



## **Filters for power lines with HEMP-Protection according to MIL-STD 188-125-1**

250/440 V, 50/60 Hz, 32/100 A

**Series/Type:** B84299C/D1101/2320E303/E313

**Date:** September 2017

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## Filters for power lines with HEMP-Protection

250/440 V, 50/60 Hz, 32/100 A

B84299C/D1101/2320E303/E313

- 4-line filters 32 and 100 A
- Multi-stage
- Stopband attenuation 14 kHz to 40 GHz
- Tested according MIL-STD 188-125-1 (short and intermediate pulse)



### Features

- General-purpose use through design with separate lines without intercoupling
- Use of single chokes. Thus the insertion loss values are not reduced under all operating current conditions and not when operated with artificial mains networks (AMN) or other equipment with high leakage currents
- Insertion loss to EN 55017

### Design

The electrical components are incorporated in an RF-tight case of stainless steel. The cables enter through glands. The RF-tight termination of the openings is produced by specially shaped lids.

The output conductors and equipment grounding conductor are connected by threaded bolts and the input conductors are connected by bus bars. The surface around the fixing holes is left as bare metal (unpainted) to ensure good RF contact with metal surfaces (chassis, ground).

### Protective measures (grounding)

The high capacitances between the lines and ground require special protective measures. If there are no product-specific requirements, protection with a secondary ground wire (cross section min. 10 mm<sup>2</sup>) in accordance with EN 50178 is necessary. For this purpose the filter case has connecting bolts at each end.

Resistors are incorporated in the filter to discharge capacitors after turn-off.

### Scope of supply

Filters are supplied complete with all parts required for RF-tight installation (fixing screws, flanges, RF gaskets, cable glands) and installation instructions.

### Installation

No welding is needed on the shielding wall, so any subsequent installation is quite simple.

### Accessories and special versions

RF-tight flexible connector fittings are available for installation spaced away from the shielding wall. To match requirements, filters can be supplied with different kinds of EMC or shielding cable glands.

### Tests

All filters are 100% tested and the results are archived under a filter's serial number. If required, a test report can be generated for the serial number.

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**Technical data and measuring conditions**

Rated voltage	$V_R$ [L-PE / L-L]	250/440 V AC (50/60 Hz)
Rated frequency	$f_R$	50/60 Hz
Rated current	$I_R$	See characteristics
Power dissipation	$P_D$	See characteristics
Test voltage line to line for 2 s <sup>1)</sup>	$V_{test}$	1200 V DC
Test voltage line to case for 2 s <sup>1)</sup>	$V_{test}$	1200 V DC
Rated temperature	$T_R$	40 °C
Overload capability (thermal)	$I_{over}$	75 × $I_R$ for 50 ms 10 × $I_R$ for 1 s 2 × $I_R$ for 1 min 1.4 × $I_R$ for 15 min
Reactive current of each phase line at 230/400 V	$I_{reactive}$	At $U_R$ and 50 Hz, see characteristics
Leakage current (IEC 60939-1: 2010, Annex A)	$I_{LK}$	At $U_R$ and 50 Hz, see characteristics
Max. permissible harmonic distortion (THD)	$THD_{max}$	8% according to EN 50160
Climatic category (IEC 60068-1: 1992)		25/085/56
Permissible ambient temperature		-25 to +40 °C
Degree of protection (IEC 60529: 2013)		IP 20
Max. DC resistance	$R_{DC}$	See characteristics

1) EMP-protection components disconnected

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### Characteristics and ordering codes

$I_R$	Mech. version <sup>1)</sup>	Terminal <sup>2)</sup>	$R_{DC}$	$P_D$	$I_{reactive}$	$I_{LK}$	Dimensional drawing	Circuit diagram	Appr. weight	Ordering code
A			m $\Omega$	W	A	mA			kg	
Filter for assembly from outside to the shielded wall										
4 × 32	C	Bus bar/M6	< 30	90	2.3	303	1	1	40	B84299C2320E303
	D						2			B84299D2320E303
4 × 100	C	Bus bar/M8	< 4	120	6.5	680	3	2	76	B84299C1101E303
	D						4			B84299D1101E303
Filter for assembly from inside to the shielded wall										
4 × 32	C	Bus bar/M6	< 30	90	2.3	303	5	3	40	B84299C2320E313
	D						6			B84299D2320E313
4 × 100	C	Bus bar/M8	< 4	120	6.5	680	7	4	76	B84299C1101E313
	D						8			B84299D1101E313

1) Connection to the shielding

C = at front side

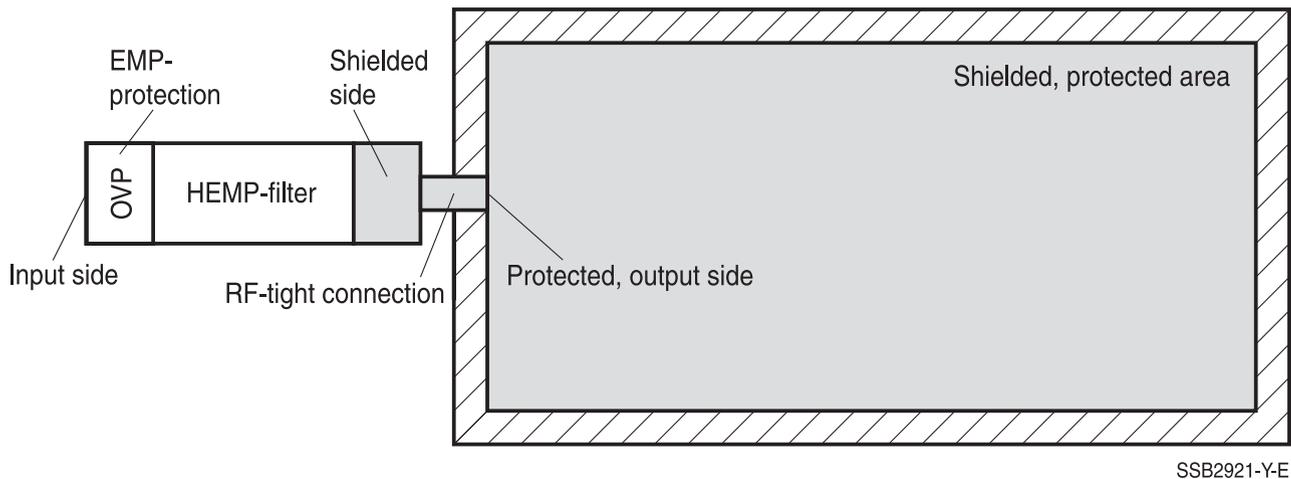
D = at bottom side

2) Bus bars at input side/threaded bolts at protected side

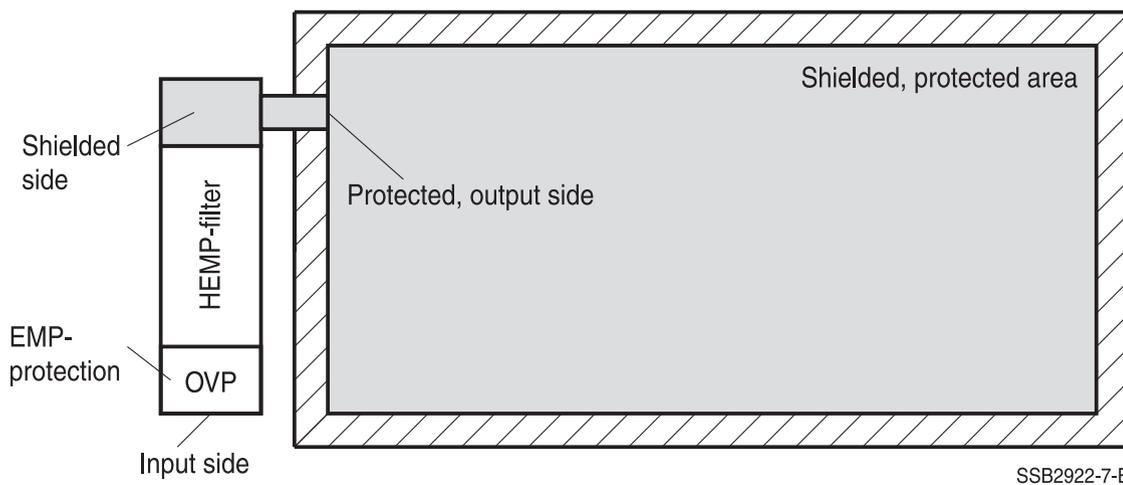
**Filters for power lines with HEMP-Protection**  
**250/440 V, 50/60 Hz, 32/100 A** **B84299C/D1101/2320E303/E313**

**Assembly of filters**

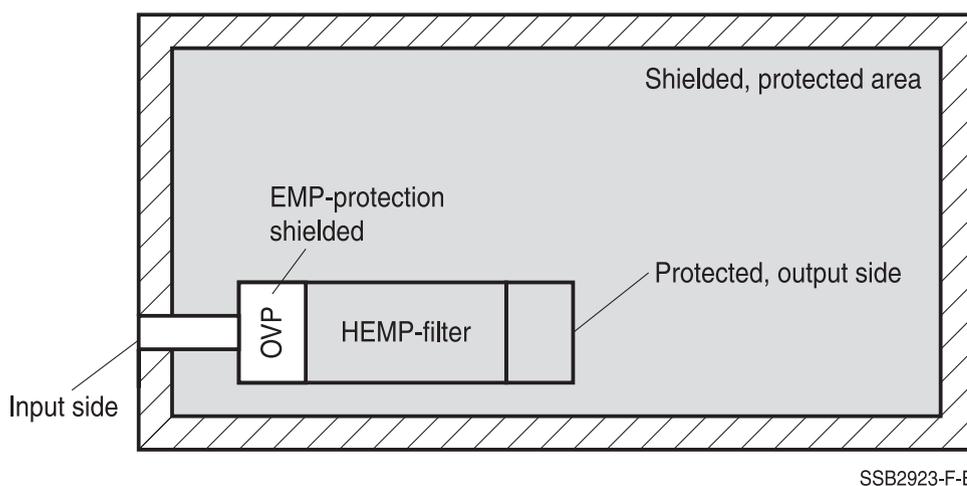
Filters B84299C2320E303, B84299C1101E303 for assembly at outside to the shielded wall



Filters B84299D2320E303, B84299D1101E303 for assembly at outside to the shielded wall



Filters B84299C2320E313, B84299C1101E313 for assembly at inside to the shielded wall

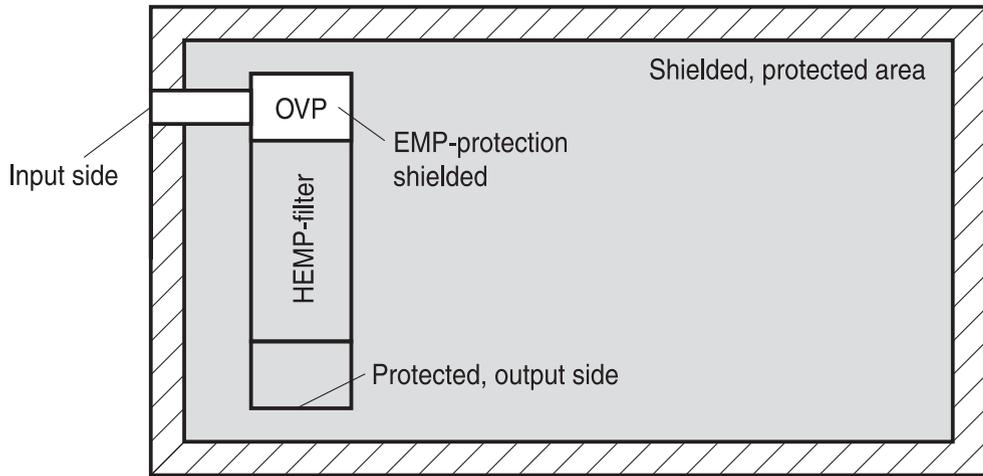


## Filters for power lines with HEMP-Protection

250/440 V, 50/60 Hz, 32/100 A

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Filters B84299D2320E313, B84299D1101E313 for assembly at inside to the shielded wall



