MANUFACTURER DOCUMENT PACKAGE

Manufacturer's Manual

Reference package for procurement and maintenance review

SIEMENS

6SL3210-1PE21-1UL0

UNFILTERED DRIVE POWER MODULE

Used with the applicable SINAMICS G120 PM240-2 configuration.

REFERENCE PACKAGE

OFFICIAL DOCUMENT

Selected official manufacturer pages follow this cover.

Source: Siemens 6SL3210-1PE21-1UL0 technical data and applicable product instructions

Table 6- 18 PM240-2, PT, frame size A, 380 V … 480 V 3 AC

Article No. without filter **Article No. with filter**	**6SL3211-1PE18-0UL1** **6SL3211-1PE18-0AL1**
LO base load power	3.0 kW
LO base load input current	10.1 A
LO base load output current	7.7 A
HO base load power	2.2 kW
HO base load input current	8.8 A
HO base load output current	5.9 A
Fuse according to IEC Fuse according to UL, class J	3NA3805 (16 A) 30 A
Power loss without filter	0.12 kW [1)]
Required cooling air flow	7 l/s
Weight without filter	1.8 kg
Weight with filter	2.0 kg

1) approx. 0.1 kW through the heatsink

Table 6- 19 PM240-2, IP20, frame size B, 380 V … 480 V 3 AC

Article No. without filter **Article No. with filter**	**6SL3210-1PE21-1UL0** **6SL3210-1PE21-1AL0**	**6SL3210-1PE21-4UL0** **6SL3210-1PE21-4AL0**	**6SL3210-1PE21-8UL0** **6SL3210-1PE21-8AL0**
LO base load power	4.0 kW	5.5 kW	7.5 kW
LO base load input current	13.3 A	17.2 A	22.2 A
LO base load output current	10.2 A	13.2 A	18.0 A
HO base load power	3.0 kW	4.0 kW	5.5 kW
HO base load input current	11.6 A	15.3 A	19.8 A
HO base load output current	7.7 A	10.2 A	13.2 A
Fuse according to IEC Fuse according to UL, class J	3NA3812 (32 A) 35 A	3NA3812 (32 A) 35 A	3NA3812 (32 A) 35 A
Power loss	0.11 kW	0.15 kW	0.2 kW
Required cooling air flow	9.2 l/s	9.2 l/s	9.2 l/s
Weight without filter	2.9 kg	2.9 kg	3.0 kg
Weight with filter	3.1 kg	3.1 kg	3.2 kg

Table 6- 28 PM240-2, IP20, frame size F, 380 V … 480 V 3 AC

Article No. without filter **Article No. with filter**	**6SL3210-1PE31-5UL0** **6SL3210-1PE31-5AL0**	**6SL3210-1PE31-8UL0** **6SL3210-1PE31-8AL0**	**6SL3210-1PE32-1UL0** **6SL3210-1PE32-1AL0**
LO base load power	75 kW	90 kW	110 kW
LO base load input current	140 A	172 A	198 A
LO base load output current	145 A	178 A	205 A
HO base load power	55 kW	75 kW	90 kW
HO base load input current	117 A	154 A	189 A
HO base load output current	110 A	145 A	178 A
Fuse according to IEC Fuse according to UL, class J	3NA3140 (200 A) 200 A	3NA3142 (224 A) 250 A	3NA3250 (300 A) 300 A
Power loss without filter	1.91 kW	2.46 kW	2.28 kW
Power loss with filter	1.93 kW	2.48 kW	2.30 kW
Required cooling air flow	153 l/s	153 l/s	153 l/s
Weight without filter	57 kg	57 kg	61 kg
Weight with filter	63 kg	63 kg	65 kg

Table 6- 29 PM240-2, IP20, frame size F, 380 V … 480 V 3 AC

Article No. without filter **Article No. with filter**	**6SL3210-1PE32-5UL0** **6SL3210-1PE32-5AL0**
LO base load power	132 kW
LO base load input current	242 A
LO base load output current	250 A
HO base load power	110 kW
HO base load input current	218 A
HO base load output current	205 A
Fuse according to IEC Fuse according to UL, class J	3NA3252 (315 A) 350 A
Power loss without filter	2.98 kW
Power loss with filter	3.02 kW
Required cooling air flow	153 l/s
Weight without filter	61 kg
Weight with filter	65 kg

