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EMC filters

3-line filters
Sine-wave output filters
300/520 V AC; 400/690 V AC, 4 A ... 320 A, 40 °C

Series/Type: **B84143V*R227**

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Sine-wave output filters for 3-phase systems
Rated voltage V_R: 300/520 V AC and 400/690 V AC
Rated current I_R: 4 A to 320 A

Schematic picture

Construction
- 3-line filters

Features
- Reduction of motor noise and eddy current losses
- Generation of sinusoidal phase-to-phase voltage with low ripple
- dv/dt reduction
- Easy to install
- Compact design
- Degree of protection[1]:
  IP20 (4 A ... 50 A, 75 A)
  IP10 (66 A, 95 A)
  IP00 (132 A ... 320 A)
- Optimized for long motor cables[2]
- Natural cooling
- Wiring between inverter and filter must be shorter than 10 meters!
- Up to 180 A: tube clip for convenient shield bonding
- UL approved insulation system class 155 (F)

Typical applications
- Frequency converters for motor drives, e.g.
  – elevators
  – pumps
  – traction and conveyer systems
  – HVAC systems (heating, ventilation and air conditioning)

Terminals
- Up to 180 A: Finger-safe terminals
- 250 A and 320 A: Busbars

Marking
Marking on component:
Manufacturer’s logo, ordering code, rated voltage, rated current, rated motor frequency, rated switching frequency, rated temperature, climatic category, date code, approvals

Minimum data on packaging:
Manufacturer's logo, ordering code, quantity, date code

1) According to IEC 60529
2) The maximum permissible motor cable length depends on the application and must be checked.

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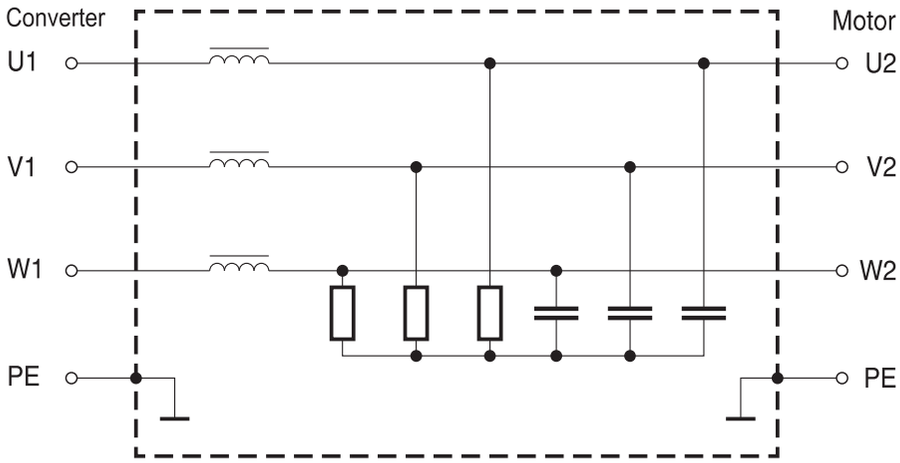
Typical circuit diagrams

Filters for 4 A ... 33 A



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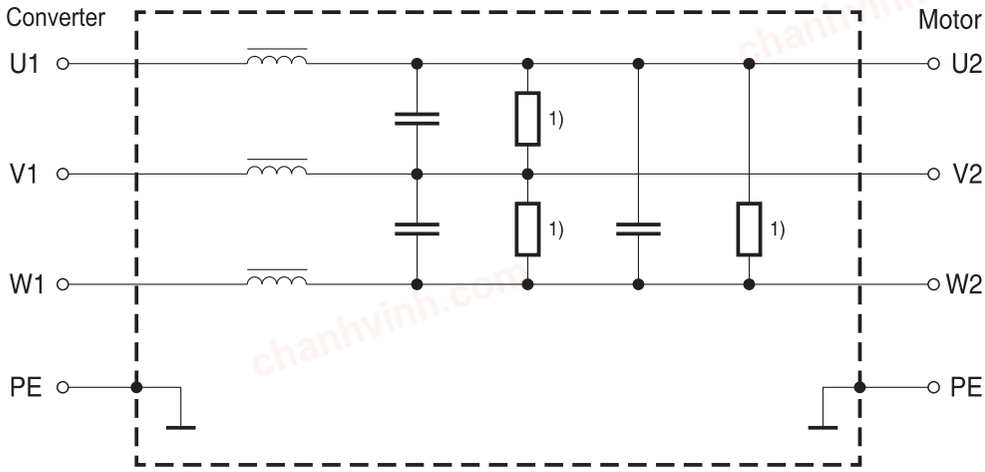
Filters for 50 A ... 320 A