SSB2924-N-E

### Approvals / Test reports acc. to MIL-STD 188-125-1

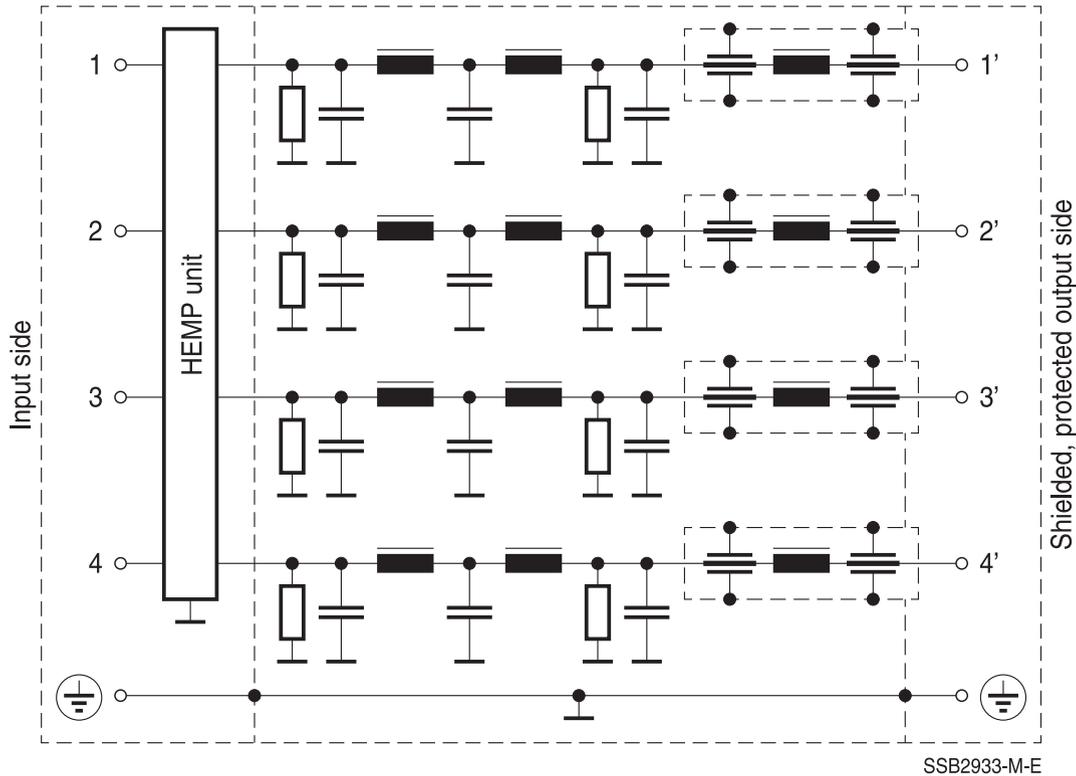
Ordering code	Test report from EMCCons DR. RAŠEK GmbH & Co. KG <a href="http://www.emcc.de">www.emcc.de</a> Test acc. MIL-STD 188-125-1 (short and intermediate pulse test)		
Filter for assembly from outside to the shielded wall			
B84299...		Response current Short pulse	Response current intermediate pulse
...C2320E303	Test report EMCC-860009.1DBB, 2016-09-16	2.61 A max.	9.57 A
...D2320E303	Test report EMCC-860009.1DBB, 2016-09-16		
...C1101E303	Test report EMCC-860009.1G, 2016-09-01	2.75 A max.	18.11 A
...D1101E303	Test report EMCC-860009.1G, 2016-09-01		
Filter for assembly from inside to the shielded wall			
...C2320E313	Test report EMCC-860009.1DBB, 2016-09-16	2.61 A max.	9.57 A
...D2320E313	Test report EMCC-860009.1DBB, 2016-09-16		
...C1101E313	Test report EMCC-860009.1G, 2016-09-01	2.75 A max.	18.11 A
...D1101E313	Test report EMCC-860009.1G, 2016-09-01		

## Filters for power lines with HEMP-Protection

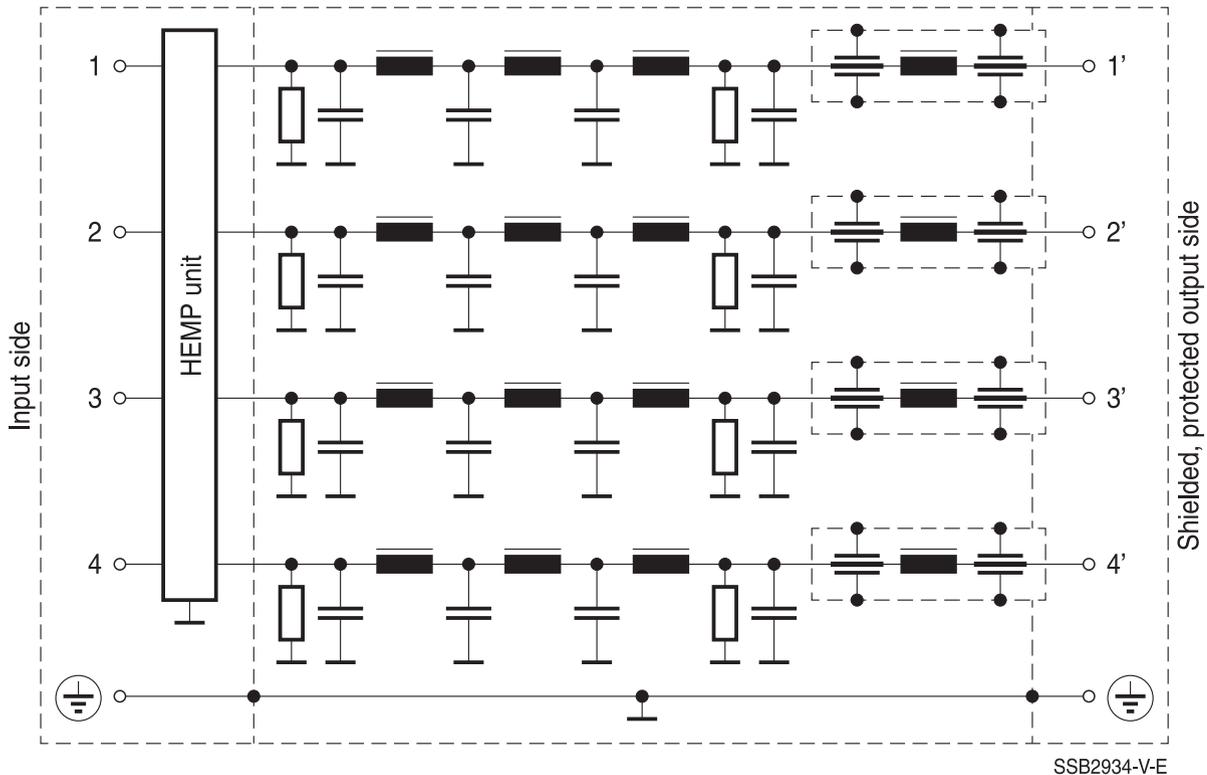
250/440 V, 50/60 Hz, 32/100 A

B84299C/D1101/2320E303/E313

Circuit diagram 1: B84299C2320E303, B84299D2320E303 (4 × 32 A)



Circuit diagram 2: B84299C1101E303, B84299D1101E303 (4 × 100 A)

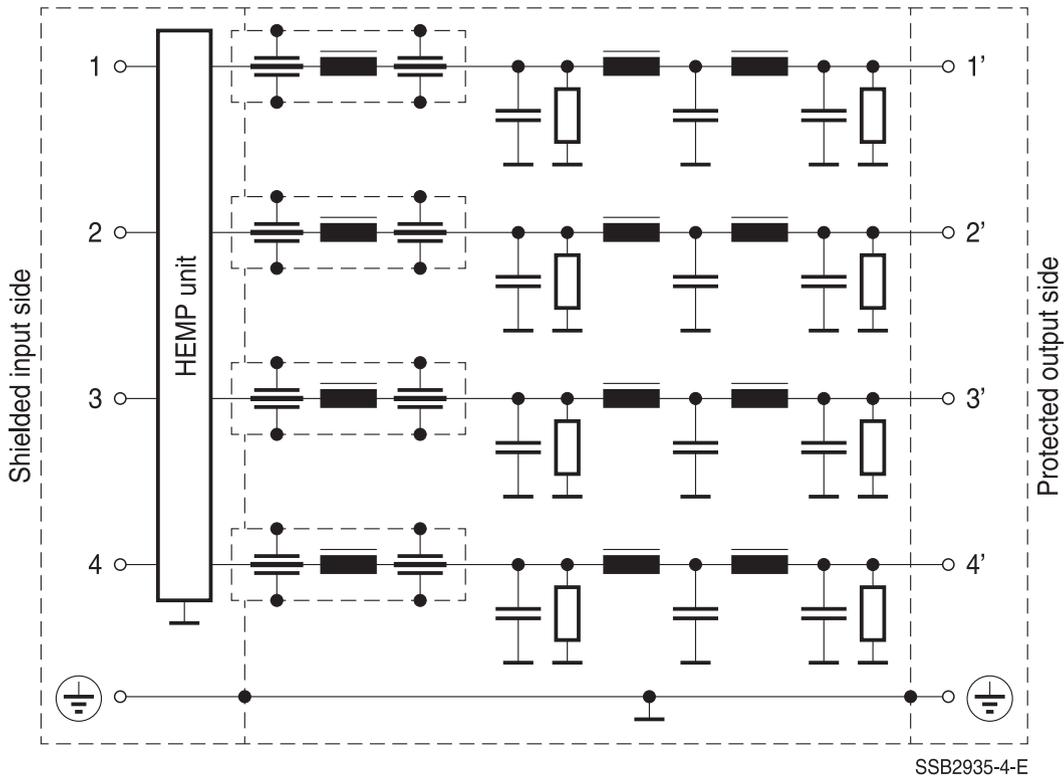


**Filters for power lines with HEMP-Protection**

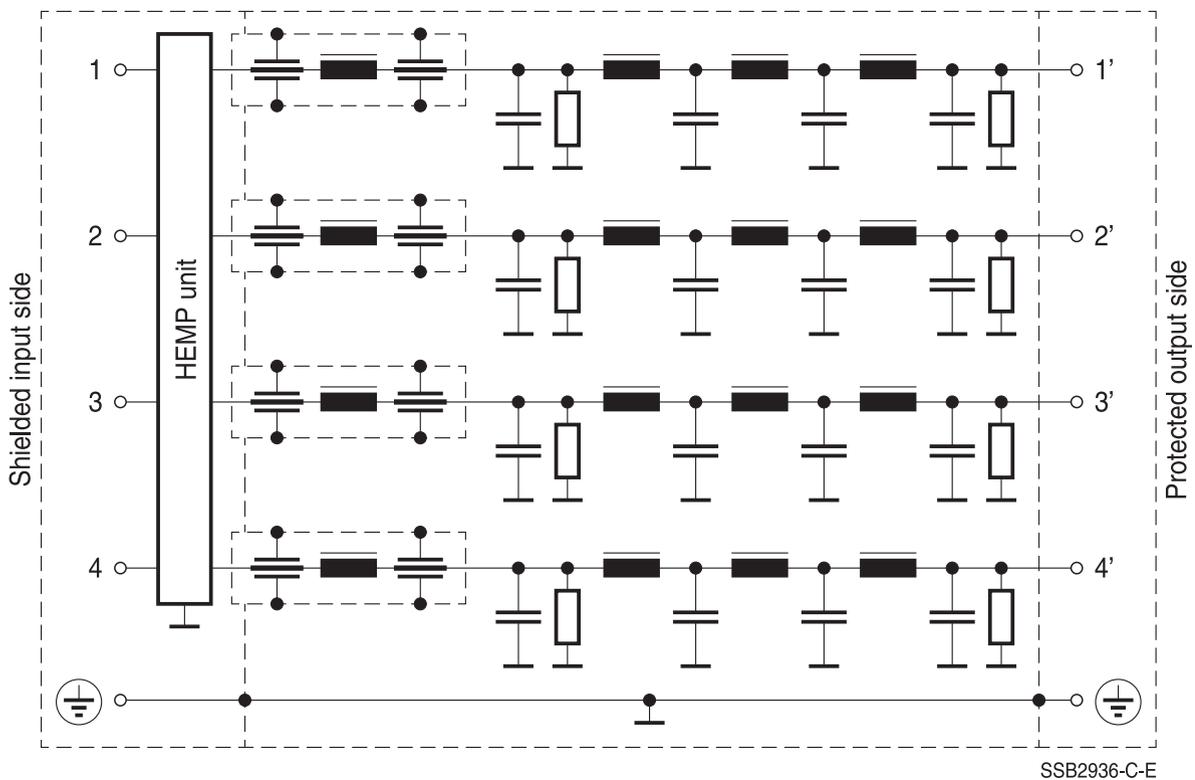
**250/440 V, 50/60 Hz, 32/100 A**

**B84299C/D1101/2320E303/E313**

Circuit diagram 3: B84299C2320E313, B84299D2320E313 (4 × 32 A)



Circuit diagram 4: B84299C1101E313, B84299D1101E313 (4 × 100 A)

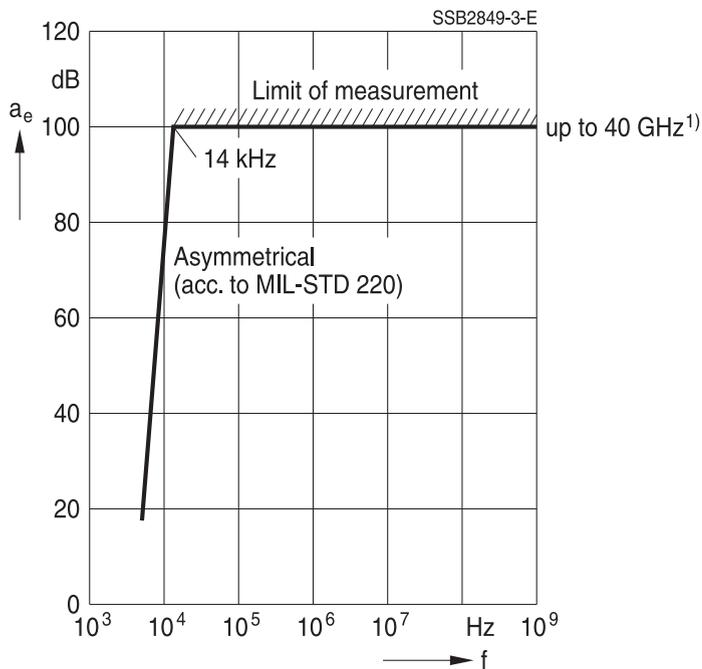


## Filters for power lines with HEMP-Protection

250/440 V, 50/60 Hz, 32/100 A

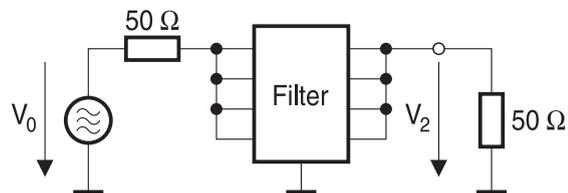
B84299C/D1101/2320E303/E313

Insertion loss  $a_e$  as a function of frequency  $f$  (typical values at  $Z = 50 \text{ Ohm}$ )