Table 6- 30 PM240-2, PT, frame size F, 380 V … 480 V 3 AC

Article No. without filter **Article No. with filter**	**6SL3211-1PE32-5UL0** **6SL3211-1PE32-5AL0**
LO base load power	132 kW
LO base load input current	242 A
LO base load output current	250 A
HO base load power	110 kW
HO base load input current	218 A
HO base load output current	205 A
Fuse according to IEC Fuse according to UL, class J	3NA3252 (315 A) 350 A
Power loss without filter	2.98 kW [1]
Power loss with filter	3.02 kW [1]
Required cooling air flow	153 l/s
Weight without filter	63.5 kg
Weight with filter	68 kg

[1] Approx. 2.6 kW through the heatsink

Table 6- 31 PM240-2, frame size G, 380 V … 480 V 3 AC

Article No. with filter class C3 **Article No. with filter class C2**	**6SL3210-1PE33-0CL0** **6SL3210-1PE33-0AL0**	**6SL3210-1PE33-7CL0** **6SL3210-1PE33-7AL0**	**6SL3210-1PE34-8CL0** **6SL3210-1PE34-8AL0**
LO base load power	160 kW	200 kW	250 kW
LO base load input current	300 A	365 A	470 A
LO base load output current	302 A	370 A	477 A
HO base load power	132 kW	160 kW	200 kW
HO base load input current	275 A	330 A	400 A
HO base load output current	250 A	302 A	370 A
Fuse according to IEC Fuse according to UL, class J Fuse according to IEC/UL	3NA3254 (355 A) 400 A 3NE1334-2 (500A)	3NA3260 (400 A) 500 A 3NE1334-2 (500A)	3NA3372 (630 A) 600 A 3NE1436-2 (630A)
Power loss with filter class C3 Power loss with filter class C2	3.67 kW 3.67 kW	4.62 kW 4.62 kW	6.18 kW 6.18 kW
Required cooling air flow	210 l/s	210 l/s	210 l/s
Weight with filter class C3 Weight with filter class C2	105 kg 107 kg	113 kg 114 kg	120 kg 120 kg

6.6.3 Current derating depending on the pulse frequency, 400 V inverters

Article number	LO power [kW]	Pulse frequency [kHz]							
		2	4 *)	6	8	10	12	14	16
		LO base load output current [A]							
6SL3210-1PE11-8 . L1	0.55	1.7	**1.7**	1.4	1.2	1	0.9	0.8	0.7
6SL3210-1PE12-3 . L1	0.75	2.2	**2.2**	1.9	1.5	1.3	1.1	1	0.9
6SL3210-1PE13-2 . L1	1.1	3.1	**3.1**	2.6	2.2	1.9	1.6	1.4	1.2
6SL3210-1PE14-3 . L1	1.5	4.1	**4.1**	3.5	2.9	2.5	2.1	1.8	1.6
6SL3210-1PE16-1 . L1	2.2	5.9	**5.9**	5	4.1	3.5	3	2.7	2.4
6SL321 . -1PE18-0 . L1	3	7.7	**7.7**	6.5	5.4	4.6	3.9	3.5	3.1
6SL3210-1PE21-1 . L0	4	10.2	**10.2**	8.7	7.1	6.1	5.1	4.6	4.1
6SL3210-1PE21-4 . L0	5.5	13.2	**13.2**	11.2	9.2	7.9	6.6	5.9	5.3
6SL321 . -1PE21-8 . L0	7.5	18	**18**	15.3	12.6	10.8	9	8.1	7.2
6SL3210-1PE22-7 . L0	11	26	**26**	22.1	18.2	15.6	13	11.7	10.4
6SL321 . -1PE23-3 . L0	15	32	**32**	27.2	22.4	19.2	16	14.4	12.8
6SL3210-1PE23-8 . L0	18.5	38	**38**	32.3	26.6	22.8	19	17.1	15.2
6SL3210-1PE24-5 . L0	22	45	**45**	38.3	31.5	27	22.5	20.3	18
6SL3210-1PE26-0 . L0	30	60	**60**	51	42	36	30	27	24
6SL321 . -1PE27-5 . L0	37	75	**75**	63.8	52.5	45	37.5	33.8	30
6SL3210-1PE28-8 . L0	45	90	**90**	76.5	63	54	45	40.5	36
6SL321 . -1PE31-1 . L0	55	110	**110**	93.5	77	---	---	---	---
6SL3210-1PE31-5 . L0	75	145	**145**	123.3	101.5	---	---	---	---
6SL3210-1PE31-8 . L0	90	178	**178**	151.3	124.6	---	---	---	---
Article number		**Pulse frequency [kHz]**							
		2 *)	**4**	**6**	**8**	**10**	**12**	**14**	**16**
		LO base load output current [A]							
6SL3210-1PE32-1 . L0	110	**205**	143.5	---	---	---	---	---	---
6SL321 . -1PE32-5 . L0	132	**250**	175	---	---	---	---	---	---
6SL3210-1PE33-0AL0	160	**302**	211.4	151	120.8	---	---	---	---
6SL3210-1PE33-7AL0	200	**370**	259	185	148	---	---	---	---
6SL3210-1PE34-8AL0	250	**477**	333.9	238.5	190.8	---	---	---	---

