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## EMC filters

3-phase line reactors for converters  
4 A ... 390 A, 40 °C, 50/60 Hz

**Series/Type:** B86305L  
**Date:** May 2014


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**3-phase line reactors for converters**
**3-phase line reactors for converters**
**Rated voltage  $V_R$ : 520 V AC**
**Rated current  $I_R$ : 4 A to 390 A**
**Construction**

- 3-phase line reactor
- Natural cooling

**Features**

- Easy to install
- Low weight
- Compact design
- Design complies with IEC 60076-6
- Degree of protection<sup>1)</sup>:
  - IP20 (4 A ... 16 A)
  - IP10 (30 A ... 60 A)
  - IP00 (100 A ... 390 A)
- Inductance constant up to  $1.5 \times I_R$
- Inductance higher than 60% rated value at  $3 \times I_R$
- UL approved insulation system
  - T-EIS-CF1 


**Typical applications**

- Frequency converters for motor drives, e.g.
  - elevators
  - pumps
  - traction systems
  - conveyor systems
  - HVAC systems (heating, ventilation and air conditioning)
- Power supplies

**Terminals**

- Finger-safe terminal blocks (< 100 A)
- Busbars from 100 A, cross section  $20 \times 3$  mm

**Marking**

Marking on component:

Manufacturer's logo, ordering code, rated current, rated frequency, inductance, approximate weight, date code

Minimum data on packaging:

Manufacturer's logo, ordering code, quantity, date code

1) According to IEC 60529

**3-phase line reactors for converters**
**Technical data and measuring conditions**

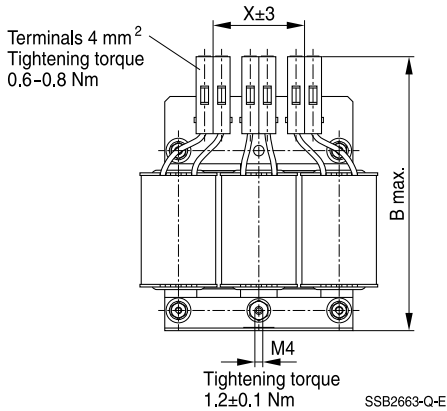
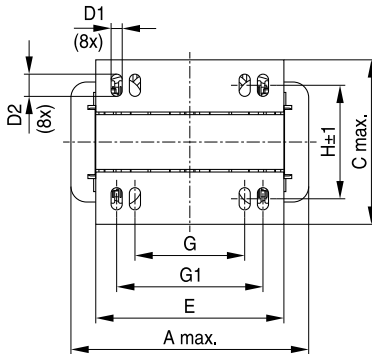
Rated voltage $V_R$	520 V AC (50/60 Hz)
Rated current $I_R$	Referred to 40 °C rated temperature
Test voltage $V_{test}$	1100 V AC, 2 s (line/line) 2500 V AC, 2 s (lines/case)
Relative voltage drop $u_k$ in %	At $I_R$ ; 50 Hz and 400 V AC
Insulation class	F (155 °C)
Overload capability (thermal)	$3 \cdot I_R$ , $t < 3$ s in 300 s
Climatic category (IEC 60068-1)	25/100/21 (-25 °C/+100 °C/21 days damp heat test)
Approvals	Insulation system class 155 (F); T-EIS-CF1 UL 1446

**Characteristics and ordering codes**

$I_R^*$ A	$u_k$ %	$R_{typ}^{(1)}$ mΩ	$L_R^{(2)}$ mH	$P_L^{(3)}$ W	Approx. weight kg	Ordering code
<b><math>V_R = 520</math> V AC</b>						
4	5.4	335.0	10.0	25	1.3	B86305L0004R000
10	5.4	78.0	4.0	43	2.7	B86305L0010R000
16	4.4	42.2	2.0	65	3.1	B86305L0016R000
30	4.1	12.4	1.0	50	5.5	B86305L0030R000
60	4.1	6.2	0.5	100	8.5	B86305L0060R000
100	4.1	3.2	0.3	160	15.0	B86305L0100S000
230	4.7	0.9	0.15	340	32.0	B86305L0230S000
390	4.0	0.6	0.075	480	44.0	B86305L0390S000

\* Higher current values upon request

- 1) Typical value at 20 °C, tolerance  $\pm 10\%$
- 2) Tolerance  $-0\%/+20\%$ ,
- 3) At  $I_R$ , 50 Hz, 20 °C