<sup>1)</sup> According to MIL-STD 285

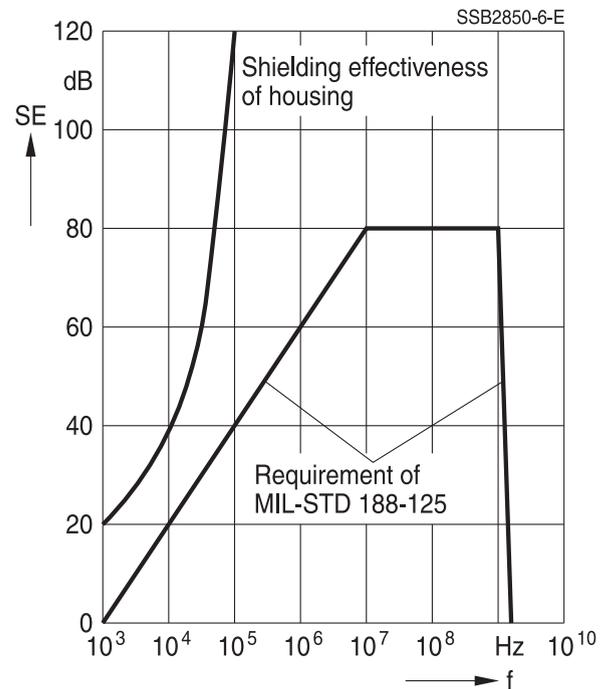
Test setup



$$a_e = 20 \lg \frac{V_0}{2 V_2} \text{ [dB]}$$

SSB2846-D-E

Shielding effectiveness of filter housing acc. MIL-STD 188-125-1/2



**Filters for power lines with HEMP-Protection**

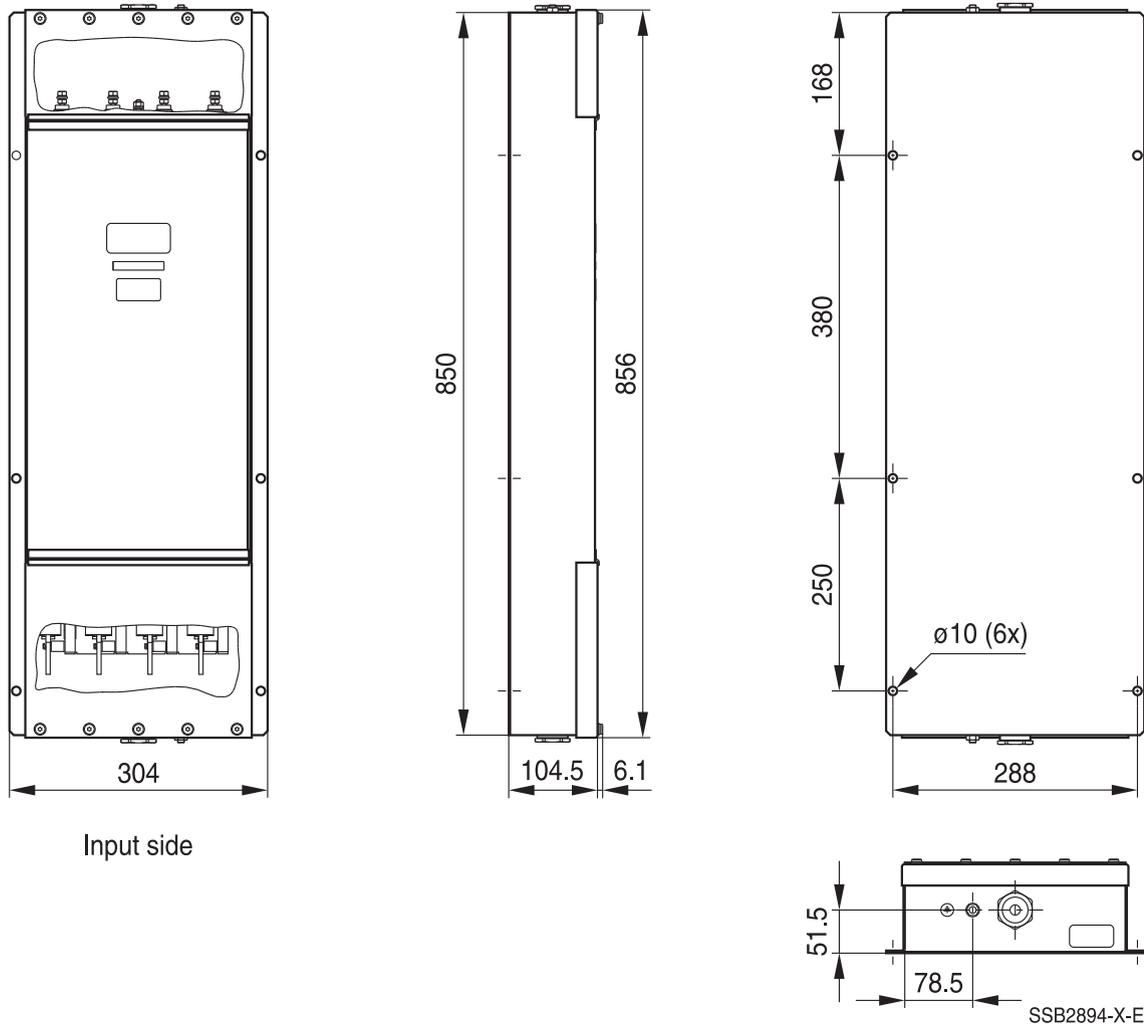
**250/440 V, 50/60 Hz, 32/100 A**

**B84299C/D1101/2320E303/E313**

**Dimensional drawings**

Drawing 1 – B84299C2320E303 (4 × 32 A) for assembly from outside to the shielded wall

Shielded, protected output side

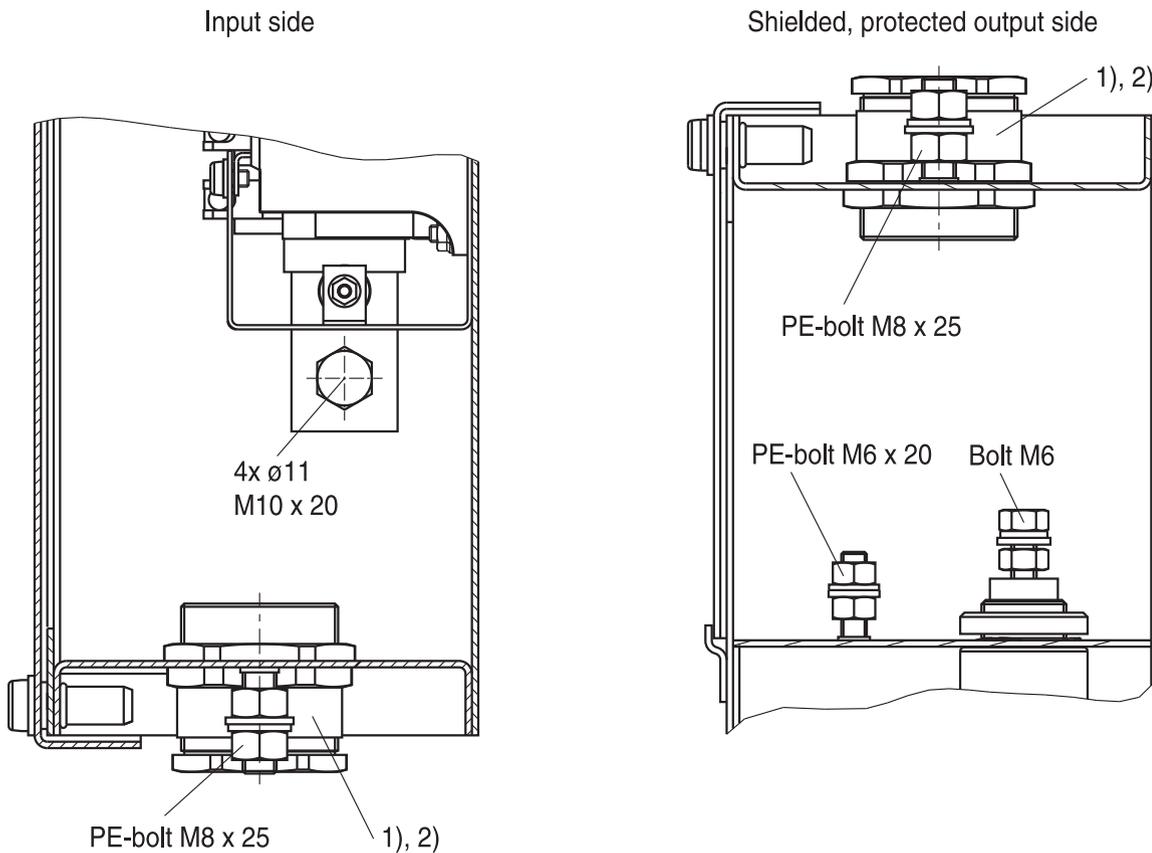


**Filters for power lines with HEMP-Protection**

**250/440 V, 50/60 Hz, 32/100 A**

**B84299C/D1101/2320E303/E313**

Drawing 1 – B84299C2320E303 (4 × 32 A) – details of connection



<sup>1)</sup> Cable glands PG 29\* with indented sealing ring,  
for cable diameters [mm]: 17 ... 19 / 20 ... 22 / 23 ... 25 / 26 ... 28

With reducer\*:

<sup>2)</sup> Cable glands PG 21\* with indented sealing ring,  
for cable diameters [mm]: 9 ... 11 / 12 ... 14 / 15 ... 17 / 18 ... 20

\* Included in delivery

SSB2895-6-E

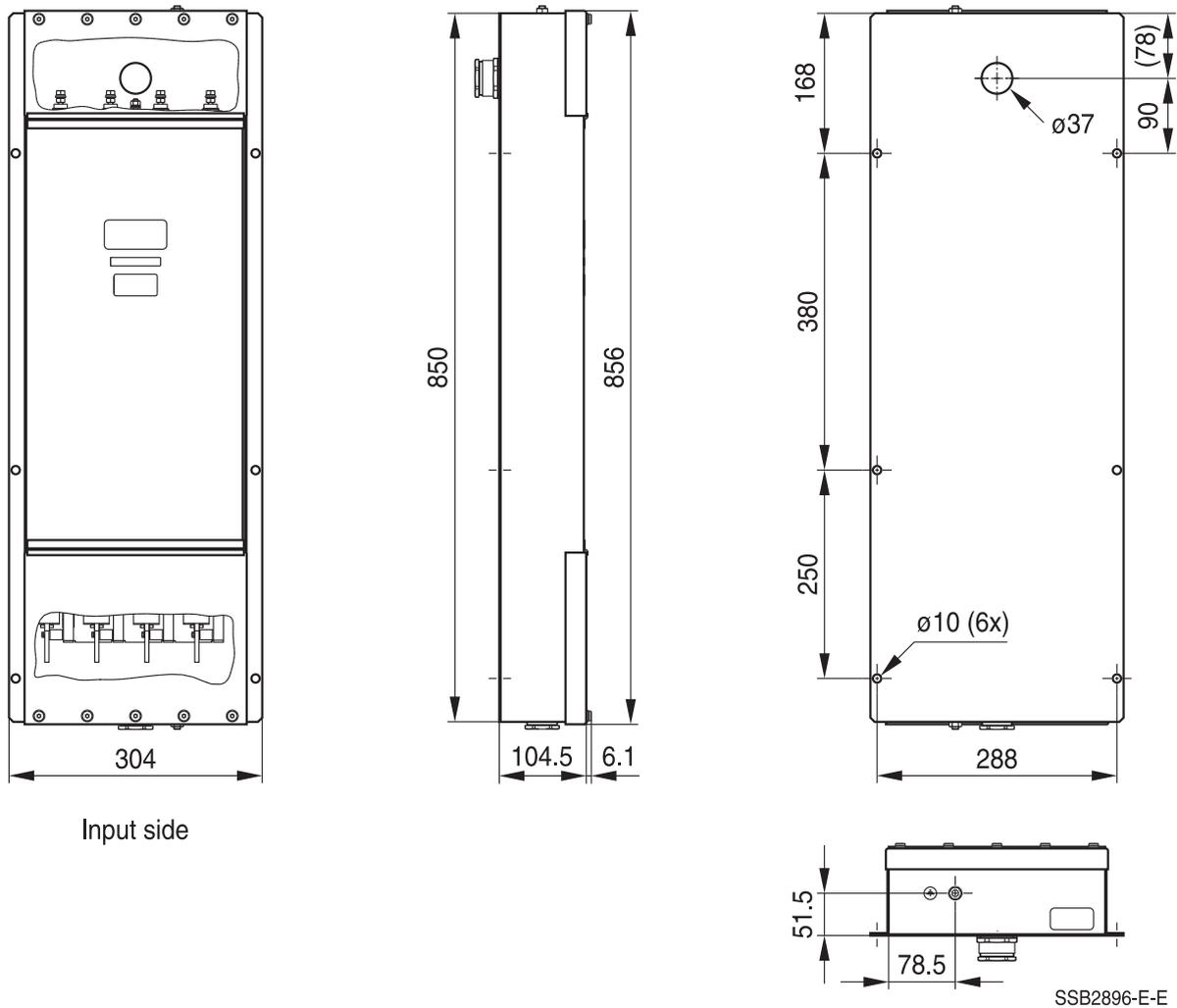
**Filters for power lines with HEMP-Protection**

