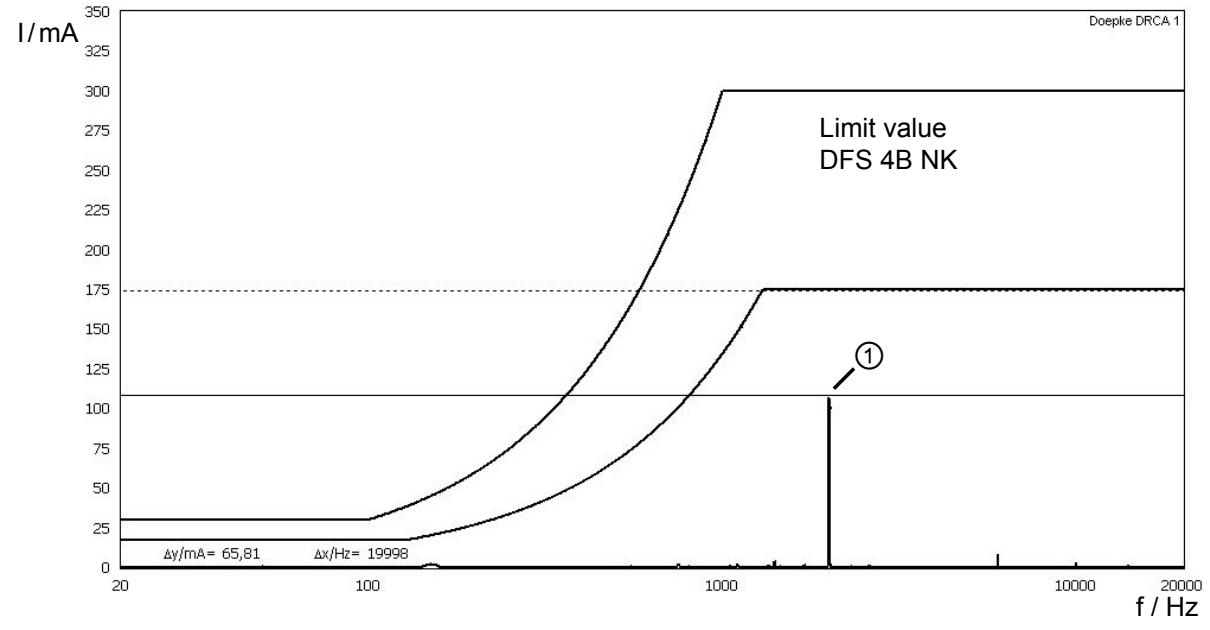
3.2.8.7 Leakage current measurement 24E6T60-3xxx



Measuring point		①
Current	*I* / mA	112.9
Frequency	*f* / Hz	2000

Figure 7: Leakage current measurement 24E6T60-3xxx

3.2.8.8 Leakage current measurement 27E6T60-3xxx



Measuring point		①
Current	*I* / mA	108.4
Frequency	*f* / Hz	2000

Figure 8: Leakage current measurement 27E6T60-3xxx

3.2.8.9 Recommendation for FI-Protective switch

Filters	Drive converter switching frequency *fs* / kHz	FI-Protective switch Doepke DFS 4B NK			
		Tripping current / % DFS 4B 30 mA NK	Tripping current / % DFS 4B 100 mA NK	Tripping current / % DFS 4B 300 mA NK	Tripping current / % DFS 4B 500 mA NK
14E6T60-1050	4	7	5	4	3
16E6T60-1050	4	10	8	8	5
18E6T60-1050	2	14	12	11	7
20E6T60-1050	2	23	21	21	13
22E6T60-1050	2	28	27	27	16
12E6T60-3xxx	8	5	3	2	2
14E6T60-3xxx	4	7	5	4	3
16E6T60-3xxx	4	10	8	8	5
18E6T60-3xxx	2	14	12	11	7
20E6T60-3xxx	2	23	21	21	13
22E6T60-3xxx	2	28	27	27	16
24E6T60-3xxx	2	28	27	27	16
27E6T60-3xxx	2	32	30	30	20
All data are typical values					

Table 13: FI-Protective switch NK recommendation

Filters	Drive converter switching frequency *fs* / kHz	FI-Protective switch Doepke DFS 4B SK			
		Tripping current / % DFS 4B 30 mA NK	Tripping current / % DFS 4B 100 mA NK	Tripping current / % DFS 4B 300 mA NK	Tripping current / % DFS 4B 500 mA NK
14E6T60-1050	4	7	5	4	3
16E6T60-1050	4	10	8	8	5
18E6T60-1050	2	14	12	11	7
20E6T60-1050	2	23	21	21	13
22E6T60-1050	2	28	27	27	16
12E6T60-3xxx	8	5	3	2	2
14E6T60-3xxx	4	7	5	4	3
16E6T60-3xxx	4	10	8	8	5
18E6T60-3xxx	2	14	12	11	7
20E6T60-3xxx	2	23	21	21	13
22E6T60-3xxx	2	28	27	27	16
24E6T60-3xxx	2	28	27	27	16
27E6T60-3xxx	2	32	30	30	20
All data are typical values					

Table 14: FI-Protective switch SK recommendation

3.2.9 Filter characteristics and motor cable length

The motor cable is a capacitance to the shield / earth / PE for the drive converter. The longer the motor cable, the higher the capacitive load of the drive converter and also of the filter. It is therefore necessary to observe the maximum cable length and the switching frequency.

The information on the maximum motor cable lengths can be found in chapter => *„Interference suppression degree“*

The line length can be increased significant by using motor chokes or output filters. KEB recommends the use for motor protection from a line length upto 50 m.

3.2.9.1 Parallel operation

The maximum motor cable length must not be exceeded even in parallel operation.

The formula for calculating the total cable length is:

$$\text{Total length} = \left(\sum_{I=1}^{n} \text{Motor cable lengths}\right) * \sqrt{n\ [\text{number of drives}]}$$

3.2.10 Use at the IT system

In isolated mains the insulation resistance is constantly tested against earth potential. During this monitoring, the used discharge resistors in the filter distort this measurement. Therefore, it is necessary to hide them during normal operation!

This function is fulfilled internally by the IT filters and they offer additionally the feature of low leakage currents besides the corresponding damping.

The rated voltage between phase conductor and artificial star point (an imaginary connection of equal impedances of each phase conductor) shall not exceed 300V (effective value).

3.3 Interference suppression degree

3.3.1 Interference suppression degree of the back mount filter up to unit size 16 (F6 housing 2)

For compliance with the corresponding limit classes, see the following tables:

Filter type		**14E6T60-1050**						
Interference voltage (limit class *EN 61800-3*)		C1			C2			
Rated switching frequency	*fs* / kHz	2	4	8	2	4	8	16
Max. motor cable (low capacitance)	*l* / m	50			100		50	

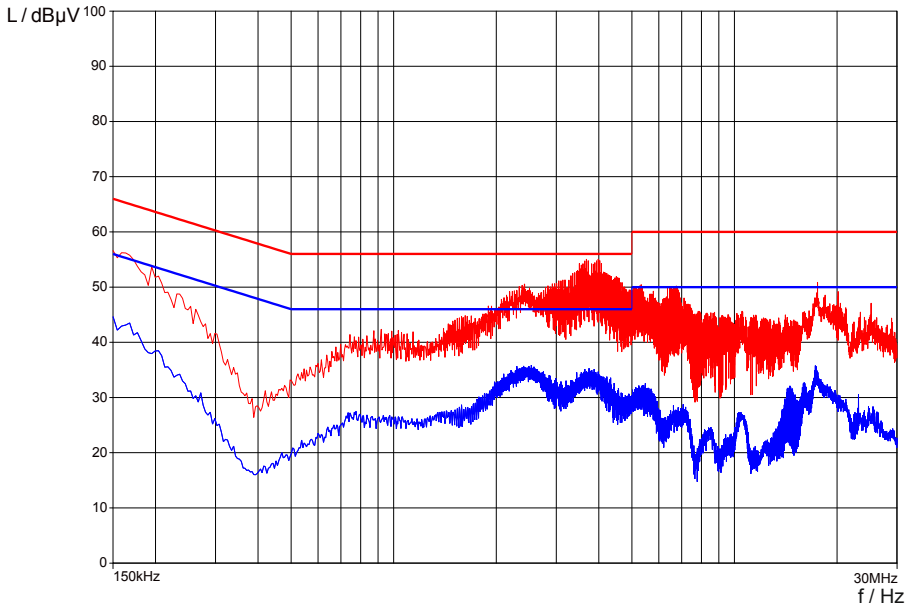
Table 15: Interference suppression degree of the back mount filter size 14 (F6 housing 2)

Filter type		**16E6T60-1050**							
Interference voltage (limit class *EN 61800-3*)		C1				C2			
Rated switching frequency	*fs* / kHz	2	4	8	16	2	4	8	16
Max. motor cable (low capacitance)	*l* / m	50			30	100		50	

Table 16: Interference suppression degree of the back mount filter size 16 (F6 housing 2)

Example diagrams 16E6T60-1050:

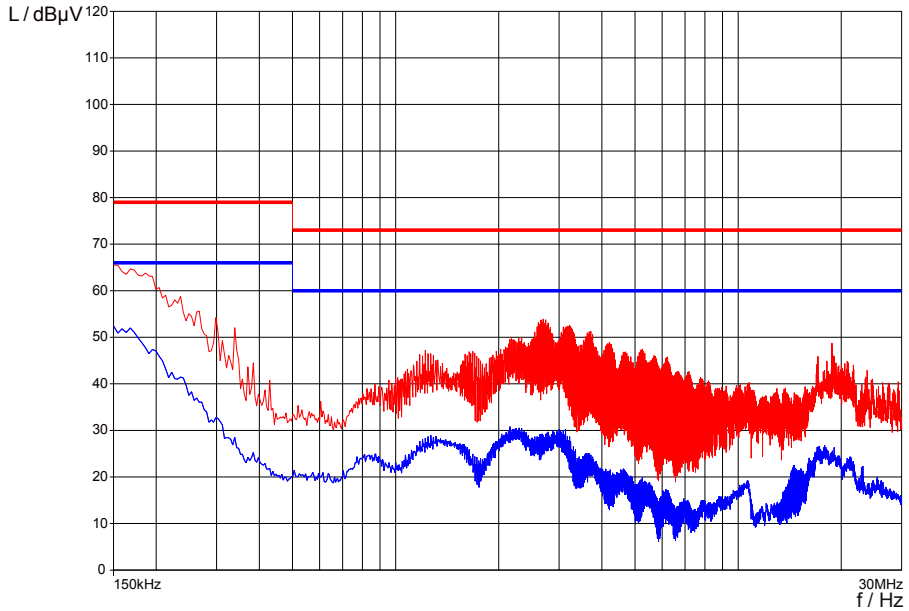
Measurement of the interference voltage, limit value C1 according to *EN 61800-3*; Motor cable $l = 50$ m, output frequency $f_{out} = 5$ Hz and rated switching frequency $f_S = 4$ kHz



Legend			
	QPeak		Average

Figure 9: 16E6T60-1050 Measurement of the interference voltage limit value C1

Measurement of the interference voltage, limit value C2 according to *EN 61800-3*; Motor cable $l = 100$ m, output frequency $f_{out} = 5$ Hz and rated switching frequency $f_S = 4$ kHz



Legend			
	QPeak		Average

Figure 10: 16E6T60-1050 Measurement of the interference voltage limit value C2

3.3.2 Interference suppression degree of the back mount filter up to size 20 (F6 housing 3)

For compliance with the corresponding limit classes, see the following tables:

Filter type		**18E6T60-1050**					
Interference voltage (limit class *EN 61800-3*)		C1			C2		
Rated switching frequency	*fs* / kHz	2	4	8	2	4	8
Max. motor cable (low capacitance)	*l* / m	50			100		50

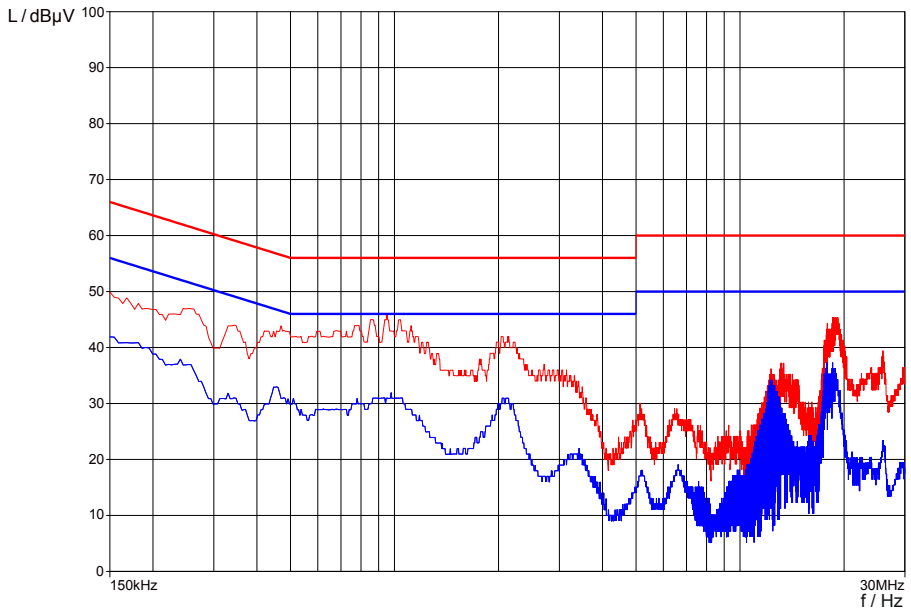
Table 17: Interference suppression degree of the back mount filter size 18 (F6 housing 3)

Filter type		**20E6T60-1050**					
Interference voltage (limit class *EN 61800-3*)		C1		C2			
Rated switching frequency	*fs* / kHz	2	4	2	4	8	16
Max. motor cable (low capacitance)	*l* / m	50		100		50	

Table 18: Interference suppression degree of the back mount filter size 20 (F6 housing 3)

Example diagrams 20E6T60-1050:

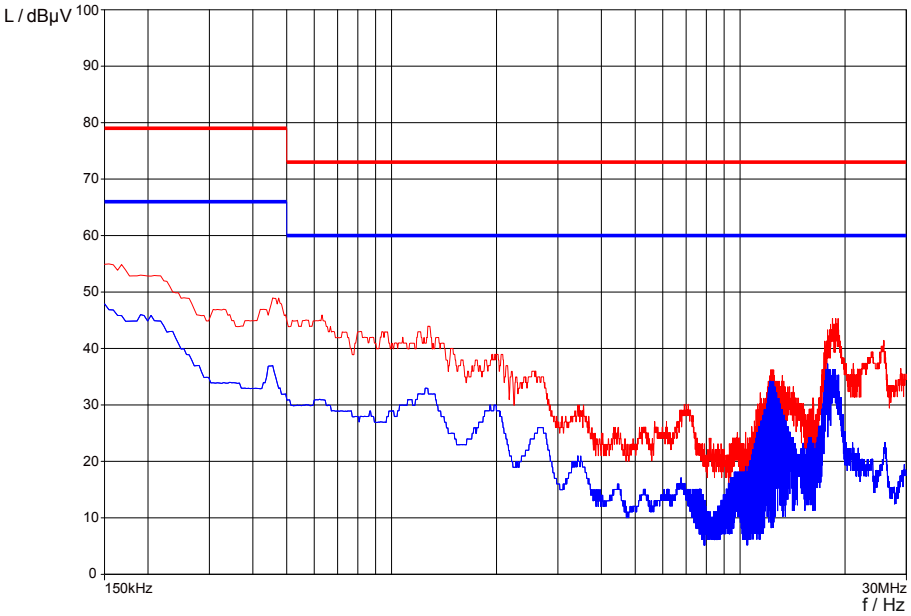
Measurement of the interference voltage, limit value C1 according to *EN 61800-3*; Motor cable $l = 50$m, output frequency $f_{out} = 5$ Hz and rated switching frequency $f_S = 4$ kHz



Legend			
	QPeak		Average

Figure 11: 20E6T60-1050 Measurement of the interference voltage limit value C1

Measurement of the interference voltage, limit value C2 according to *EN 61800-3*; Motor cable $l = 100$ m, output frequency $f_{out} = 5$ Hz and rated switching frequency $f_S = 4$ kHz



Legend			
	QPeak		Average

Figure 12: 20E6T60-1050 Measurement of the interference voltage limit value C2

3.3.3 Interference suppression degree of the back mount filter size 22 (F6 housing 4)

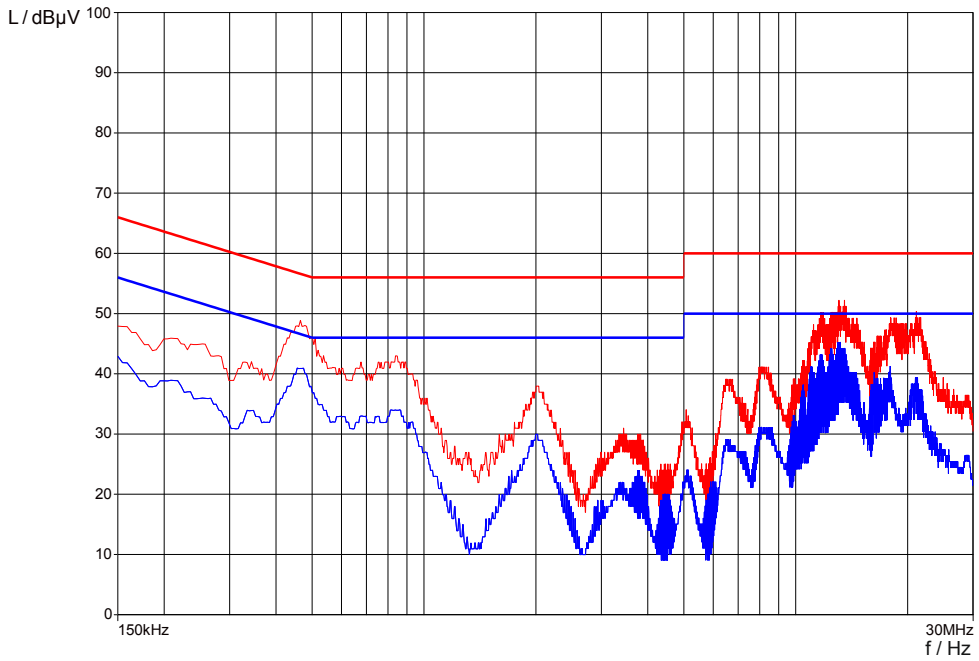
For compliance with the corresponding limit classes, see the following table:

Filter type		**22E6T60-1050**					
Interference voltage (limit class *EN 61800-3*)		C1		C2			
Rated switching frequency	f_S / kHz	2	4	2	4	8	16
Max. motor cable (low capacitance)	l / m	50		100		50	

Table 19: Interference suppression degree of the back mount filter size 22 (F6 housing 4)

Example diagrams 22E6T60-1050:

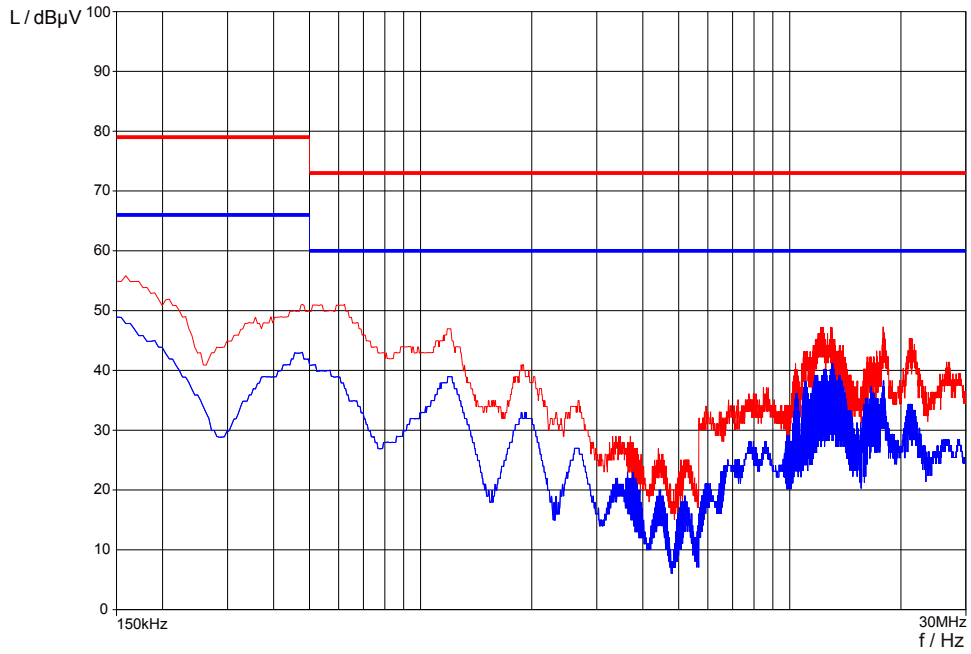
Measurement of the interference voltage, limit value C1 according to *EN 61800-3*; Motor cable l = 50 m, output frequency f_{out} = 5 Hz and rated switching frequency f_S = 4 kHz



Legend			
	QPeak		Average

Figure 13: 22E6T60-1050 Measurement of the interference voltage limit value C1

Measurement of the interference voltage, limit value C2 according to *EN 61800-3*; Motor cable $l = 100\,m$, output frequency $f_{out} = 5\,Hz$ and rated switching frequency $f_S = 4\,kHz$



Legend			
	QPeak		Average

Figure 14: 22E6T60-1050 Measurement of the interference voltage limit value C2

3.3.4 Interference suppression degree of the side mount filter up to size 16

For compliance with the corresponding limit classes, see the following tables:

Filter type		12E6T60-3xxx							
Interference voltage (limit class *EN 61800-3*)		C1				C2			
Rated switching frequency	f_S / kHz	2	4	8	16	2	4	8	16
Max. motor cable (low capacitance)	l / m	50			30	100			

Table 20: Interference suppression degree of the side mount filter size 12

Filter type		14E6T60-3xxx							
Interference voltage (limit class *EN 61800-3*)		C1				C2			
Rated switching frequency	f_S / kHz	2	4	8	16	2	4	8	16
Max. motor cable (low capacitance)	l / m	50			30	100			

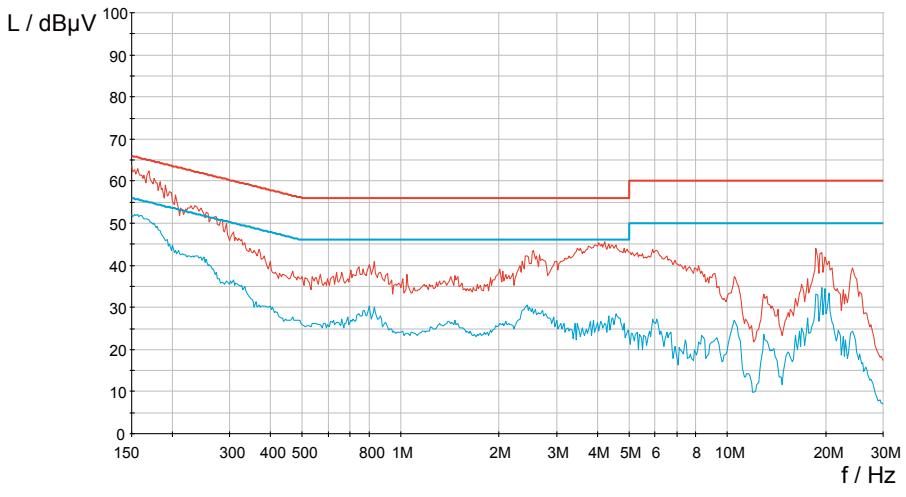
Table 21: Interference suppression degree of the side mount filter size 14

Filter type		16E6T60-3xxx							
Interference voltage (limit class *EN 61800-3*)		C1				C2			
Rated switching frequency	f_S / kHz	2	4	8	16	2	4	8	16
Max. motor cable (low capacitance)	l / m	50			30	100			

Table 22: Interference suppression degree of the side mount filter size 16

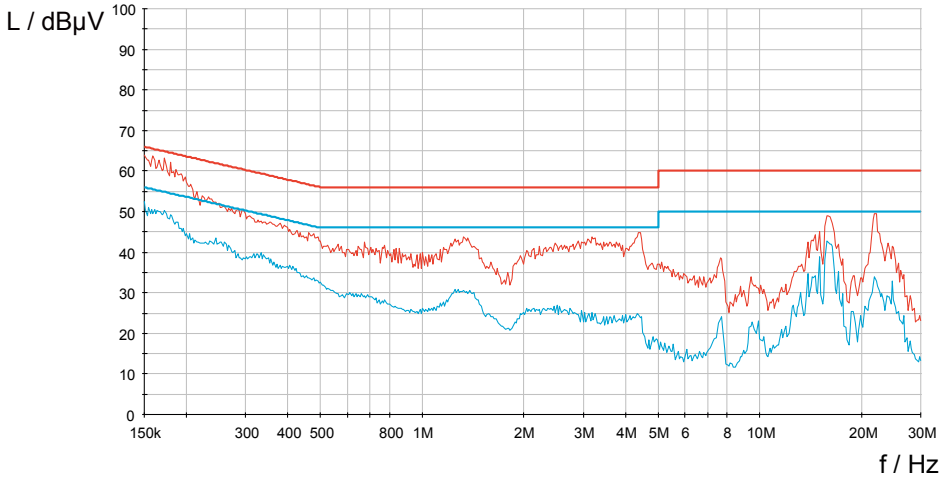
Example diagrams12E6T60-3xxx, 14E6T60-3xxx, 16E6T60-3xxx:

Measurement of the interference voltage, limit value C1 according to *EN 61800-3*; Motor cable l = 50 m, output frequency f_{out} = 5 Hz and rated switching frequency f_S = 4 kHz



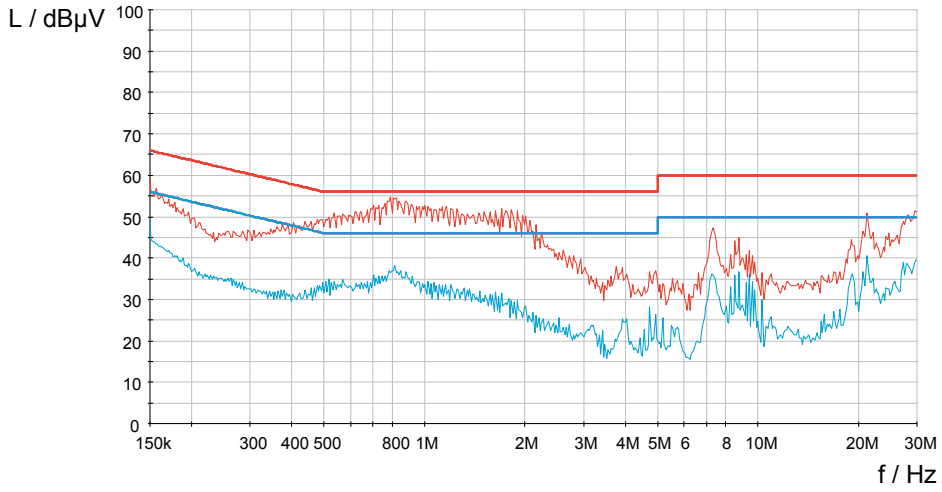
Legend			
	QPeak		Average

Figure 15: 12E6T60-3xxx Measurement of the interference voltage limit value C1



Legend			
	QPeak		Average

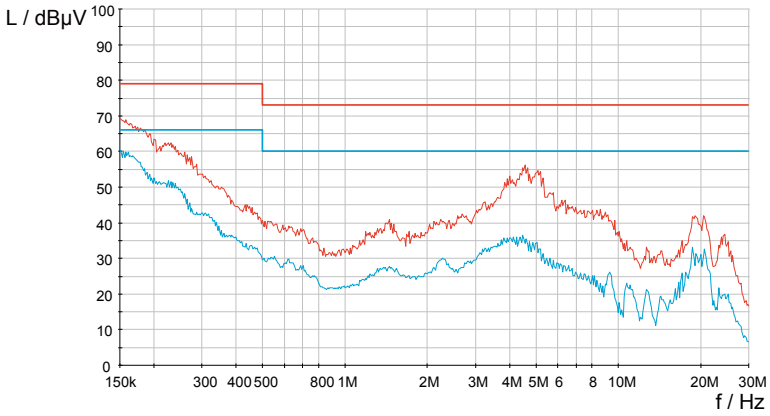
Figure 16: 14E6T60-3xxx Measurement of the interference voltage limit value C1



Legend			
	QPeak		Average

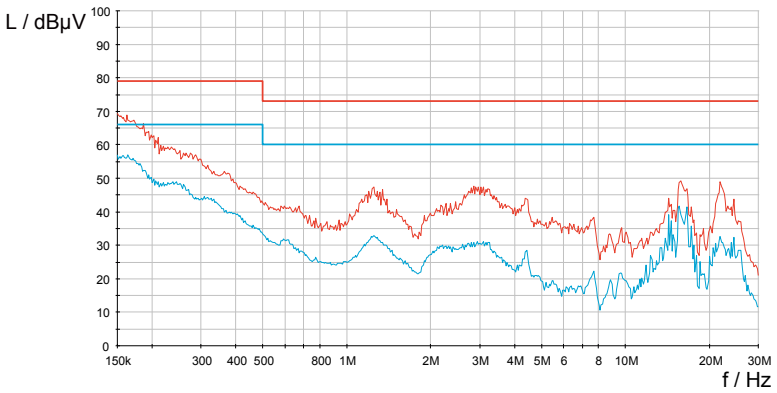
Figure 17: 16E6T60-3xxx Measurement of the interference voltage limit value C1

