

**PRODUCT CATALOG**  
**APRIL 2022**

# Personalized Catalog

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# General Purpose EMC Filter



- EMC solution for industrial inverters and motor drives
- Rated currents from 8 to 280 A
- Selectable voltage level of 440 V and 520 V
- High differential and common-mode attenuation



### Performance indicators

Attenuation performance



## Technical specifications

<b>Maximum continuous operating voltage</b>	3x 440/250 VAC (FN 351) 3x 520/300 VAC (FN 351 H)
<b>Operating frequency</b>	DC to 60 Hz
<b>Rated currents</b>	8 to 280 A @ 40°C
<b>High potential test voltage</b>	P → E 2600 VDC for 2 sec (FN 351) P → P 1900 VDC for 2 sec (FN 351) P → E 2750 VDC for 2 sec (FN 351 H) P → P 2250 VDC for 2 sec (FN 351 H)
<b>Protection category</b>	IP 20
<b>Overload capability</b>	4x rated current at switch on, 1.5x rated current for 1 minute, once per hour
<b>Temperature range (operation and storage)</b>	-25°C to +85°C (25/085/21) (FN 351)
<b>Temperature range (operation and storage)</b>	-25°C to +100°C (25/100/21) (FN 351 H)
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
<b>MTBF @ 40°C/400 V (Mil-HB-217F)</b>	135,000 hours

### Approvals & Compliances



Approvals up to 110 A

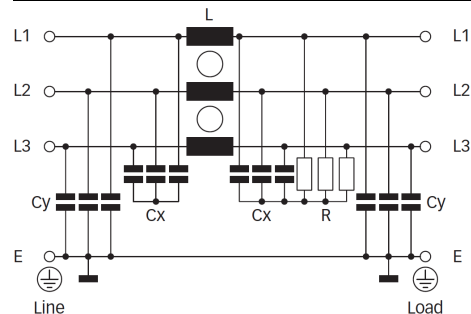
### Features and benefits

- Broad range of power ratings for fast and convenient filter selection
- Available as 440 VAC (FN 351) and 520 VAC (FN 351 H) versions for network-specific applications
- FN 351 filters provide a broadband common and differential-mode attenuation performance, which remains available also when high interference levels are present
- Solid, touch-safe filter terminals contribute to overall equipment safety
- Introduced as one of the very first motor drive EMC filters in the market, FN 351 has been widely imitated and has successfully proven its function over more than 10 years



### Typical applications

- Three-phase motor drives
- Inverters and converters
- Industrial automation equipment
- UPS
- SMPS
- General purpose three-phase filtering

### Typical electrical schematic



### Filter selection table

Filter*	Rated current	Typical drive	Leakage current***	Power loss	Input/Output connections		Weight
	@ 40°C (25°C)	power rating**	@ 440/520 VAC/50 Hz	@ 25°C/50 Hz			
	[A]	[kW]	[mA]	[W]			[kg]
FN 351-8-29	8 (9.2)	3	0.3	7	-29		0.8
FN 351-16-29	16 (18.5)	5.5	0.3	8	-29		1.3
FN 351-25-33	25 (28.9)	11	3.2	8	-33		1.4
FN 351-36-33	36 (41.6)	15	3.2	9	-33		1.5
FN 351-50-..	50 (57.7)	22	3.5	11	-33		1.6
FN 351-64-..	64 (73.9)	30	3.5	15	-33	-34	1.7
FN 351-80-34	80 (92.3)	37	3.7	23	-34		5.6
FN 351-110-35	110 (127)	55	3.7	25	-35		5.8
FN 351-180-36	180 (208)	90	3.7	49	-36		13.0
FN 351-280-37	280 (323)	132	4.3	70	-37		28.0
FN 351 H-8-29	8 (9.2)	4	0.3	7	-29		1.1
FN 351 H-16-29	16 (18.5)	7.5	0.3	8	-29		1.3
FN 351 H-25-33	25 (28.9)	15	3.8	8	-33		1.4
FN 351 H-36-33	36 (41.6)	18.5	3.8	9	-33		1.5
FN 351 H-50-..	50 (57.7)	30	3.8	11	-33		1.6
FN 351 H-64-33	64 (73.9)	37	3.8	15	-33		1.7
FN 351 H-80-34	80 (92.3)	45	4.4	23	-34		5.6
FN 351 H-110-35	110 (127)	75	4.4	25	-35		5.8
FN 351 H-180-36	180 (208)	110	4.4	49	-36		13.0

\* To compile a complete part number, please replace the .. with the required I/O connection style.

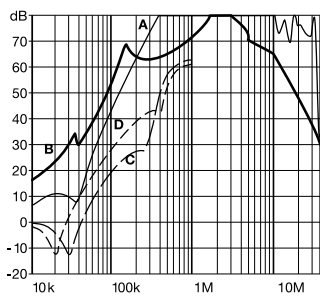
\*\* Calculated at rated current, 400 VAC (FN 351)/480 VAC (FN 351 H) and cos phi=0.8. The exact value depends upon the efficiency of the drive, the motor and the entire application.

\*\*\* Standardized calculated leakage current acc. IEC60939 under normal operating conditions (FN 351 at 440 VAC and FN 351H at 520 VAC).

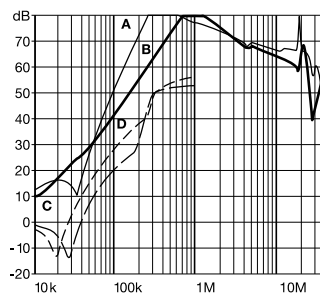
### Typical filter attenuation

Per CISPR 17; A=50 Ω/50 Ω sym; B=50Ω/50Ω asym; C=0.1 Ω/100 Ω sym; D=100 Ω/0.1 Ω sym

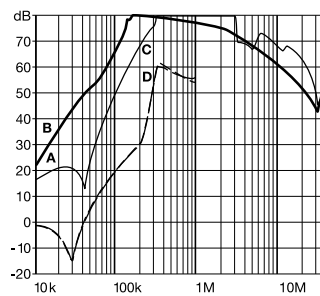
8 A types



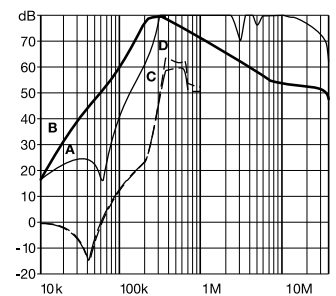
16 A types



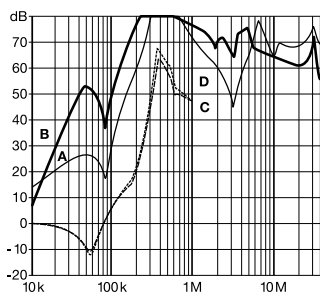
25 A types



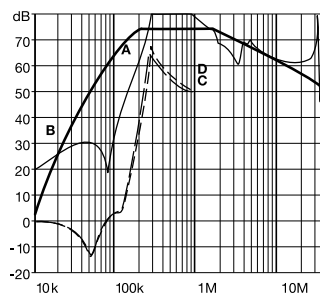
36 and 50 A types



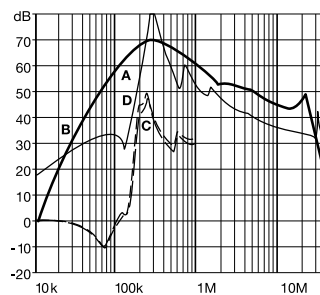
64 A types



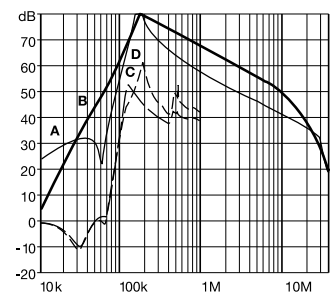
80 and 110 A types



180 A types

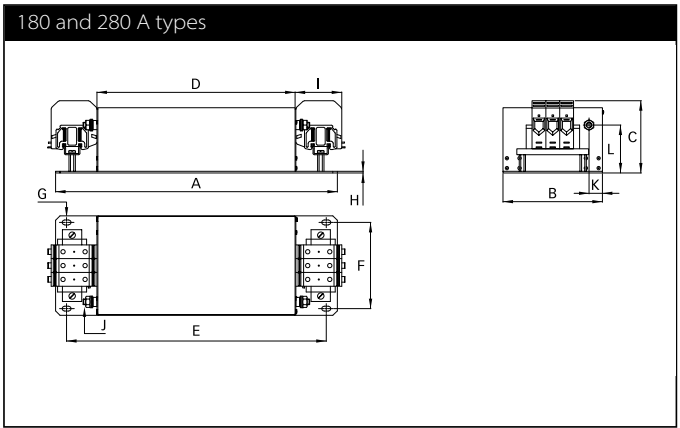
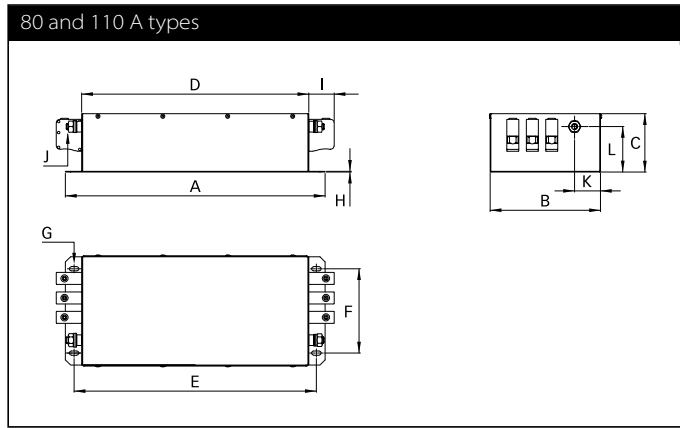
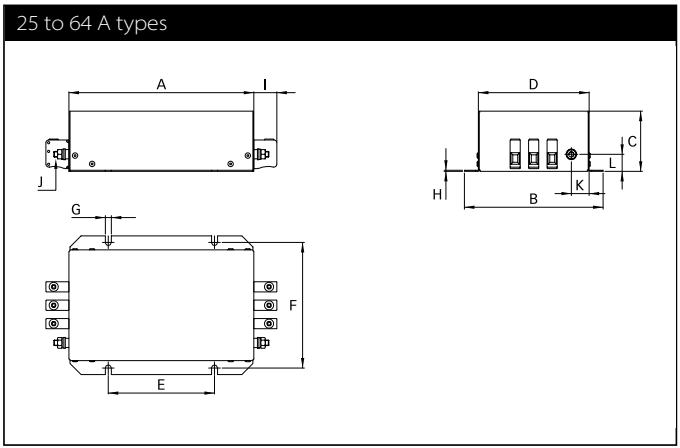
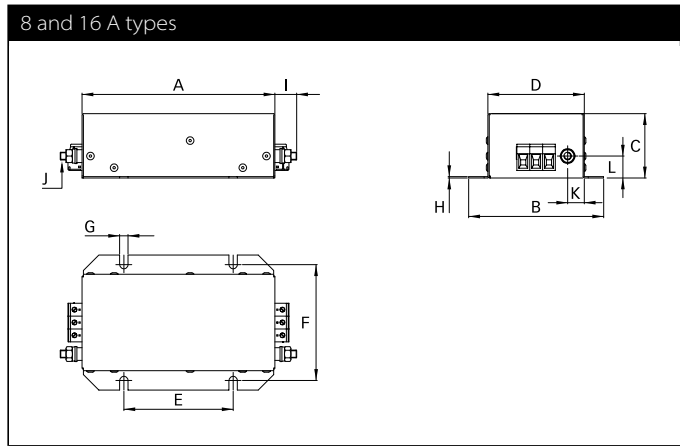


280 A types





### Mechanical data









## Dimensions

	8 A	8 A (-H)	16 A	25 A	36 A	50 A (-33)	50 A (-34)	64 A (-33)	64 A (-34)	80 A	110 A	180 A	280 A
<b>A</b>	180	200	200	200	200	200	200	200	200	400	400	510	700
<b>B</b>	115	150	150	150	150	150	150	150	150	170	170	180	260
<b>C</b>	60	65	65	65	65	65	65	65	80	90	90	133	155
<b>D</b>	85	120	120	120	120	120	120	120	120	350	350	360	530
<b>E</b>	115	115	115	115	115	115	115	115	115	373	373	470	660
<b>F</b>	100	136	136	136	136	136	136	136	136	130	130	156	220
<b>G</b>	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	15 x 6.5	15 x 6.5	16 x 9	16 x 9
<b>H</b>	1	1	1	1	1	1	1	1	1	1	1	4	4
<b>I</b>	17	17	17	25	25	25	39	25	39	39	45	83	110
<b>J</b>	M6	M6	M6	M6	M6	M6	M6	M6	M6	M10	M10	M10	M10
<b>K</b>	13	19.25	19.25	19.25	19.25	19.25	18.75	19.25	18.75	40	40	25	30
<b>L</b>	17	17	17	18.4	18.4	18.4	17	18.4	17	70	70	85	100

All dimensions in mm; 1 inch = 25.4 mm  
Tolerances according: ISO 2768-m / EN 22768-m

## Filter input/output connector cross sections

	-29	-33	-34	-35	-36	-37
						
<b>Solid wire</b>	6 mm <sup>2</sup>	16 mm <sup>2</sup>	35 mm <sup>2</sup>	50 mm <sup>2</sup>	95 mm <sup>2</sup>	150 mm <sup>2</sup>
<b>Flex wire</b>	4 mm <sup>2</sup>	10 mm <sup>2</sup>	25 mm <sup>2</sup>	50 mm <sup>2</sup>	95 mm <sup>2</sup>	150 mm <sup>2</sup>
<b>AWG type wire</b>	AWG 10	AWG 6	AWG 2	AWG 1/0	AWG 4/0	AWG 6/0
<b>Recommended torque</b>	0.6-0.8 Nm	1.5-1.8 Nm	4.0-4.5 Nm	7-8 Nm	17-20 Nm	27-30 Nm

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.

# Compact Three-phase and Neutral Line Filter for High Frequency Attenuation



- Compact four-wire filter for applications with limited space
- High attenuation performance up to 300 MHz
- Equally suitable for star and delta power networks

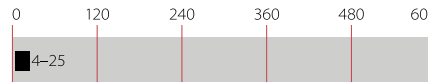


### Performance indicators

Attenuation performance



Rated current [A]



### Approvals & Compliances



### Features and benefits

- The FN 354 family of filters is intended primarily for applications that require extremely effective interference suppression across a broad frequency spectrum.
- Advanced two-stage filter circuits with highly saturating resistant toroidal inductors, in conjunction with feedthrough capacitors on each of the three phases and the neutral line, ensure that these filters provide very high attenuation in the upper frequency band.
- FN 354 are equally suitable for the operation on star and delta power networks.