*) Factory setting

The permissible motor cable length depends on the particular cable type and the pulse frequency that has been selected

Current reduction as a function of the installation altitude and ambient temperature

At installation altitudes above 1000 m the permissible inverter output current is reduced.

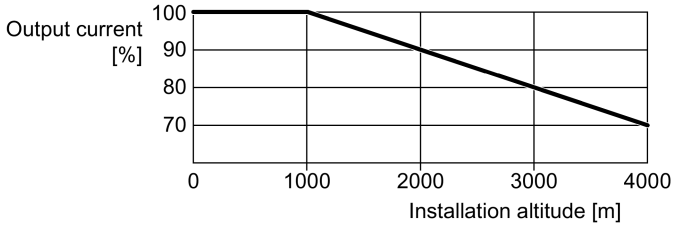


Figure 6-3 Current reduction as a function of the installation altitude

At installation altitudes above 1000 m, you can compensate the permissible inverter output current to a certain extent using the ambient temperature. The following tables contain the details.

Table 6- 38 Maximum permitted output current for loading according to LO

Installation altitude [m] up to	Ambient temperature [°C]								
	20	25	30	35	40	45	50	55	60
	Output current in [%] when loading to LO								
1000	100					93	85	76	66
1500	100				95	88	81	72	63
2000	100			97	90	83	77	68	59
2500	100		98	91	85	79	72	64	56
3000	100	98	92	86	80	74	68	60	53
3500	98	92	86	81	75	69	64	57	50
4000	91	86	81	75	70	65	60	53	46

Table 6- 39 Maximum permitted output current when loading according to HO

Installation altitude [m] up to	Ambient temperature [°C]								
	20	25	30	35	40	45	50	55	60
	Output current in [%] when loading to HO								
1000	100							87	74
1500	100						95	83	70
2000	100				99	95	90	78	67
2500	100			98	94	89	85	74	63
3000	100		96	92	88	84	80	70	59
3500	98	94	90	86	83	79	75	65	56
4000	91	88	84	81	77	74	70	61	52

Also observe the maximum permissible ambient operating temperatures for the Control Unit and possibly the Operator Panel.

Permissible line supplies dependent on the installation altitude

- For installation altitudes ≤ 2000 m above sea level, it is permissible to connect the inverter to any of the line supplies that are specified for it.
- For installation altitudes 2000 m ... 4000 m above sea level, the following applies:
  - Connection to a TN line system with grounded neutral point is permissible.
  - TN systems with grounded line conductor are not permitted.
  - The TN line system with grounded neutral point can also be supplied using an isolation transformer.
  - The phase-to-phase voltage does not have to be reduced.

Note

Using Power Modules connected to TN line supplies with voltages ≥ 600 V for installation altitudes 2000 m … 4000 m

For voltages ≥ 600 V, the TN line supply must have a grounded neutral point established using an isolating transformer.

6.9 Electromagnetic compatibility of variable-speed drives

EMC (electromagnetic compatibility) means that the devices function satisfactorily without interfering with other devices and without being disrupted by other devices. EMC applies when the emitted interference (emission level) and the interference immunity are matched with each other.

The product standard IEC/EN 61800-3 describes the EMC requirements placed on "Variable-speed drive systems".

A variable-speed drive system (or Power Drive System PDS) consists of the inverter as well as the associated electric motors and encoders including the connecting cables.

The driven machine is not part of the drive system.

Note

PDS as component of machines or systems

When you install PDS into machines or systems, additional measures may be required so that the product standards of these machines or systems is complied with. The machine or system builder is responsible for taking these measures.

Environments and categories

Environments

IEC/EN 61800-3 makes a distinction between the "first environment" and "second environment" - and defines different requirements for these environments.