Measurement of the interference voltage, limit value C2 according to *EN 61800-3*; Motor cable $l = 100$ m, output frequency $f_{out} = 5$ Hz and rated switching frequency $f_S = 4$ kHz



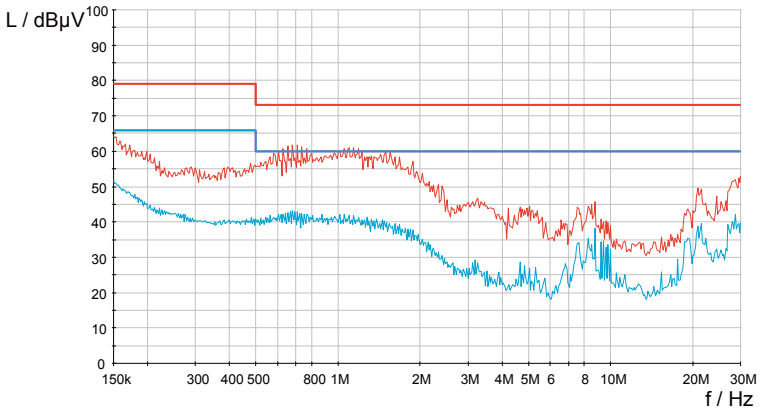
Legend			
	QPeak		Average

Figure 18: 12E6T60-3xxx Measurement of the interference voltage limit value C2



Legend			
	QPeak		Average

Figure 19: 14E6T60-3xxx Measurement of the interference voltage limit value C2



Legend			
	QPeak		Average

Figure 20: 16E6T60-3xxx Measurement of the interference voltage limit value C2

3.3.5 Interference suppression degree of the side mount filter up to size 20

For compliance with the corresponding limit classes, see the following tables:

Filter type		**18E6T60-3xxx**							
Interference voltage (limit class *EN 61800-3*)		C1				C2			
Rated switching frequency	*fs* / kHz	2	4	8	16	2	4	8	16
Max. motor cable (low capacitance)	*l* / m	50			30	100			

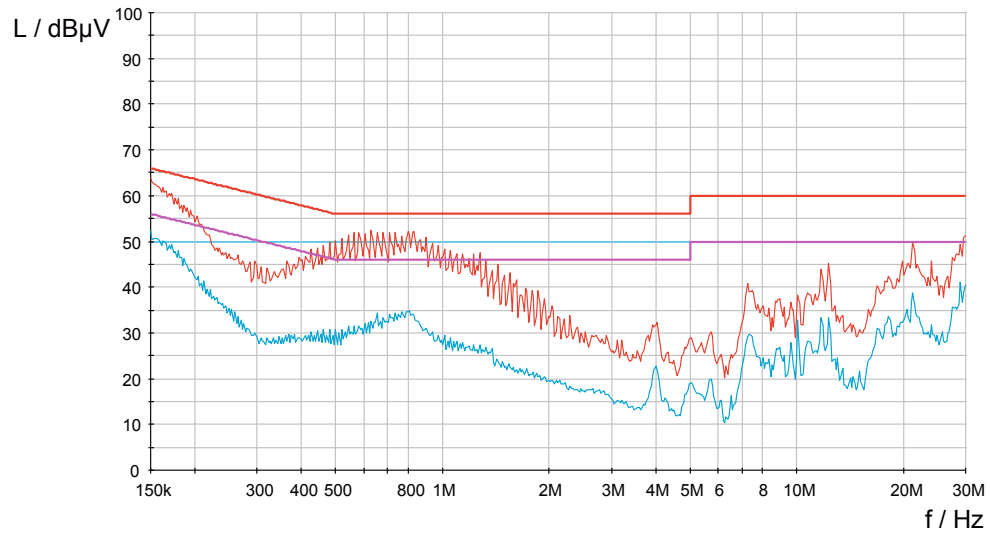
Table 23: Interference suppression degree of the side mount filter size 18

Filter type		**20E6T60-3xxx**							
Interference voltage (limit class *EN 61800-3*)		C1				C2			
Rated switching frequency	*fs* / kHz	2	4	8	16	2	4	8	16
Max. motor cable (low capacitance)	*l* / m	50			30	100			

Table 24: Interference suppression degree of the side mount filter size 20

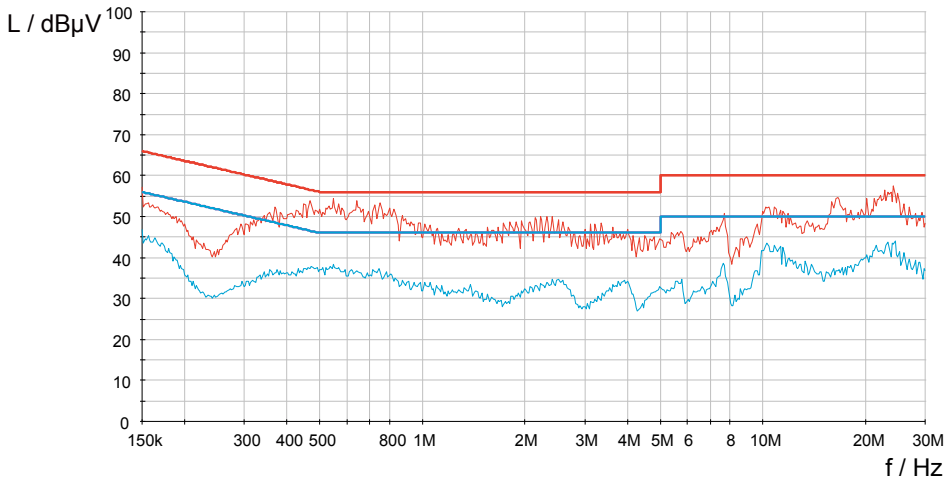
Example diagrams 18E6T60-3xxx, 20E6T60-3xxx:

Measurement of the interference voltage, limit value C1 according to *EN 61800-3*; Motor cable $l = 50$ m, output frequency $f_{out} = 5$ Hz and rated switching frequency $f_S = 4$ kHz



Legend			
	QPeak		Average

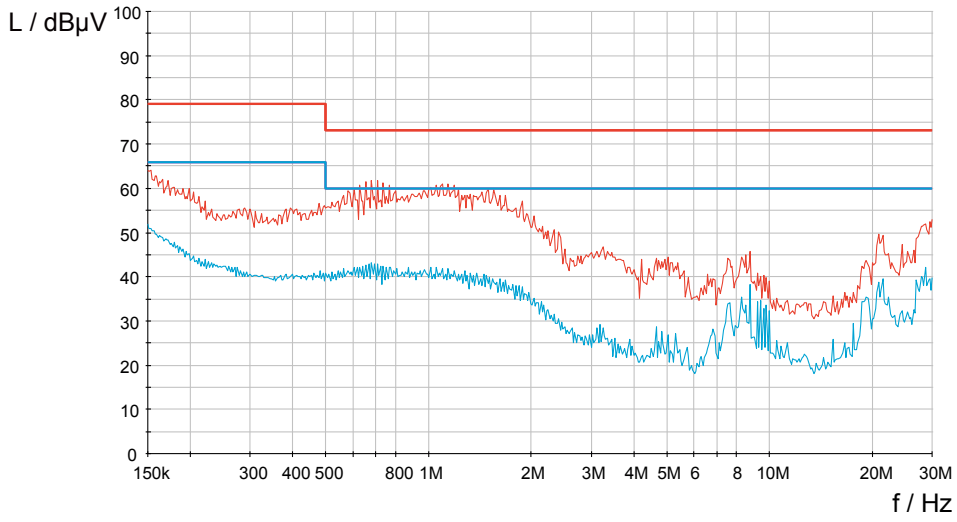
Figure 21: 18E6T60-3xxx Measurement of the interference voltage limit value C1



Legend			
	QPeak		Average

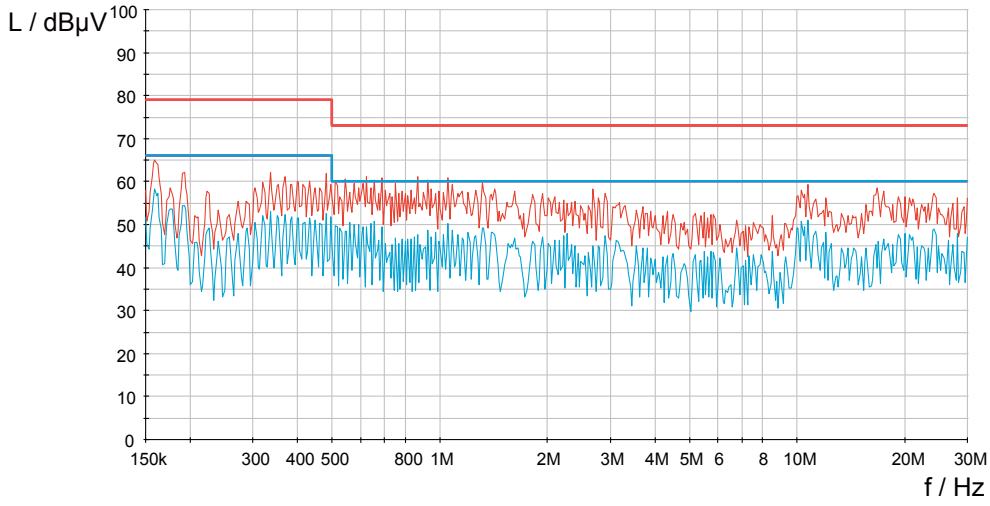
Figure 22: 20E6T60-3xxx Measurement of the interference voltage limit value C1

Measurement of the interference voltage, limit value C2 according to *EN 61800-3*; Motor cable $l = 100\,m$, output frequency $f_{out} = 5\,Hz$ and rated switching frequency $f_S = 4\,kHz$



Legend			
	QPeak		Average

Figure 23: 18E6T60-3xxx Measurement of the interference voltage limit value C2



Legend			
	QPeak		Average

Figure 24: 20E6T60-3xxx Measurement of the interference voltage limit value C2

3.3.6 Interference suppression degree of the side mount filter up to size 24

For compliance with the corresponding limit classes, see the following tables:

Filter type		**22E6T60-3xxx**							
Interference voltage (limit class *EN 61800-3*)		C1				C2			
Rated switching frequency	f_S / kHz	2	4	8	16	2	4	8	16
Max. motor cable (low capacitance)	l / m	50		30		100			

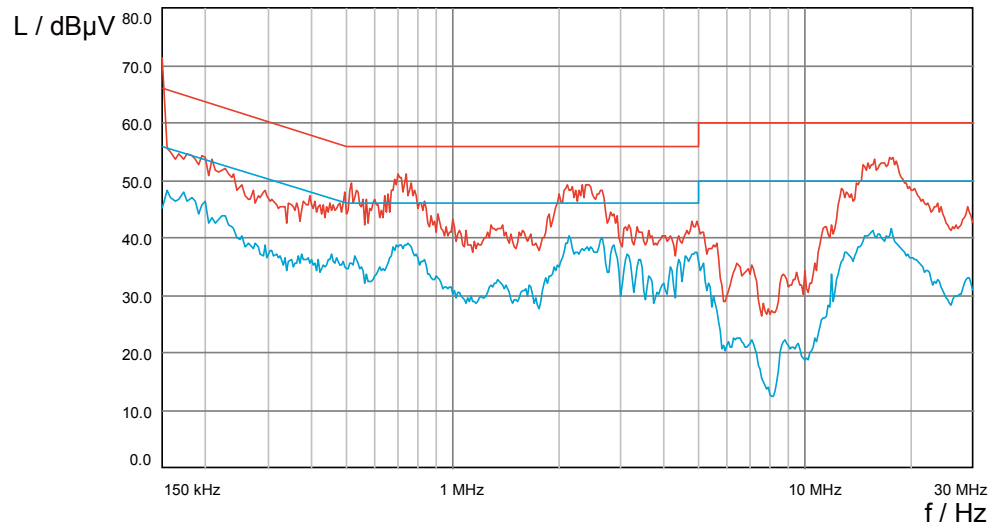
Table 25: Interference suppression degree of the side mount filter size 22

Filter type		**24E6T60-3xxx**					
Interference voltage (limit class *EN 61800-3*)		C1			C2		
Rated switching frequency	f_S / kHz	2	4	8	2	4	8
Max. motor cable (low capacitance)	l / m	50		30	100		

Table 26: Interference suppression degree of the side mount filter size 24

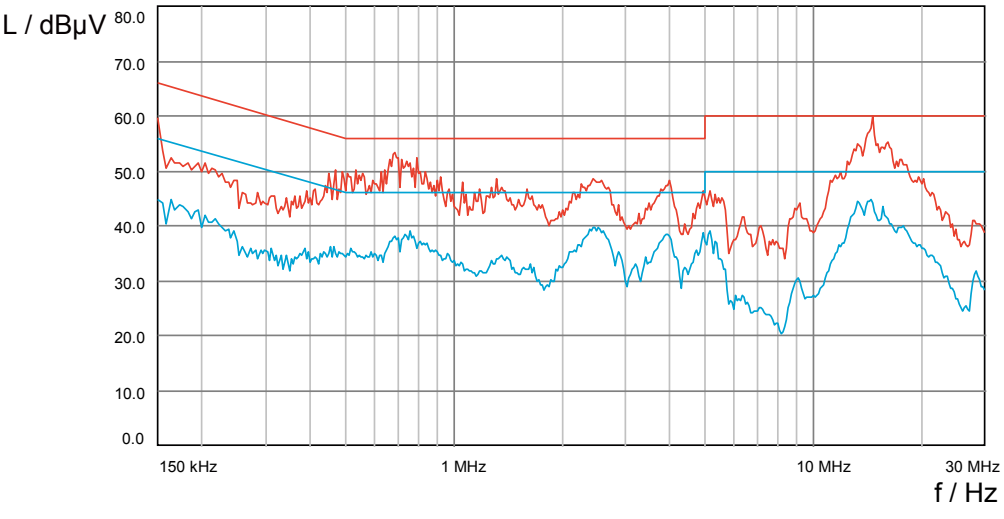
Example diagrams 22E6T60-3xxx:

Measurement of the interference voltage, limit value C1 according to *EN 61800-3*; Motor cable $l = 100\,m$, output frequency $f_{out} = 5\,Hz$ and rated switching frequency $f_S = 4\,kHz$



Legend			
	QPeak		Average

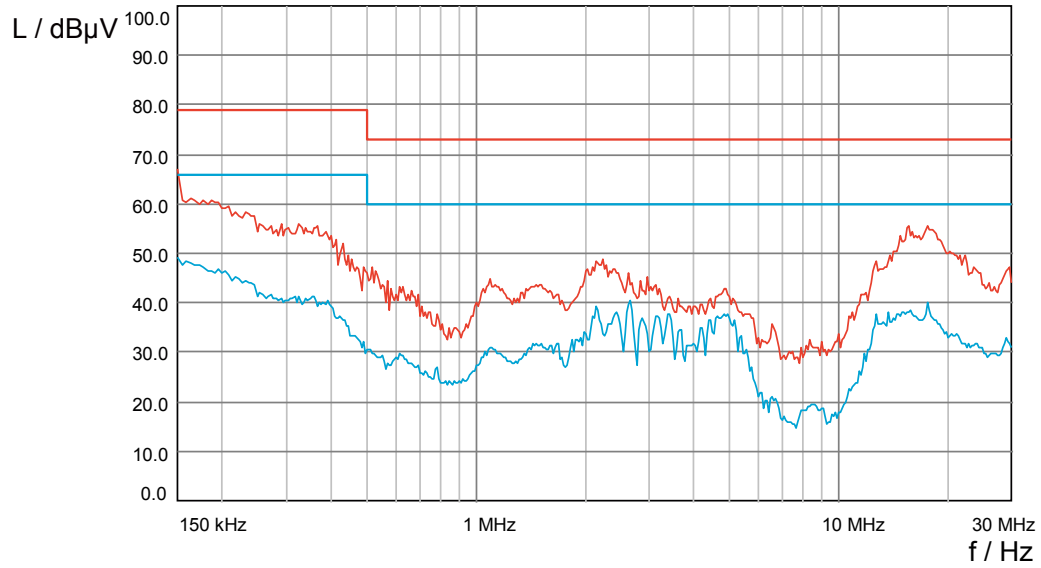
Figure 25: 22E6T60-3xxx Measurement of the interference voltage limit value C1



Legend			
	QPeak		Average

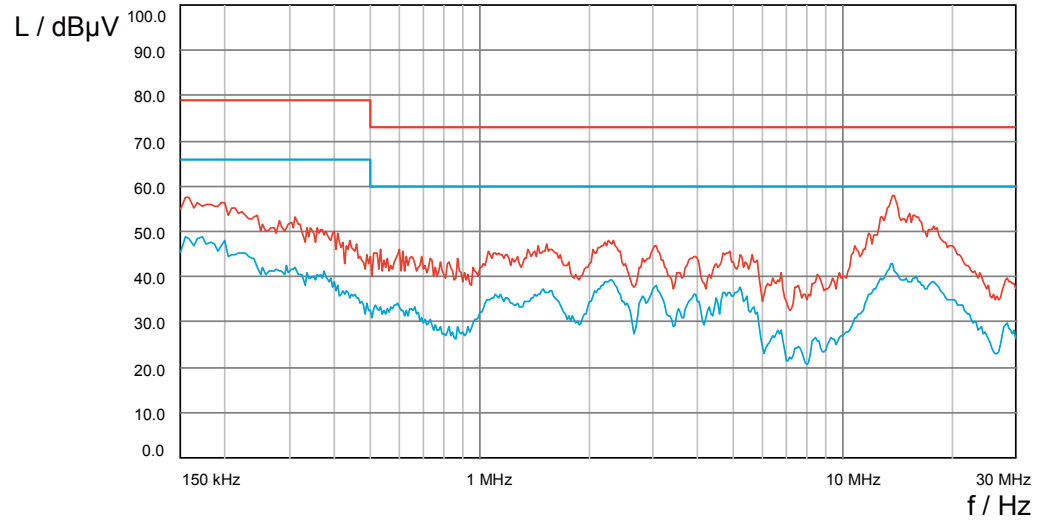
Figure 26: 24E6T60-3xxx Measurement of the interference voltage limit value C1

Measurement of the interference voltage, limit value C2 according to *EN 61800-3*; Motor cable $l = 100\,m$, output frequency $f_{out} = 5\,Hz$ and rated switching frequency $f_S = 4\,kHz$



Legend			
	QPeak		Average

Figure 27: 22E6T60-3xxx Measurement of the interference voltage limit value C2



Legend			
	QPeak		Average

Figure 28: 24E6T60-3xxx Measurement of the interference voltage limit value C2

3.3.7 Interference suppression degree of the side mount filter size 27

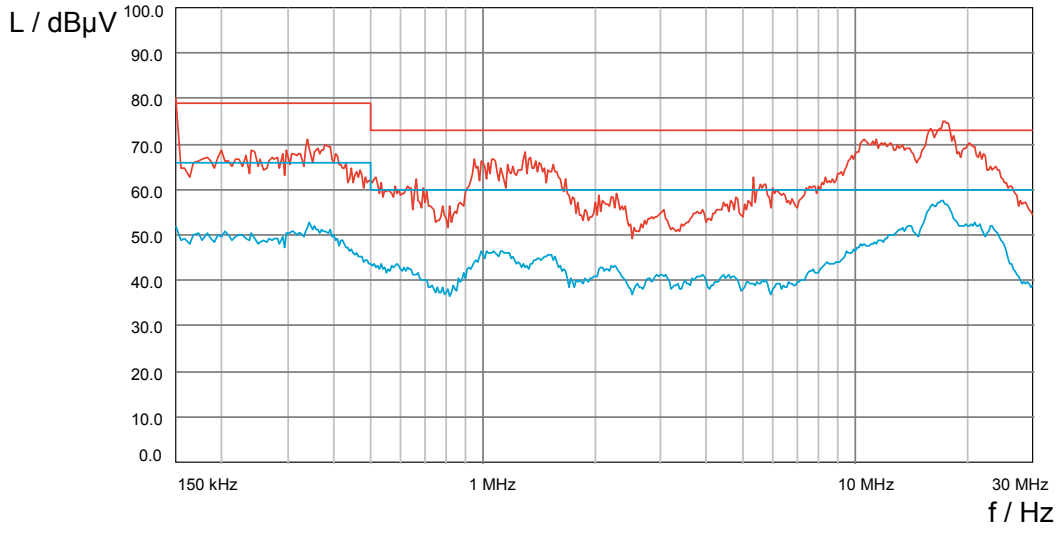
For compliance with the corresponding limit classes, see the following table:

Filter type		**27E6T60-3xxx**		
Interference voltage (limit class *EN 61800-3*)		C2		
Rated switching frequency	f_S / kHz	2	4	8
Max. motor cable (low capacitance)	l / m	100		

Table 27: Interference suppression degree of the side mount filter size 27

Example diagrams 27E6T60-3xxx:

Measurement of the interference voltage, limit value C2 according to *EN 61800-3*; Motor cable $l = 100$ m, output frequency $f_{out} = 5$ Hz and rated switching frequency $f_S = 4$ kHz



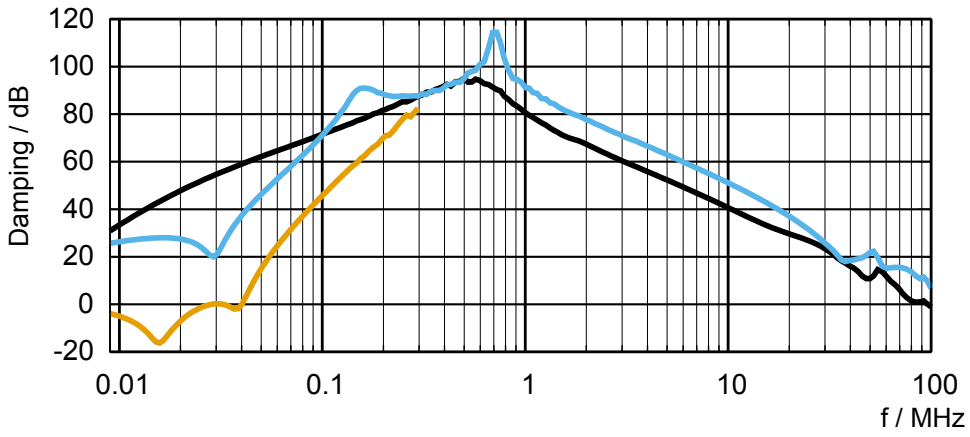
Legend			
	QPeak		Average

Figure 29: 27E6T60-3xxx Measurement of the interference voltage limit value C2

3.4 Insertion loss

The measurement of the insertion loss was performed according to *EN 55017*.

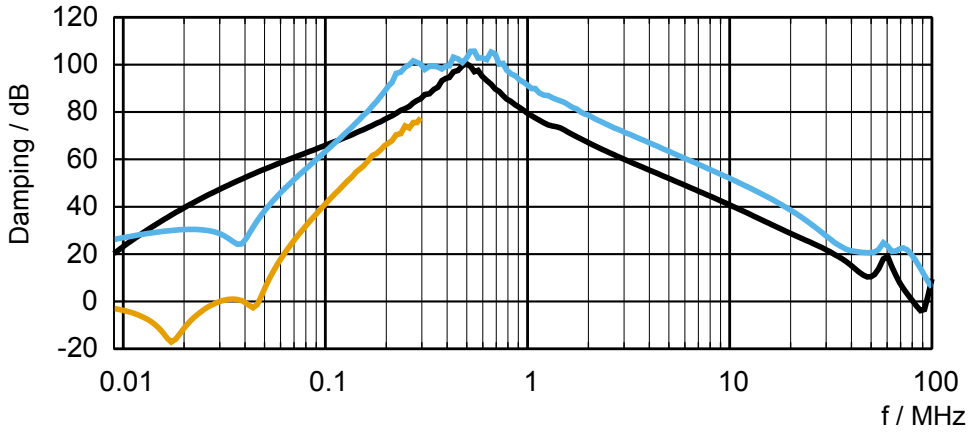
3.4.1 Insertion loss 14E6T60-1050



Legend	
	Asymmetrical insertion loss (Common Mode)
	Unsymmetrical insertion loss (Normal Mode)
	0.1Ω/100Ω system symmetrical insertion loss (Differential Mode)

Figure 30: Insertion loss 14E6T60-1050

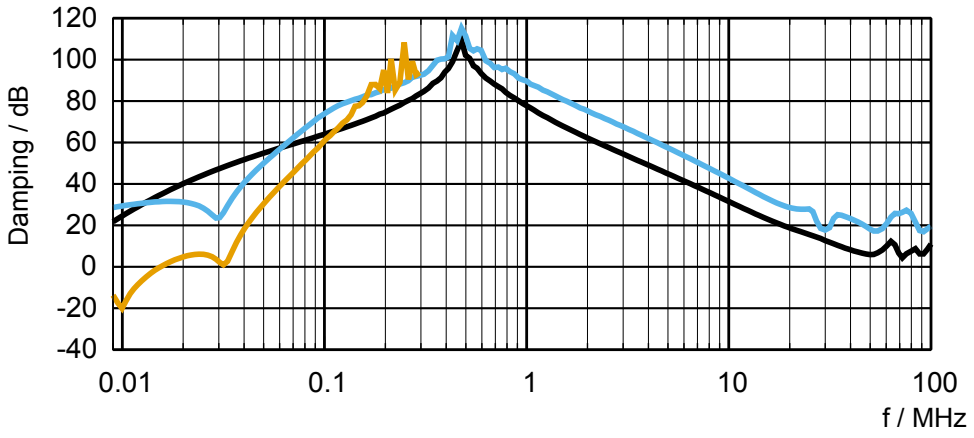
3.4.2 Insertion loss 16E6T60-1050



Legend	
	Asymmetrical insertion loss (Common Mode)
	Unsymmetrical insertion loss (Normal Mode)
	0.1Ω/100Ω system symmetrical insertion loss (Differential Mode)

Figure 31: Insertion loss 16E6T60-1050

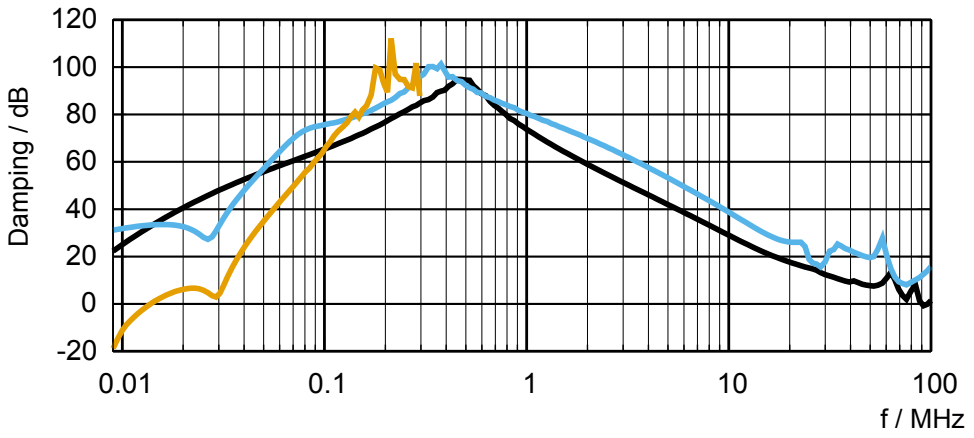
3.4.3 Insertion loss 18E6T60-1050



Legend	
	Asymmetrical insertion loss (Common Mode)
	Unsymmetrical insertion loss (Normal Mode)
	0.1Ω/100Ω system symmetrical insertion loss (Differential Mode)

Figure 32: Insertion loss 18E6T60-1050

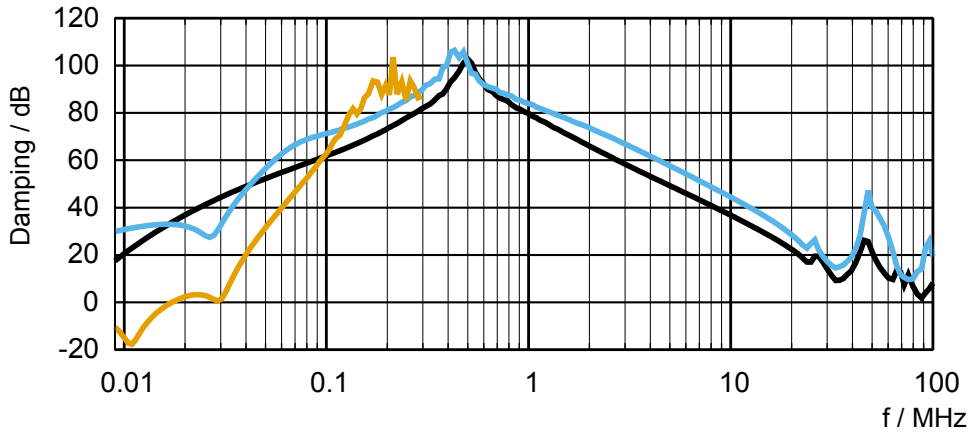
3.4.4 Insertion loss 20E6T60-1050



Legend	
	Asymmetrical insertion loss (Common Mode)
	Unsymmetrical insertion loss (Normal Mode)
	0.1Ω/100Ω system symmetrical insertion loss (Differential Mode)