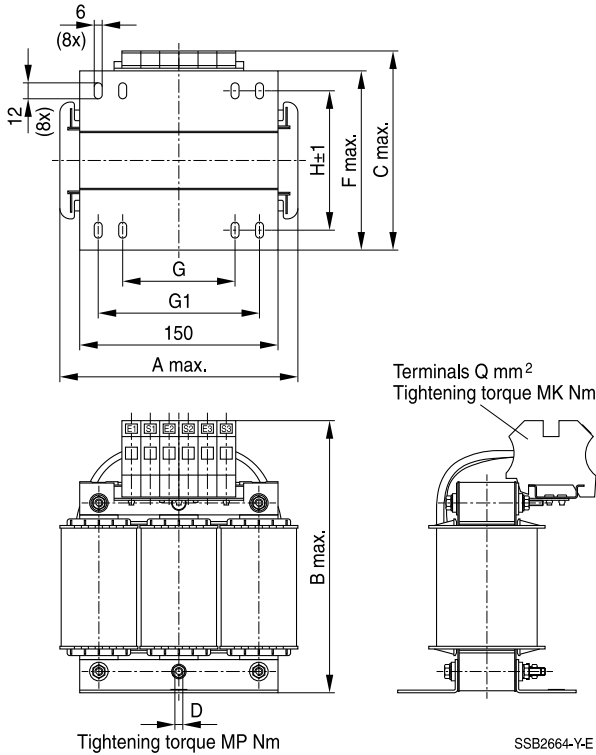
**3-phase line reactors for converters**
**Dimensional drawings**
**B86305L0004R000 ... B86305L0016R000 (4 A ... 16 A)**


Ordering code	A	B	C	D1 × D2	E	G	G1	H	X
B86305L0004R000	100	135	60	6 × 9	80	40	60	42	40
B86305L0010R000	130	150	90	6 × 12	100	60	80.5	62	50
B86305L0016R000	130	150	90	6 × 12	100	60	80.5	62	50

General tolerances according to ISO 2768–cL  
Dimensions in mm

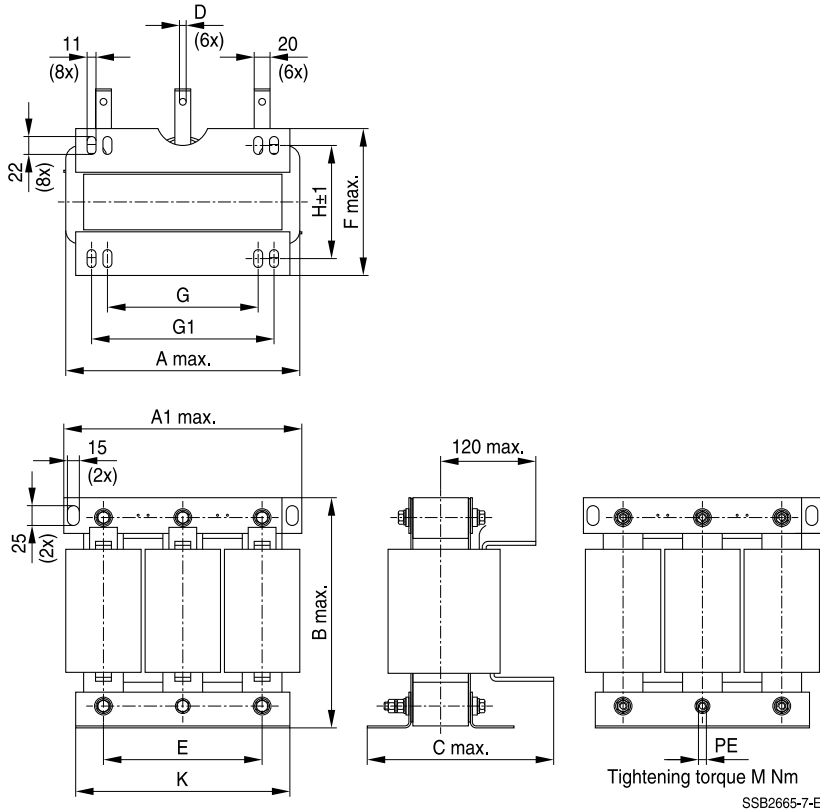
3-phase line reactors for converters

B86305L0030R000, B86305L0060R000 (30 A, 60 A)



Ordering code	A	B	C	E	F	G	G1	H	Q (mm <sup>2</sup> )	MK (Nm)	PE D	PE MP (Nm)
B86305L0030R000	155	170	135	125	120	75	107	90	16	2.0-2.3	M4	1.2±0.1
B86305L0060R000	180	205	150	150	135	85	122	105	35	3.2-3.7	M6	3.0±0.15