- **First environment:**
  Residential buildings or locations at which the PDS is directly connected to a public low-voltage supply without intermediate transformer.
- **Second environment:**
  All industrial plant/systems or locations that are connected to the public grid through their own, dedicated transformer.

Categories

IEC/EN 61800-3 makes a distinction between four drive system categories:

- **Category C1:**
  Drive systems for rated voltages < 1000 V for unrestricted use in the "first environment"
- **Category C2:**
  Stationary PDS for rated voltages < 1000 V for operation in the "second environment".

  Appropriately qualified personnel are required to install the PDS. An appropriately trained and qualified person has the necessary experience for installing and commissioning a PDS, including the associated EMC aspects.

  Additional measures are required for operation in the "first environment".
- **Category C3:**
  PDS for rated voltages < 1000 V - only for operation in the "second environment".
- **Category C4:**
  PDS for IT line supplies for operation in complex systems in the "second environment".

  An EMC plan is required.

6.9.1 Inverter applications

Inverters involve equipment used on a professional basis, deployed in certain areas of business and industry - and are not operated in the general public domain.

For an EMC-compliant installation, observe the information provided in the Configuration manual: EMC installation guideline (http://support.automation.siemens.com/WW/view/en/60612658).

The devices described there are intended for operation in the first and second environments. Conditions for operation in the respective environment are subsequently listed.

6.9.1.1 Operation in the Second Environment

Interference immunity

You do not have to take any additional measures regarding interference immunity.

Interference emission - operation in the second environment, Category C2

The drive system must comply with the following conditions in order to comply with the limit values of the second environment, Category C2:

- The drive system is installed by appropriately qualified personnel in compliance with EMC regulations - and the installation notes provided in the manual.
- You use a shielded motor cable with low capacitance.
- The pulse frequency is not higher than the value set in the factory.

- The drive system is connected to a TN or TT line supply.
- You comply with the permissible motor cable length.
   Length of the motor cable (Page 60).
- The inverters are equipped with a Category C2 line filter (internal or external).
  - **200 V inverter frame size FSA … FSC**

    Inverters with integrated filter are suitable for operation in the second environment, Category C2.
  - **200 V inverter frame size FSD … FSF**

    The inverters require an external filter, Category C2
  - **400 V inverter**

    Inverters with integrated filter are suitable for operation in the second environment, Category C2.
  - **690 V inverter**

    Inverters of frame sizes FSD and FSE with integrated filter are suitable for operation in the Second Environment, Category C2.

    Inverters of frame sizes FSF and FSG with integrated filter are suitable for operation in the Second Environment, Category C3.

  With the external filters, from Section  Line filter (Page 137), the inverters without integrated filter comply with the requirements of the Second Environment, Category C2 with reference to interference emission.

  If you use inverters without integrated filter or a filter other than those mentioned above, then you are responsible for verifying that the interference emission is limited.

  You can use a dedicated radio interference suppression filter for each inverter - or a common filter for several inverters.



Further information on unfiltered devices can be found on the Internet:

Compliance with EMC limits with unfiltered devices
(https://support.industry.siemens.com/cs/ww/en/view/109750634)

Interference emission - operation in the second environment, Category C4

When connected to IT line supplies, only filtered inverters are permissible. Use external filters without capacitors with respect to ground to limit symmetrical interference emission. When necessary, contact one of our Solution Partners (https://www.automation.siemens.com/solutionpartner/partnerfinder/Home/Index?country=DE&program=1&technology=19&lang=en).

6.9.1.2 Operation in the First Environment

Interference immunity

You do not have to take any additional measures regarding interference immunity.

Interference emission - operation in the first environment, Category C2

In order that you may operate the drive system in the first environment, Category C2, then in addition to the requirements for use in the second environment, you must also observe the limit values related to harmonic currents.

Note

Maintaining the limit values for harmonic currents

With respect to the compliance with limits for harmonic currents, the EMC product standard EN61800-3 for PDS refers to compliance with standards EN 61000-3-2 and EN 61000-3-12.

Inverter with an LO base load power ≤ 1 kW:

It cannot be guaranteed that the limit values are complied with corresponding to IEC 61000-3-2. The installation person/company or company operating the professionally used device must obtain authorization from the grid operator to connect the device regarding the harmonic currents.

Typical harmonic currents (Page 123)

Inverters with an LO base load input current ≤ 16 A:

These devices are not subject to any limit values, and as a consequence can be connected to the public low-voltage grid without any prior consultation.