Figure 33: Insertion loss 20E6T60-1050

3.4.5 Insertion loss 22E6T60-1050



Legend	
	Asymmetrical insertion loss (Common Mode)
	Unsymmetrical insertion loss (Normal Mode)
	0.1Ω/100Ω system symmetrical insertion loss (Differential Mode)

Figure 34: Insertion loss 22E6T60-1050

3.5 Fuse protection of the filters

3.5.1 Fuse protection of the xxE6T60-1050 for IEC

Filters	Input voltage / V	Max. size of the fuse / A
		Class gG
		SCCR 30 kA
14E6T60-1050	400	25
16E6T60-1050		50
18E6T60-1050		80
20E6T60-1050		100
22E6T60-1050		160

Table 28: Fuse protection of the xxE6T60-1050 for IEC

3.5.2 Fuse protection of the xxE6T60-1050 for UL

Filters	Input voltage / V	Max. size of the fuse / A			
		Class RK5		Class gR	
		SCCR		SCCR 30 kA	Type
		5 kA	10 kA		
14E6T60-1050	480	25	-	25	SIBA 50 140 06.25
16E6T60-1050		50	-	50	SIBA 50 140 06.50
18E6T60-1050		60	-	63	SIBA 20 189 20.63
					COOPER BUSSMANN 170M1365
				60	LITTELFUSE L70QS060
20E6T60-1050		-	90	100	SIBA 20 189 20.100
					COOPER BUSSMANN 170M1367
				90	LITTELFUSE L70QS090
22E6T60-1050		-	125	125	SIBA 20 189 20.125
					COOPER BUSSMANN 170M1368

Table 29: Protection of the xxE6T60-1050 for UL

The fuse values of the filters correspond to the fuse values of the corresponding drive converter.

3.5.3 Fuse protection of the xxE6T60-3xxx for IEC

Filters	Input voltage / V	Max. size of the fuse / A
		Class gG
		SCCR 30 kA
12E6T60-3000	400	20
14E6T60-3000		2
16E6T60-3000		50
18E6T60-3000		80
20E6T60-3000		100
20E6T60-3100		100
22E6T60-3000		160
22E6T60-3100		160
24E6T60-3000		250

Table 30: Fuse protection of the xxE6T60-3xxx for IEC

3.5.4 Fuse protection of the xxE6T60-3xxx for UL

Filters	Input voltage / V	Max. size of the fuse / A		
		Class RK5		
		SCCR		
		5 kA	10 kA	30 kA
12E6T60-3000	230	25	-	-
14E6T60-3000	480	30	-	30
16E6T60-3000		50	-	50
18E6T60-3000		70	-	70
20E6T60-3000		-	100	100
20E6T60-3100		-	100	100
22E6T60-3000		-	175	175
22E6T60-3100		-	175	175
24E6T60-3000		-	250	250

Table 31: Fuse protection of the xxE6T60-3xxx for UL

Note

When using F6 drive converters, the fuse values must be taken from the corresponding power unit.

Short-circuit capacity
After requests from *EN 60939-1* and *EN 61800-5-1* the following is valid for the connection to a network: The units are suitable for use in a circuit capable of delivering not more than 30 kA eff. unaffected symmetrical short-circuit current.

4 Installation

4.1 Protective earth connection

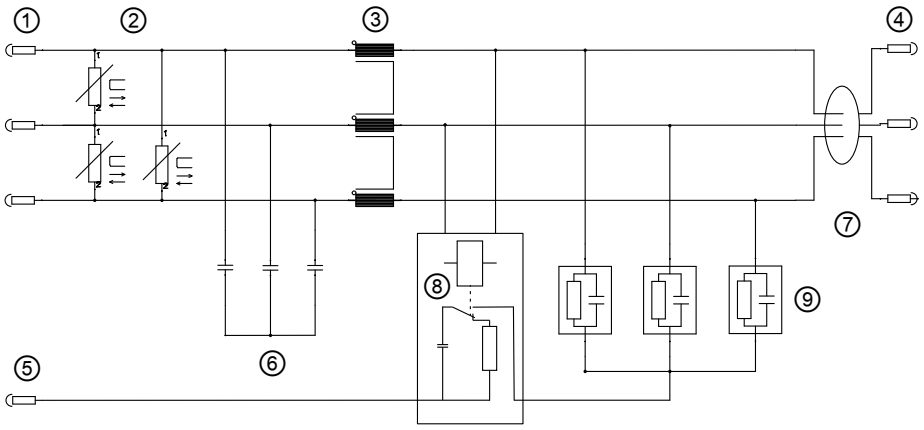
The filter is earthed via the protective earth connection.

The EMC-technical required connection to the drive converter is ensured by screwing the side mount filter to the conductive mounting plate. For back mount filters, this is guaranteed by mounting on the drive converter.

The motor cable shield must be attached between drive converter and filter on the mounting plate or on the shield connection braket of the drive converter.

The shield of the motor cable must be contacted all around on the shield connection braket of the drive converter. If this is not possible, the shield must be contacted in the immediate vicinity of the drive converter / filter all around the mounting plate.

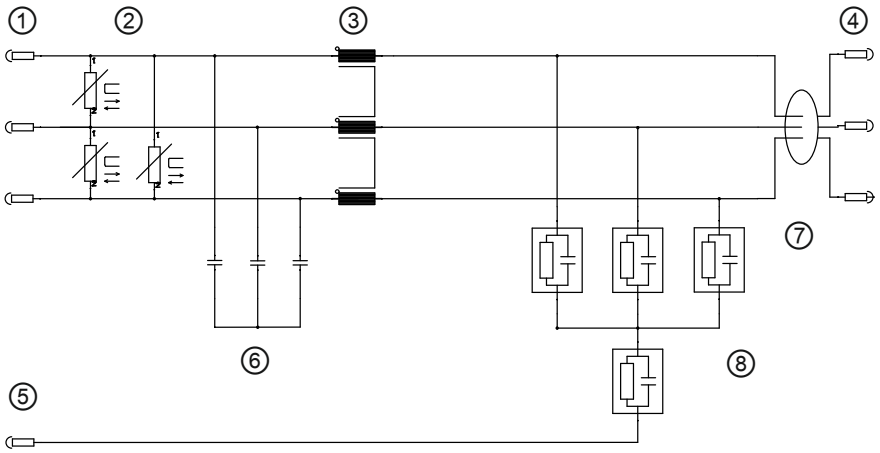
4.2 Schematic diagram IT mains filter



Legend			
1	Mains input (L1, L2, L3)	6	Capacitor module
2	Varistors	7	Ferrite core (current-compensated)
3	Choke (current-compensated)	8	IT logic
4	Mains output (L1‘, L2‘, L3‘)	9	Capacitor module
5	Protective earth (PE)		

Figure 35: Schematic diagram IT mains filter

4.3 Schematic diagram TN, TT mains filter

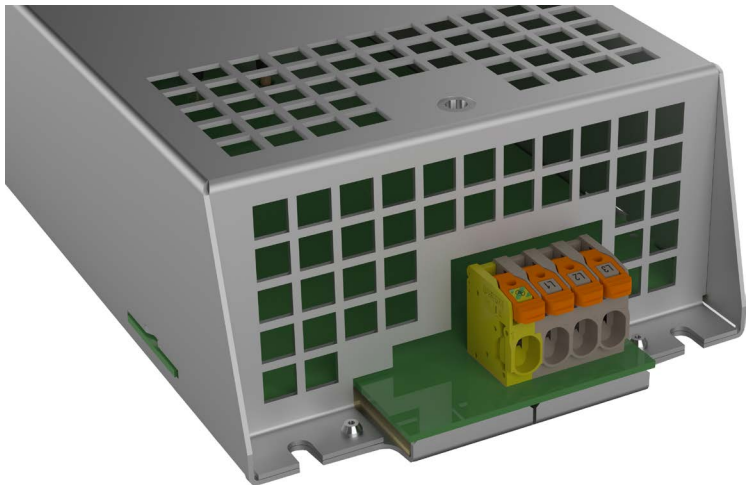


Legend			
1	Mains input (L1, L2, L3)	5	Protective earth (PE)
2	Varistors	6	Capacitor module
3	Choke (current-compensated)	7	Ferrite core (current-compensated)
4	Mains output (L1‘, L2‘, L3‘)	8	Capacitor module

Figure 36: Schematic diagram TN, TT mains filter

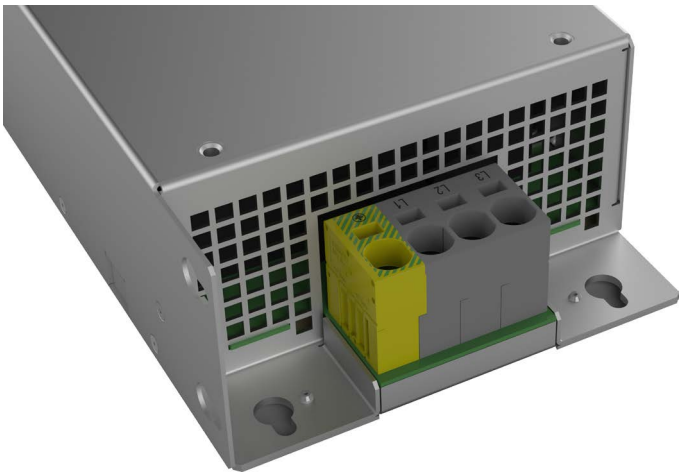
4.4 Connection of the filters

4.4.1 Connection of the back mount filter (xxE6T60-1050)



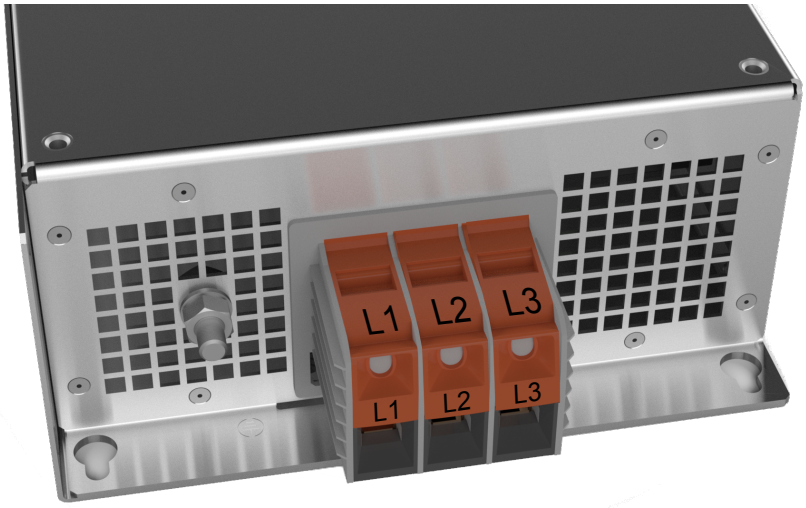
Material number	Connection			Cross-section area in mm² / AWG		Cross-section	Tightening torque in Nm / lb Inch		
	L1, L2, L3	PE	Output	L1, L2, L3	PE	Output	L1, L2, L3	PE	Output
14E6T60-1050	Spring-loaded terminal	Spring-loaded terminal	Stranded wire Betatherm	0.2...6 / 24...10	0.2...6 / 24...10	6 / 10	–	–	–
16E6T60-1050				0.75...25 / 18...4	0.75...25 / 18...4	10 / 8	–	–	–

Figure 37: Connection of the back mount filter for unit sizes 14, 16 (F6 housing 2)



Material number	Connection			Cross-section area in mm² / AWG		Cross-section	Tightening torque in Nm / lb Inch		
	L1, L2, L3	PE	Output	L1, L2, L3	PE	Output	L1, L2, L3	PE	Output
18E6T60-1050	Spring-loaded terminal	Spring-loaded terminal	Stranded wire Betatherm	4...35 / 14...2	4...35 / 14...2	16 / 6	–	–	–
20E6T60-1050				4...35 / 14...2	4...35 / 14...2	35 / 2	–	–	–

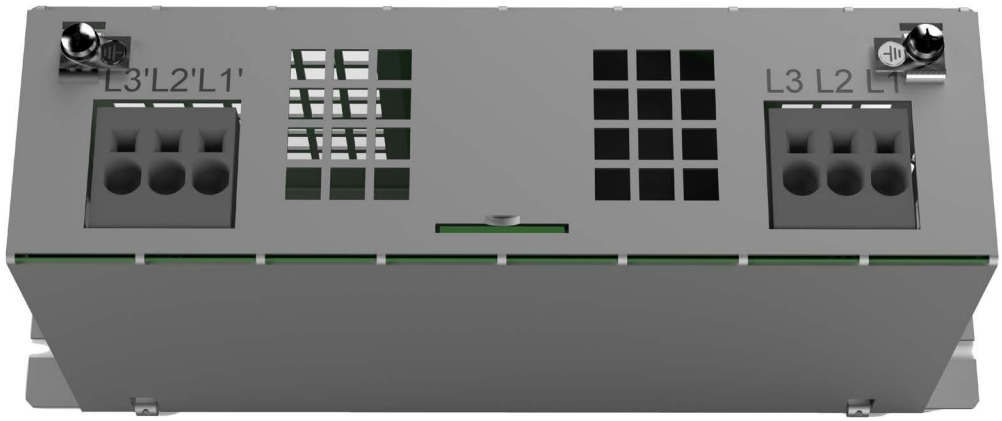
Figure 38: Connection of the back mount filter for unit sizes 18, 20 (F6 housing 3)



Material number	Connection			Cross-section area in mm² / AWG		Cross-section	Tightening torque in Nm / lb Inch		
	L1, L2, L3	PE	Output	L1, L2, L3	Output		L1, L2, L3	PE	Output
22E6T60-1050	Spring-loaded terminal	M6 bolt for crimp connector	Stranded wire Betatherm	10...50 / 8...1/0	50 / 1/0		–	10	–