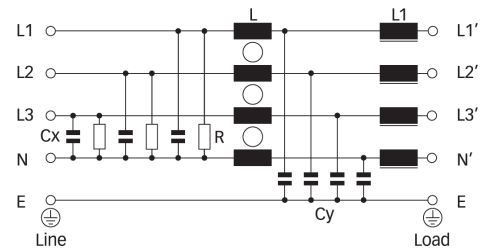
### Technical specifications

<b>Maximum continuous operating voltage</b>	3x 440/250 VAC
<b>Operating frequency</b>	DC to 60 Hz
<b>Rated currents</b>	4 to 25 A @ 40°C max.
<b>High potential test voltage</b>	P/N → E 2000 VAC for 2 sec P → P 1900 VDC for 2 sec P → N 1100 VDC for 2 sec
<b>Protection category</b>	IP 20 (version with -47 connections)
<b>Overload capability</b>	4x rated current at switch on, 1.5x rated current for 1 minute, once per hour
<b>Temperature range (operation and storage)</b>	-25°C to +100°C (25/100/21)
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
<b>MTBF @ 40°C/230 V (Mil-HB-217F)</b>	500,000 hours



### Typical applications

- Applications requiring high-frequency attenuation
- Power supplies
- Medical equipment
- Office and data processing equipment

### Typical electrical schematic



## Filter selection table

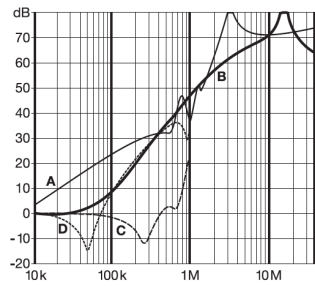
Filter	Rated current	Leakage current*	Power loss	Input/Output connections	Weight
	@ 40°C (25°C)	@ 440 VAC/50 Hz	@ 25°C/50 Hz		
	[A]	[mA]	[W]		
FN 354-4-05	4 (4.5)	0.1	2.0	-05	0.23
FN 354-6-05	6 (6.7)	0.1	3.9	-05	0.38
FN 354-12-05	12 (13.4)	0.1	7.8	-05	1.1
FN 354-15-47	15 (16.8)	0.1	10.8	-47	4.3
FN 354-25-47	25 (28)	0.2	16.9	-47	4.4

\* Standardized calculated leakage current acc. IEC60939 under normal operating conditions.

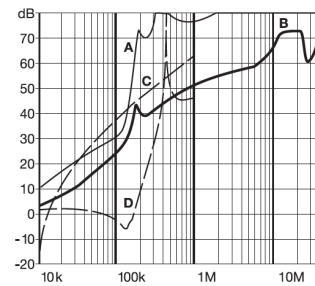
## Typical filter attenuation

Per CISPR 17; A=50 Ω/50 Ω sym; B=50 Ω/50 Ω asym; C=0.1 Ω/100 Ω sym; D=100 Ω/0.1 Ω sym

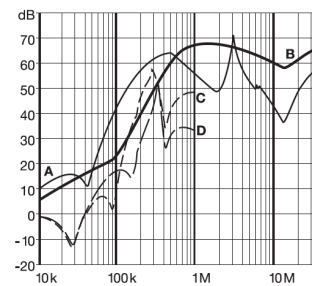
4 and 6 A types



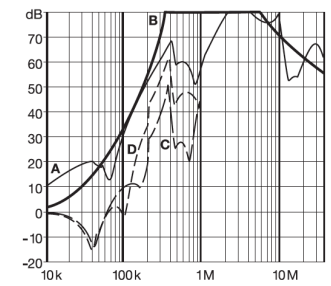
12 A types



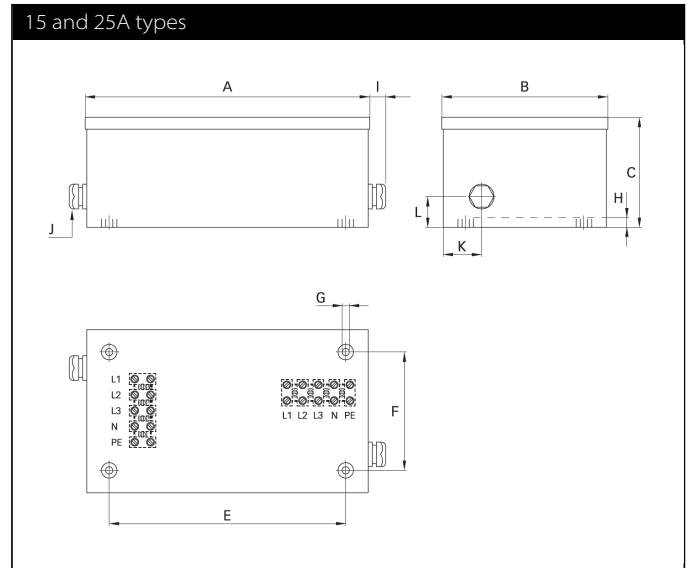
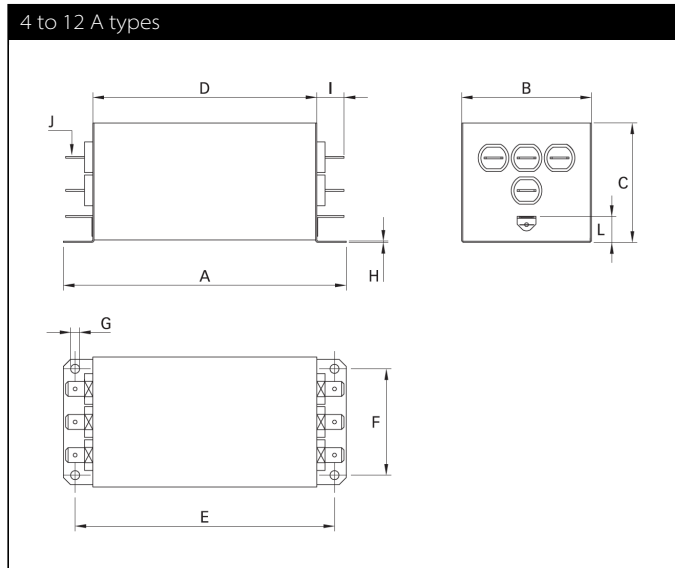
15 A types



25 A types



### Mechanical data



### Dimensions

	4 A	6 A	12 A	15 A	25 A
<b>A</b>	103	120	150	273.6	273.6
<b>B</b>	43	55	65	158.6	158.6
<b>C</b>	40.5	50.5	60	107	107
<b>D</b>	80	95	125		
<b>E</b>	95	110	140	230	230
<b>F</b>	35	45	55	115	115
<b>G</b>	Ø3.8	Ø3.8	7.5 x 4.4	M8	M8
<b>H</b>	0.5	0.5	0.75	9.5	9.5
<b>I</b>	11.1	11.1	11.1	~20	~20
<b>J</b>	Faston 6.3 x 0.8	Faston 6.3 x 0.8	Faston 6.3 x 0.8	PG13	PG13
<b>K</b>				35.5	35.5
<b>L</b>	7	11	11	30	30

All dimensions in mm; 1 inch=25.4 mm  
Tolerances according: ISO 2768-m/EN 22768-m

### Filter input/output connector cross sections

	-05	-47
<b>Solid wire</b>	n/a	16 mm <sup>2</sup>
<b>Flex wire</b>	n/a	10 mm <sup>2</sup>
<b>AWG type wire</b>	n/a	AWG 8
<b>Recommended torque</b>	n/a	1.9-2.2 Nm

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.

# Ultra-compact Low Leakage current EMC/EMI Filter



- Ultra-compact four-wire filter for applications lacking space
- Exceptional low operating leakage current
- Equally suitable for star and delta power networks

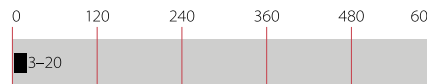


### Performance indicators

Attenuation performance



Rated current [A]



### Approvals & Compliances



### Features and benefits

- The FN 355 family of three-phase and neutral line filters provides a cost-effective interference suppression solution for a wide variety of applications
- Available in four versions, with current ratings from 3 to 20 A, the filters employ a single-stage four-wire LC circuit with saturating resistant chokes, and have a very low operational leakage current
- FN 355 filters are contained within an extremely compact metal housing, making them ideal for use in situations where space is at a premium

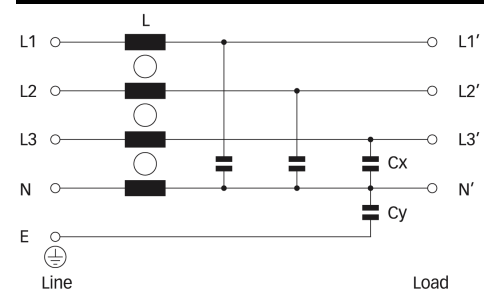
### Technical specifications

<b>Maximum continuous operating voltage</b>	3x 440/250 VAC
<b>Operating frequency</b>	DC to 400 Hz
<b>Rated currents</b>	3 to 20 A @ 40°C
<b>High potential test voltage</b>	P/N → E 2000 VAC for 2 sec P → P 1350 VDC for 2 sec P → N 800 VAC for 2 sec
<b>Overload capability</b>	4x rated current at switch on, 1.5x rated current for 1 minute, once per hour
<b>Temperature range (operation and storage)</b>	-25°C to +100°C (25/100/21)
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
<b>MTBF @ 40°C/230 V (Mil-HB-217F)</b>	850,000 hours




### Typical applications

- Office equipment
- Medical equipment
- General purpose four-wire filtering
- Applications with tight space conditions

### Typical electrical schematic



### Filter selection table

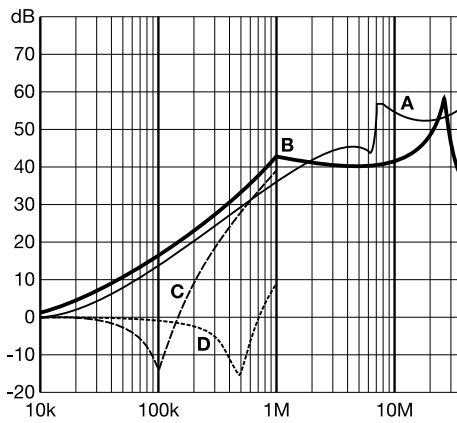
Filter	Rated current	Leakage current*	Power loss	Input/Output connections			weight
	@ 40°C (25°C)	@ 440 VAC/50 Hz	@ 25 °C/ 50Hz				[kg]
	[A]	[mA]	[W]				
<b>FN 355-3-05</b>	3 (3.4)	0.0	1.4		-05		0.15
<b>FN 355-6-05</b>	6 (6.9)	0.0	1.5		-05		0.21
<b>FN 355-10-05</b>	10 (11.5)	0.0	1.8		-05		0.25
<b>FN 355-20-06</b>	20 (23)	0.1	3.4		-06		0.29
<b>FN 355-20-03</b>	20 (23)	0.1	3.4	-03			0.29
<b>FN 355-30-44</b>	30 (34)	0.2	4.1			-44	0.44

\* Standardized calculated leakage current acc. IEC60939 under normal operating conditions.

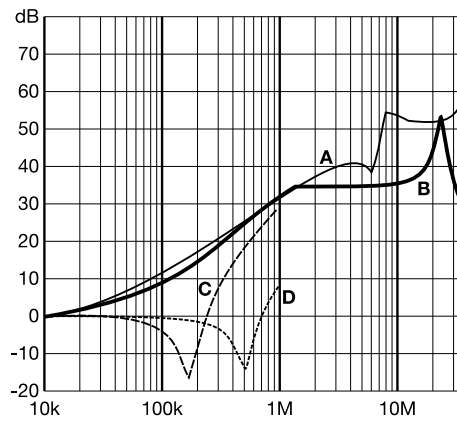
### Typical filter attenuation

Per CISPR 17; A=50 Ω/50 Ω sym; B=50 Ω/50 Ω asym; C=0.1 Ω/100 Ω sym; D=100 Ω/0.1 Ω sym

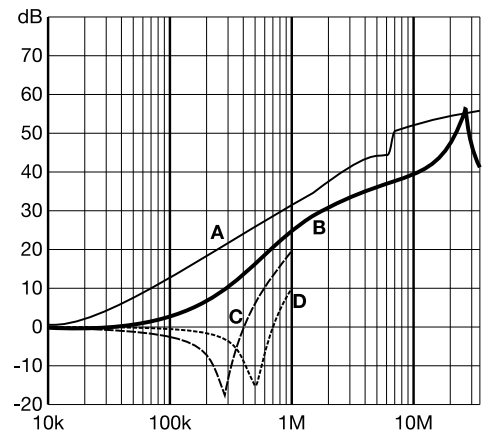
3 A types



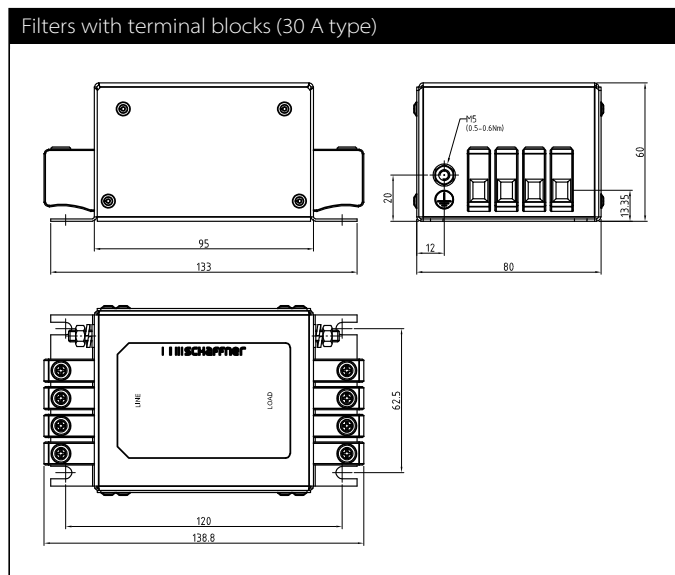
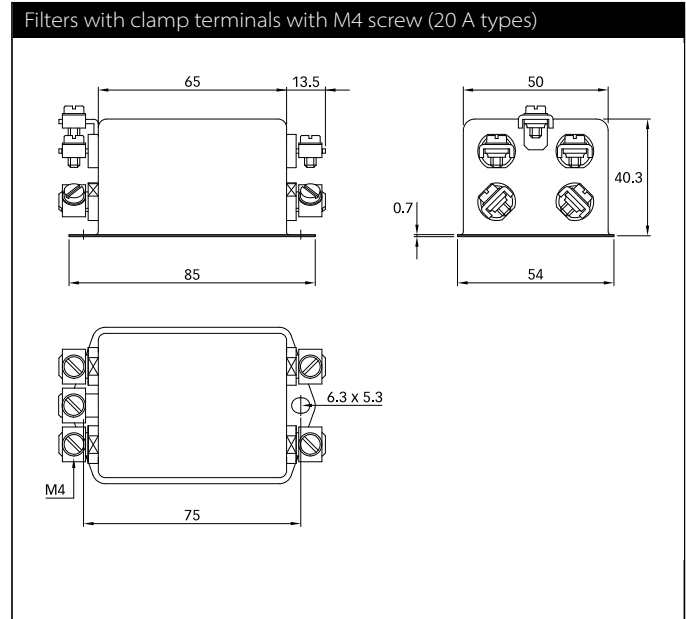
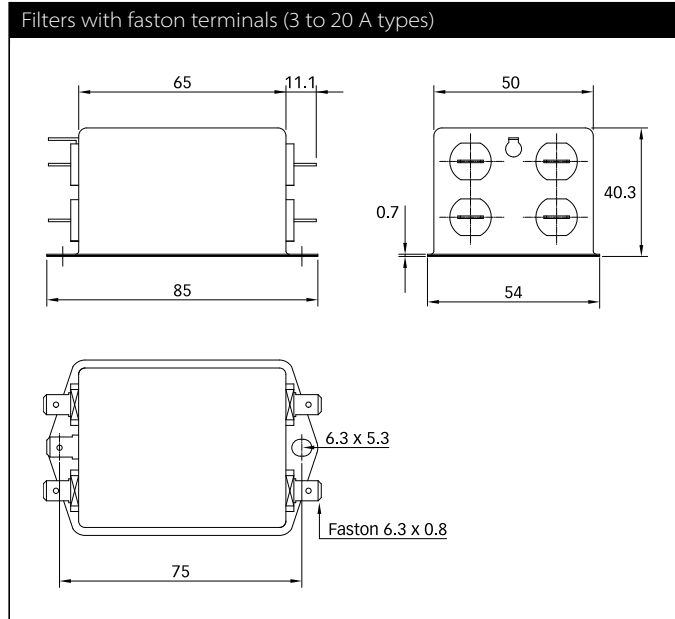
6 A types



10 and 30A types



## Mechanical data



All dimensions in mm; 1 inch = 25.4 mm  
Tolerances according: ISO 2768-m / EN 22768-m

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on connectors.