1) Mounted on the capacitor

SSB3278-F-E

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Sine-wave output filters for 3-phase systems

Technical data and measuring conditions

Rated voltage V_R	Filters 4 A ... 132 A: 300/520 V AC (50/60 Hz) Filters 180 A ... 320 A: 400/690 V AC (50/60 Hz)
Rated current I_R	Referred to 40 °C rated temperature
Test voltage V_{test}	1500 V DC, 2 s (line/line) 2500 V DC, 2 s (lines/case)
Rated inductance L_R	See table "Characteristics and ordering codes"
Rated capacitance C_R	Based on star connection independent of the real used circuit; see table "Characteristics and ordering codes"
Converter output frequency f_M	0 ... 100 Hz
Pulse frequency f_P	See table "Characteristics and ordering codes"
Overload capability (thermal)	1.5 · I_R for 1 min per hour
Voltage drop ΔV (Input to output)	At I_R and 50 Hz
Max. dv/dt on filter input	5 kV/µs (higher values can be approved individually)
Climatic category (IEC 60068-1)	Filters 4 A ... 33 A: 25/90/21 Filters 50 A ... 95 A: 25/55/21 Filters 132 A ...320 A: 25/70/21
Insolation class	155 (F)
Approvals	Insulation system class 155 (F)

Characteristics and ordering codes

I_R* A	Terminal cross section mm^2	R_{typ} mΩ	L_R mH	C_R µF	ΔV %	f_P[1] min. kHz	f_P max. kHz	P_L[2] W	Approx. weight kg	Ordering code
V_R = 520 V AC										
4	4	390	12.0	2.2	5	3	16	40	3.3	B84143V0004R227
6	4	290	8.5	2.2	5	3	16	45	3.5	B84143V0006R227
11	4	70	4.5	3.3	5	3	16	55	5.3	B84143V0011R227
16	6	37	3.0	5.6	7	3	10	60	8.5	B84143V0016R227
25	10	28	2.5	10	7	3	10	100	16	B84143V0025R227
33	10	20	1.8	10	8	3	10	150	20	B84143V0033R227
50	35	12	1.2	12	8	3	10	190	25	B84143V0050R227
66	35	9	0.95	18	8	3	8	250	26	B84143V0066R227
75	35	7	0.86	27	9	3	8	320	38	B84143V0075R227
95	35	6.3	0.75	27	10	3	8	330	52	B84143V0095R227
132	95	3.7	0.52	60	10	3	8	380	67	B84143V0132R227

* Higher current values upon request

1) For lower frequencies please contact TDK
2) Estimated losses at I_R and V_R when running with an inverter at f_p min

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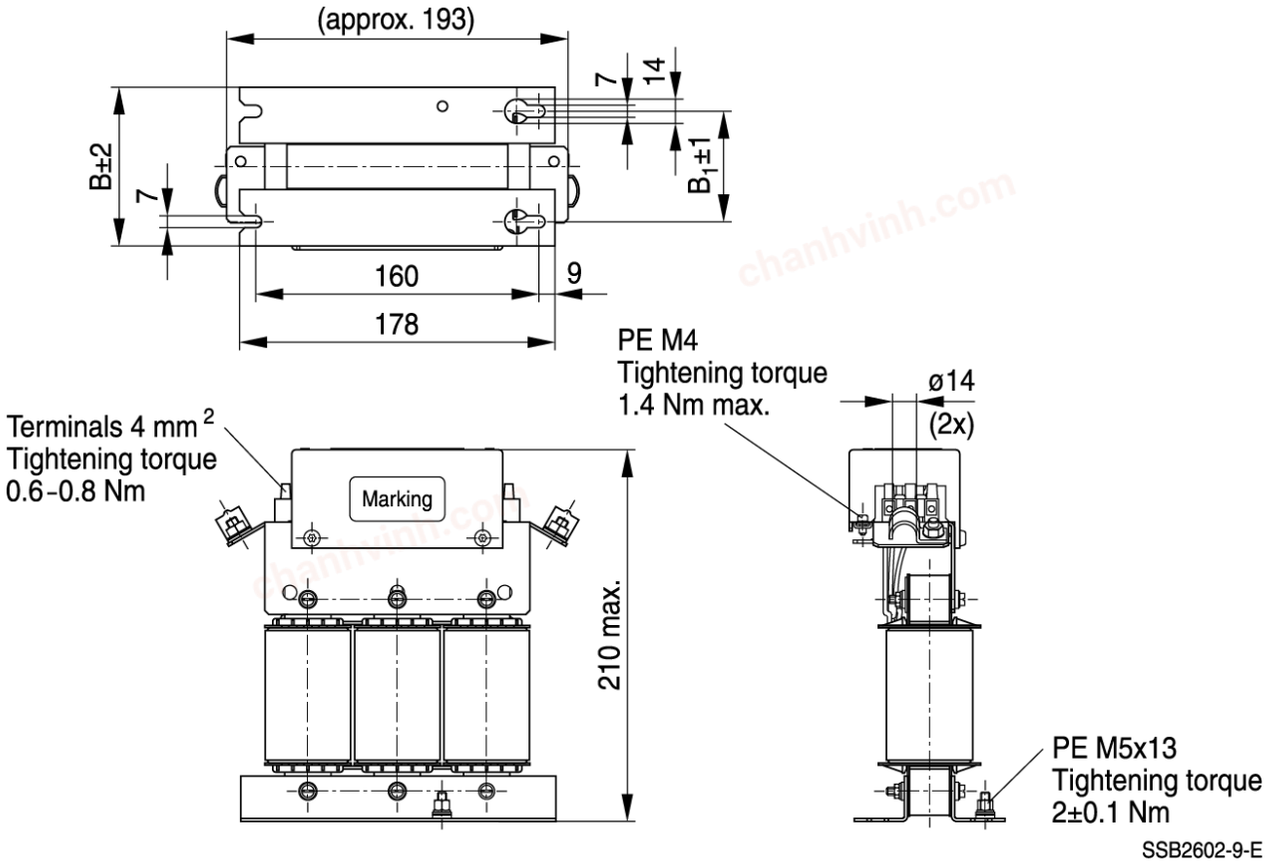
Sine-wave output filters for 3-phase systems