General tolerances according to ISO 2768-cL  
Dimensions in mm


**3-phase line reactors for converters**
**B86305L0100S000 ... B86305L0390S000 (100 A ... 390 A)**


Ordering code	A	A1	B	C	∅D	E	F	G	G1	H	K	PE	M
B86305L0100S000	270	270	210	180	6.5	180	145	105	181	100	240	M8	6±0.3
B86305L0230S000	320	300	290	235	8.5	200	185	190	230	142	270	M10	10±1
B86305L0390S000 <sup>1)</sup>	320	300	290	265	8.5	200	215	190	230	168.5	270	M10	10±1

General tolerances according to ISO 2768–cL  
Dimensions in mm

1) Preliminary data: Size of Cu connectors 30 × 3 mm

## Cautions and warnings

Please read all safety and warning notes carefully before installing the EMC filter and putting it into operation (see ). The same applies to the warning signs on the filter. Please ensure that the signs are not removed nor their legibility impaired by external influences.

Death, serious bodily injury and substantial material damage to equipment may occur if the appropriate safety measures are not carried out or the warnings in the text are not observed.

## Using according to the terms

The EMC filters may be used only for their intended application within the specified values in low-voltage networks in compliance with the instructions given in the data sheets and the data book. The conditions at the place of application must comply with all specifications for the filter used.

### Warning

- It shall be ensured that only qualified persons (electricity specialists) are engaged on work such as planning, assembly, installation, operation, repair and maintenance. They must be provided with the corresponding documentation.
- Danger of electric shock. EMC filters contain components that store an electric charge. Dangerous voltages can continue to exist at the filter terminals for longer than five minutes even after the power has been switched off.
- The protective earth connections shall be the first to be made when the EMC filter is installed and the last to be disconnected. Depending on the magnitude of the leakage currents, the particular specifications for making the protective-earth connection must be observed.
- Impermissible overloading of the EMC filter or filter, such as with circuits able to cause resonances, impermissible voltages at higher frequencies etc. can lead to bodily injury and death as well as cause substantial material damages (e.g. destruction of the filter housing).
- EMC filters and filters must be protected in the application against impermissible exceeding of the rated currents by overcurrent protective circuitry.
- In case of leakage currents  $>3.5$  mA you shall mount the PE conductor stationary with the required cross section before beginning of operation and save it against disconnecting. For leakage currents  $I_L^{(1)} < 10$  mA the PE conductor must have a KU value<sup>2)</sup> of  $4.5 A^{3)}$ ; for leakage currents  $I_L \geq 10$  mA the PE conductor must have a KU value of 6.<sup>4)</sup>
- Output chokes and output filters must be protected in the application against impermissible exceeding of the component temperature.
- The converter output frequency must be within the specified range to avoid resonances and uncontrolled warming of the output chokes and output filters.

1)  $I_L$  = leakage current let-go

2) The KU value (symbol KU) is a classification parameter of safety-referred failure types designed to ensure protection against hazardous body currents and excessive heating.

3) A value of KU = 4.5 with respect to interruptions is attained with: a) a permanently connected protective earth circuit  $\geq 2.5$  mm<sup>2</sup> connected via shroud connectors (IEC 60309–2) and b) a protective earth circuit.

4) KU = 6 with respect to interruptions is achieved for fixed–connection lines  $\geq 10$  mm<sup>2</sup> where the type of connection and line layout correspond to the requirements for PEN conductors as specified in relevant standards.



**3-phase line reactors for converters**

The table below summarizes the safety instructions that must be observed without fail. A detailed description can be found in the relevant chapters of the databook.

Topic	Instructions	Reference chapter (data book), paragraph
Selecting a filter	When selecting a filter, it is mandatory to observe the rated data of the equipment (such as its rated input current, rated voltage, harmonic content etc.) as well as the derating instructions in Chapters 9 and 10.	Selection guide for converter filters
Rated voltage	When power distribution systems deviating from the symmetric TN-S system it is to check the suitability of the EMC filters and the allowed voltages including the fault cases.	Power distribution systems, 7
Protection from residual voltages Discharge resistors	Active parts must be discharged within 5 s to a voltage of less than 60 V (or 50 $\mu$ C). If this limit cannot be observed due to the operating mode, the hazardous point must be permanently marked in a clearly visible way.  Filters which are not permanently connected (e.g. when the test voltage is applied to the filter at the incoming goods inspection) must be discharged after the voltage has been switched off.	Safety regulations, 6.1  Safety regulations, 6.2
Installing and removing of EMC filters Installation	When installing and removing our EMC filters, a voltage-free state must be set up and secured with observance of the five safety rules described in EN 50110-1.	Safety regulations, 6.4
Use in IT systems	The special features of the IT system ("first fault case" and other fault cases) shall be observed.	Power distribution system (network types), 7.6
Safety notes on leakage currents	The filter leakage currents specified in the data book are intended for user information only. The maximum leakage current of the entire electrical equipment or appliance has to be limited for safety reasons. Please obtain the applicable limits for your application from the relevant regulations, provisions and standards.	Leakage current, 8.4 Leakage current, 8.6
Voltage derating Hazards caused by overloading the filters	If the permissible limits for the higher-frequency voltages at the filter are exceeded, the filter may be damaged or destroyed.	Voltage derating, 9.8
Current derating at elevated ambient temperatures	Non-observance of the current derating may lead to overheating and consequently represents a fire hazard.	Current derating, 10.1