## Filter input/output connector cross sections

	-44
<b>Solid wire</b>	 0.5-10 mm <sup>2</sup>
<b>Flex wire</b>	0.5-6 mm <sup>2</sup>
<b>Flex wire AWG</b>	AWG 20-8
<b>Recommended torque</b>	1.0-1.2 Nm

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.



# General Purpose EMC/EMI Line Filter

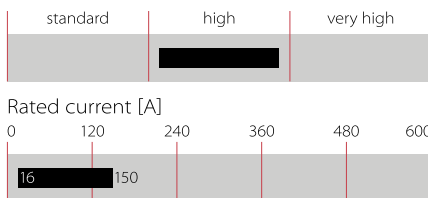


- Three-phase and neutral line filter for general four-wire filtering tasks
- Choice of connection style
- Low operating leakage current
- Compliant with IEC 60950
- Suitable to meet EN 55011/14/22



### Performance indicators

Attenuation performance



## Technical specifications

<b>Maximum continuous operating voltage</b>	3x 440/250 VAC
<b>Rated currents</b>	16 to 150 A @ 40°C max.
<b>High potential test voltage</b>	P/N → E 2000 VAC for 2 sec P → P 1900 VDC for 2 sec P → N 1100 VDC for 2 sec
<b>Protection category</b>	IP 20 (filters with connectors -29, -33, -34) IP 00 (filters with connectors -06, -24, -28)
<b>Overload capability</b>	4x rated current at switch on, 1.5x rated current for 1 minute, once per hour
<b>Temperature range (operation and storage)</b>	-25°C to +100°C (25/100/21)
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
<b>MTBF @ 40°C/400 V (Mil-HB-217F)</b>	220,000 hours

### Approvals & Compliances



(FN 356 up to 100 A)

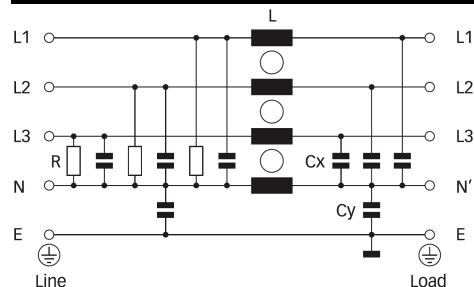
### Features and benefits

- FN 356 represents the industry standard filter solutions for EMC compliance on three-phases and the neutral conductor, providing high attenuation of both symmetrical and asymmetrical interference
- Choice of connection style is offered for an application-specific filter selection
- Solid touch-safe terminal blocks (-29, -33, -34 versions) offer a generous contacting cross section and contribute to overall safety (IP 20)
- Used as a mains input filter, FN 356 filters increase the conducted immunity and thus contribute to system reliability
- Design compliance with IEC 60950 provides additional application flexibility

### Typical applications

- General purpose four-wire filtering
- Mainframe computer systems
- High power office equipment
- UPS
- Installations comprising automation equipment

### Typical electrical schematic



### Filter selection table

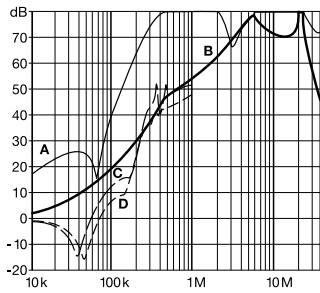
Filter*	Buy	Rated current @ 40°C (25°C)	Leakage current** @ 440 VAC/50 Hz	Power loss @ 25 °C/ 50Hz	Input/Output connections			Weight [kg]
					[A]	[mA]	[W]	
FN356-16-..		16 (18.4)	0.1	7.0	-06		-29	1.2
FN356-25-..		25 (28.8)	0.1	10.1		-24	-33	1.5
FN356-36-..		36 (41.5)	0.1	10.9		-24	-33	1.6
FN356-50-..		50 (57.7)	0.1	15.8		-24	-33	2.3
FN356-100-..		100 (115.0)	0.3	24.0		-28	-34	5.9
FN356-150-28		150 (172.5)	1.7	45.9		-28		8.1

\* To compile a complete part number, please replace the .. with the required I/O connection style.  
 \*\* Standardized calculated leakage current acc. IEC60939 under normal operating conditions.

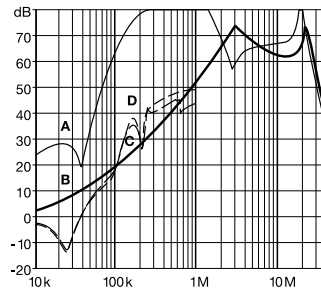
### Typical filter attenuation

Per CISPR 17; A=50 Ω/50 Ω sym; B=50 Ω/50 Ω asym; C=0.1 Ω/100 Ω sym; D=100 Ω/0.1 Ω sym

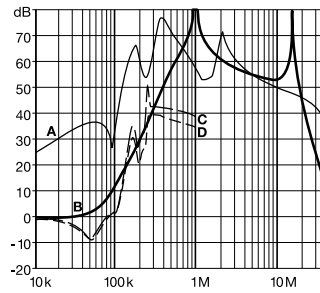
16 A types



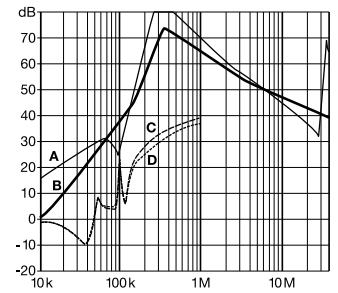
25 to 50 A types



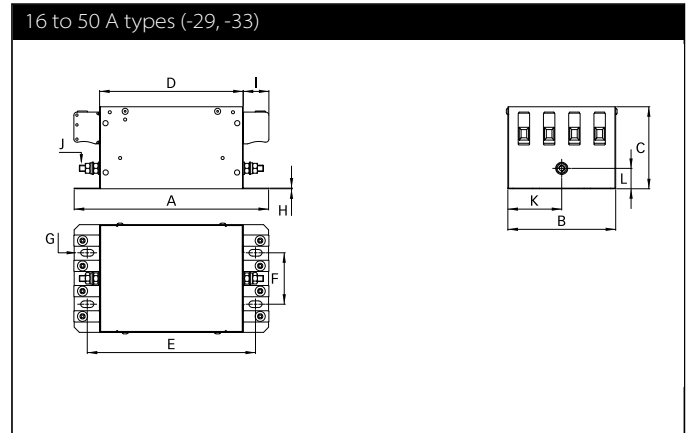
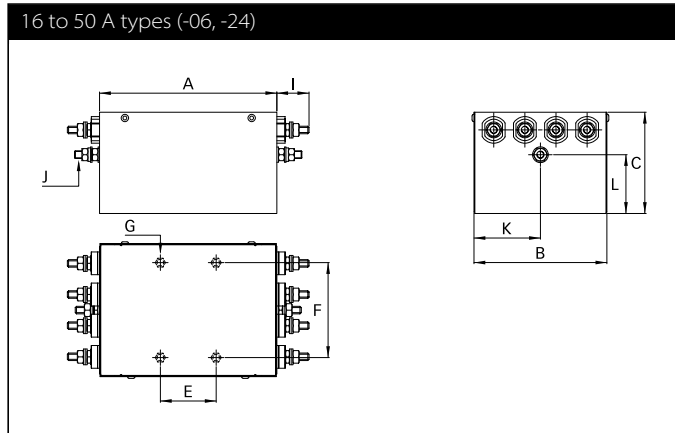
100 A types

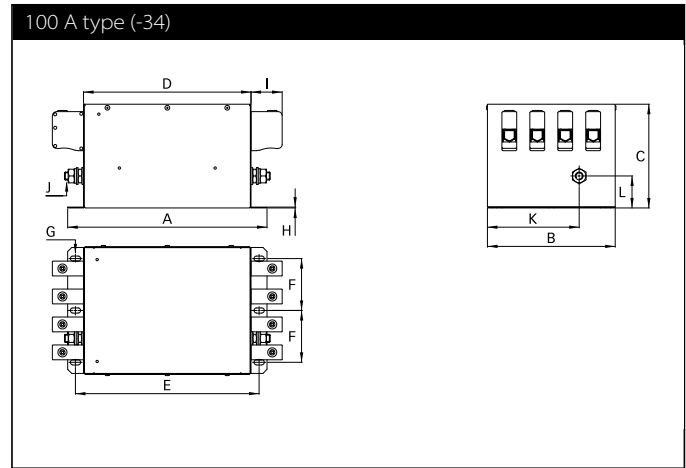
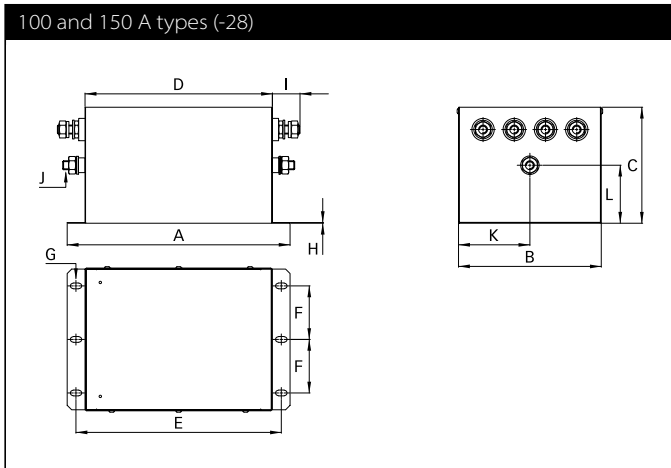


150 A types



### Mechanical data





Note: in favour of a better readability, connectors and earth studs are not shown in the horizontal projection.

## Dimensions

	16 A (-06)	16 A (-29)	25 A (-24)	25 A (-33)	36 A (-24)	36 A (-33)	50 A (-24)	50 A (-33)	100 A (-28)	100 A (-34)	150 A
<b>A</b>	149	189.5	140	189.5	140	189.5	143.25	192	250	250	340
<b>B*</b>	104	105	105	105	105	105	122	122	160	160	160
<b>C</b>	50	80	80	80	80	80	102	102	130	130	130
<b>D</b>		140		140		140		142.5	210	210	300
<b>E</b>	44 ±0.3	165.5	44 ±0.3	165.5	44 ±0.3	165.5	44 ±0.3	168	230	230	320
<b>F</b>	75 ±0.3	80	75 ±0.3	50	75 ±0.3	50	75 ±0.3	98	60	65	60
<b>G</b>	M5 x 7	13 x 6.5	M5 x 7	13 x 6.5	M5 x 7	13 x 6.5	M5 x 7	13 x 6.5	13 x 6.5	13 x 6.5	13 x 6.5
<b>H</b>		0.7		0.7		0.7		0.7	1	1	1
<b>I</b>	11	10.9	25.4	25	25.4	25	25.4	25	34	39	34
<b>J</b>	6.3 x 0.8	M6	M6	M6	M6	M6	M6	M6	M10	M10	M10
<b>K</b>	52	82	52.5	52.5	52.5	52.5	61	61	80	116	80
<b>L</b>	22.5	25	46.5	20	46.5	20	68.5	35	65	40	65

\* Rivets exceed this dimension by max. 1.3mm on each side.

All dimensions in mm; 1 inch = 25.4 mm

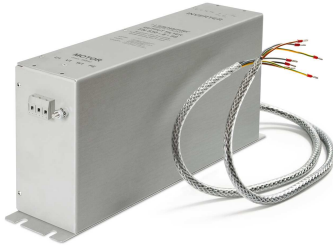
Tolerances according: ISO 2768-m/EN 22768-m

## Filter input/output connector cross sections

	-06 (6.3 x 0.8mm)	-24 (M6)	-28 (M10)	-29	-33	-34
<b>Solid wire</b>	n/a	n/a	n/a	6 mm <sup>2</sup>	16 mm <sup>2</sup>	35 mm <sup>2</sup>
<b>Flex wire</b>	n/a	n/a	n/a	4 mm <sup>2</sup>	10 mm <sup>2</sup>	25 mm <sup>2</sup>
<b>AWG type wire</b>	n/a	n/a	n/a	AWG 10	AWG 6	AWG 2
<b>Recommended torque</b>	n/a	3.5-4.0 Nm	15-17 Nm	0.6-0.8 Nm	1.5-1.8 Nm	4.0-4.5 Nm

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.