I_R* A	Terminal cross section mm²	R_{typ} mΩ	L_R mH	C_R µF	ΔV %	f_P[3] min. kHz	f_P max. kHz	P_L[4] W	Approx. weight kg	Ordering code
V_R = 690 V AC										
180	95	3.8	0.40	90	10	3 [5]	6	480	74	B84143V0180R227
250	40 × 3	1.4	0.32	102	11	2.4	6	560	91	B84143V0250R227
320	40 × 3	1.2	0.25	167	11	2.4	6	750	145	B84143V0320R227

* Higher current values upon request

Dimensional drawings

B84143V0004R227 ... B84143V0011R227 (4 A ... 11 A)



Ordering code	B	B_1
B84143V0004R227	85	60
B84143V0006R227	85	60
B84143V0011R227	100	75

General tolerances according to ISO 2768–cL
Dimensions in mm

3) For lower frequencies please contact TDK
4) Estimated losses at I_R and V_R when running with an inverter at f_p min
5) 4 kHz in case the filter is mounted vertically on the wall

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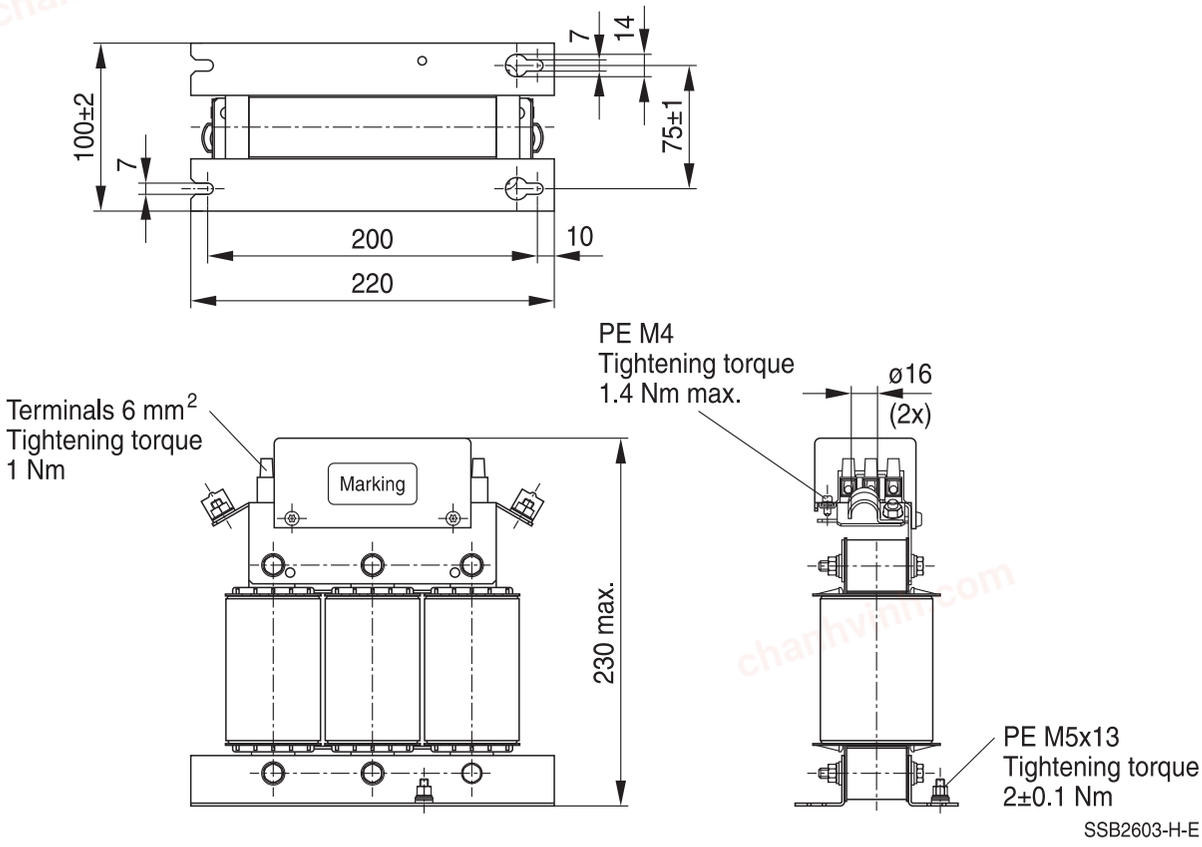
B84143V0016R227 (16 A)