**250/440 V, 50/60 Hz, 32/100 A**

**B84299C/D1101/2320E303/E313**

Drawing 2 – B84299D2320E303 (4 × 32 A) for assembly from outside to the shielded wall

Shielded, protected output side

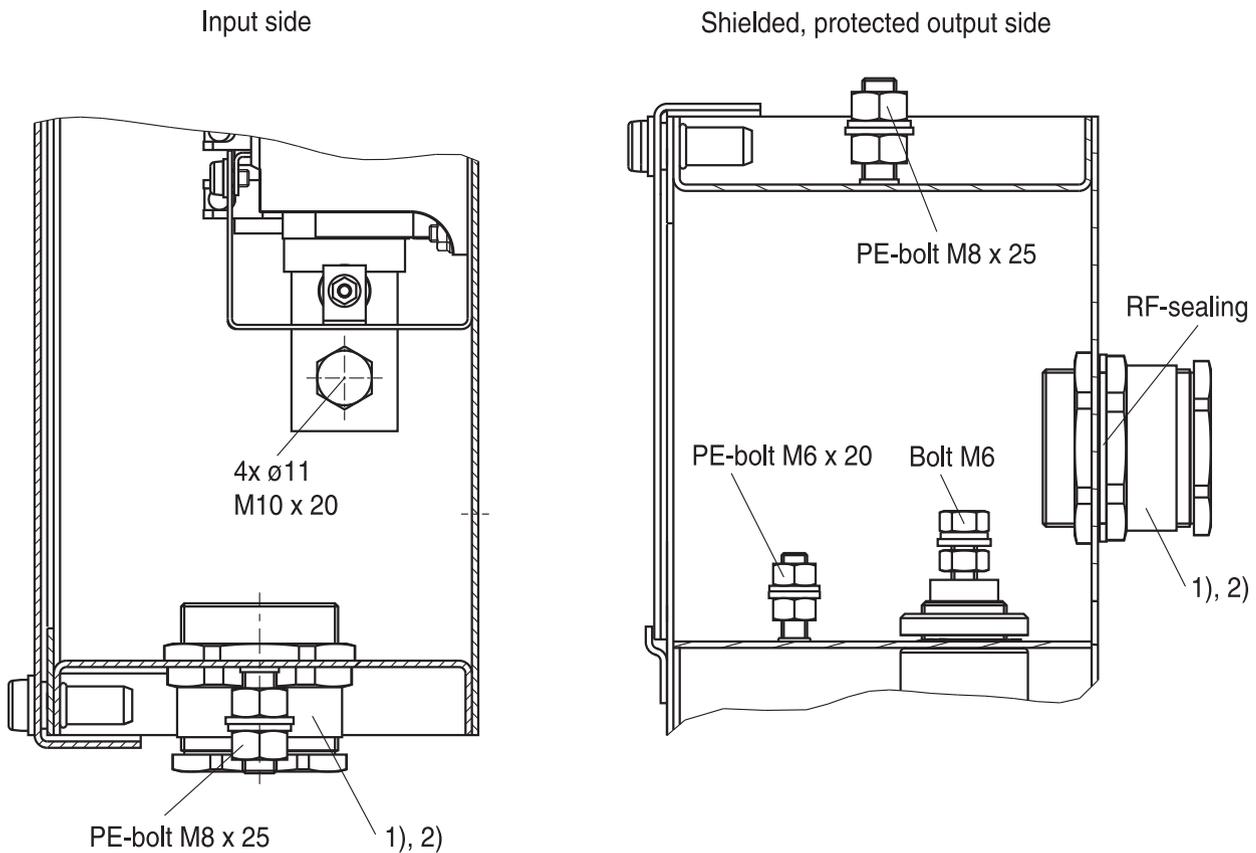


**Filters for power lines with HEMP-Protection**

**250/440 V, 50/60 Hz, 32/100 A**

**B84299C/D1101/2320E303/E313**

Drawing 2 – B84299D2320E303 (4 × 32 A) – details of connection



1) Cable glands PG 29\* with indented sealing ring,  
for cable diameters [mm]: 17 ... 19 / 20 ... 22 / 23 ... 25 / 26 ... 28

With reducer\*:

2) Cable glands PG 21\* with indented sealing ring,  
for cable diameters [mm]: 9 ... 11 / 12 ... 14 / 15 ... 17 / 18 ... 20

\* Included in delivery

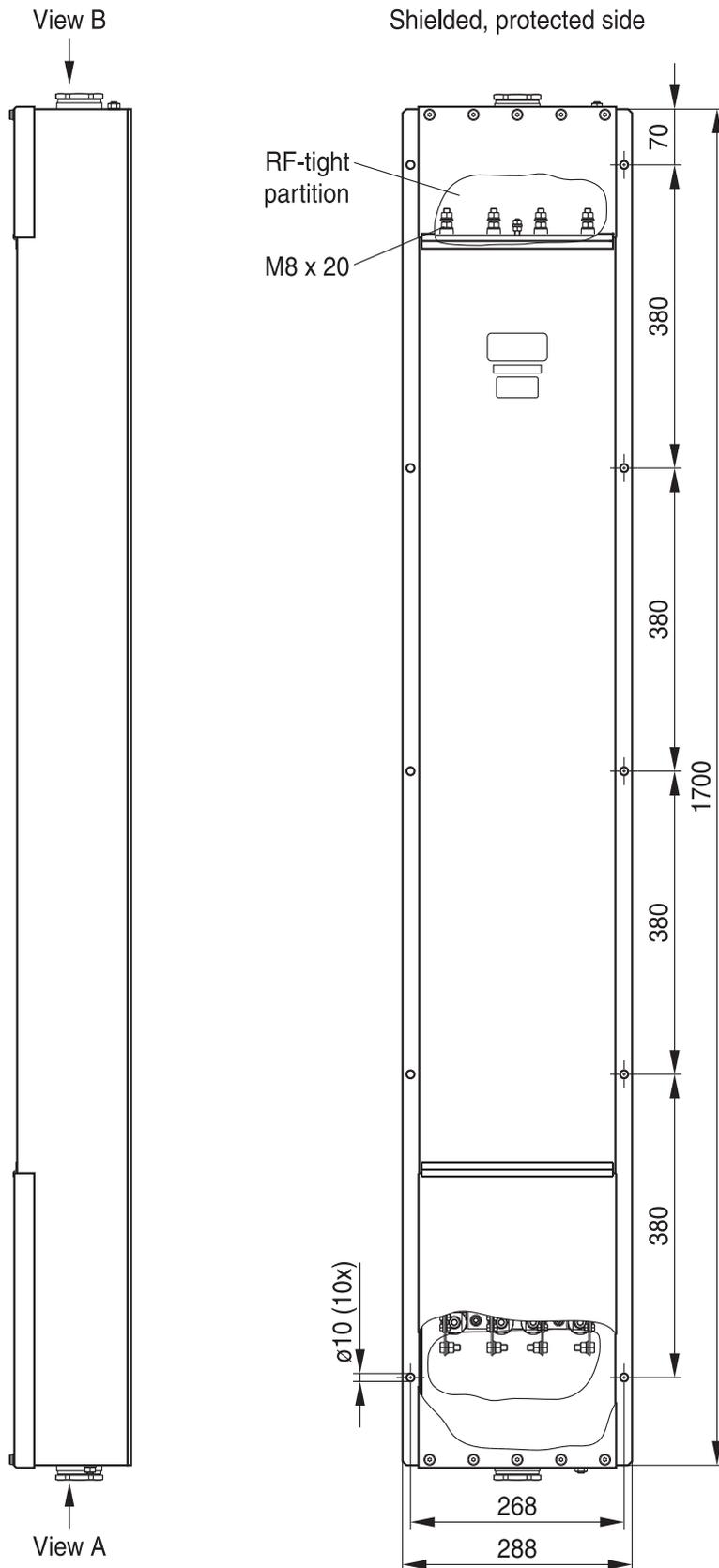
SSB2897-M-E

**Filters for power lines with HEMP-Protection**

**250/440 V, 50/60 Hz, 32/100 A**

**B84299C/D1101/2320E303/E313**

Drawing 3 – B84299C1101E303 (4 × 100 A) for assembly from outside to the shielded wall



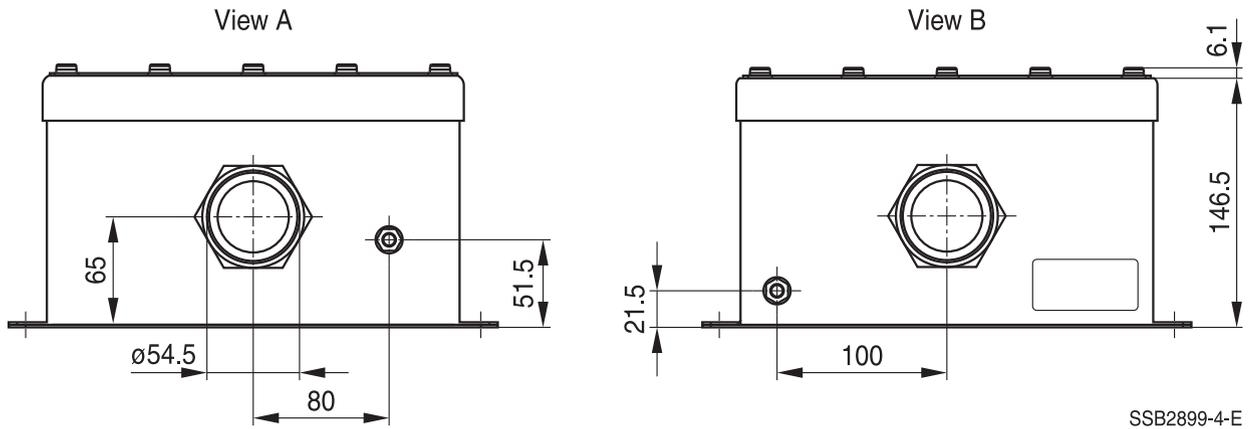
SSB2998-V-E

**Filters for power lines with HEMP-Protection**

**250/440 V, 50/60 Hz, 32/100 A**

**B84299C/D1101/2320E303/E313**

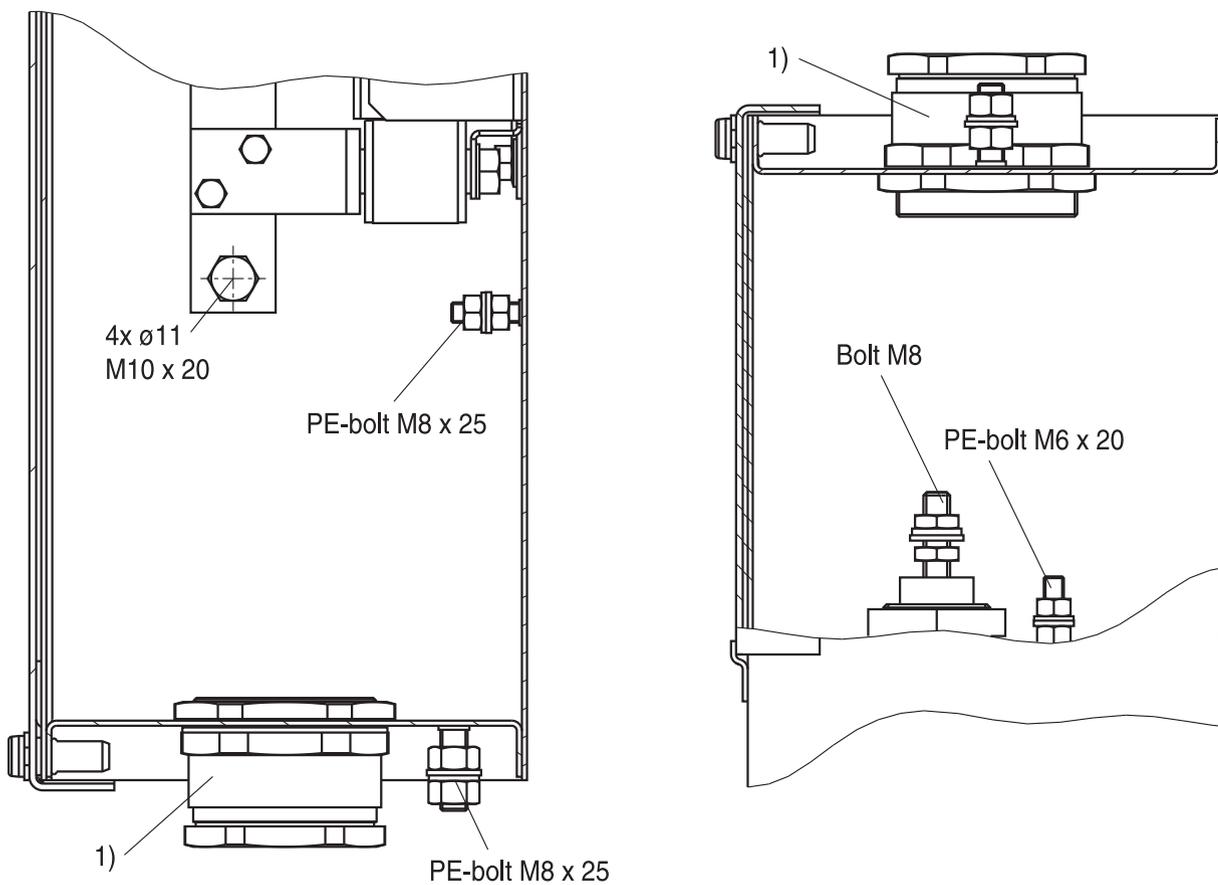
Drawing 3 – B84299C1101E303 (4 × 100 A) – details of connection