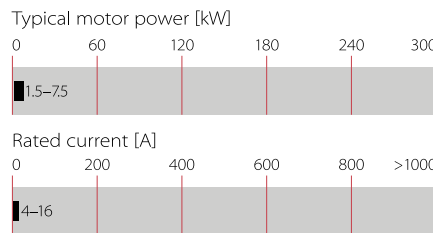
# Sine Wave and EMC Output Filter for Motor Drives with a DC Link Access



- Smoothing of PWM drive output voltage
- Efficient motor protection
- Reduction of common-mode interferences on motor cables
- Improvement of EMC environment
- Elimination of motor bearing damages
- Possibility to use very long unshielded motor cables
- Improvement of system reliability



### Performance indicators



## Technical specifications

<b>Nominal operating voltage</b>	3 x 480 VAC
<b>dc link voltage</b>	850 VDC max.
<b>Motor frequency</b>	0 to 200 Hz
<b>Switching frequency</b>	6 to 20 kHz
<b>Rated currents</b>	4 to 16 A @ 40°C
<b>Motor cable length</b>	≤1000 m max.
<b>Voltage drop</b>	≤10 V @ 50 Hz
<b>Current in +/- control loop</b>	1 to 2 A approx.
<b>Residual ripple voltage</b>	<5%
<b>High potential test voltage</b>	P → E 2500 VDC for 2 sec P → P 1100 VDC for 2 sec
<b>Protection category</b>	IP 20
<b>Overload capability</b>	1.4x rated current for 1 minute, every 15 minutes
<b>Temperature range (operation and storage)</b>	-25°C to +100°C (25/100/21)
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
<b>MTBF @ 40°C/400 V (Mil-HB-217F)</b>	>100,000 hours

### Approvals

### ROHS



### Features and benefits

- Conversion of the PWM output signal (differential and common-mode voltage components) of motor drives into a smooth sine wave with low residual ripple
- Elimination of premature motor damage caused by high dv/dt, overvoltages, motor overheating, eddy current losses or bearing damage
- Elimination of interference propagation towards components or conductors in the vicinity
- Provision of all benefits of traditional LC sine wave filters, plus:
- Allows the use of extremely long unshielded motor cables without causing radiation problems (EN 55014, MDS clamp)
- Restricts pulse currents to ground and hence limits leakage currents in the PE
- Reduces the required EMI suppression efforts on the line side
- Allows the use of lower rated drives with long motor cables due to lower losses in the IGBTs and in the motor cable

### Typical applications

- Motor drive applications with extremely long motor cables
- Motor drive applications with unshielded motor cables
- Chemical and petro-chemical applications
- Semi-conductor manufacturing
- Mission critical applications
- Applications with multiple motors in parallel
- Retrofit of motor drives into existing installations with old wiring and motors

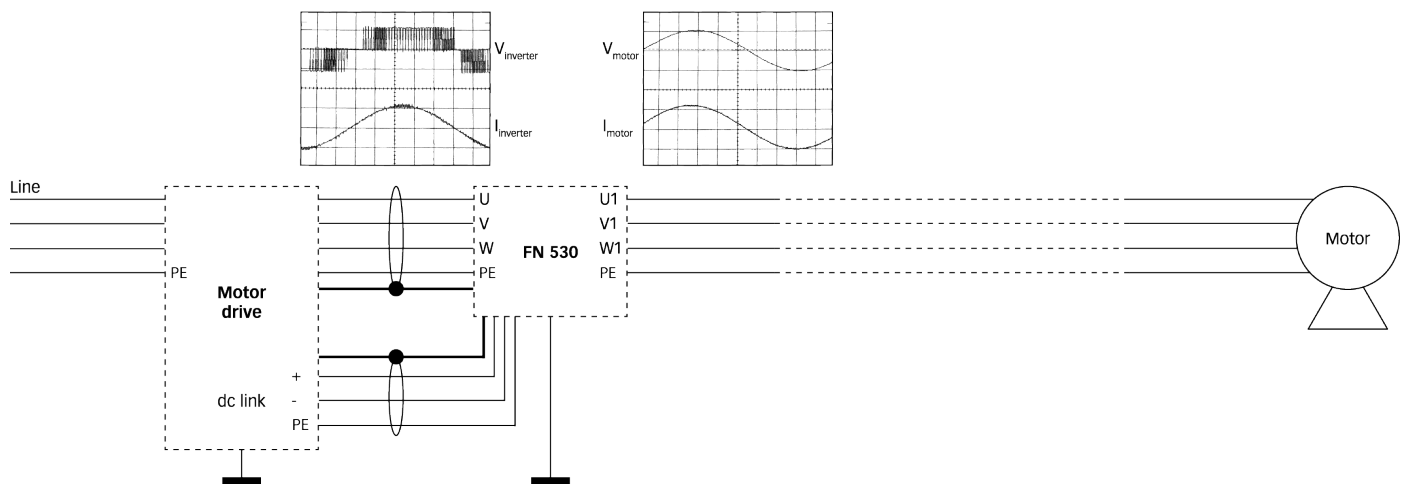
## Filter selection table

Filter	Rated current @ 40°C	Typical motor power rating*	Typical power loss**	Motor side 	Motor drive side 	Weight [kg]
	[A]	[kW]	[W]			
FN 530-4-99	4	1.5	15	-29	-99	11.5
FN 530-8-99	8	3.0	33	-29	-99	15
FN 530-12-99	12	5.5	50	-29	-99	18.5
FN 530-16-99	16	7.5	37	-33	-99	21

\* General purpose four-pole (1500 r/min) AC induction motor rated 400 V/50 Hz.

\*\* Exact value depends upon the motor cable type and length, switching frequency, motor frequency and further stray parameters within the system.

## Typical block schematic



## Connection to the dc link

For best results, the connection to the dc link of the motor drive is required with this series of filters.

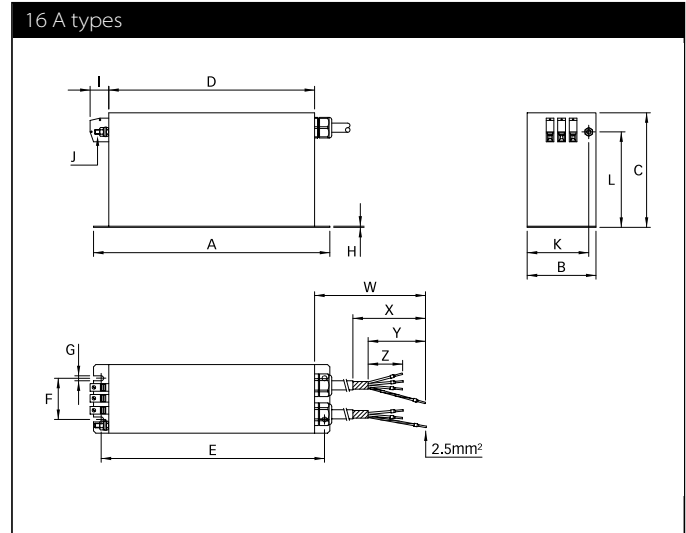
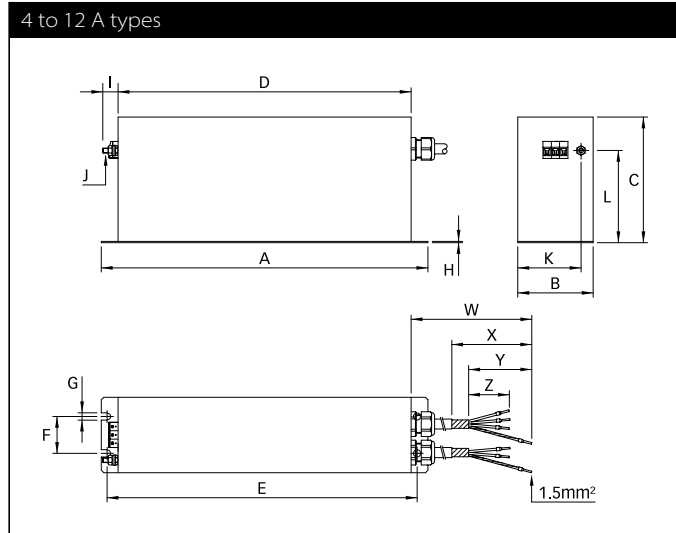
If only one connection to the dc link is brought out of the drive («+» or «-») then the dc link cable connections from the filter (identified by «DC+» and «DC-») must be connected together to the «+» or «-» motor drive connection.

The operation of the sine wave interference filter is not seriously affected as a result. The «+» and «-» connections on the motor drive must never be connected together. Otherwise a short-circuit will result.

The PWM switching frequency must lie within the range from 6 to 20kHz in order to ensure satisfactory operation of the filter. A lower switching frequency or a pure square wave is unsuitable and will result in the motor drive switching off with the error message «overcurrent or short to earth.»

For additional information please refer to the Schaffner application note "Sine Wave Filter Solutions for Motor Drives Applications" available on the homepage [www.schaffner.com/downloads](http://www.schaffner.com/downloads)

## Mechanical data





## Dimensions

	4 A	8 A	12 A	16 A
<b>A</b>	390	390	390	350
<b>B</b>	90	90	90	140
<b>C</b>	150	180	215	230
<b>D</b>	350	350	350	310
<b>E</b>	373	370	370	330
<b>F</b>	44	44	44	95
<b>G</b>	6.5	8.7	8.7	8.7
<b>H</b>	1.5	1.5	1.5	2.3
<b>I</b>	19	19	19	25
<b>J</b>	M6	M6	M6	M6
<b>K</b>	75	75	75	107.5
<b>L</b>	107	137	172	181
<b>W</b>	720 +15/-0	720 +15/-0	720 +15/-0	720 +15/-0
<b>X</b>	120	120	120	120
<b>Y</b>	100	100	100	100
<b>Z</b>	70	70	70	70

All dimensions in mm; 1 inch = 25.4 mm  
Tolerances according: ISO 2768-m / EN 22768-m

## Filter input connector cross sections

	-29	-33
<b>Solid wire</b>	 6 mm <sup>2</sup>	 16 mm <sup>2</sup>
<b>Flex wire</b>	4 mm <sup>2</sup>	10 mm <sup>2</sup>
<b>AWG type wire</b>	AWG 10	AWG 6
<b>Recommended torque</b>	0.6-0.8 Nm	1.5-1.8 Nm

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.

# DIN-Rail EMC/RFI Filter with Minimum Leakage Current



- Compact state-of-the-art filter concept
- Light weight plastic enclosure design
- Minimized filter leakage current
- Hinged safety covers
- Revolutionary embedded filter terminals
- Chassis or DIN-rail mounting option
- Selectable performance level
- Environmental friendly design without potting compound

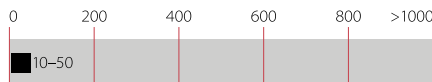


### Performance indicators

Attenuation performance



Rated current [A]



### Approvals & Compliances



Design protected by European patent (EP 1727280)

### Features and benefits

- Two different mounting versions: FN 3025 for chassis mounting and FN3026 for DIN rail mounting
- Two different performance levels (L types, P types)
- A plastic housing and a metal ground plate are cleverly combined to get the lowest possible product weight without compromising EMC behavior
- The embedded jump-terminal system from Schaffner guarantees user-friendly handling as well as fast and reliable electrical connection
- Captive hinged protective covers contribute to overall safety by offering protection against unintended contact with live conductors. They are included in the standard delivery package without causing extra cost
- Very low leakage current values make these filter ranges ideally suitable for use in Japanese electricity networks as well as in applications which set value on safety and reliability

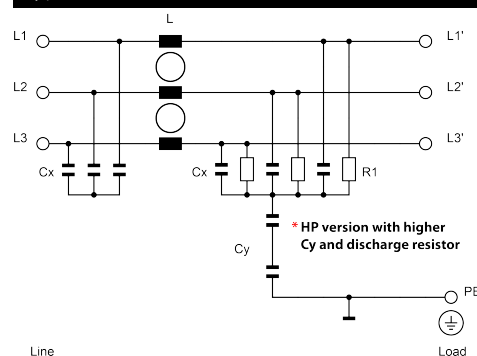
### Technical specifications

<b>Maximum continuous operating voltage</b>	3x 520/300 VAC
<b>Operating frequency</b>	DC to 60 Hz
<b>Rated currents</b>	10 to 50 A @ 50°C
<b>High potential test voltage</b>	P → E 2000 VAC for 2 sec (HL types) P → E 3000 VDC for 2 sec (HP types) P → P 2250 VDC for 2 sec
<b>Protection category</b>	IP 00 (protection according to VBG 4)
<b>Overload capability</b>	4x rated current at switch on, 1.5x rated current for 1 minute, once per hour
<b>Temperature range (operation and storage)</b>	-25°C to +100°C (25/100/21)
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
<b>MTBF @ 50°C/400 V (Mil-HB-217F)</b>	>200,000 hours

### Typical applications

- Applications with the requirement for extremely compact filter solutions
- Applications with tough leakage current requirements or sensitive earth leakage detectors
- Applications with insufficient internal filtering or moderate interference levels
- Automation equipment
- Motor drives and servo drives with short motor cables
- Applications including stepping motors
- Semiconductor manufacturing equipment
- Three-phase power supplies
- Medical equipment (not patient-coupled)

### Typical electrical schematic of HL version



## Filter selection table

Filter	Rated current @ 50°C (40°C)	Typical drive power rating*	Leakage current** @ 520 VAC/50 Hz	Power loss @ 25°C/50 Hz	Input/Output connections 	Weight [kg]
	[A]	[kW]	[mA]	[W]		
FN 3025 HL-10-71	10 (10.7)	5.5	0.1	4.8	-71	0.52
FN 3025 HL-20-71	20 (21.4)	11	0.1	6.2	-71	0.52
FN 3025 HL-30-71	30 (32.1)	18.5	0.1	7.0	-71	0.54
FN 3025 HL-40-71	40 (43.8)	25	0.1	8.5	-71	0.63
FN 3025 HL-50-72	50 (53.5)	30	0.1	10.5	-72	0.93
FN 3025 HP-10-71	10 (10.7)	5.5	0.4	4.8	-71	0.52
FN 3025 HP-20-71	20 (21.4)	11	0.4	6.2	-71	0.52
FN 3025 HP-30-71	30 (32.1)	18.5	0.4	7.0	-71	0.54
FN 3025 HP-40-71	40 (43.8)	25	0.4	8.5	-71	0.63
FN 3025 HP-50-72	50 (53.5)	30	0.4	10.5	-72	0.93
FN 3026 HL-10-71	10 (10.7)	5.5	0.1	4.8	-71	0.56
FN 3026 HL-20-71	20 (21.4)	11	0.1	6.2	-71	0.56
FN 3026 HL-30-71	30 (32.1)	18.5	0.1	7.0	-71	0.58
FN 3026 HL-40-71	40 (43.8)	25	0.1	8.5	-71	0.74
FN 3026 HL-50-72	50 (53.5)	30	0.1	10.5	-72	0.98
FN 3026 HP-10-71	10 (10.7)	5.5	0.4	4.8	-71	0.56
FN 3026 HP-20-71	20 (21.4)	11	0.4	6.2	-71	0.56
FN 3026 HP-30-71	30 (32.1)	18.5	0.4	7.0	-71	0.58
FN 3026 HP-40-71	40 (43.8)	25	0.4	8.5	-71	0.74
FN 3026 HP-50-72	50 (53.5)	30	0.4	10.5	-72	0.98

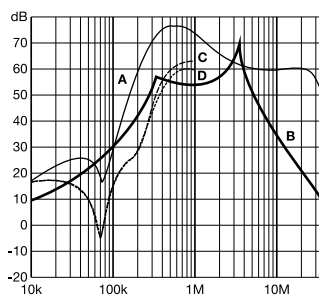
\* Calculated at rated current, 480 VAC and  $\cos \phi=0.8$ . The exact value depends upon the efficiency of the drive, the motor and the entire application.

\*\* Standardized calculated leakage current acc. IEC60939 under normal operating conditions.