General tolerances according to ISO 2768−cL
Dimensions in mm

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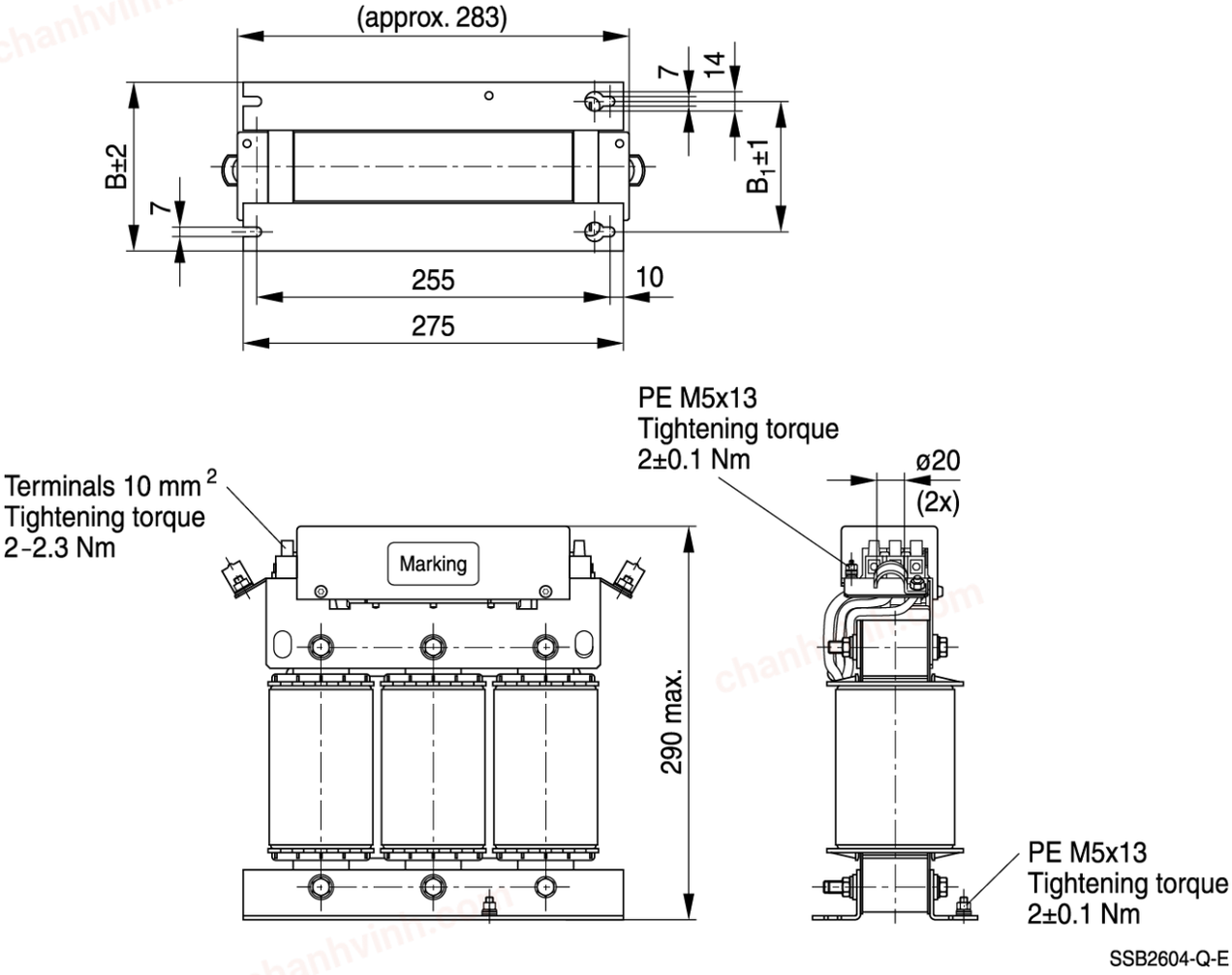
B84143V0025R227, B84143V0033R227 (25 A, 33 A)