SSB2899-4-E

Input side

Shielded, protected output side



<sup>1)</sup> Cable glands PG 42\* with indented sealing ring,  
for cable diameters [mm]: 29 ... 31 / 32 ... 34 / 35 ... 37 / 38 ... 40

\* Included in delivery

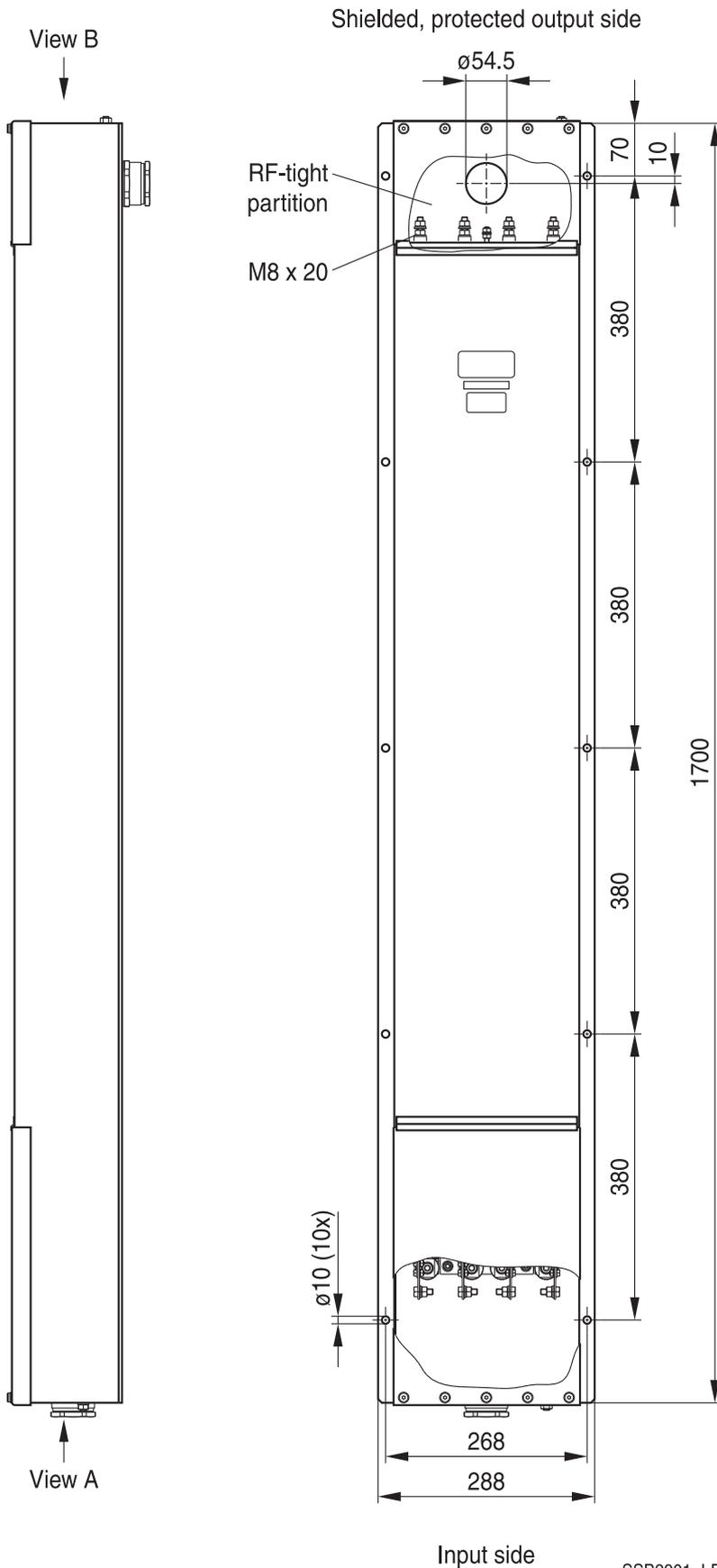
SSB2900-B-E

**Filters for power lines with HEMP-Protection**

**250/440 V, 50/60 Hz, 32/100 A**

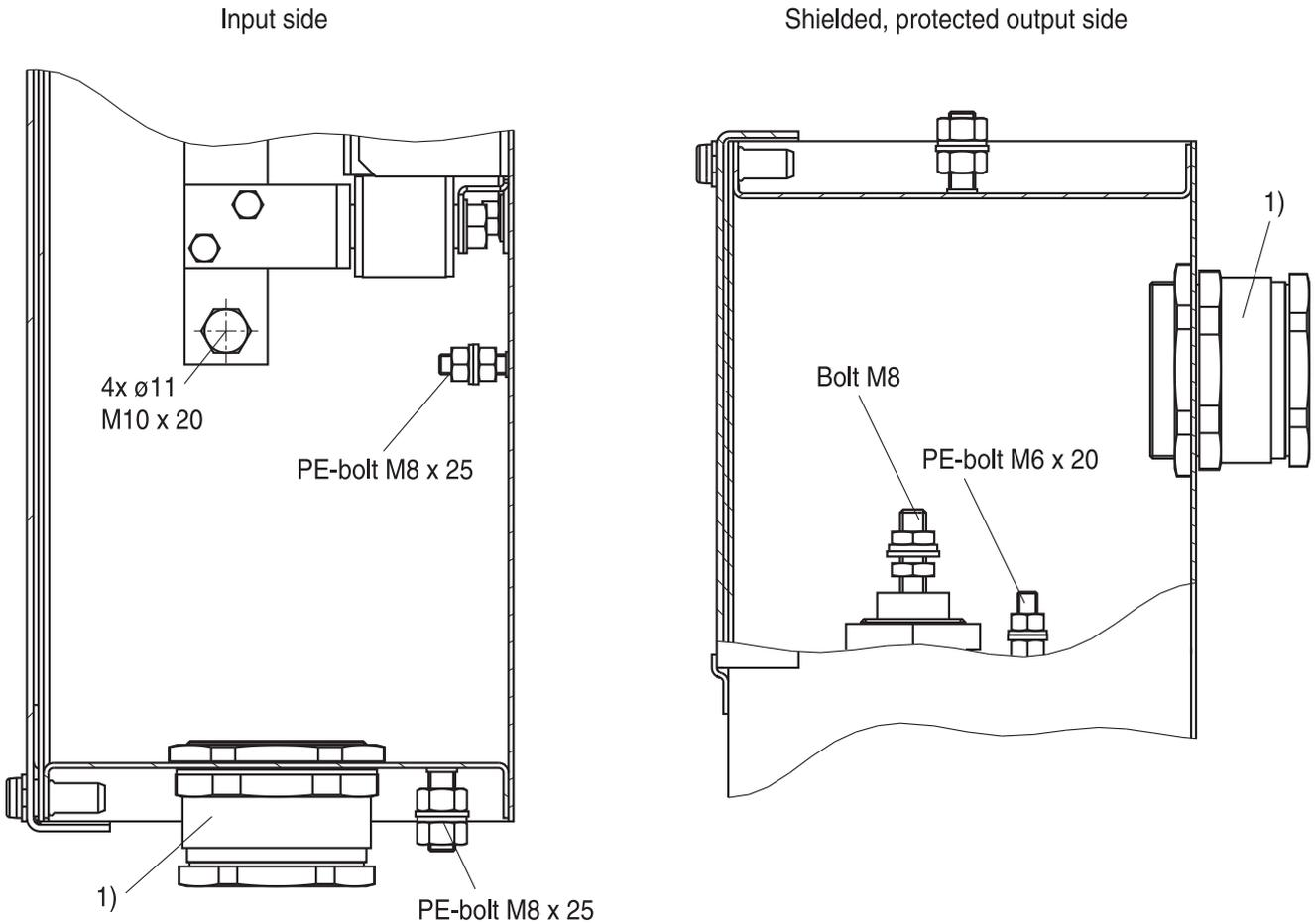
**B84299C/D1101/2320E303/E313**

Drawing 4 – B84299D1101E303 (4 × 100 A) for assembly from outside to the shielded wall



**Filters for power lines with HEMP-Protection**  
**250/440 V, 50/60 Hz, 32/100 A** **B84299C/D1101/2320E303/E313**

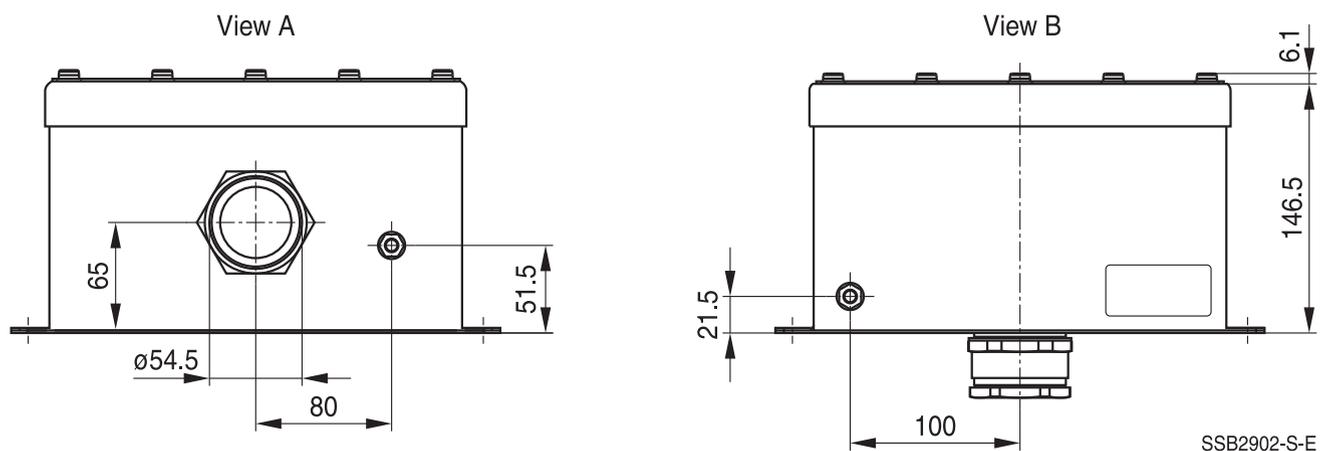
Drawing 4 – B84299D1101E303 (4 × 100 A) – details of connection



1) Cable glands PG 42\* with indented sealing ring,  
 for cable diameters [mm]: 29 ... 31 / 32 ... 34 / 35 ... 37 / 38 ... 40

\* Included in delivery

SSB2903-1-E



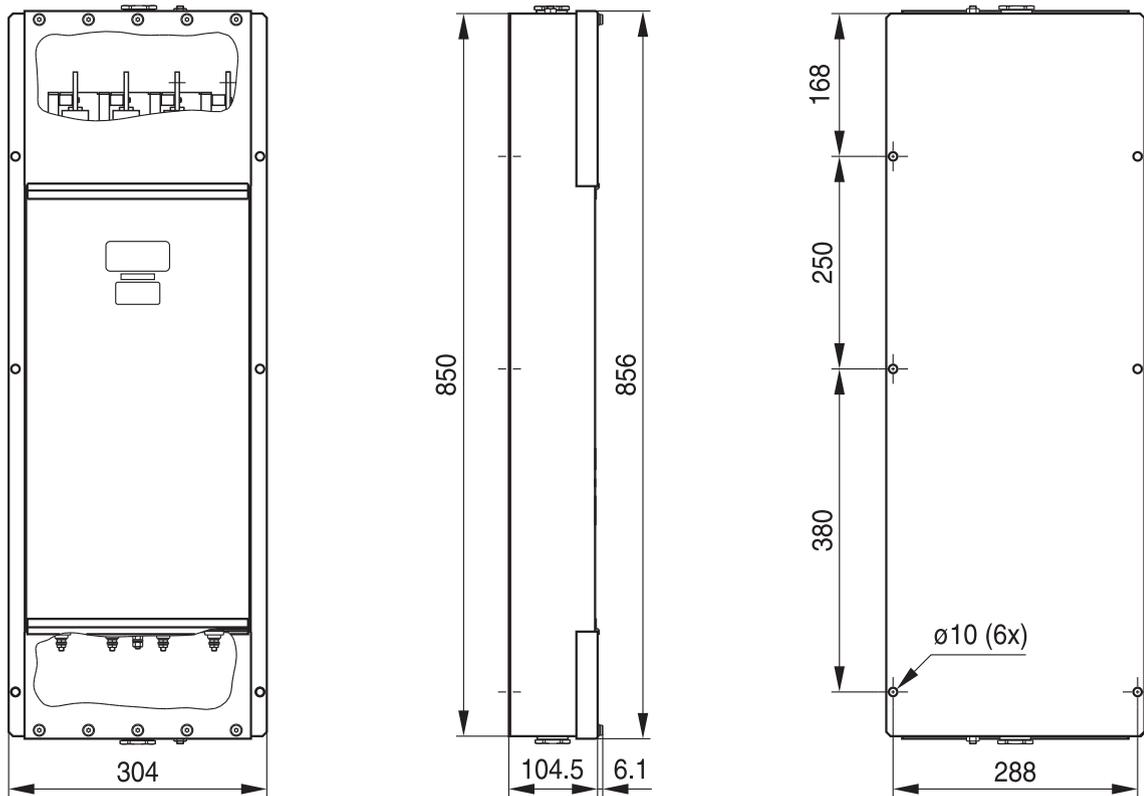
**Filters for power lines with HEMP-Protection**