Inverters with an LO base load input current > 16 A and ≤ 75 A

The drive system is in compliance with IEC/EN 61000-3-12 under the following preconditions:

- FSC Power Module, input voltage 3 AC 200 … 240 V: You use a 3% or 4% line reactor.
- FSD Power Module, input voltage 3 AC 200 … 240 V: A line reactor is not required
- FSB/FSC Power Module, input voltage 3 AC 380 … 480 V: You use a 3% or 4% line reactor.

- Power Module FSD, input voltage 380 … 480 V 3 AC: A line reactor is not required

  Note
  Line reactor

  Contact our Solution Partners (https://www.automation.siemens.com/solutionpartner/partnerfinder/Home/Index?country=DE&program=1&technology=19&lang=en) for a line reactor.

- Short-circuit power S_{SC} at the connection point of the customer's system to the public grid, is greater than or equal to the value according to the following formula:

  $S_{SC} \geq 120 \times \sqrt{3} \times V_{in} \times$ LO base load input current

  Example: FSD inverter, 400 V, input current, 70 A:

  $S_{SC} \geq 120 \times \sqrt{3} \times 400\ V \times 70\ A$
  This corresponds to a low-voltage transformer with an apparent power rating of 300 kVA … 400 kVA with V_K = 4% … 6%

  The installation company or company operating the equipment is responsible for ensuring that this equipment is only connected at a connection point with an appropriate short-circuit power (fault level).

If these preconditions do not apply, then the installation company or company operating the device must obtain authorization from the grid operator to connect the device regarding the harmonic currents.

Typical harmonic currents (Page 123)

Inverters with an LO base load current > 75A

There are no standard-related requirements for installing devices such as these. However, we recommend that the grid operator is informed when such a device is connected.
400 V inverters conform to EN 61000-3-12.

6.9.2 Typical harmonic currents

Table 6- 40 Typical harmonic currents (%) of the inverter

Inverter	Harmonic number							
	5th	7th	11th	13th	17th	19th	23rd	25th
FSA … FSC, 200 V, 400 V [1]	54	39	11	5.5	5	3	2	2
FSD … FSF, 200 V [2]	28	14	8	6	5	4	3	3
FSD … FSG, 400 V [2]	37	21	7	5	4	3	3	2
FSD … FSG, 690 V [2]	34	18	8	5	4	3	3	2

[1] Values relative to the LO input current for V_K 1%

[2] Values relative to the LO input current

6.9.3 EMC limit values in South Korea

The following statements apply for filtered 400 V inverters, frame sizes FSD ... FSF.

All other inverters do not comply with the limit values.

이 기기는 업무용(A 급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다. For sellers or users, please keep in mind that this device is an A-grade electromagnetic wave device. This device is intended to be used in areas other than home.

The EMC limit values to be observed for Korea correspond to the limit values of the EMC product standard for variable-speed electric drives EN 61800-3 of category C2 or the limit value class A, Group 1 to KN11.

By implementing appropriate additional measures, the limit values according to category C2 or limit value class A, Group 1, are observed.

Additional measures, such as the use of an additional RFI suppression filter (EMC filter), may be necessary.

In addition, measures for EMC-compliant configuration of the plant or system are described in detail in this manual.