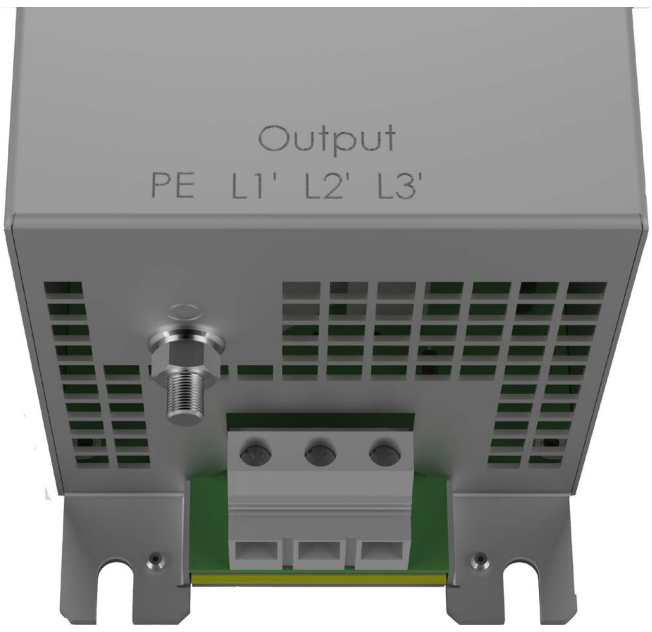
Figure 39: Connection of the back mount filter for unit size 22 (F6 housing 4)

4.4.2 Connection of the side mount filters (xxE6T60-3xxx)



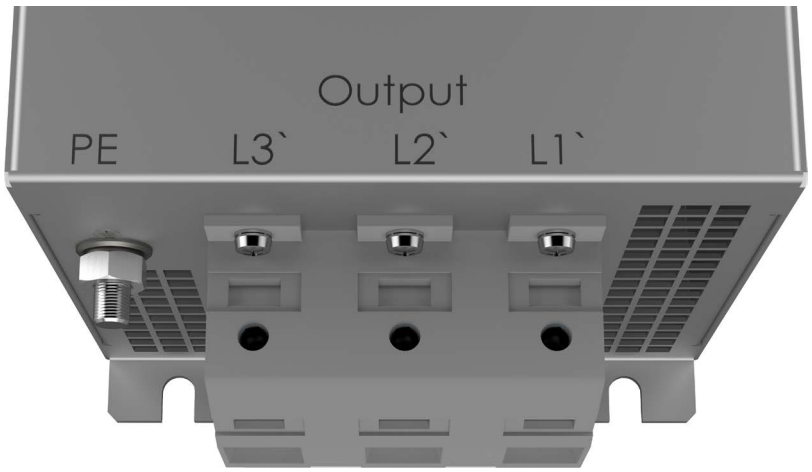
Material number	Connection		Cross-section area in mm² / AWG	Tightening torque in Nm / lb Inch	
	L1, L2, L3 / L1´, L2´, L3´	PE	L1, L2, L3 / L1´, L2´, L3´	L1, L2, L3 / L1‘, L2‘, L3‘	PE
12E6T60-3xxx	Spring-loaded terminal	M4 screw for PE connection	0.2...6 / 24...10	–	1.7 / 15
14E6T60-3xxx			0.2...6 / 24...10	–	1.7 / 15
16E6T60-3xxx			0.7...16 / 20...6	–	1.7 / 15

Figure 40: Connection of the side mount filter for unit sizes 12, 14, 16



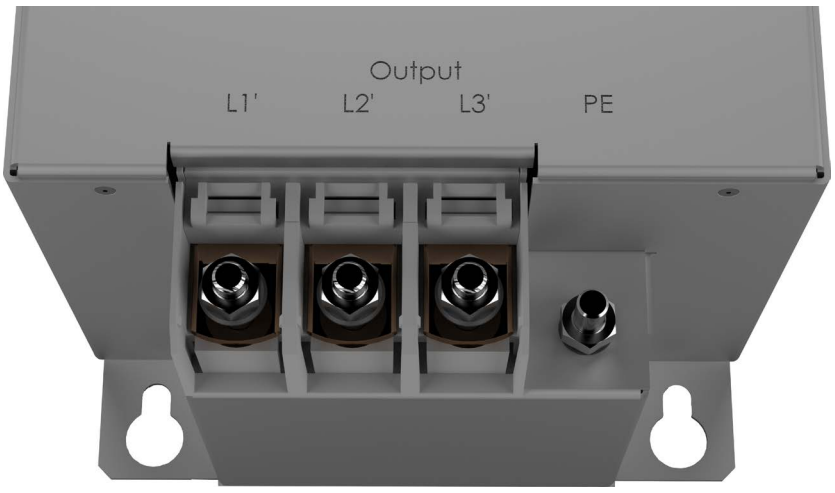
Material number	Connection		Cross-section area in mm² / AWG	Tightening torque in Nm / lb Inch	
	L1, L2, L3 / L1´, L2´, L3´	PE	L1, L2, L3 / L1´, L2´, L3´	L1, L2, L3 / L1´, L2´, L3´	PE
18E6T60-3xxx	Terminal	M6 bolt for crimp connector	1.5...25 / 16...4	2.6 / 22	14.2 / 125
20E6T60-3xxx		M6 bolt for crimp connector	0.5...50 / 20...1	2.6 / 22	14.2 / 125

Figure 41: Connection of the side mount filter for unit sizes 18, 20



Material number	Connection		Cross-section area in mm² / AWG	Tightening torque in Nm / lb Inch	
	L1, L2, L3 / L1´, L2´, L3´	PE	L1, L2, L3 / L1´, L2´, L3´	L1, L2, L3 / L1´, L2´, L3´	PE
22E6T60-3xxx	Terminal	M10 bolt for crimp connector	35...95 / 4...4/0	15 / 132	35 / 310
24E6T60-3xxx		M10 bolt for crimp connector	35...95 / 4...4/0	15 / 132	35 / 310

Figure 42: Connection of the side mount filter for unit sizes 22, 24

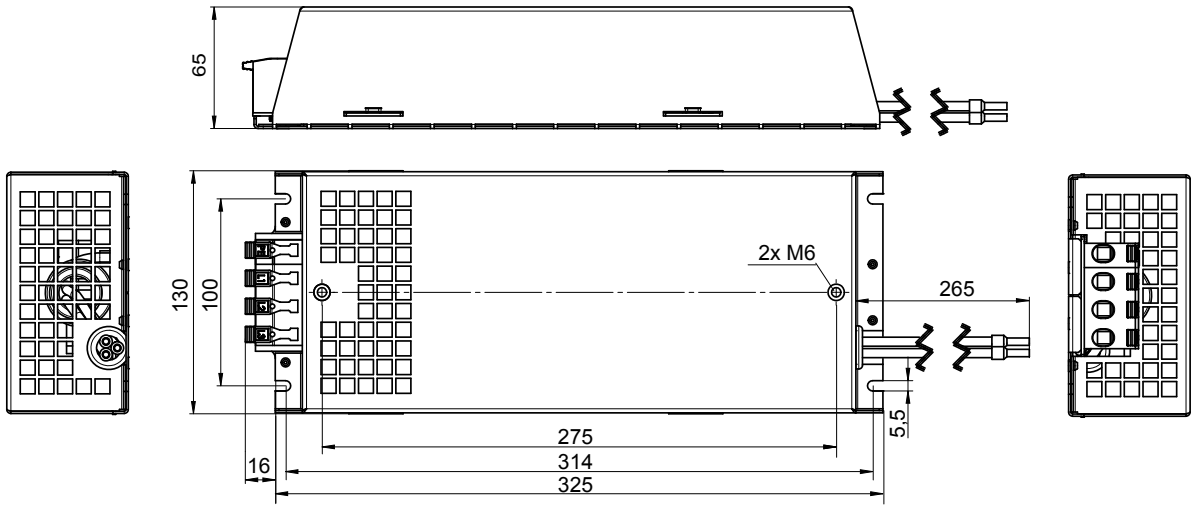


Material number	Connection		Cross-section area in mm²	Tightening torque in Nm / lb Inch	
	L1, L2, L3 / L1´, L2´, L3´	PE	L1, L2, L3 / L1´, L2´, L3´	L1, L2, L3 / L1´, L2´, L3´	PE
27E6T60-3xxx	M10 bolt for crimp connector	M10 bolt for crimp connector	max. 2 x 120mm²	23 / 203	35 / 310

Figure 43: Connection of the side mount filter for unit size 27

4.5 Mechanical construction

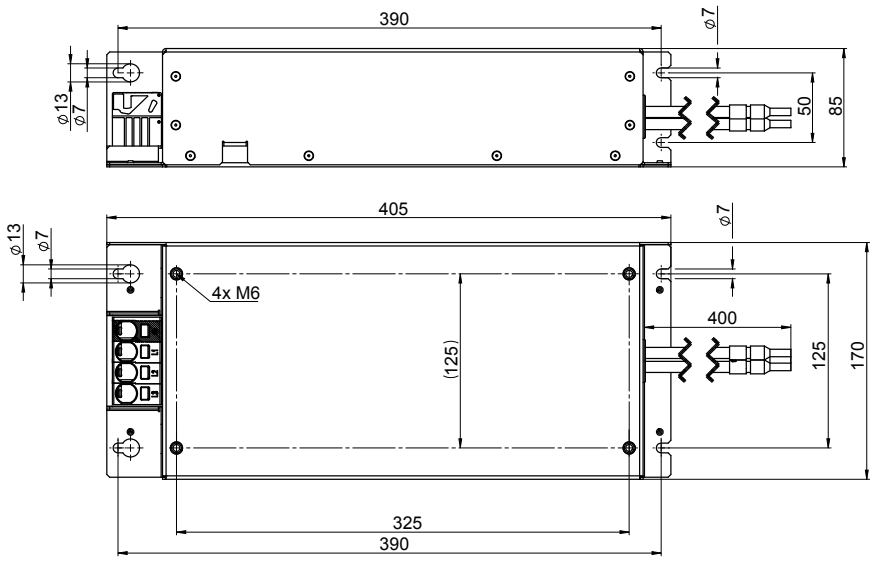
4.5.1 Dimensions of the back mount filter for unit sizes 14, 16 (F6 housing 2)



Legend	
Weight 14E6T60-1050	2.05 kg
Weight 16E6T60-1050	2.55 kg
Dimensions	All dimensions in mm

Figure 44: Dimensions of the back mount filter for unit sizes 14, 16 (F6 housing 2)

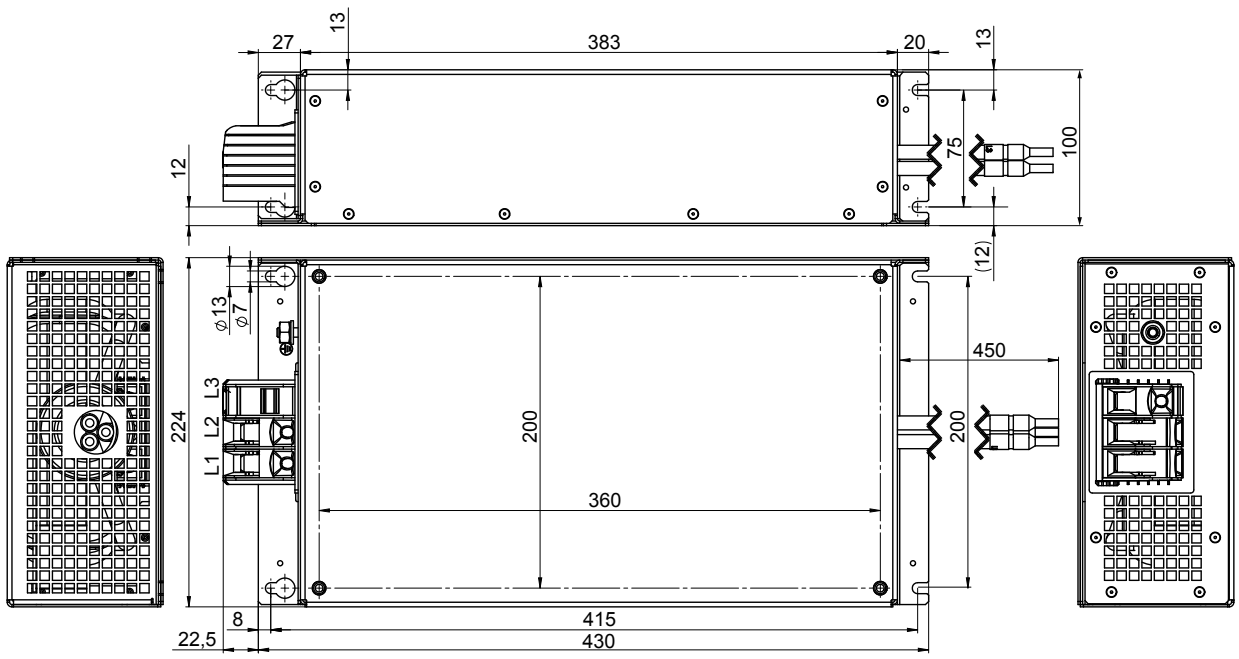
4.5.2 Dimensions of the back mount filter for unit sizes 18, 20 (F6 housing 3)



Legend	
Weight 18E6T60-1050	5.50 kg
Weight 20E6T60-1050	6.45 kg
Dimensions	All dimensions in mm

Figure 45: Dimensions of the back mount filter for unit sizes 18, 20 (F6 housing 3)

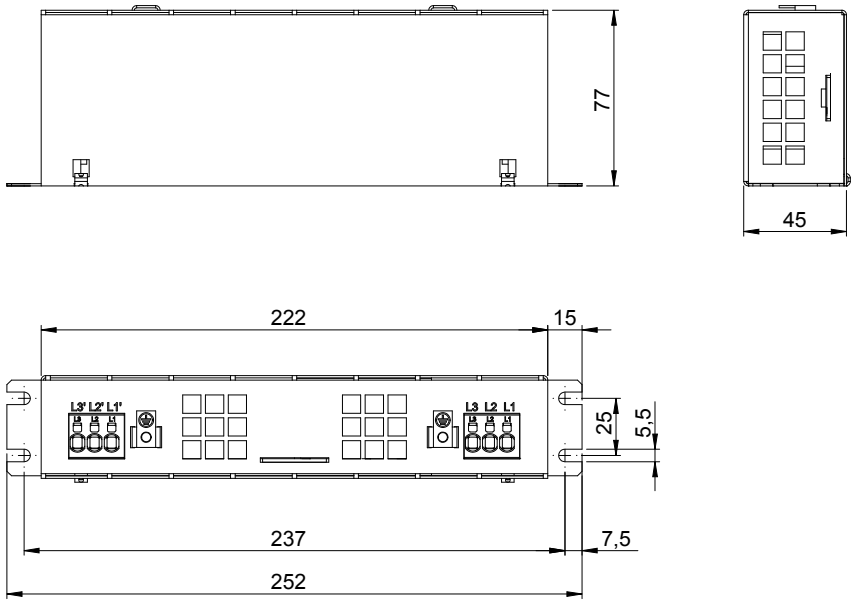
4.5.3 Dimensions of the back mount filter for unit size 22 (F6 housing 4)