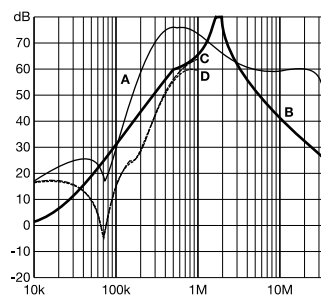
## Typical filter attenuation

Per CISPR 17; A=50  $\Omega$ /50  $\Omega$  sym; B=50  $\Omega$ /50  $\Omega$  asym; C=0.1  $\Omega$ /100  $\Omega$  sym; D=100  $\Omega$ /0.1  $\Omega$  sym

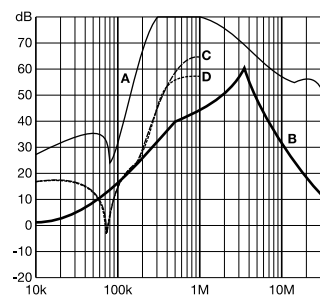
10 and 20 A HL types



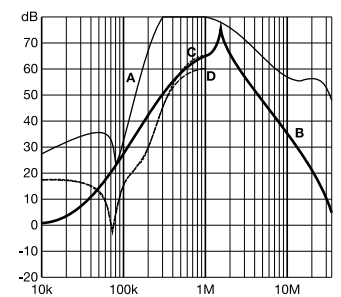
10 and 20 A HP types



30 to 50 A HL types

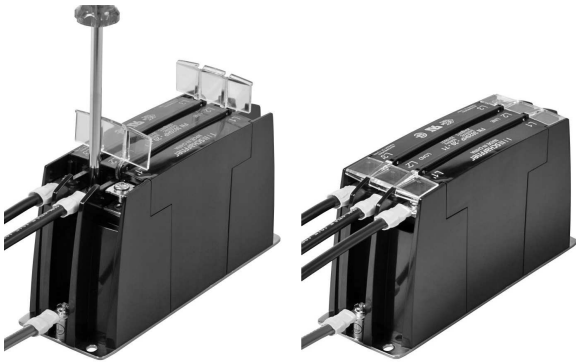


30 to 50 A HP types





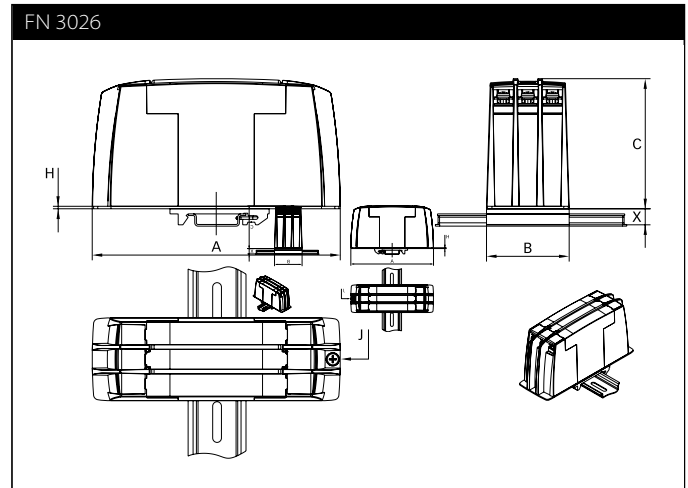
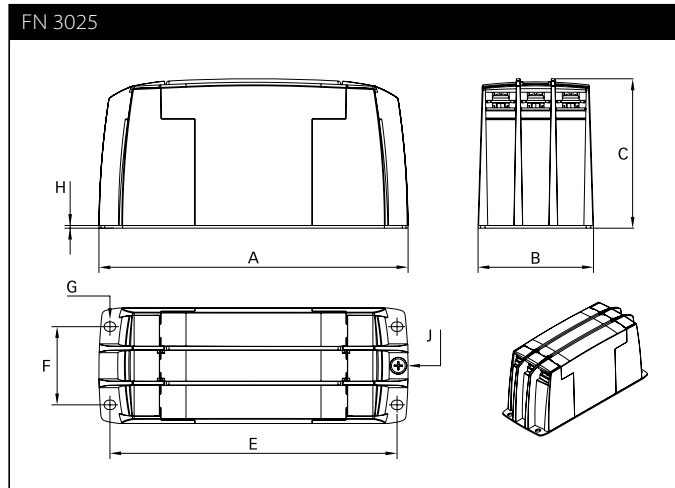
## Installation



FN 3025/FN 3026 are delivered with closed plastic covers and unfastened terminals. To install the filter please proceed as follows:

- Mount the filter on a metal surface with four screws or snap it onto a TS 35 DIN- rail.
- First connect the green/yellow wire to the earth stud of the filter.
- Gently lift the two hinged plastic covers.
- Connect phase wires with cable lugs by pushing down and tightening the screws.
- Please note the torque recommendation on top of the filter.
- Push the covers back into their locked position to finish the filter installation.

## Mechanical data







## Dimensions

50

	FN 3025					FN 3026				
	10 A	20 A	30 A	40 A	50 A	10 A	20 A	30 A	40 A	50 A
<b>A</b>	150	150	150	150	177	150	150	150	150	177
<b>B</b>	50	50	50	50	65	50	50	50	50	65
<b>C</b>	78	78	78	78	84	78	78	78	78	84
<b>E</b>	140	140	140	140	162					
<b>F</b>	32	32	32	32	44					
<b>G</b>	4.3 x 5.5	4.3 x 5.5	4.3 x 5.5	4.3 x 5.5	5.3 x 6.5					
<b>H</b>	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
<b>J</b>	M4	M4	M4	M4	M5	M4	M4	M4	M4	M5
<b>X</b>						9.7	9.7	9.7	9.7	9.7

All dimensions in mm; 1 inch = 25.4 mm  
Tolerances according: ISO 2768-m/EN 22768-m

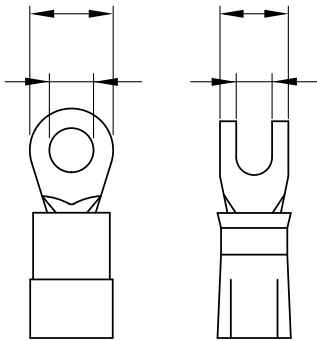
## Filter input/output connector cross sections

	-71 (10 A)	-71 (20 A)	-71 (30 A and 40 A)	-72 (50 A)
				
<b>Flex wire</b>	1.3-2.5 mm <sup>2</sup>	4-6 mm <sup>2</sup>	8-10 mm <sup>2</sup>	16-20 mm <sup>2</sup>
<b>AWG type wire</b>	AWG 16-AWG 13	AWG 12-AWG 10	AWG 8-AWG 7	AWG 5-AWG 4
<b>Ring/fork lug (W/d)*</b>	max. 11 mm (9.5 mm)/ min. Ø4.3 mm**	max. 11 mm (9.5 mm)/ min. Ø4.3 mm**	max. 11 mm (9.5 mm)/ min. Ø4.3 mm**	max. 16.5 mm (15 mm)/ min. Ø5.3 mm**
<b>Recommended torque</b>	1.0-1.2 Nm	1.0-1.2 Nm	1.0-1.2 Nm	1.9-2.2 Nm

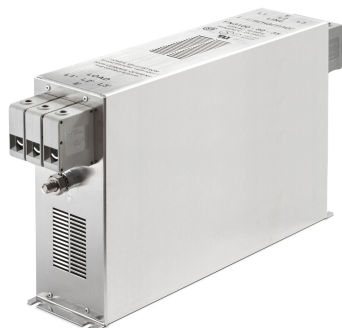
\* Schaffner recommends the use of insulated and UL-recognized ring lugs or fork lugs of the appropriate size.

\*\* Specification in ( ) relates to earth connector.

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.



# Bookstyle EMC/EMI Filter for Motor Drives



- Exceptional broadband attenuation performance from 10 kHz up to 30 MHz
- Slim and user-friendly book-style design with touch-safe terminal blocks for minimum space and maximum safety
- Enables compliance with Class B limits

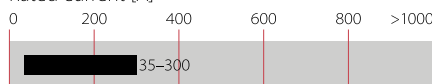


### Performance indicators

Attenuation performance



Rated current [A]



### Approvals & Compliances



(FN 3100 up to 150 A)

### Features and benefits

- High performance filter for mainly industrial motor drive applications with significant interference levels
- Attenuation performance for Class B compliance in applications comprising multiple motor drives (e.g. machine tool with up to 8 driving axes with ~10 to 20 m motor cable each)
- Broadband filter performance with low frequency attenuation down to 10 kHz for reliable suppression of conducted interference
- Slim book-style shape requiring minimum cabinet space and allowing convenient installation right beside the motor drive
- Touch-safe terminal blocks provide unsurpassed electrical safety and contacting cross section according to EN 60204-1 installation standard
- For even better filter specifications, please consider FN 3120 H series from Schaffner

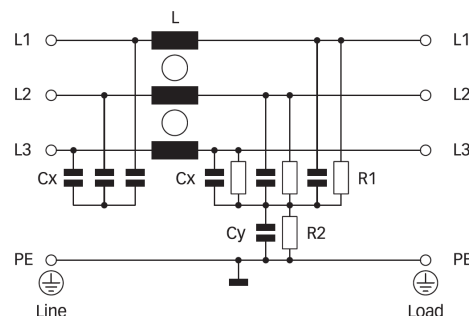
### Technical specifications

<b>Maximum continuous operating voltage</b>	3x 520/300 VAC
<b>Operating frequency</b>	DC to 60 Hz
<b>Rated currents</b>	35 to 300 A @ 50°C
<b>High potential test voltage</b>	P → E 2750 VDC for 2 sec P → P 2250 VDC for 2 sec
<b>Protection category</b>	IP 20
<b>Overload capability</b>	4x rated current at switch on, 1.5x rated current for 1 minute, once per hour
<b>Temperature range (operation and storage)</b>	-25°C to +100°C (25/100/21)
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
<b>MTBF @ 50°C/400 V (Mil-HB-217F)</b>	>400,000 hours



### Typical applications

- Conventional motor drives with long motor cables and high interference levels
- Four quadrant motor drives and servo drives with energy regeneration mode (in combination with a suitable line reactor or LCL filter)
- Industrial applications comprising power conversion devices, such as machinery, machine tools and process automation equipment
- Uninterruptible power supplies (UPS)
- Converters for renewable energy generation
- Thyristor drives
- Elevators and cranes

### Typical electrical schematic



### Filter selection table

Filter	Rated current @ 50°C (40°C)	Typical drive power rating*	Leakage current** @ 520 VAC/50 Hz	Power loss @ 25°C/50 Hz	Input/Output connections		Weight
	[A]	[kW]	[mA]	[W]			[kg]
<b>FN 3100-35-33</b>	35 (38.4)	22	6.8	11.8	-33		2.3
<b>FN 3100-50-34</b>	50 (54.8)	30	9.3	18.0	-34		3.4
<b>FN 3100-80-35</b>	80 (87.6)	45	10.0	25.9	-35		5.0
<b>FN 3100-110-35</b>	110 (120.5)	55	10.0	32.7	-35		5.4
<b>FN 3100-150-40</b>	150 (164.3)	75	10.0	50.6	-40		8.5
<b>FN 3100-200-40</b>	200 (219)	110	10.0	67.2	-40		9.1
<b>FN 3100-230-40</b>	230 (230)	132	10.0	36.5	-40		9.2
<b>FN 3100-300-99</b>	300 (329)	160	10.0	54.0		-99	11.8

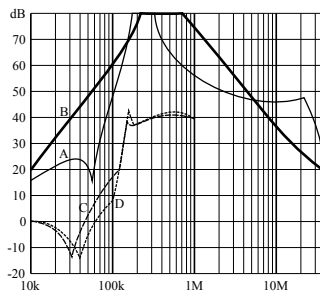
\* Calculated at rated current, 480 VAC and cos phi=0.8. The exact value depends upon the efficiency of the drive, the motor and the entire application.

\*\* Standardized calculated leakage current acc. IEC60939 under normal operating conditions.

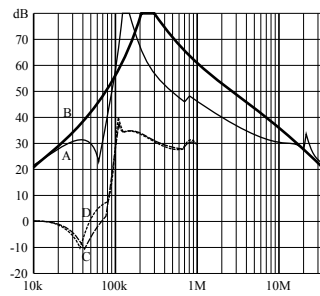
### Typical filter attenuation

Per CISPR 17; A=50 Ω/50 Ω sym; B=50 Ω/50 Ω asym; C=0.1 Ω/100 Ω sym; D=100 Ω/0.1 Ω sym

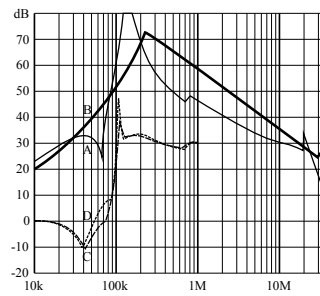
35 to 80 A types



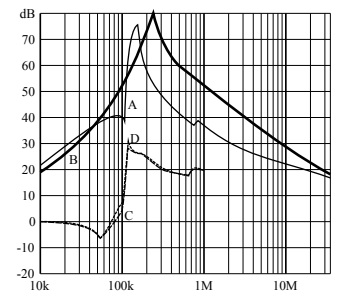
110 and 150 A types



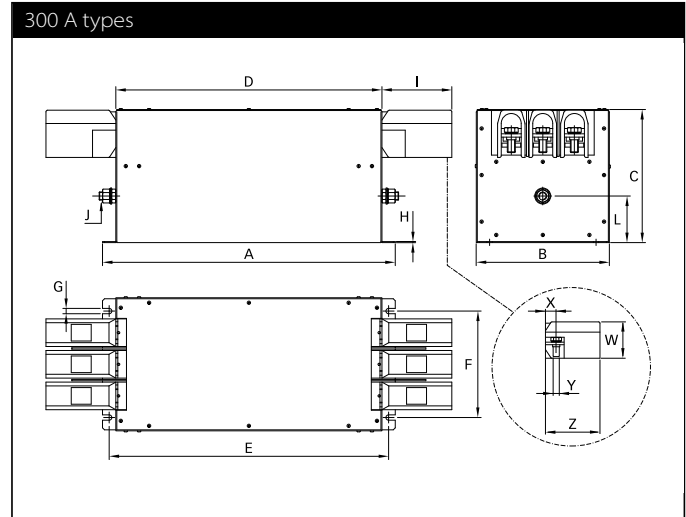
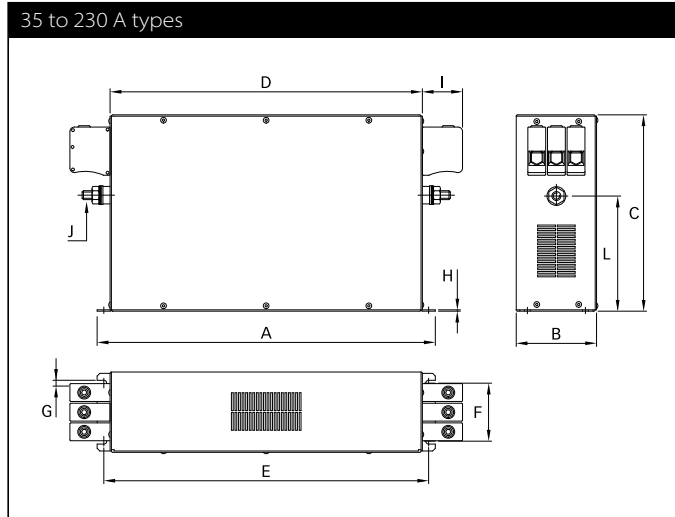
200 A types