Ordering code	B	B_1
B84143V0025R227	110	82
B84143V0033R227	120	92

General tolerances according to ISO 2768−cL
Dimensions in mm

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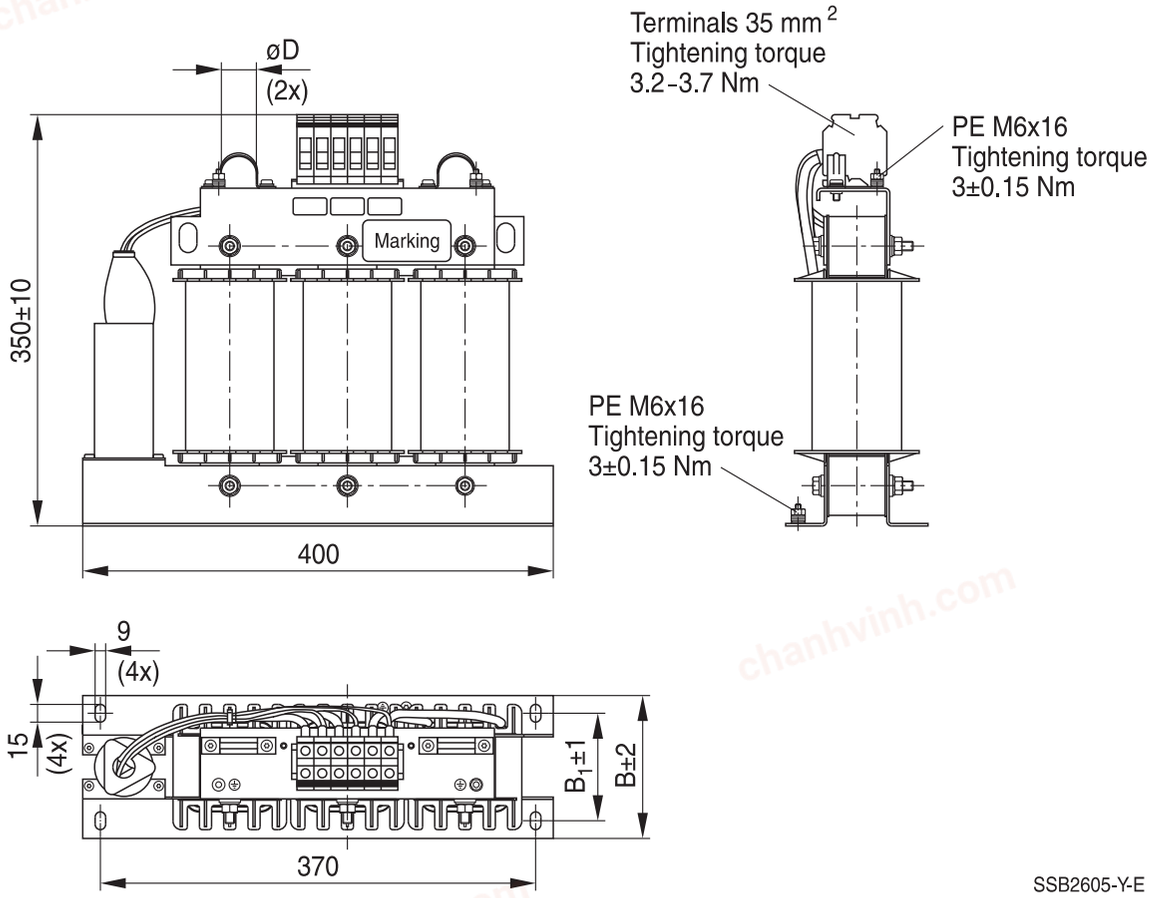
B84143V0050R227 ... B84143V0075R227 (50 A ... 75 A)