**250/440 V, 50/60 Hz, 32/100 A**

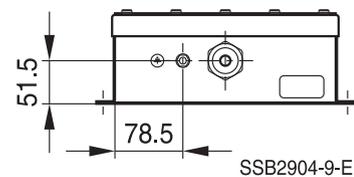
**B84299C/D1101/2320E303/E313**

Drawing 5 – B84299C2320E313 (4 × 32 A) for assembly from inside to the shielded wall

Shielded input side



Protected output side

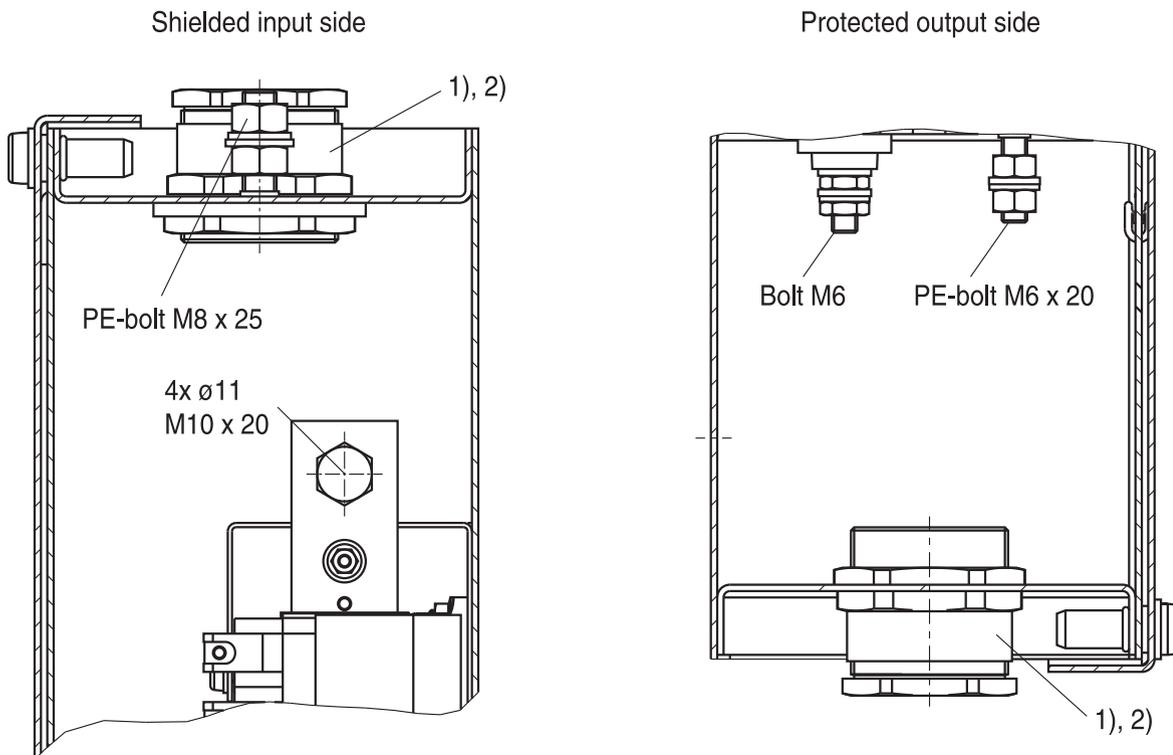


## Filters for power lines with HEMP-Protection

250/440 V, 50/60 Hz, 32/100 A

B84299C/D1101/2320E303/E313

Drawing 5 – B84299C2320E313 (4 × 32 A) – details of connection



<sup>1)</sup> Cable glands PG 29\* with indented sealing ring,  
for cable diameters [mm]: 17 ... 19 / 20 ... 22 / 23 ... 25 / 26 ... 28  
With reducer\*:

<sup>2)</sup> Cable glands PG 21\* with indented sealing ring,  
for cable diameters [mm]: 9 ... 11 / 12 ... 14 / 15 ... 17 / 18 ... 20

\* Included in delivery

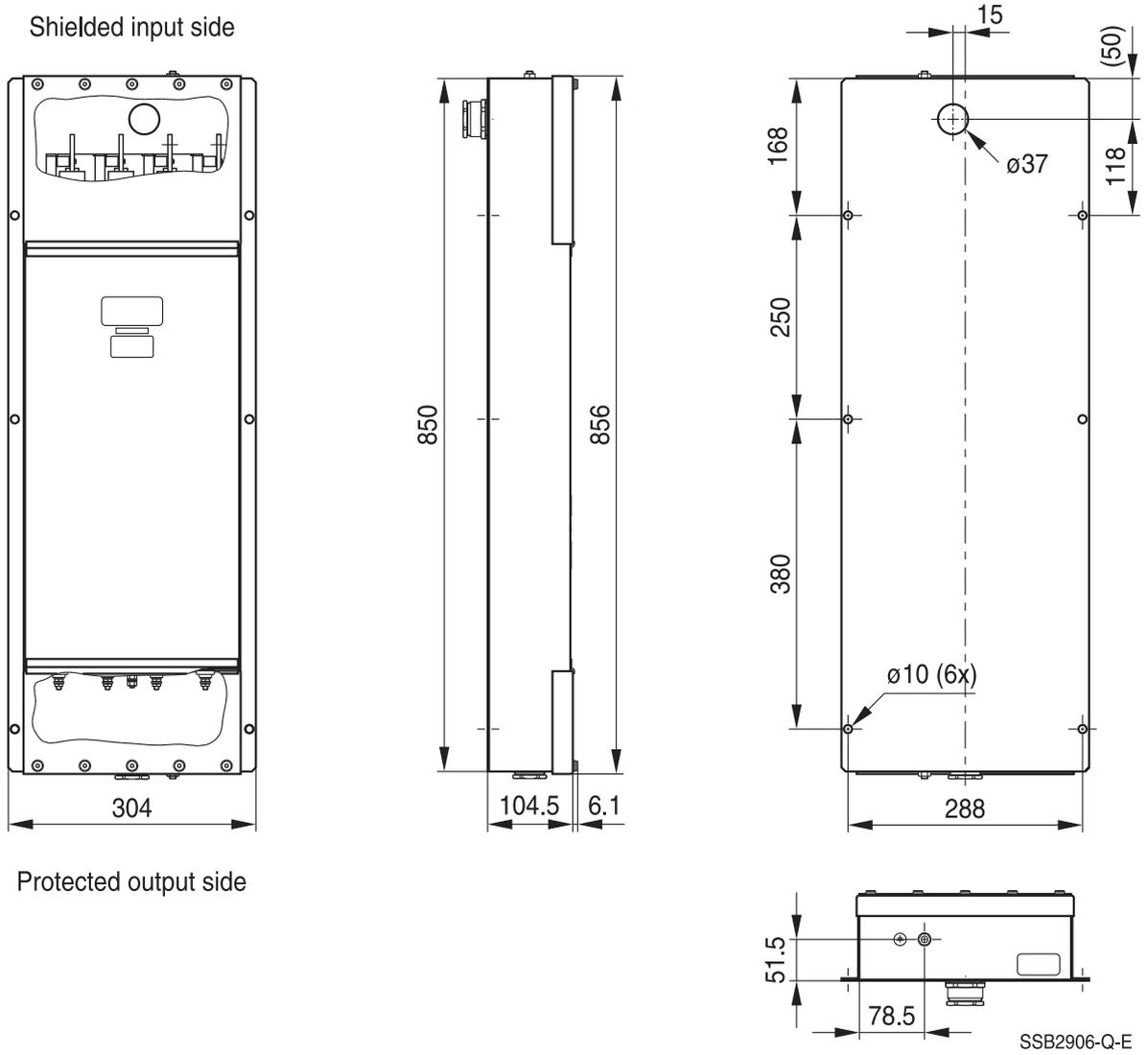
SSB2905-H-E

**Filters for power lines with HEMP-Protection**

**250/440 V, 50/60 Hz, 32/100 A**

**B84299C/D1101/2320E303/E313**

Drawing 6 – B84299D2320E313 (4 × 32 A) for assembly from inside to the shielded wall

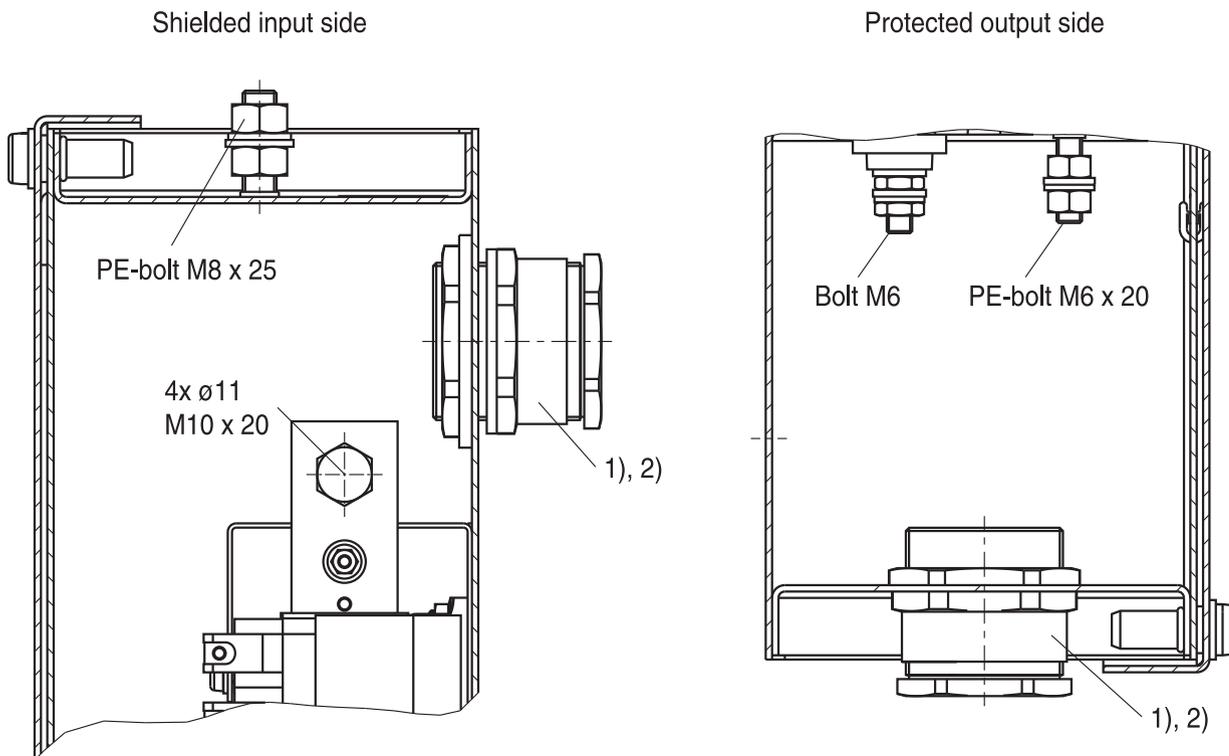


**Filters for power lines with HEMP-Protection**

**250/440 V, 50/60 Hz, 32/100 A**

**B84299C/D1101/2320E303/E313**

Drawing 6 – B84299D2320E313 (4 × 32 A) – details of connection



<sup>1)</sup> Cable glands PG 29\* with indented sealing ring,  
for cable diameters [mm]: 17 ... 19 / 20 ... 22 / 23 ... 25 / 26 ... 28  
With reducer\*:

<sup>2)</sup> Cable glands PG 21\* with indented sealing ring,  
for cable diameters [mm]: 9 ... 11 / 12 ... 14 / 15 ... 17 / 18 ... 20