230 and 300 A types



## Mechanical data



## Dimensions

	35 A	50 A	80 A	110 A	150 A	200 A	230 A	300 A
<b>A</b>	335	329	379	379	438	438	438	440
<b>B</b>	60	80	90	90	110	110	110	200
<b>C</b>	150	185	220	220	240	240	240	200
<b>D</b>	305	300	350	350	400	400	400	400
<b>E</b>	320	314	364	364	413	413	413	420
<b>F</b>	35	55	65	65	80	80	80	160
<b>G</b>	6.5	6.5	6.5	6.5	6.5	6.5	6.5	8
<b>H</b>	1	1.5	1.5	1.5	4	4	4	1.5
<b>I</b>	25	39	45	45	51	51	51	105
<b>J</b>	M5	M6	M10	M10	M10	M10	M10	M12
<b>L</b>	93.5	107	129	129	108	108	108	70
<b>W</b>								71.5
<b>X</b>								~22
<b>Y</b>								M12
<b>Y</b>								~105

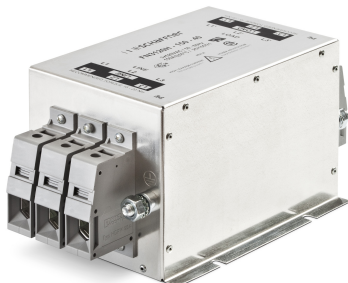
All dimensions in mm; 1 inch = 25.4 mm  
Tolerances according: ISO 2768-m/EN 22768-m

## Filter input/output connector cross sections

	-33	-34	-35	-40	-99
<b>Solid wire</b>	16 mm <sup>2</sup>	35 mm <sup>2</sup>	50 mm <sup>2</sup>	95 mm <sup>2</sup>	-
<b>Flex wire</b>	10 mm <sup>2</sup>	25 mm <sup>2</sup>	50 mm <sup>2</sup>	95 mm <sup>2</sup>	150 mm <sup>2</sup>
<b>AWG type wire</b>	AWG 6	AWG 2	AWG 1/0	AWG 4/0	AWG 6/0
<b>Recommended torque</b>	1.5 - 1.8 Nm	4.0 - 4.5 Nm	7 - 8 Nm	17 - 20 Nm	27 - 30 Nm

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.

# High-Performance EMC/RFI Filter for Drives



- High performance filter for extremely noisy applications
- Significantly improves the reliability and immunity of installations
- Enables compliance with Class B limits even with very long cables

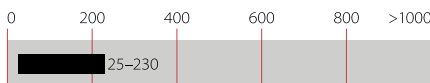


### Performance indicators

Attenuation performance



Rated current [A]



## Technical specifications

<b>Maximum continuous operating voltage</b>	3x 520/300 VAC (480 VAC +10% possible)
<b>Operating frequency</b>	DC to 60 Hz
<b>Rated currents</b>	25 to 230 A @ 50°C
<b>High potential test voltage</b>	P → E 2750 VDC for 2 sec P → P 2250 VDC for 2 sec
<b>Protection category</b>	IP 20
<b>Overload capability</b>	4x rated current at switch on, 1.5x rated current for 1 minute, once per hour
<b>Temperature range (operation and storage)</b>	-25°C to +100°C (25/100/21)
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
<b>MTBF @ 50°C/400 V (Mil-HB-217F)</b>	>300,000 hours

### Approvals & Compliances



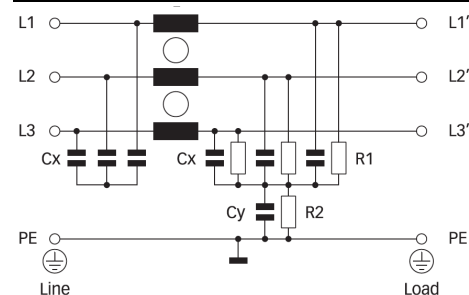
### Features and benefits

- High-performance filter for mainly industrial motor drive applications with extremely high noise levels, providing sufficient interference suppression to achieve Class B even with very long motor cables (e.g. machine tools with up to 12 axes with ~10 to 20 m cables each)
- Broadband attenuation performance and exceptional saturating resistance ensure reliable interference suppression
- FN 3120 operated on the mains input of machines or equipment contributes significantly to the reliability and immunity by offering protection against conducted interference phenomena coming from the environment
- Solid, touch-safe terminal blocks offer sufficient contacting cross section according to the EN 60204-1 installation standard, which is very common for industrial equipment like machine tools
- Compact dimensions and light weight design with good accessibility for automatic and hand tools guarantee a simple time and space-saving installation


### Typical applications

Mainly industrial equipment, machinery and machine tools such as printing machines, packaging machines, extruders, wood working machines, milling and drilling machines, laser cutting machines, welding machines, robotics, conveyors, assembly lines, pumps, oil production, chemical and mining industry, etc. The filters are ideal for most motor drive applications and particularly for regenerative drives with suitable line reactor or LCL filter.

### Typical electrical schematic



### Filter selection table

Filter	Rated current	Typical drive	Leakage current**	Power loss	Input/Output	Weight
	@ 50°C (40°C)	power rating*	@ 520 VAC/50 Hz	@ 25°C/50 Hz	connections	
	[A]	[kW]	[mA]	[W]		[kg]
FN 3120 H-25-33	25 (27)	15	10.5	17.1	-33	2.4
FN 3120 H-50-53	50 (54)	30	10.5	17.5	-53	2.7
FN 3120 H-80-35	80 (87)	45	10.5	25.9	-35	5.0
FN 3120 H-110-35	110 (120)	55	10.5	25.4	-35	6.1
FN 3120 H-150-40	150 (164)	75	10.5	40.5	-40	6.3
FN 3120 H-230-40	230 (230)	132	10.5	33.5	-40	13.3

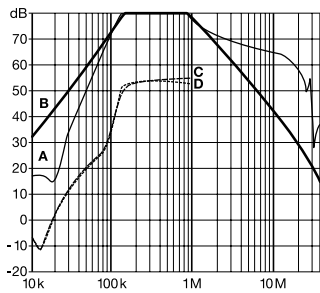
\* Calculated at rated current, 480 VAC and cos phi=0.8. The exact value depends upon the efficiency of the drive, the motor and the entire application.

\*\* Standardized calculated leakage current acc. IEC60939 under normal operating conditions.

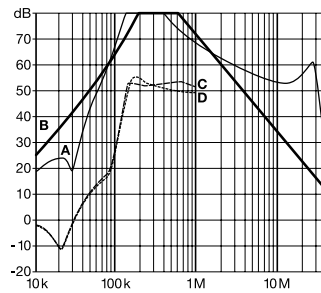
### Typical filter attenuation

Per CISPR 17; A=50 Ω/50 Ω sym; B=50 Ω/50 Ω asym; C=0.1 Ω/100 Ω sym; D=100 Ω/0.1 Ω sym

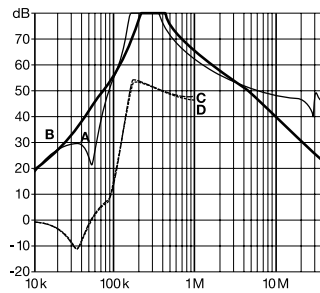
25 A types



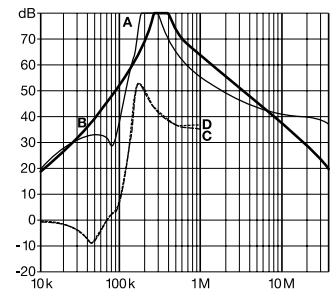
50 to 110 A types



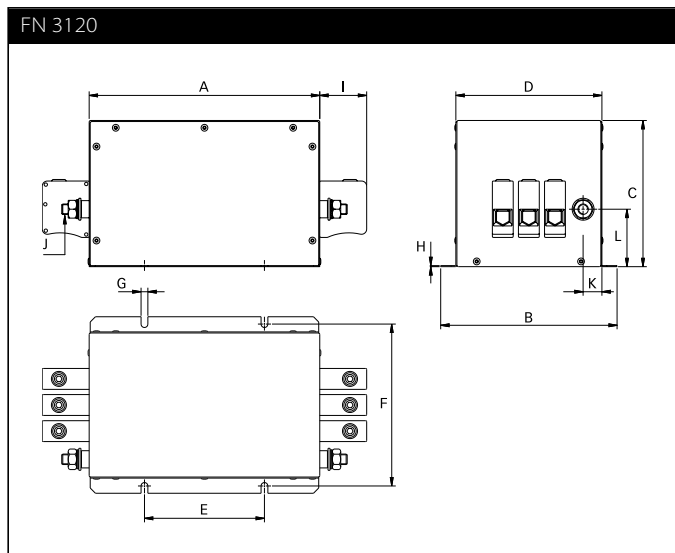
150 A types



230 A types



### Mechanical data







## Dimensions

	25 A	50 A	80 A	110 A	150 A	230 A
<b>A</b>	214	214	221	221	221	300
<b>B</b>	159	159	169	169	169	168
<b>C</b>	64	64	140	140	140	140
<b>D</b>	129	129	140	140	140	140
<b>E</b>	115	115	115	115	115	165 (82.5/82.5)*
<b>F</b>	145	145	155	155	155	155
<b>G</b>	6.5	6.5	6.5	6.5	6.5	6.5
<b>H</b>	1	1	1	1	1	1
<b>I</b>	25	29.45	45	45	51	51
<b>J</b>	M5	M6	M10	M10	M10	M10
<b>K</b>	21.5	24.5	18	18	13	13
<b>L</b>	26	35	55	55	62	62

\* 230 A filters provide 2 additional mounting slots, to do justice to the additional product weight. They are located right in the center of those mounting slots shown in the drawing above (82.5/82.5 → 165 mm).

All dimensions in mm; 1 inch = 25.4 mm  
Tolerances according: ISO 2768-m/EN 22768-m

## Filter input/output connector cross sections

	-33	-35	-40	-53
				
<b>Solid wire</b>	16 mm <sup>2</sup>	50 mm <sup>2</sup>	95 mm <sup>2</sup>	25 mm <sup>2</sup>
<b>Flex wire</b>	10 mm <sup>2</sup>	50 mm <sup>2</sup>	95 mm <sup>2</sup>	16 mm <sup>2</sup>
<b>AWG type wire</b>	AWG 6	AWG 1/0	AWG 4/0	AWG 4
<b>Recommended torque</b>	1.5-1.8 Nm	7-8 Nm	17-20 Nm	2.0-2.3 Nm

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.



# Compact Line Filter for Industrial Machinery/Equipment



- Compact, space-saving design, optimized for industrial machinery
- Combines high attenuation performance with low leakage current
- Performance according to the machine tool standard EN 50370-1
- Increases also the immunity if operated directly on the mains input

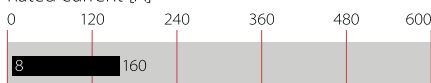


### Performance indicators

Attenuation performance



Rated current [A]



### Approvals & Compliances



### Features and benefits

- An extremely compact and light weight filter design with a „cubic“ shape, requiring minimum mounting space and thus taking the constructional conditions on the mains input of machinery into account
- Simple and time-saving installation with good accessibility for automatic and hand tools
- Solid, touch-safe terminal blocks offering sufficient contacting cross section according to the EN 60204-1 installation standard, which is very common in industrial applications
- As a mains input filter for three phases and neutral line, FN 3256 ensures the compliance with the new product family standard for machine tools in mainly industrial environments EN 50370-1. Further, its use will also increase the conducted immunity of the entire installation significantly
- FN 3256 provides the attenuation performance to meet the requirements of various machine tools with up to 8 driving axes with ~10 m of motor cable each
- For easy selection and application, the filter current ratings are aligned with common fuse values

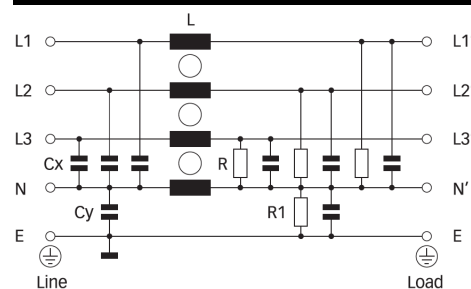
### Technical specifications

<b>Maximum continuous operating voltage</b>	3x 520/300 VAC (480 VAC +10% possible)
<b>Operating frequency</b>	DC to 60 Hz
<b>Rated currents</b>	8 to 160 A @ 50°C
<b>High potential test voltage</b>	P/N -> E 2750 VDC for 2 sec P -> P 2250 VDC for 2 sec P -> N 1300 VDC for 2 sec
<b>Protection category</b>	IP 20
<b>Overload capability</b>	4x rated current at switch on, 1.5x rated current for 1 minute, once per hour
<b>Temperature range (operation and storage)</b>	-25°C to +100°C (25/100/21)
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
<b>MTBF @ 50°C/400 V (Mil-HB-217F)</b>	>410,000 hours

### Typical applications

Mainly industrial equipment, machinery, machine tools and diverse process auto- mation systems with three-phase and neutral electricity supply. Further, these filters are suitable for power supplies, high-power office equipment and further applications, where efficient interference suppression on three phases and the neutral line is required and where space is critical. Because of the very low leakage current, FN 3256 can even be used for some medical devices.

### Typical electrical schematic



## Filter selection table

Filter	Buy	Rated current	Leakage current*	Power loss	Resistance**	Resistance**	Input/Output connections	Weight
		@ 50°C (40°C)	@ 520 VAC/50 Hz	@ 25°C/50 Hz	R	R1		
		[A]	[mA]	[W]	[kOhm]	[kOhm]		[kg]
FN3256H-8-29		8 (8.8)	0.6	2.7	1500	680	-29	0.6
FN3256H-16-29		16 (17.5)	0.6	5.0	1500	680	-29	0.7
FN3256H-25-33		25 (27)	0.6	9.8	1500	680	-33	1.1
FN3256H-36-33		36 (39)	0.6	11.3	1500	680	-33	1.2
FN3256H-64-34		64 (70)	0.6	17.2	1500	680	-34	2.3
FN3256H-80-35		80 (88)	0.6	14.5	1500	680	-35	3.5
FN3256H-120-35		120 (131)	0.9	25.0	1500	680	-35	4.7
FN3256H-160-40		160 (175)	1.3	26.9	1500	680	-40	5.7
FN3256H-8-29-R69		8 (8.8)	0.6	2.7	1500	10000	-29	0.6
FN3256H-16-29-R69		16 (17.5)	0.6	5.0	1500	10000	-29	0.7
FN3256H-25-33-R69		25 (27)	0.6	9.8	1500	10000	-33	1.1
FN3256H-36-33-R69		36 (39)	0.6	11.3	1500	10000	-33	1.2
FN3256H-64-34-R69		64 (70)	0.6	17.2	1500	10000	-34	2.3
FN3256H-80-35-R69		80 (88)	0.6	14.5	1500	10000	-35	3.5
FN3256H-120-35-R69		120 (131)	0.9	25.0	1500	10000	-35	4.7
FN3256H-160-40-R69		160 (175)	1.3	26.9	1500	10000	-40	5.7

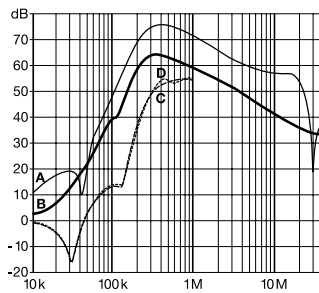
\* Standardized calculated leakage current acc. IEC60939 under normal operating conditions.