SSB2605-Y-E

Ordering code	B	B_1	∅D
B84143V0050R227	121	91	30
B84143V0066R227	121	91	30
B84143V0075R227	146	116	43

General tolerances according to ISO 2768−cL
Dimensions in mm

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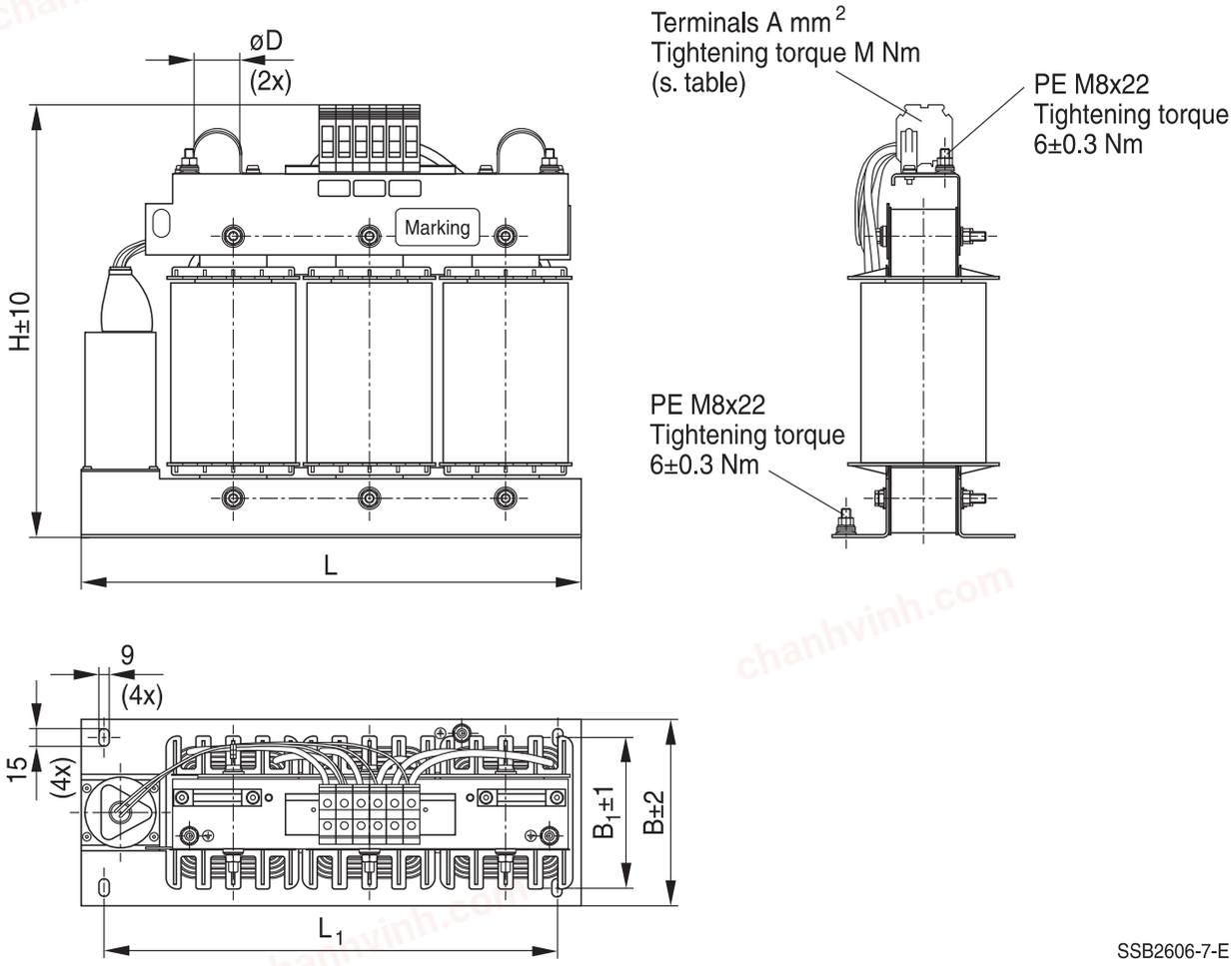
B84143V0095R227 ... B84143V0180R227 (95 A ... 180 A)



Ordering code	L	L_1	B	B_1	H	∅D	A	M
B84143V0095R227	440	400	161	125	400	43	35	3.2-3.7
B84143V0132R227	480	400	176	140	430	55	95	15-20
B84143V0180R227	500	460	191	155	430	55	95	15-20