Legend	
Weight 22E6T60-1050	10.35 kg
Dimensions	All dimensions in mm

Figure 46: Dimensions of the back mount filter for unit size 22 (F6 housing 4)

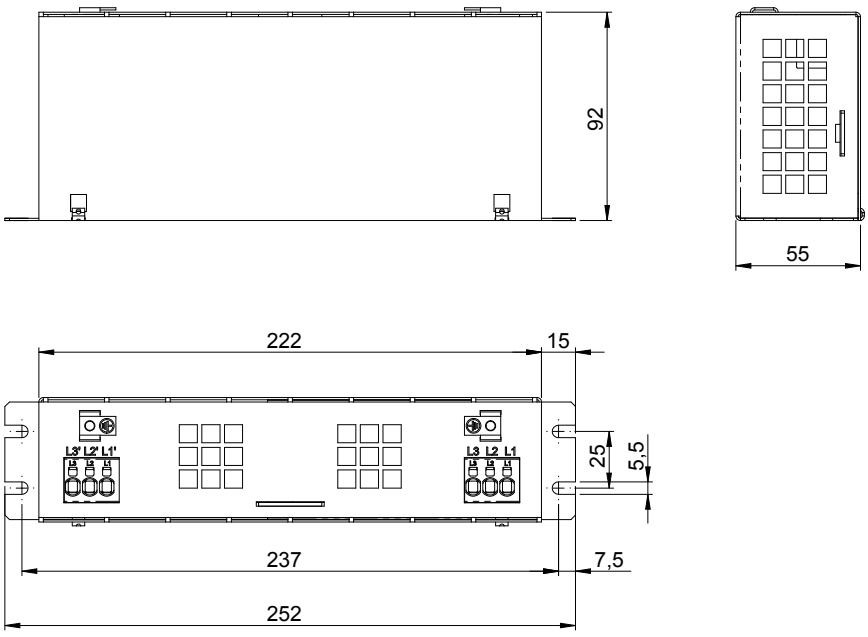
4.5.4 Dimensions side mount filter 12E6T60-3xxx



Legend	
Weight	0.8 kg
Dimensions	All dimensions in mm

Figure 47: Dimensions side mount filter 12E6T60-3xxx

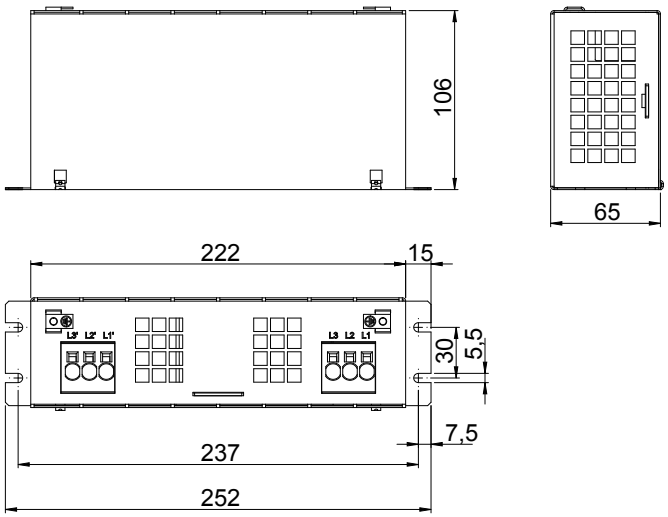
4.5.5 Dimensions side mount filter 14E6T60-3xxx



Legend	
Weight	1.22 kg
Dimensions	All dimensions in mm

Figure 48: Dimensions side mount filter 14E6T60-3xxx

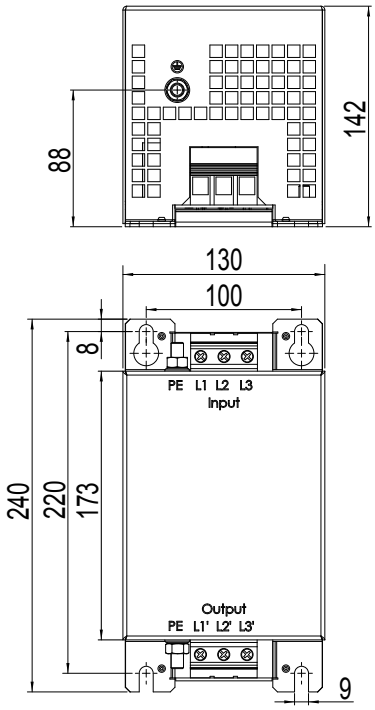
4.5.6 Dimensions side mount filter 16E6T60-3xxx



Legend	
Weight	1.79 kg
Dimensions	All dimensions in mm

Figure 49: Dimensions side mount filter 16E6T60-3xxx

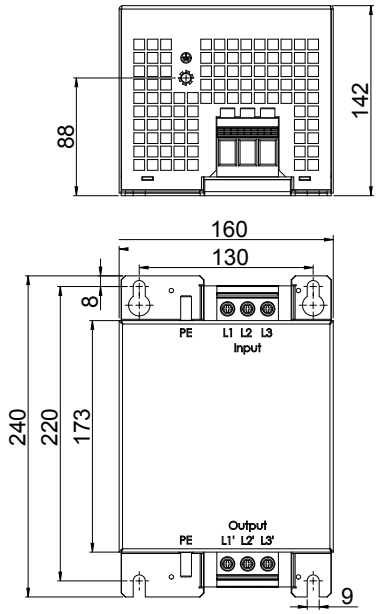
4.5.7 Dimensions side mount filter 18E6T60-3xxx



Legend	
Weight	3.9 kg
Dimensions	All dimensions in mm

Figure 50: Dimensions side mount filter 18E6T60-3xxx

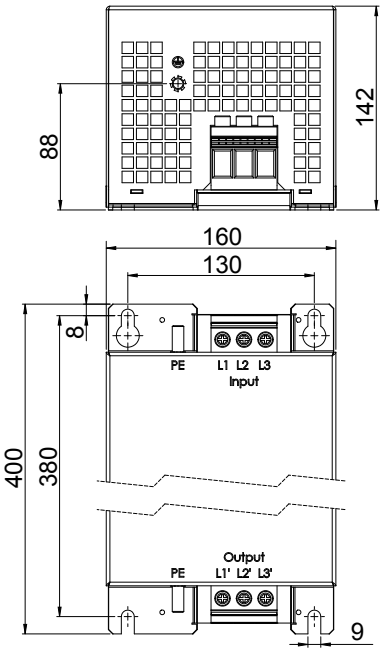
4.5.8 Dimensions side mount filter 20E6T60-30xx



Legend	
Weight	4.95 kg
Dimensions	All dimensions in mm

Figure 51: Dimensions side mount filter 20E6T60-30xx

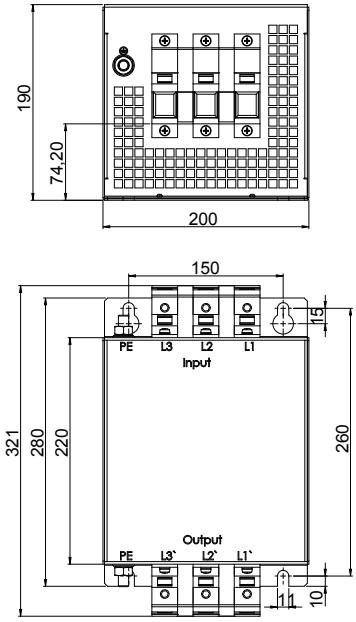
4.5.9 Dimensions side mount filter 20E6T60-31xx



Legend	
Weight	8.35 kg
Dimensions	All dimensions in mm

Figure 52: Dimensions side mount filter 20E6T60-31xx

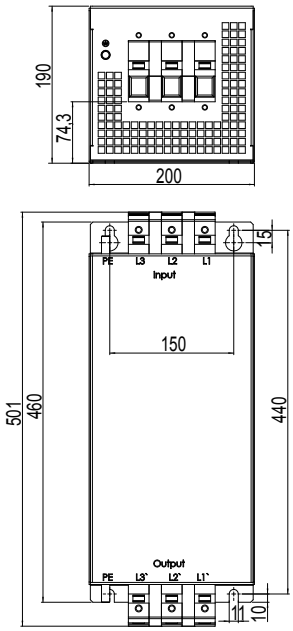
4.5.10 Dimensions side mount filter 22E6T60-30xx



Legend	
Weight	9 kg
Dimensions	All dimensions in mm

Figure 53: Dimensions side mount filter 22E6T60-30xx

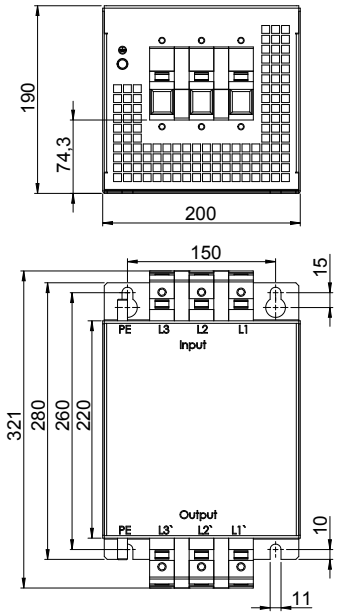
4.5.11 Dimensions side mount filter 22E6T60-31xx



Legend	
Weight	15.1 kg
Dimensions	All dimensions in mm

Figure 54: Dimensions side mount filter 22E6T60-31xx

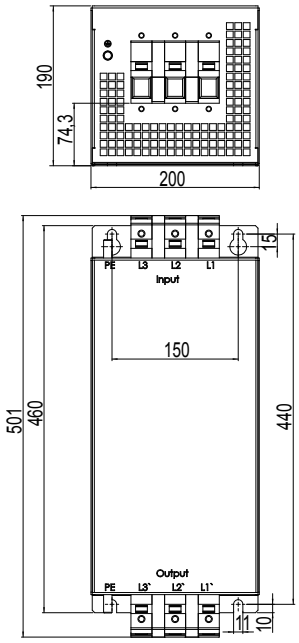
4.5.12 Dimensions side mount filter 24E6T60-30xx



Legend	
Weight	9.1 kg
Dimensions	All dimensions in mm

Figure 55: Dimensions side mount filter 24E6T60-30xx

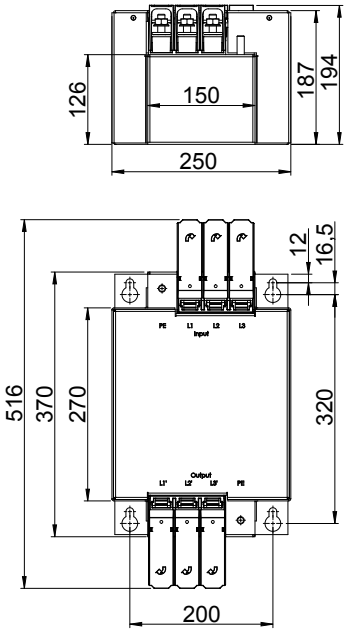
4.5.13 Dimensions side mount filter 24E6T60-31xx



Legend	
Weight	15.1 kg
Dimensions	All dimensions in mm

Figure 56: Dimensions side mount filter 24E6T60-31xx

4.5.14 Dimensions side mount filter 27E6T60-3xxx



Legend	
Weight	22.6 kg
Dimensions	All dimensions in mm

Figure 57: Dimensions side mount filter 27E6T60-3xxx

5 Assembly

5.1 Assembly of the back mount filter at the drive converter

The mechanical housing sizes of the COMBILNE E6 back mount filters correspond to those of the COMBIVERT F6 drive converters.

	COMBILINE E6	COMBIVERT F6
Housing	2 (14E6T60-1050, 16E6T60-1050)	2
	3 (18E6T60-1050, 20E6T60-1050)	3
	4 (22E6T60-1050)	4

The example shows the assembly of a COMBILINE back mount filter housing 2 to a COMBIVERT F6 housing 2.