\* Included in delivery

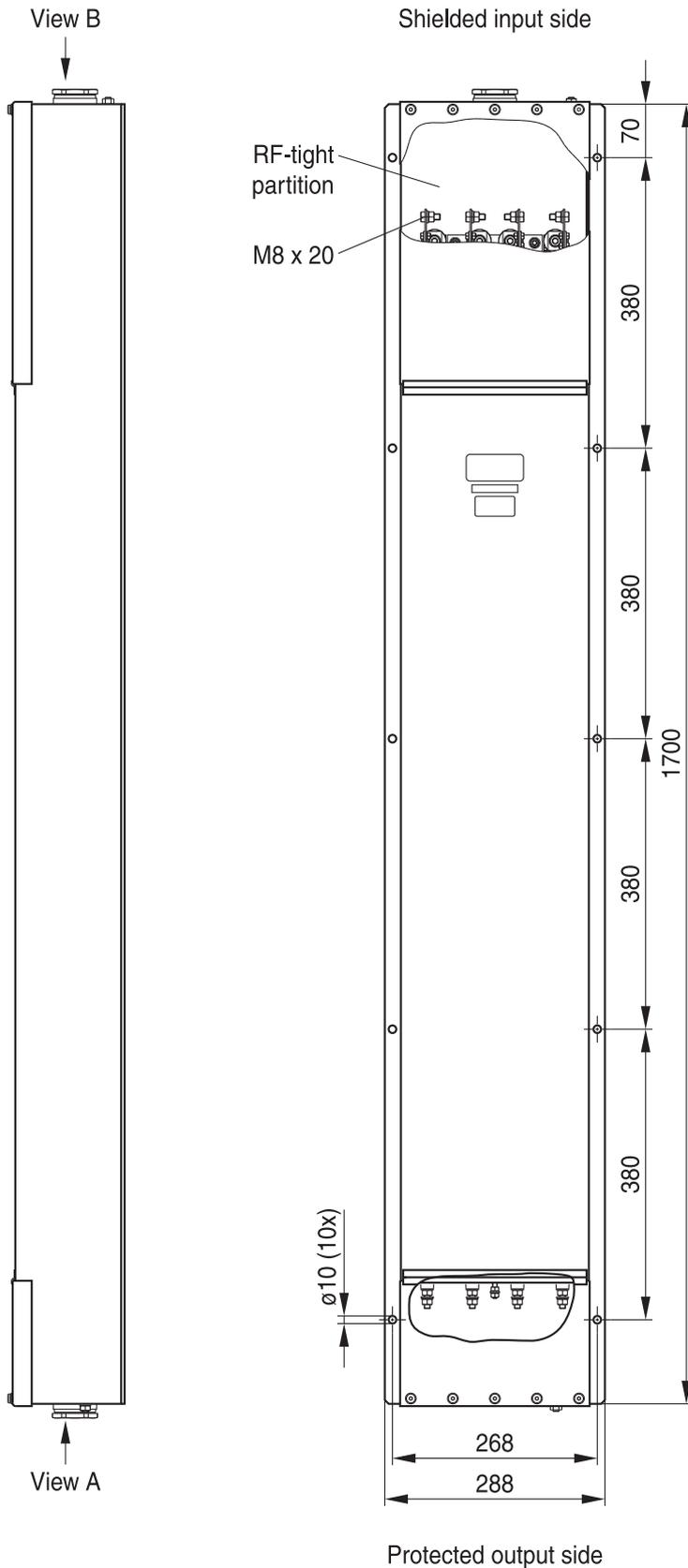
SSB2907-Y-E

**Filters for power lines with HEMP-Protection**

**250/440 V, 50/60 Hz, 32/100 A**

**B84299C/D1101/2320E303/E313**

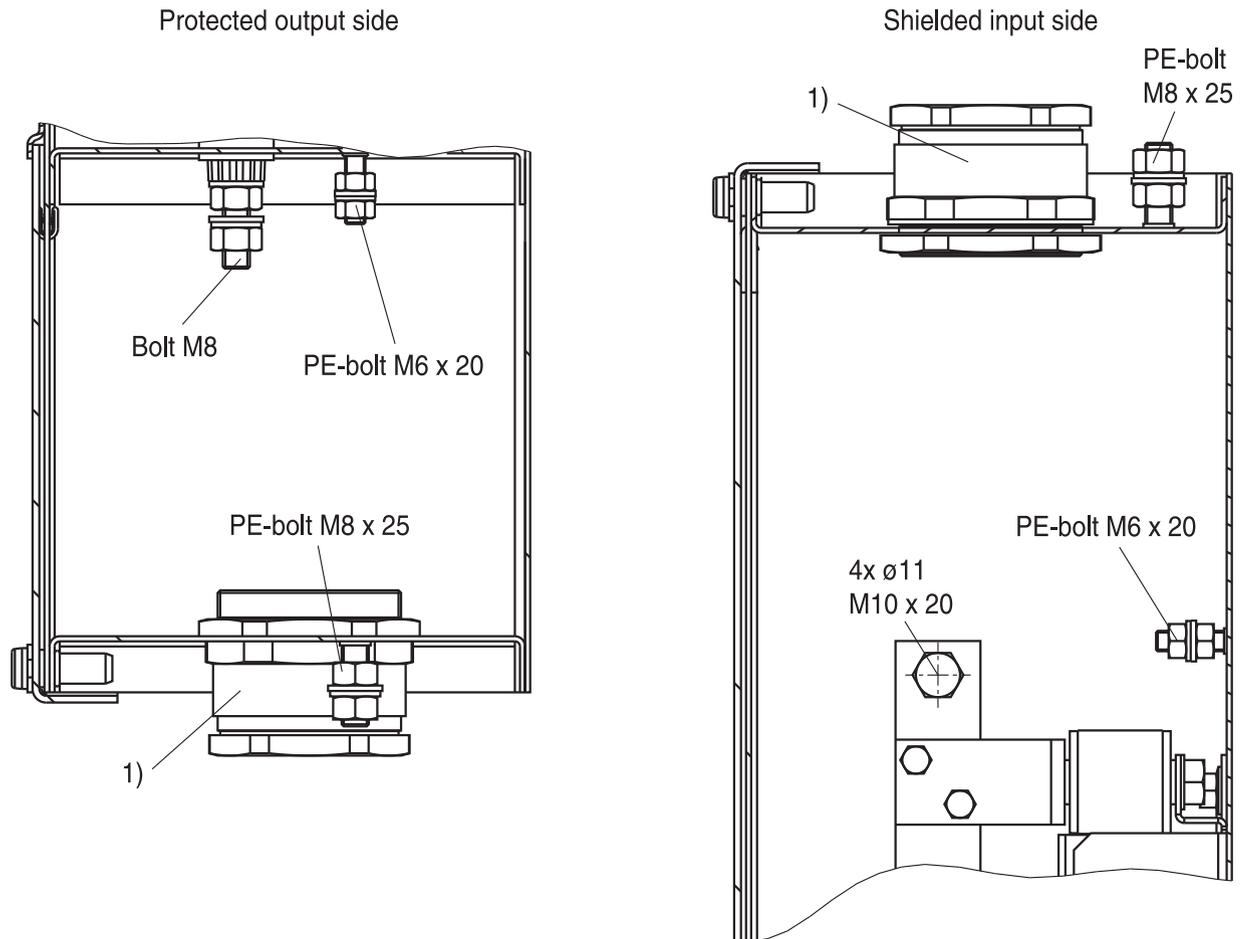
Drawing 7 – B84299C1101E313 (4 × 100 A) for assembly from inside to the shielded wall



SSB2908-7-E

**Filters for power lines with HEMP-Protection**  
**250/440 V, 50/60 Hz, 32/100 A** **B84299C/D1101/2320E303/E313**

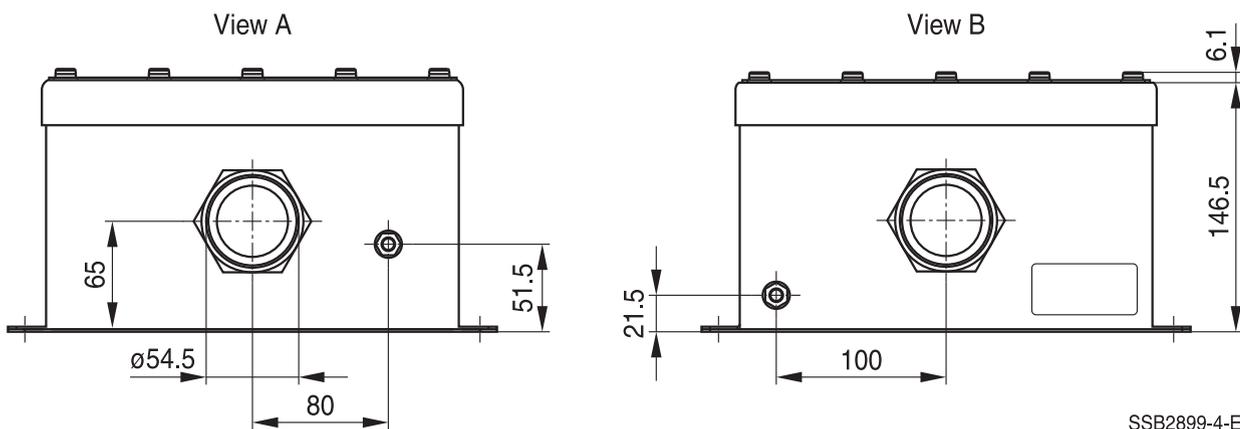
Drawing 7 – B84299C1101E313 (4 × 100 A) – details of connection



1) Cable glands PG 42\* with indented sealing ring,  
 for cable diameters [mm]: 29 ... 31 / 32 ... 34 / 35 ... 37 / 38 ... 40

\* Included in delivery

SSB2910-I-E



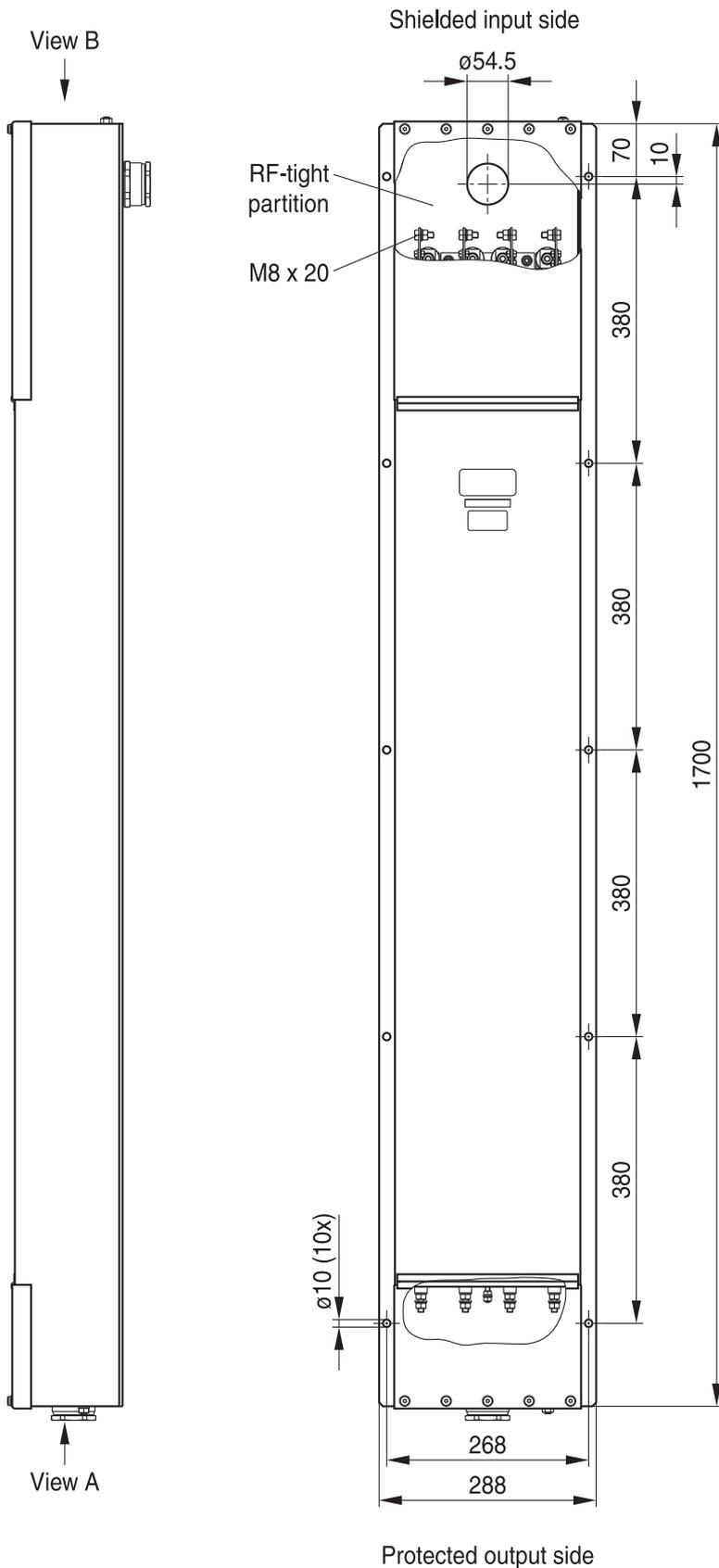
SSB2899-4-E

**Filters for power lines with HEMP-Protection**

**250/440 V, 50/60 Hz, 32/100 A**

**B84299C/D1101/2320E303/E313**

Drawing 8 – B84299D1101E313 (4 × 100 A) for assembly from inside to the shielded wall