General tolerances according to ISO 2768−cL
Dimensions in mm

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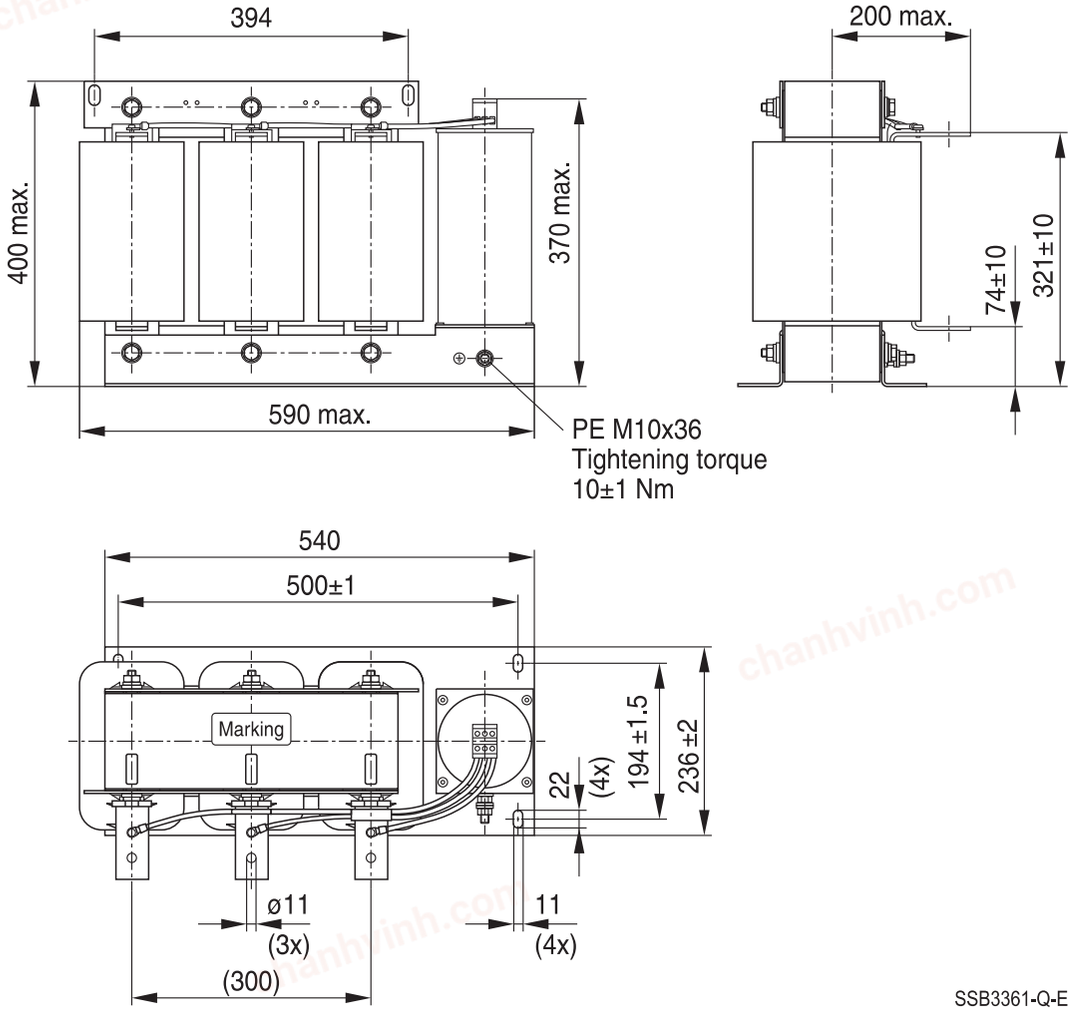
B84143V0250R227 (250 A)