\*\* Tolerances apply: Inductance: -30/+50%, Capacitance: ±20%, Resistance: ±10%

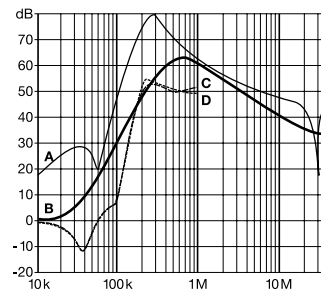
## Typical filter attenuation

Per CISPR 17; A=50 Ω/50 Ω sym; B=50 Ω/50 Ω asym; C=0.1 Ω/100 Ω sym; D=100 Ω/0.1 Ω sym

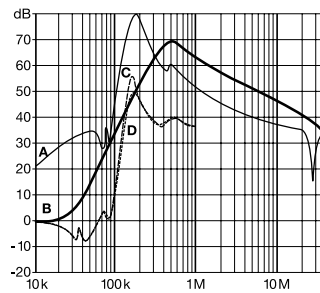
8 to 36 A types



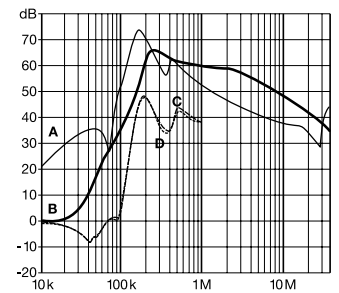
64 and 80 A types



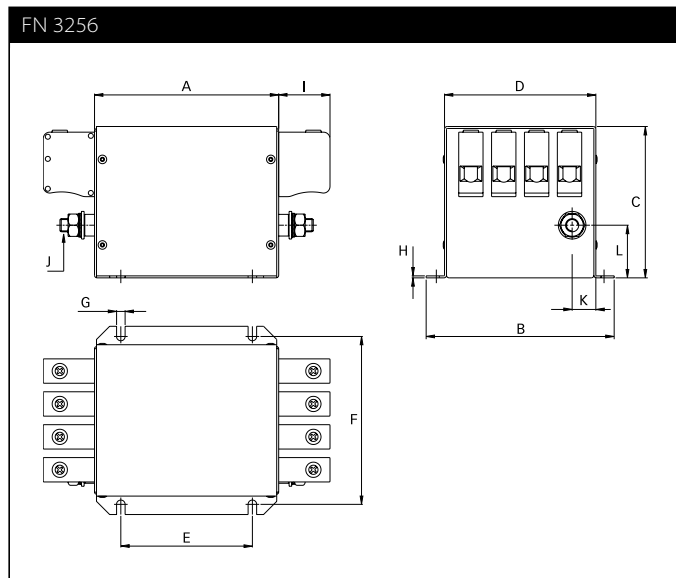
120 A types



160 A types



## Mechanical data



## Dimensions

	8 A	16 A	25 A	36 A	64 A	80 A	120 A	160 A
<b>A</b>	110	110	130	130	140	170	210	200
<b>B</b>	110	110	118	118	143	163	170	190
<b>C</b>	70	70	85	85	115	125	125	130
<b>D</b>	82	82	90	90	115	135	140	160
<b>E</b>	70	70	90	90	100	120	160	150
<b>F</b>	94.5	94.5	102.5	102.5	127.5	147.5	153.5	173.5
<b>G</b>	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
<b>H</b>	1	1	1	1	1.5	1.5	1.5	1.5
<b>I</b>	10.9	10.9	25	25	39	45	45	51
<b>J</b>	M6	M6	M6	M6	M10	M10	M10	M10
<b>K</b>	12	12	12	12	18	18	17.5	16.5
<b>L</b>	33	33	40	40	40	35	44	55

All dimensions in mm; 1 inch = 25.4 mm  
Tolerances according: ISO 2768-m/EN 22768-m

## Filter input/output connector cross sections

	-29	-33	-34	-35	-40
<b>Solid wire</b>	6 mm <sup>2</sup>	16 mm <sup>2</sup>	35 mm <sup>2</sup>	50 mm <sup>2</sup>	95 mm <sup>2</sup>
<b>Flex wire</b>	4 mm <sup>2</sup>	10 mm <sup>2</sup>	25 mm <sup>2</sup>	50 mm <sup>2</sup>	95 mm <sup>2</sup>
<b>AWG type wire</b>	AWG 10	AWG 6	AWG 2	AWG 1/0	AWG 4/0
<b>Recommended torque</b>	0.6-0.8 Nm	1.5-1.8 Nm	4.0-4.5 Nm	7-8 Nm	17-20 Nm

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.

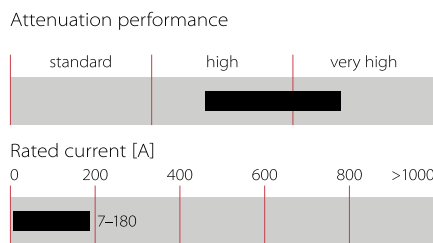
# Ultra-compact EMC/RFI Filter for Motor Drives Applications



- New: solid safety connector blocks available for the whole range
- Exceptional attenuation performance from 150 kHz to 30 MHz
- Excellent saturation resistance up to 50 m cable length
- Most compact and slim filter design in its class



### Performance indicators



### Approvals & Compliances



### Features and benefits

- The extremely compact and slim filter design allows a trouble-free installation even where the available mounting space is minimal
- With new additional filter types providing safety terminal blocks, the most preferred connection style can be chosen fast and easy. This helps to stay in line with the electrical connection concept of a given application
- FN 3258 filters ensure compliance with Class A limits according to EN 55011 up to 50 m cable length and beyond. Further they can contribute significantly to meet conducted emission limits according to Class B
- Filter operation on the mains input side of consumers increases their reliability and conducted immunity significant
- Chokes with exceptional saturation resistance and excellent thermal behavior are a vital part of FN 3258 design. Thus, all filters retain the expected filter performance even in very noisy applications and under full load conditions

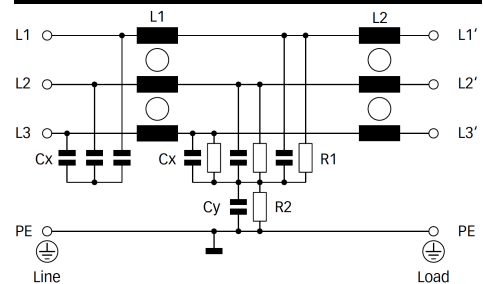
### Technical specifications

<b>Maximum continuous operating voltage</b>	3x 480/277 VAC (FN 3258) 3x 520/300 VAC (FN 3258 H)
<b>Operating frequency</b>	DC to 60 Hz
<b>Rated currents</b>	7 to 180 A @ 50°C
<b>High potential test voltage</b>	P → E 2650 / 2750 VDC for 2 sec (FN 3258 / FN 3258H) P → P 2100 / 2250 VDC for 2 sec (FN 3258 / FN 3258H)
<b>Protection category</b>	IP 20
<b>Overload capability</b>	1.5x rated current for 1 minute, once per hour 4x rated current at switch on,
<b>Temperature range (operation and storage)</b>	-25°C to +100°C (25/100/21)
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
<b>MTBF @ 50°C/400 V (Mil-HB-217F)</b>	300,000 hours




















### Typical applications

- Three-phase variable speed motor drives, servo drives, inverters and converters
- Applications comprising energy conversion devices like machines or process automation equipment
- HVAC equipment, elevators, power supplies, UPS and further three-phase applications

### Typical electrical schematic



## Filter selection table

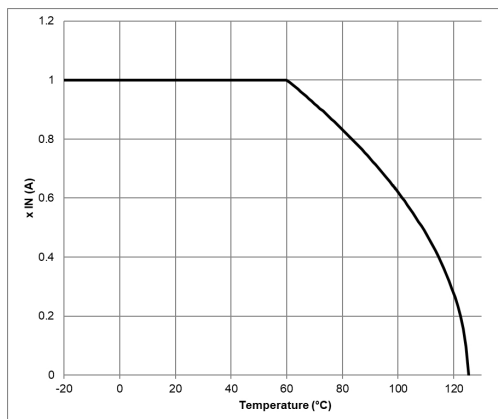
Filter	Buy	Rated current @ 50°C (40°C) [A]	Typical drive Power Rating* [kW]	Leakage current** @ 480/520 VAC/50 Hz [mA]	Power loss @ 25°C/50 Hz [W]	Input/Output Connections 	Weight [kg]
<b>FN3258-7-44</b>		7 (7.7)	4	4.3	3.8	-44	0.5
<b>FN3258-16-44</b>		16 (17.5)	7.5	4.3	6.1	-44	0.8
<b>FN3258-30-33</b>		30 (32.9)	15	4.3	11.8	-33	1.2
<b>FN3258-42-33</b>		42 (46.0)	22	4.3	15.7	-33	1.4
<b>FN3258-55-34</b>		55 (60.2)	30	4.3	25.9	-34	2.0
<b>FN3258-75-34</b>		75 (82.2)	37	4.3	32.2	-34	2.7
<b>FN3258-100-35</b>		100 (109.5)	55	4.3	34.5	-35	4.3
<b>FN3258-130-35</b>		130 (142.4)	75	4.3	43.1	-35	4.5
<b>FN3258-180-40</b>		180 (197.1)	90	4.3	58.3	-40	6.0
<b>FN3258H-7-44</b>		7 (7.7)	4	4.7	3.8	-44	0.5
<b>FN3258H-16-44</b>		16 (17.5)	7.5	4.7	6.1	-44	0.8
<b>FN3258H-30-33</b>		30 (32.9)	18.5	4.7	11.8	-33	1.2
<b>FN3258H-42-33</b>		42 (46.0)	22	4.7	15.7	-33	1.4
<b>FN3258H-55-34</b>		55 (60.2)	37	4.7	25.9	-34	2.0
<b>FN3258H-75-34</b>		75 (82.2)	45	4.7	32.2	-34	2.7
<b>FN3258H-100-35</b>		100 (109.5)	55	4.7	34.5	-35	4.3
<b>FN3258H-130-35</b>		130 (142.4)	75	4.7	43.1	-35	4.5
<b>FN3258H-180-40</b>		180 (197.1)	110	4.7	58.3	-40	6.0

\* Calculated at rated current, 440 VAC (FN3258)/480 VAC (FN3258H) and  $\cos \phi=0.8$ . The exact value depends upon the efficiency of the drive, the motor and the entire application.

\*\* Standardized calculated leakage current acc. IEC60939 under normal operating conditions (FN3258 at 480 VAC and FN3258H at 520 VAC).

### Thermal Derating

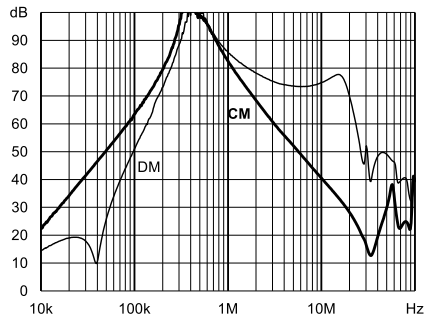
If higher ambient temperatures than the specified apply, the nominal current needs to be reduced according to the graph below.



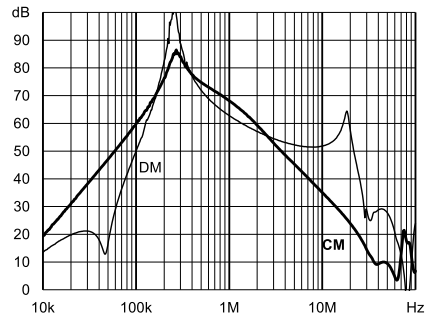
## Typical filter attenuation

Per CISPR 17; DM=50/50 sym; CM=50/50 asym

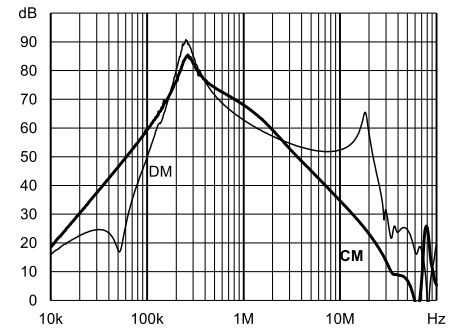
7 A type



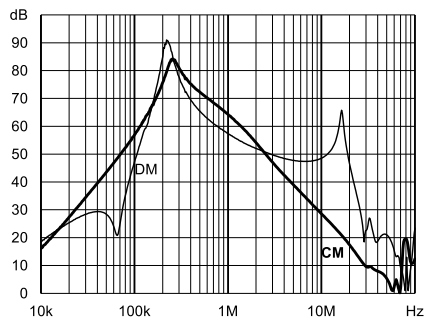
16 A type



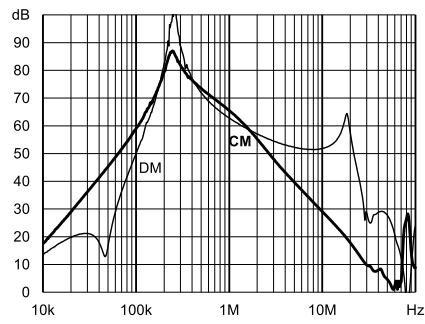
30 A type



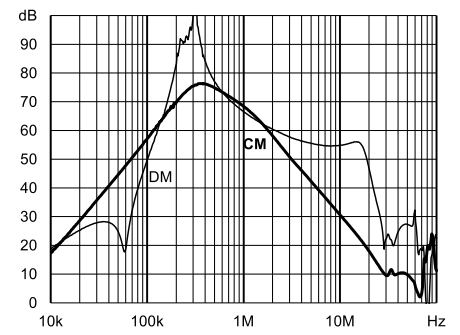
42 A type



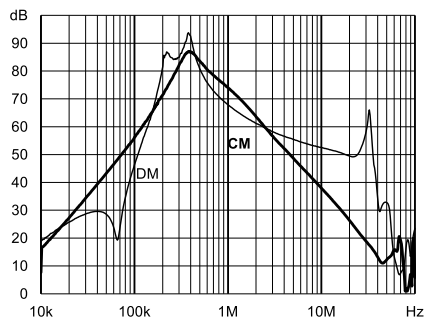
55 A type



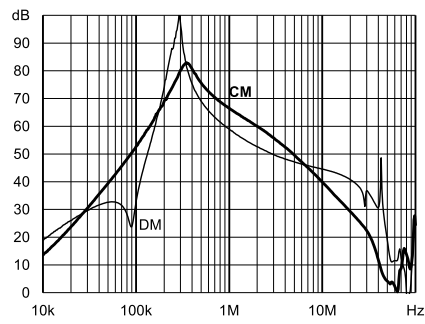
75 A type



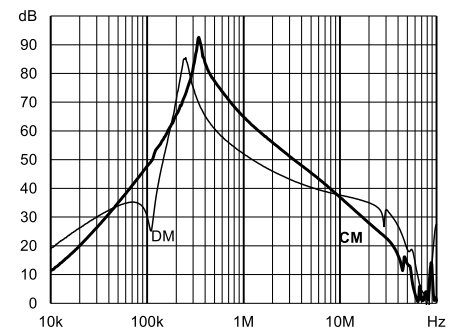
100 A type

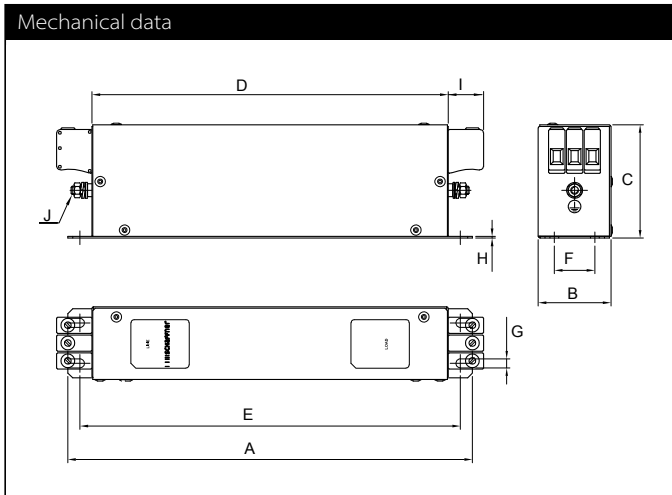


130 A type



180 A type





Note: in favour of a better readability, connectors and earth studs are not shown in the horizontal projection.