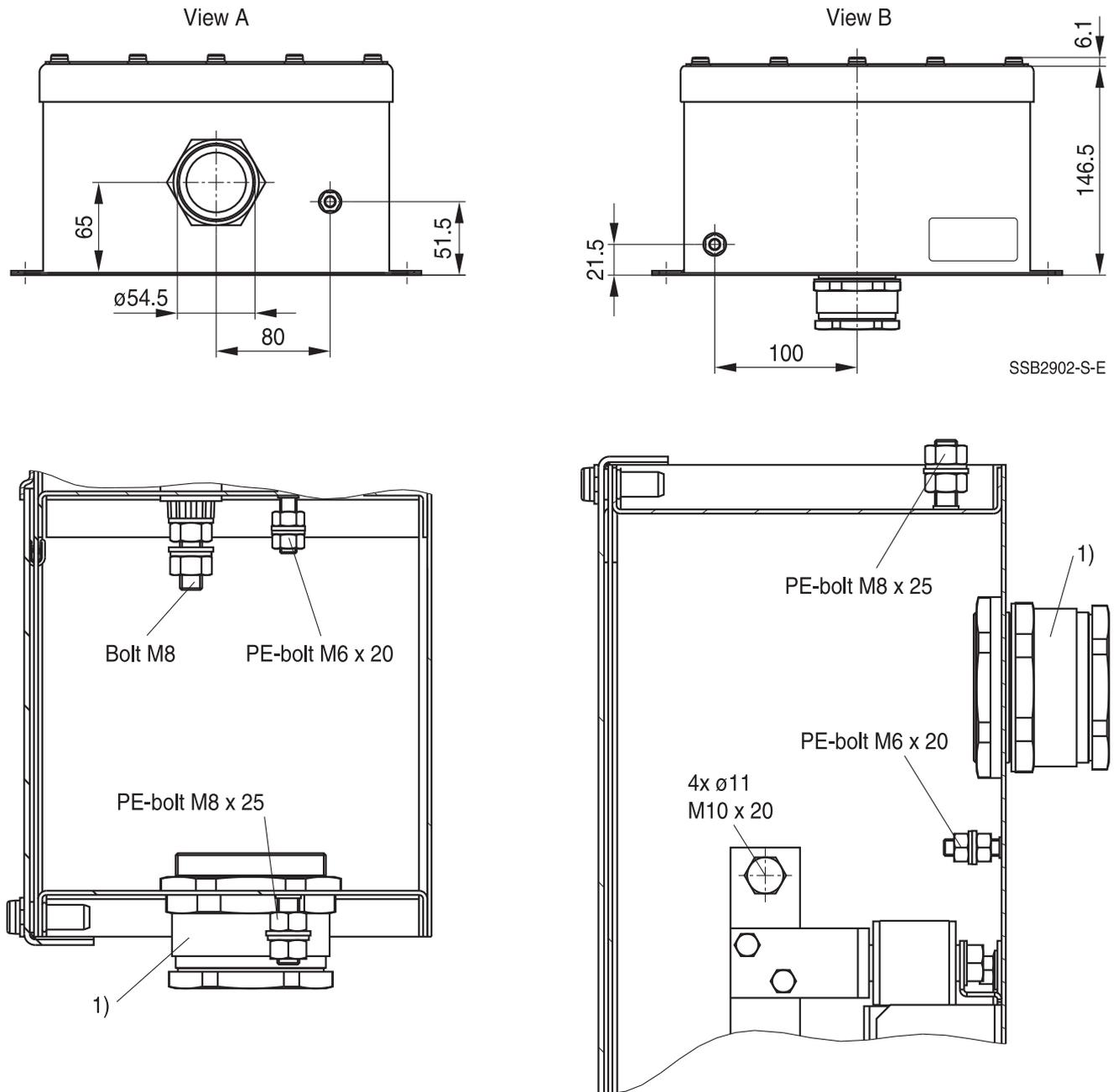
SSB2911-R-E

**Filters for power lines with HEMP-Protection**

**250/440 V, 50/60 Hz, 32/100 A**

**B84299C/D1101/2320E303/E313**

Drawing 8 – B84299D1101E313 (4 × 100 A) – details of connection



<sup>1)</sup> Cable glands PG 42\* with indented sealing ring, for cable diameters [mm]: 29 ... 31 / 32 ... 34 / 35 ... 37 / 38 ... 40

\* Included in delivery

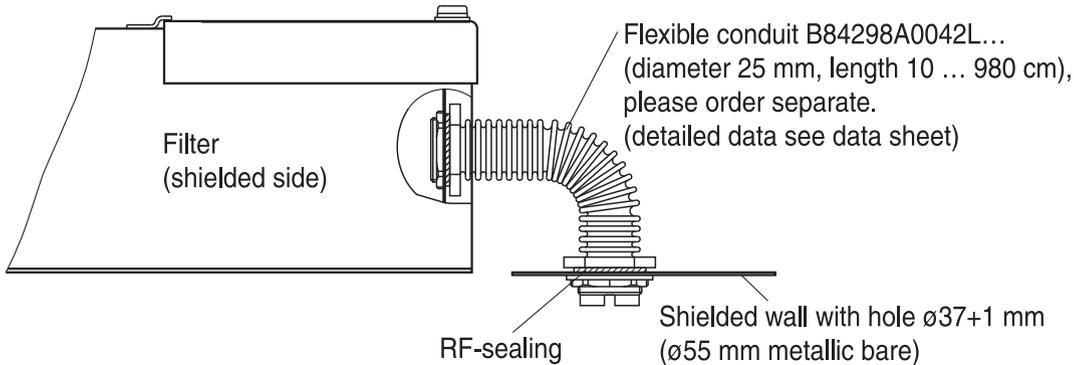
SSB2913-8-E

## Filters for power lines with HEMP-Protection

250/440 V, 50/60 Hz, 32/100 A

B84299C/D1101/2320E303/E313

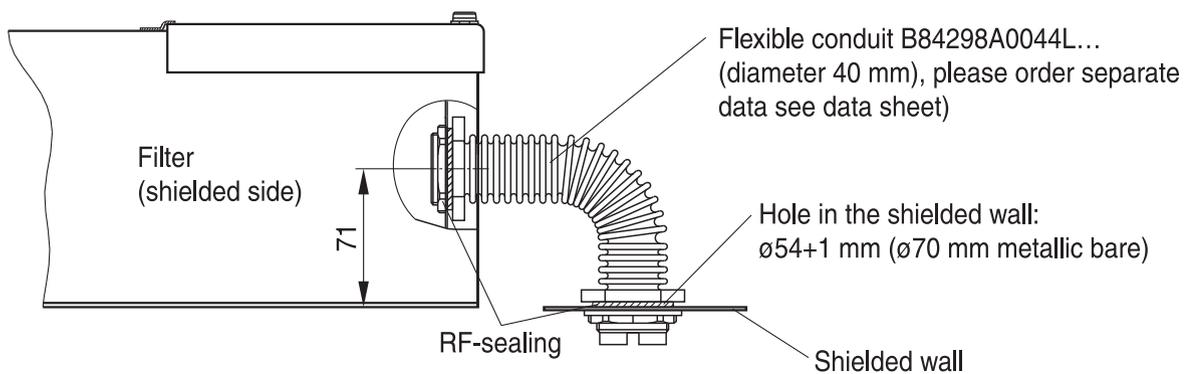
RF-tight connection of types B84299C2... with connection hole 37 mm



Note: The bending radius of the flexible conduit depends on the used type of cable

SSB2917-6-E

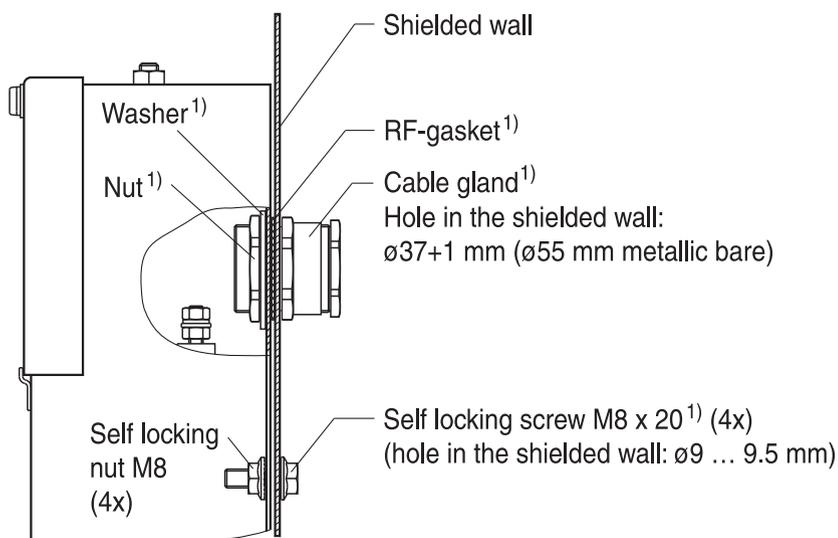
RF-tight connection of types B84299C1... with connection hole 54 mm



Note: The bending radius of the flexible conduit depends on the used type of cable

SSB2918-E-E

RF-tight connection of types B84299D2... with connection hole 37 mm



<sup>1)</sup> Included in delivery

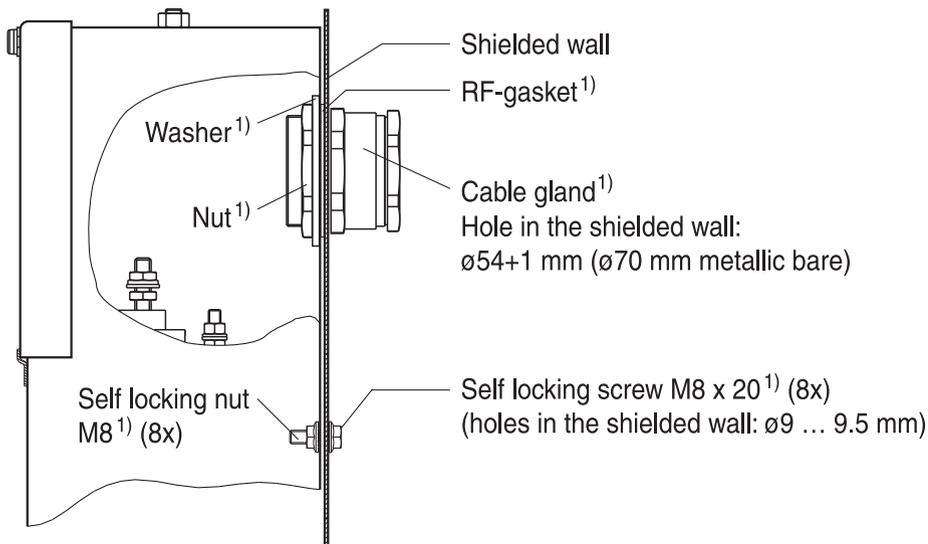
SSB2919-M-E

**Filters for power lines with HEMP-Protection**

**250/440 V, 50/60 Hz, 32/100 A**

**B84299C/D1101/2320E303/E313**

RF-tight connection of types B84299D1... with connection hole 54 mm



<sup>1)</sup> Included in delivery

SSB2920-Q-E

Please read all safety and warning notes carefully before installing the filter and putting it into operation. 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  $I_L^{1)} \leq 10$  mA the PE conductor must have a KU value<sup>2)</sup> of  $4.5^3)$ ; for leakage currents  $I_L > 10$  mA the PE conductor must have a KU value of  $6^4)$ .
- 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!

### Display of ordering codes for EPCOS products

The ordering code for one and the same EPCOS product can be represented differently in data sheets, data books, other publications, on the EPCOS website, or in order-related documents such as shipping notes, order confirmations and product labels. **The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products.** Detailed information can be found on the Internet under [www.epcos.com/orderingcodes](http://www.epcos.com/orderingcodes)

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)  $I_L$  = A value of  $KU = 4.5$  with respect to interruptions is attained with: a) permanently connected protective earth connection  $\geq 1.5$  mm<sup>2</sup> and b) a protective earth connection  $\geq 2.5$  mm<sup>2</sup> via connectors for industrial equipment (IEC 6030902)

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 installation correspond to the requirements for PEN conductors as specified in relevant standards.

**Filters for power lines with HEMP-Protection**
**Symbols and terms**
**B84299C/D1101/2320E303/E313**

Symbol	English	German
$dv/dt$	Rate of voltage rise	Spannungsanstiegsgeschwindigkeit
$f_R$	Rated frequency	Bemessungsfrequenz
$f_{Pass}$	Passband	
$I_{LK}$	Filter leakage current	Filter-Ableitstrom
$I_{reactive}$	Capacitive reactive current	Kapazitiver Blindstrom
$I_N$	Nominal current	Nennstrom
$I_R$	Rated current	Bemessungsstrom
$I_{over}$	Overcurrent	Überstrom
$P_D$	Power dissipation	Verlustleistung
$R_I$	Internal resistance	Innenwiderstand
$R_{DC}$	Maximum DC resistance	Max. Gleichstromwiderstand (Gleichspannung)
$T_A$	Ambient temperature	Umgebungstemperatur
$T_D$	Transverse delay time	
$T_R$	Rated temperature	Bemessungstemperatur
$THD_{max}$	Max. permissible harmonic distortion	
$V_{br}$	Breakdown voltage	
$V_{cl}$	Max. clamping voltage	
$V_N$	Nominal network voltage	Netzspannung
$V_{test}$	Test voltage	Prüfspannung
$V_R$	Rated voltage	Bemessungsspannung
$Z$	Impedance	Scheinwiderstand
$Z_L$	Line impedance	Leitungsimpedanz
$\alpha_e$	Insertion loss	Einfügungsdämpfung
$\Delta V$	Voltage drop	Spannungsabfall

## Important notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application**. As a rule we are either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether a product with the properties described in the product specification is suitable for use in a particular customer application.
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 life-saving 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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