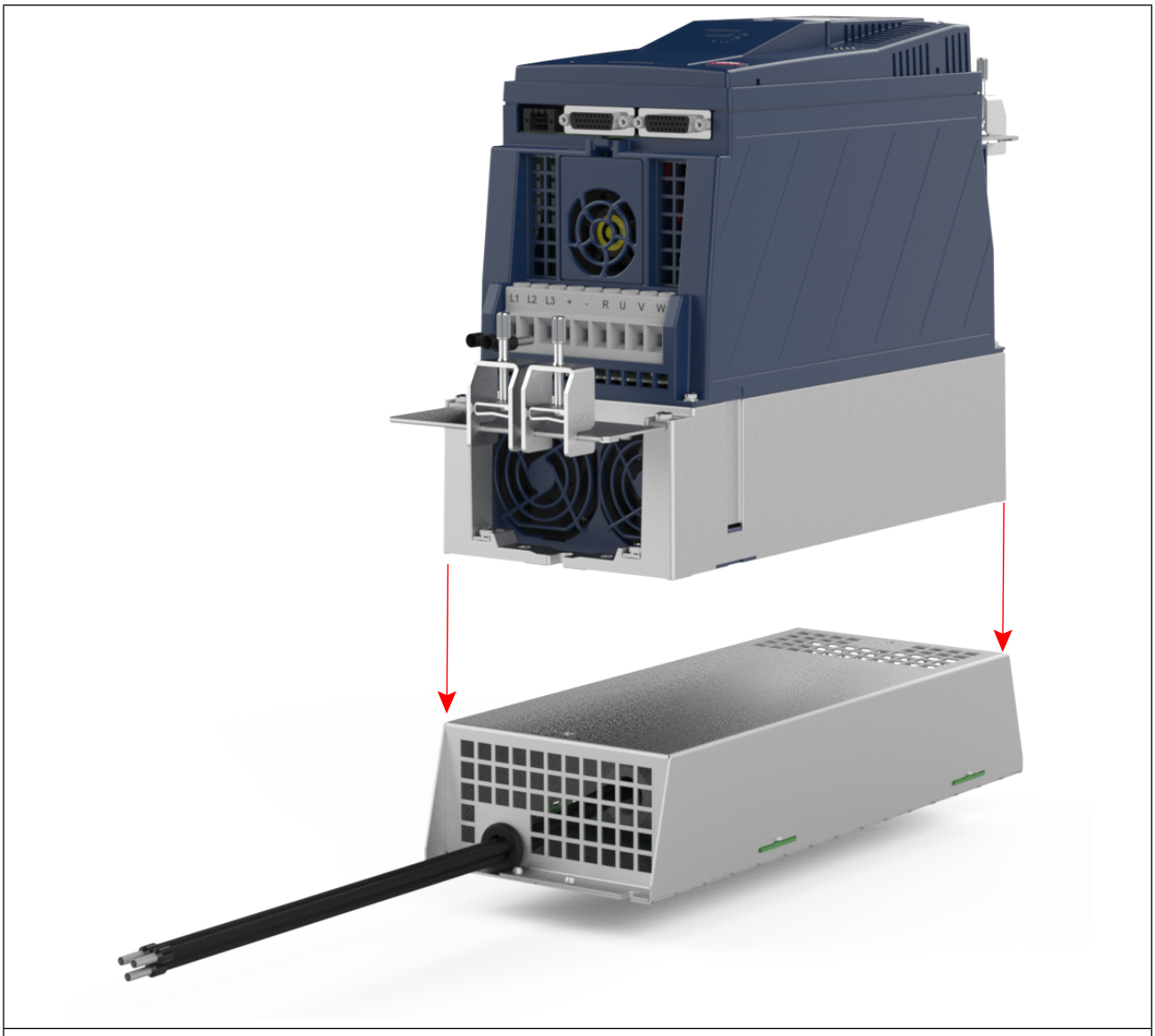
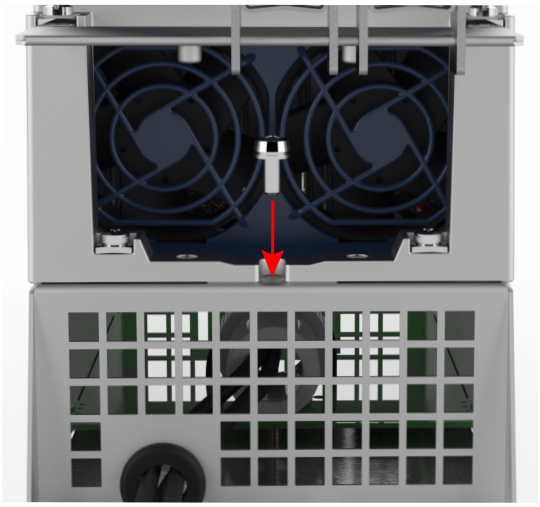
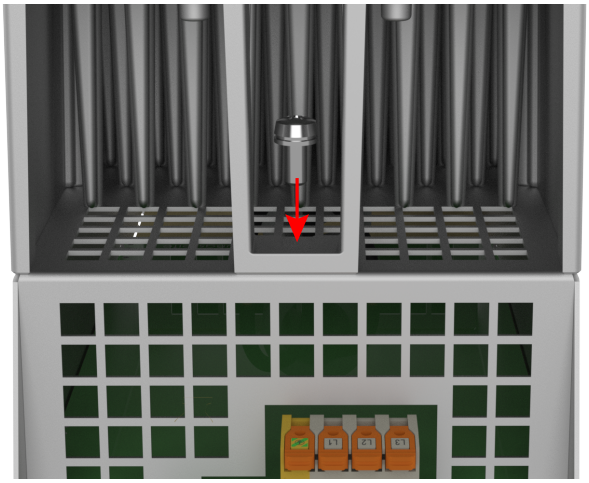


Figure 58: Place the drive converter

► Place the drive converter flush on the back mount filter.



Front



Back

Figure 59: Screw the screws into the thread

► Attach the drive converter to the filter. To do this, screw the supplied screws into the provided thread. The tightening torques can be found in the following table.

F6 housing	Screw type	Tightening torque
2	Screw assembly - M6 x 12 - 8.8	6.5 Nm 58 lb inch
3		
4		

Table 32: Tightening torques of the fixing screws on the drive converter

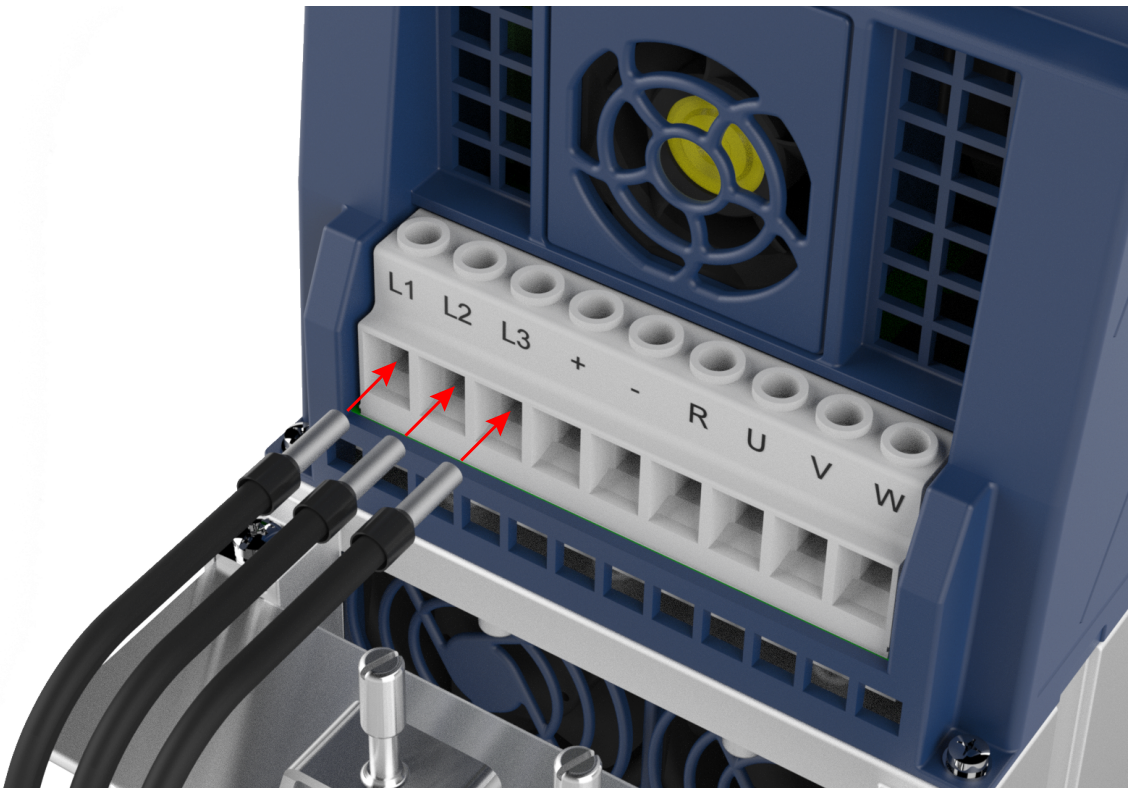


Figure 60: Tighten the cables

► Tighten the cables of the filter into the input terminals (L1, L2, L3) of the drive converter.

The tightening torques of the terminals must be taken from the corresponding power unit instructions. => *F6 Power units*

The connection sequence of the lines is not relevant.

Figure 61: Mounted filter with shield connection braket

Back mount filter mounted at the drive converter.

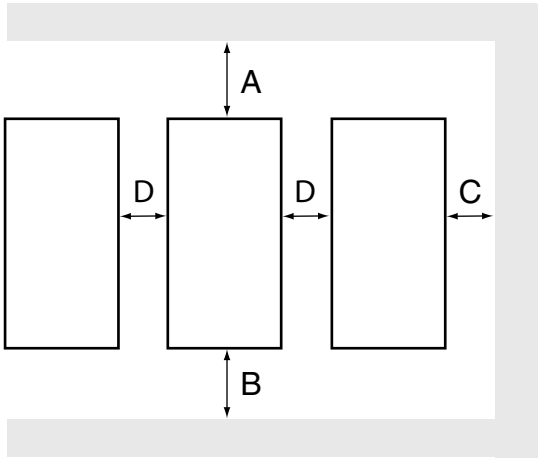
The drive converter can not be earthed via the filter, it must be earthed separately!

5.2 Use of the back mount filters as side mount filters

The COMBILINE E6 back mount filters can be used as side mount filters, independent of the housing size of the drive converter.

The minimum distances of the side mount filters must be observed
-> *„Installation distances of the side mount filters“*.

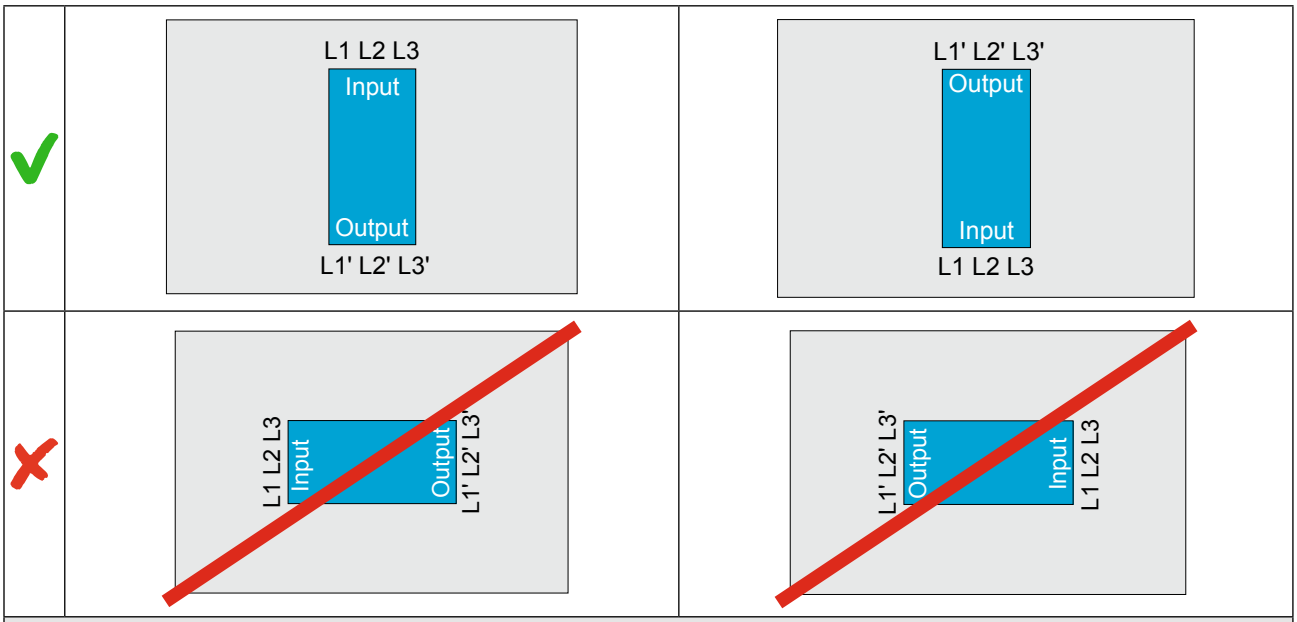
5.3 Installation distances of the side mount filters

Installation distances	Dimension	Distance in mm	Distance in inch
	A	100	4
	B	100	4
	C	10	0.4
	D	2	0.08
	X [1]	–	–

[1] Distance to preceding elements in the control cabinet door.

Figure 62: Installation distances of the side mount filters

5.4 Installation positions of the filters



Legend	
	COMBILINE E6 filter
	Mounting plate

Figure 63: Installation positions of the filters

5.5 Fixing on the mounting plate

The following mounting materials with the appropriate quality must be used to mount the filters on a mounting plate.KEB recommends the following tightening torques.

	Type	Tightening torque
Screw	M5 - 8.8	4.5 Nm 40 lb inch
Washer	Flat washer *ISO 7092* - 5 - 200 HV	–
Screw	M6 - 8.8	8 Nm 70 lb inch
Washer	Flat washer *ISO 7092* - 6 - 200 HV	–
Screw	M8 - 8.8	20 Nm 177 lb inch
Washer	Flat washer *ISO 7092* - 8 - 200 HV	–
Screw	M10 - 8.8	40 Nm 354 lb inch
Washer	Flat washer *ISO 7092* - 10 - 200 HV	–
Screw	M12 - 8.8	70 Nm 619 lb inch
Washer	Flat washer *ISO 7092* - 12 - 200 HV	–

Table 33: Mounting instructions

When using press-in elements, the tightening torques of them must be observed.

6 Certification

6.1 CE-Marking

CE marked output filters have been developed and manufactured in accordance with *EN 60939-1*.

6.2 UL certification

c UL us	Acceptance according to UL is marked at KEB filters with the adjacent logo on the name-plate.

To be conform according to UL for use on the North American and Canadian Market the following additionally instructions must be observed (original text of the UL-File):

- Only for use in WYE 480V/277V supply sources
- Identification for which Inverters (Cat. Nos.) the Filters are intended for, according to Illustration No.1.
- Use 75°C Copper Conductors Only
- Use in a Pollution Degree 2 environment
- WARNING – The opening of the branch circuit protective device may be an indication that a fault current has been interrupted. To reduce the risk of fire or electrical shock, current-carrying parts and other components of the controller should be examined and replaced if damaged.

  AVERTISSEMENT – LE DÉCLENCHEMENT DU DISPOSITIF DE PROTECTION DU CIRCUIT DE DÉRIVATION PEUT ÊTRE DÛ À UNE COUPURE QUI RÉSULTE D'UN COURANT DE DÉFAUT. POUR LIMITER LE RISQUE D'INCENDIE OU DE CHOC ÉLECTRIQUE, EXAMINER LES PIÈCES PORTEUSES DE COURANT ET LES AUTRES ÉLÉMENTS DU CONTRÔLEUR ET LES REMPLACER S'ILS SONT ENDOMMAGÉS.

Cat. No Filter	Max. Electrical Ratings			Used with inverter	
	Voltage	Current	Nos of phases	F5 inverter housing	F6 inverter housing
12E6T60-3000	240V	10.6A	3	D	-
					-
14E6T60-3000	480V	19.6A	3	D	2
				E	
				G	
16E6T60-3000	480V	35A	3	E	2
				G	
				H	
18E6T60-3000	480V	52A	3	G	3
				H	
				R	
20E6T60-3000	480V	72A	3	H	3
				R	4
20E6T60-3100	480V	72A	3	H	3
				R	4
22E6T60-3000	480V	105A	3	R	4
					6
22E6T60-3100	480V	105A	3	R	4
24E6T60-3000	480V	169A	3	R	6
				U	
14E6T60-1050	480V	18A	3	-	2
16E6T60-1050 [1)]	480V	35A	3	-	2
18E6T60-1050	480V	48A	3	-	3
20E6T60-1050	480V	71A	3	-	3
22E6T60-1050	480V	106A	3	-	4

Table 34: Illustration No.1

[1)] There is no cUL certification!

7 Revision History

Version	Date	Description
00	2019-02	Completion of pre-series instructions
01	2019-10	Technical data adapted, damping measurements added
02	2020-01	Completion of the series version, inclusion of the fuses, extension of the UL certification

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