General tolerances according to ISO 2768−cL
Dimensions in mm

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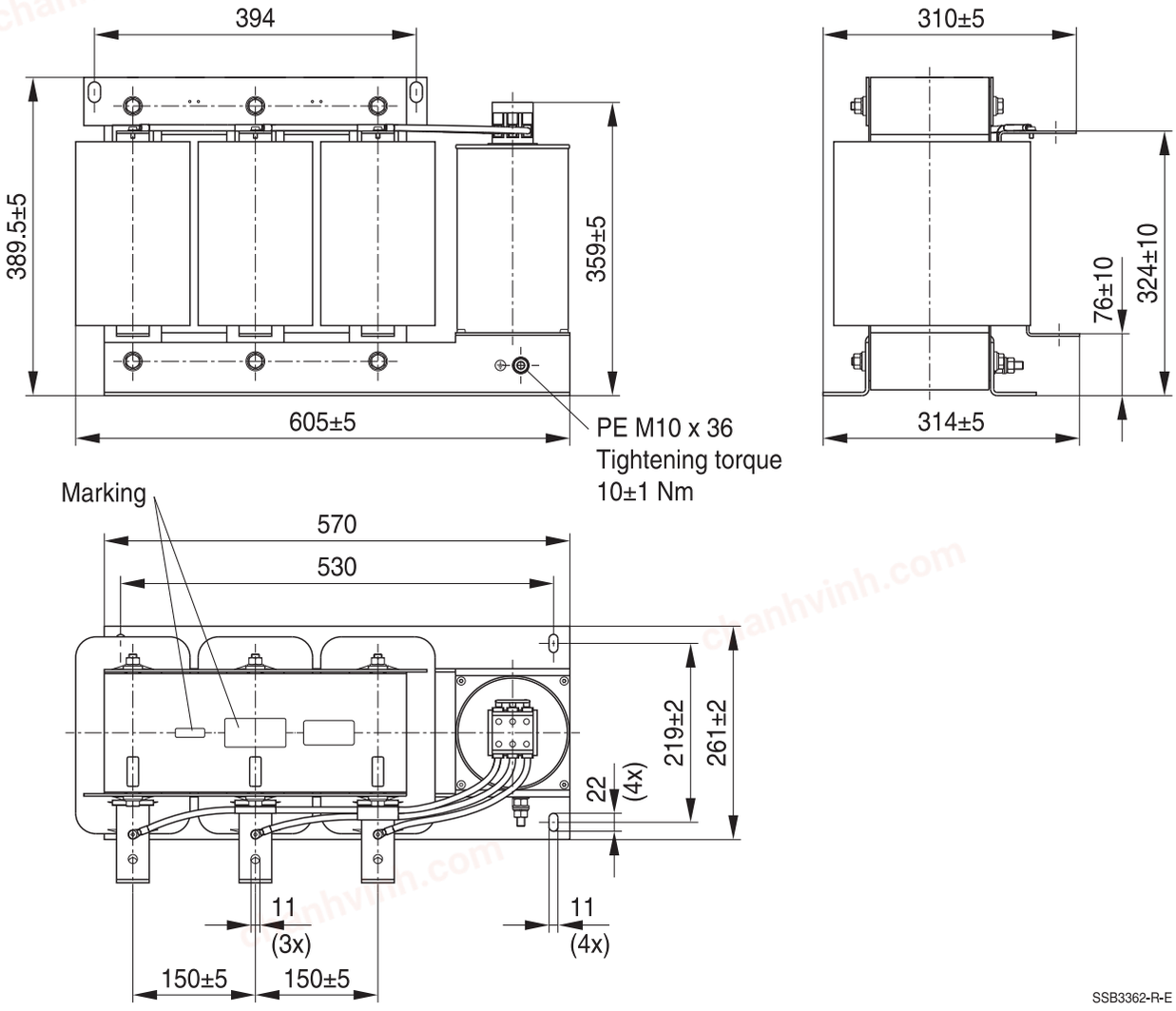
B84143V0320R227 (320 A)



General tolerances according to ISO 2768−cL
Dimensions in mm

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Cautions and warnings

Please read all warning and safety notes carefully before installing the 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 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. 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 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 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).
- Filters must be protected in the application against impermissible exceeding of the rated currents by overcurrent protective devices.
- 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[2] of 4.5[3]; for leakage currents I_L >10 mA the PE conductor must have a KU value of 6[4].
- 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.
- Because the product can become very hot during operation, there is the risk of burns if touched. The product can remain hot for some time after the power is switched off!

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) permanently connected protective earth connection ≥1.5 mm² and b) a protective earth connection ≥2.5 mm² via connectors for industrial equipment (IEC 60309−2)
4) KU = 6 with respect to interruptions is achieved for fixed-connection lines ≥10 mm² where the type of connection and installation correspond to the requirements for PEN conductors as specified in relevant standards.

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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 is to check the suitability of the 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 µ C). If this limit cannot be observed due to the operating mode, the hazardous point must be permanently marked in a clearly visible way.	Safety regulations, 6.1
	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, 6.2
Installing and removing of filters Installation	When installing and removing our 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 exeeded, 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

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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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Symbols and terms

Symbol	English	German
α	Insertion loss	Einfügungsdämpfung
C_R	Rated capacitance	Bemessungskapazität
C_X	Capacitance X capacitor	Kapazität X-Kondensator
C_Y	Capacitance Y capacitor	Kapazität Y-Kondensator
ΔV	Voltage drop (input to output)	Spannungsabfall (Eingang zu Ausgang)
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 typisch
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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2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified**. In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or lifesaving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.
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Important notes

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