**3-phase line reactors for converters**

Topic	Instructions	Reference chapter (data book), paragraph
Protective earth connection at operating currents >250 A	For operating currents greater than 250 A, we recommend the PE connection to be set up between the feed (filter: line) and output (filter: load) not via the PE terminal bolt in the filter housing.	Mounting instructions, point 2
Mounting position	Note the mounting position of the filters! It must always be ensured that natural convection is not impaired.	Mounting instructions, point 13
Long motor cables	Long motor cables cause parasitic currents in the installation. The cable lengths indicated for the output chokes and output filters serve for orientation. The user must check the technical parameters and especially the choke temperatures for the respective application.	Mounting instructions, point 15

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**3-phase line reactors for converters**
**Symbols and terms**

Symbol	English	German
$\alpha$	Insertion loss	Einfügungsdämpfung
$C_R$	Rated capacitance	Bemessungskapazität
$C_X$	Capacitance X capacitor	Kapazität X-Kondensator
$C_Y$	Capacitance Y capacitor	Kapazität Y-Kondensator
$\Delta V$	Voltage drop (input to output)	Spannungsabfall im Filter
$dv/dt$	Rate of voltage rise	Spannungsanstiegsgeschwindigkeit
$f$	Frequency	Frequenz
$f_M$	Converter output frequency	Motorfrequenz
$f_P$	Pulse frequency	Pulsfrequenz
$f_R$	Rated frequency	Bemessungsfrequenz
$f_{res}$	Resonant frequency	Resonanzfrequenz
$I_C$	Current through capacitor	Strom durch Kondensator
$I_{LK}$	Filter leakage current	Filter-Ableitstrom
$I_{max}$	Maximum current	Maximalstrom
$I_N$	Nominal current	Nennstrom
$I_{op}$	Operating current (design current)	Betriebsstrom
$I_{pk}$	Rated peak withstand current	Bemessungs-Stoßstromfestigkeit
$I_q$	Capacitive reactive current	Kapazitiver Blindstrom
$I_R$	Rated current	Bemessungsstrom
$I_S$	Interference current	Störstrom
$L$	Inductance	Induktivität
$L_R$	Rated inductance	Bemessungsinduktivität
$L_{stray}$	Stray inductance	Streuinduktivität
$P_L$	Power loss	Verlustleistung
$R$	Resistance	Widerstand
$R_{is}$	Insulation resistance	Isolationswiderstand
$R_{typ}$	DC resistance, typical value	Gleichstromwiderstand, Richtwert
$T_A$	Ambient temperature	Umgebungstemperatur
$T_{max}$	Upper category temperature	Obere Kategorietemperatur
$T_{min}$	Lower category temperature	Untere Kategorietemperatur
$T_R$	Rated temperature	Bemessungstemperatur
$u_k$	Referred voltage drop in %	Bezogener Spannungsabfall in %
$V_{eff}$	RMS voltage	Effektivspannung
$V_K$	Voltage drop	Spannungsabfall
$V_{LE}$	Voltage line to earth; voltage line to ground	Spannung Phase zu Erdpotential
$V_N$	Nominal voltage	Nennspannung
$V_R$	Rated voltage	Bemessungsspannung
$V_{peak}$	Peak voltage	Spitzenspannung
$V_{test}$	Test voltage	Prüfspannung
$V_X$	Voltage over X capacitor	Spannung über X-Kondensator
$V_Y$	Voltage over Y capacitor	Spannung über Y-Kondensator
$X_L$	Inductive reactance	Induktiver Blindwiderstand
$Z$	Impedance	Scheinwiderstand
$ Z $	Impedance, absolute value	Scheinwiderstand (Betragswert)

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