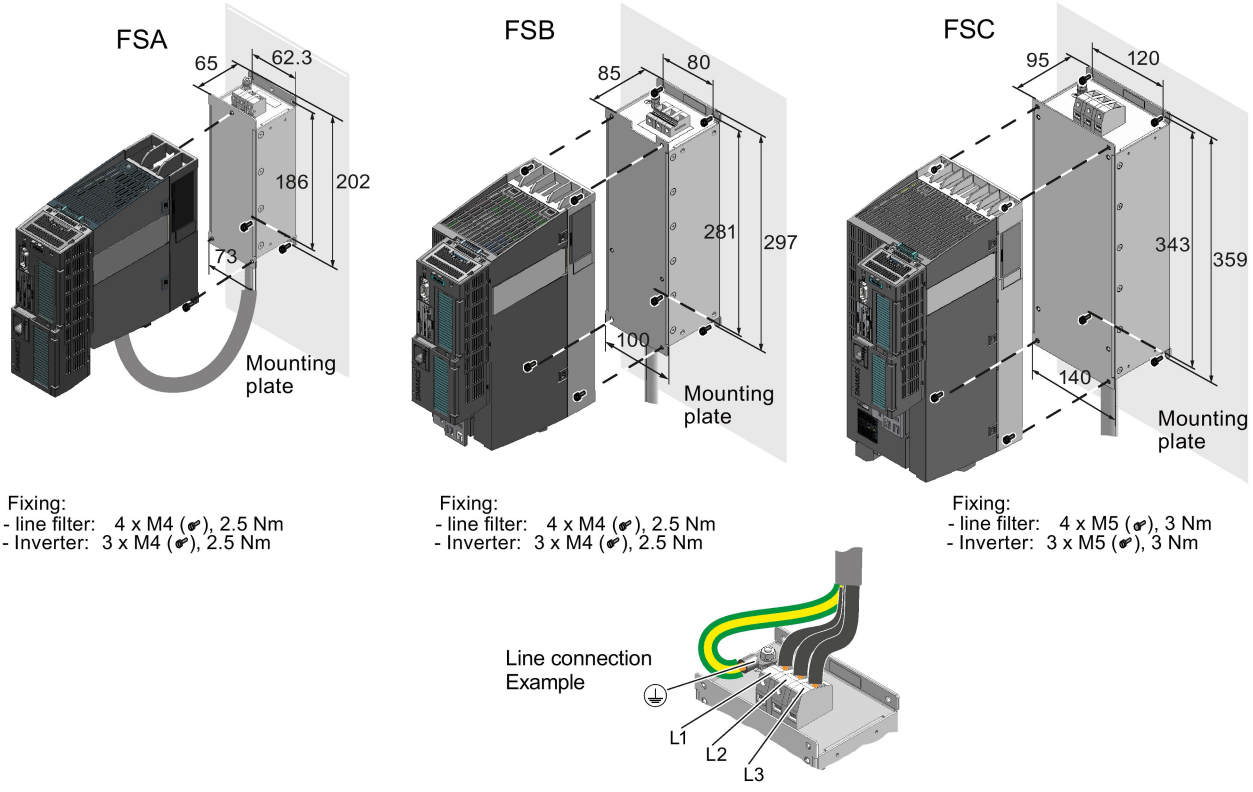
You can find additional information about EMC-compliant configuration of the plant or system on the Internet:

EMC installation guideline
(http://support.automation.siemens.com/WW/view/en/60612658)

The final statement on compliance with the applicable standard is given by the respective label attached to the individual device.

8.5 Line filter

Dimensions for mounting the line filter



Fixing:
- line filter: 4 x M4 (✔), 2.5 Nm
- Inverter: 3 x M4 (✔), 2.5 Nm

Fixing:
- line filter: 4 x M4 (✔), 2.5 Nm
- Inverter: 3 x M4 (✔), 2.5 Nm

Fixing:
- line filter: 4 x M5 (✔), 3 Nm
- Inverter: 3 x M5 (✔), 3 Nm

Table 8- 3 Technical data of the line filter (Class B)

Article number	Power loss [W]	Connection		Weight [kg]
		Line supply and Power Module	PE	
6SL3203-0BE17-7BA0	13	2.5 mm² / 0.8 Nm 14 AWG / 7 lbf in	2.5 mm² / 2 Nm 14 AWG / 17.7 lbf in	1.75
6SL3203-0BE21-8BA0	22	6 mm² / 1.8 Nm 10 AWG / 15.9 lbf in	2.5 mm² / 2 Nm 14 AWG / 17.7 lbf in	4.0
6SL3203-0BE23-8BA0	50	16 mm² / 4 Nm 6 AWG / 35.4 lbf in	16 mm² / 32 Nm 6 AWG / 26.5 lbf in	7.3

Line filters are designed to IP20 degree of protection.

Table 8- 4 Assignment table

Power Module, 400 V			Line filter (Class B)
Frame size	Article number	Power	Article number
FSA	6SL3210-1PE11-8UL1 6SL3210-1PE12-3UL1 6SL3210-1PE13-2UL1 6SL3210-1PE14-3UL1 6SL3210-1PE16-1UL1 6SL321 . -1PE18-0UL1	0.55 0.75 1.1 1.5 2.2 3.0	6SL3203-0BE17-7BA0
FSB	6SL3210-1PE21-1UL0 6SL3210-1PE21-4UL0 6SL321 . -1PE21-8UL0	4.0 5.5 7.5	6SL3203-0BE21-8BA0
FSC	6SL3210-1PE22-7UL0 6SL321 . -1PE23-3UL0	11 15	6SL3203-0BE23-8BA0