## Dimensions

	7 A	16 A	30 A	42 A	55 A	75 A	100 A	130 A	180 A
<b>A</b>	190	250	270	310	250	270	270	270	380
<b>B</b>	40	45	50	50	85	80	90	90	120
<b>C</b>	70	70	85	85	90	135	150	150	170
<b>D</b>	160	220	240	280	220	240	240	240	350
<b>E</b>	180	235	255	295	235	255	255	255	365
<b>F</b>	20	25	30	30	60	60	65	65	102
<b>G</b>	4.5	5.4	5.4	5.4	5.4	6.5	6.5	6.5	6.5
<b>H</b>	1	1	1	1	1	1.5	1.5	1.5	1.5
<b>I</b>	22	22	25	25	39	39	45	45	51
<b>J</b>	M5	M5	M5	M6	M6	M6	M10	M10	M10
<b>K</b>	20	22.5	25	25	42.5	40	45	45	60
<b>L2</b>	29.5	29.5	39.5	37.5	26.5	70.5	64	64	47

All dimensions in mm; 1 inch = 25.4 mm

Tolerances according: ISO 2768-m/EN 22768-m

## Filter input/output connector cross sections

	-33	-34	-35	-40	-44
<b>Solid wire</b>	16 mm <sup>2</sup>	35 mm <sup>2</sup>	50 mm <sup>2</sup>	95 mm <sup>2</sup>	10 mm <sup>2</sup>
<b>Flex wire</b>	10 mm <sup>2</sup>	25 mm <sup>2</sup>	50 mm <sup>2</sup>	95 mm <sup>2</sup>	6 mm <sup>2</sup>
<b>AWG type wire</b>	AWG 6	AWG 2	AWG 1/0	AWG 4/0	AWG 8
<b>Recommended torque</b>	1.5-1.8 Nm	4.0-4.5 Nm	7-8 Nm	17-20 Nm	1.0-1.2 Nm

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.

# EMC/EMI Filter for Installations with Residual Current Device (RCD)



- Full functionality with RCDs according to IEC 61008 and new VDE 0664-110\*
- Compatible with 30 mA RCDs up to 30 m motor cable for electric shock protection according to IEC 61008
- Compatible with 300 mA RCDs up to 100 m motor cable for fire protection according to IEC 60364-4-42 (VDE 0100-482)

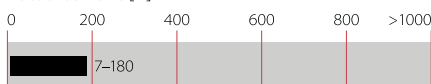


### Performance indicators

Attenuation performance



Rated current [A]



### Approvals & Compliances



### Features and benefits

- Innovative low-leakage current filter with same smallest dimensions as FN 3258
- Significant reduction of leakage and ground currents caused by long motor cables
- Prevents unwanted fault shut-downs from RCDs in machines and process automation equipment
- Patented filter design avoiding early saturation and ringing effects
- Excellent attenuation compliant with: C1 limits EN 61800-3 with 30 meter motor cable and 30 mA RCD (electric shock protection)\*\*
- C2 limits EN 61800-3 with 100 meter motor cable and 300 mA RCD (fire protection)

### Technical specifications

<b>Maximum continuous operating voltage</b>	3x 520/300 VAC
<b>Operating frequency</b>	DC to 60 Hz
<b>Rated currents</b>	7 to 180 A @ 50°C
<b>High potential test voltage</b>	P → E 2750 VDC for 2 sec P → P 2250 VDC for 2 sec
<b>Protection category</b>	IP 20
<b>Overload capability</b>	4x rated current at switch on, 1.5x rated current for 1 minute, once per hour
<b>Temperature range (operation and storage)</b>	-25°C to +100°C (25/100/21)
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
<b>MTBF @ 50°C/400 V (Mil-HB-217F)</b>	>300,000 hours

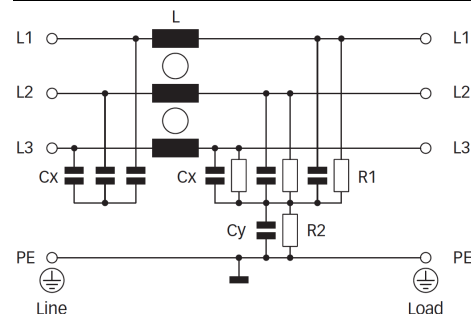
\* If supply voltage is contaminated with harmonics according to IEC 61000-2-4, class 2, where odd-numbered multiplies of three are limited to 30%.

\*\* Filter types 7 A up to 42 A: C1, 30 m, 30 mA; 55 A: C2, 30 m, 30 mA; 75 A up to 180 A: C2, 100 m, 300 mA

### Typical applications


- Three-phase variable speed drives (VSD), servo drives, and inverters
- Machinery and process automation equipment
- Building automation, HVAC equipment, pumps, ventilation, and elevators
- Conveyors, handling and storage systems, and cranes
- Machine tools, wood working machines, and printing machines

### Typical electrical schematic





## Filter selection table

Filter	Rated current @ 50°C (40°C)	Typical drive power rating*	Leakage current @ 520 VAC/50 Hz	Power loss @ 25°C/50 Hz	Input/Output connections	Weight
	[A]	[kW]	[mA]**	[W]		[kg]
FN 3268-7-44	7 (7.7)	4	2.5	4.5	-44	0.5
FN 3268-16-44	16 (17.5)	7.5	2.6	6.1	-44	0.8
FN 3268-30-33	30 (32.9)	18.5	2.6	13.5	-33	1.2
FN 3268-42-33	42 (46.0)	22	2.6	17.4	-33	1.4
FN 3268-55-34	55 (60.2)	37	2.6	18.1	-34	2.2
FN 3268-75-34	75 (82.2)	45	10.8	25.3	-34	2.9
FN 3268-100-35	100 (109.5)	55	9.6	30.0	-35	4.1
FN 3268-130-35	130 (142.4)	75	14.2	38.0	-35	4.6
FN 3268-180-40	180 (197.1)	110	17.4	48.6	-40	6.0

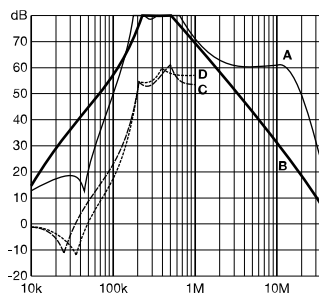
\* Calculated at rated current, 440 VAC and  $\cos \phi=0.8$ . The exact value depends upon the efficiency of the drive, the motor and the entire application.

\*\* Standardized calculated leakage current acc. IEC60939 under normal operating conditions.

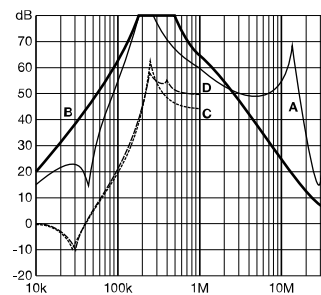
## Typical filter attenuation

Per CISPR 17; A=50  $\Omega$ /50  $\Omega$  sym; B=50  $\Omega$ /50  $\Omega$  asym; C=0.1  $\Omega$ /100  $\Omega$  sym; D=100  $\Omega$ /0.1  $\Omega$  sym

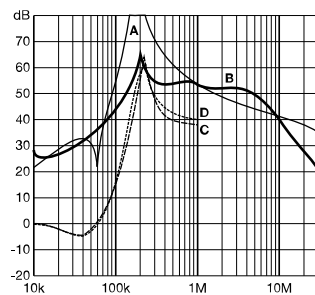
7 to 42 A types



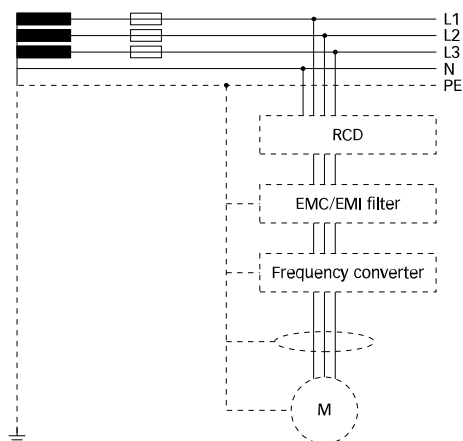
55 to 100 A types



130 and 180 A types



## Installation



Typical installation with RCD, EMC/EMI filter and motor drive system

### RCD

Please note that for electrical devices with 6-pulse rectifiers at line input, like three-phase motor drives, a RCD type B or B+ is required. RCD with time delay are needed to prevent unwanted fault trip at switch on or voltage spikes. These RCD types B with time delay have often an added letter "S" or "K"; please ask the supplier for correct type. Caution: Please validate system with chosen RCD to guarantee functionality.

### EMC/EMI filter FN 3268

Filter types from 7 to 55 A are designed to be compatible with 30 mA RCDs according to IEC 61008 and new VDE 0664-110 standards. Filters from 75 up to 180 A are designed to be compatible with 300 mA RCDs. Install the filter as close as possible at line side of the motor drive. Regarding correct EMC installation, please refer to the EMC installation guide in the manual from motor drive supplier.

### Motor drive

Please set the PWM pulse pattern of the variable speed motor drive fixed to 4 kHz. Other pulse patterns cause higher leakage currents. Filter designs with other pulse pattern than 4 kHz are possible upon request.

### Motor cable length

Motor cable length should not exceed 30 meters for 7 up to 55 A filter types to fulfill class C1 of recommended standard EN 61800-3. For 75 up to 180 A filters, cable length should not exceed 100 meters to fulfill class C2.

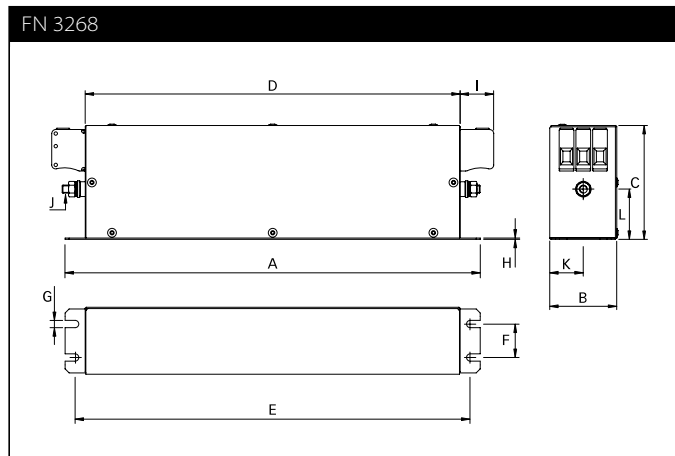
### Internal EMC/EMI components

Please disconnect all internal Y-capacitors (internal EMC/EMI filters) in the motor drive, because these capacitors cause additional leakage currents.

### Harmonics on line voltage

High voltage harmonics can create additional system leakage currents. FN 3268 filters are tested under following conditions: Supply voltage is contaminated with harmonics according to IEC 61000-2-4, class 2, where odd-numbered multiples of three are limited to 30%.

## Mechanical data



Note: in favour of a better readability, connectors and earth studs are not shown in the horizontal projection.

## Dimensions

	7 A	16 A	30 A	42 A	55 A	75 A	100 A	130 A	180 A
<b>A</b>	190	250	270	310	250	270	270	270	380
<b>B</b>	40	45	50	50	85	80	90	90	120
<b>C</b>	70	70	85	85	90	135	150	150	170
<b>D</b>	160	220	240	280	220	240	240	240	350
<b>E</b>	180	235	255	295	235	255	255	255	365
<b>F</b>	20	25	30	30	60	60	65	65	102
<b>G</b>	4.5	5.4	5.4	5.4	5.4	6.5	6.5	6.5	6.5
<b>H</b>	1	1	1	1	1	1.5	1.5	1.5	1.5
<b>I</b>	22	22	25	25	39	39	45	45	51
<b>J</b>	M5	M5	M5	M6	M6	M6	M10	M10	M10
<b>K</b>	20	22.5	25	25	42.5	40	45	45	60
<b>L</b>	29.5	29.5	39.5	37.5	26.5	70.5	64	64	47

All dimensions in mm; 1 inch = 25.4 mm  
Tolerances according: ISO 2768-m/EN 22768-m

## Filter input/output connector cross sections

	-33	-34	-35	-40	-44
<b>Solid wire</b>	16 mm <sup>2</sup>	35 mm <sup>2</sup>	50 mm <sup>2</sup>	95 mm <sup>2</sup>	10 mm <sup>2</sup>
<b>Flex wire</b>	10 mm <sup>2</sup>	25 mm <sup>2</sup>	50 mm <sup>2</sup>	95 mm <sup>2</sup>	6 mm <sup>2</sup>
<b>AWG type wire</b>	AWG 6	AWG 2	AWG 1/0	AWG 4/0	AWG 8
<b>Recommended torque</b>	1.5-1.8 Nm	4.0-4.5 Nm	7-8 Nm	17-20 Nm	1.0-1.2 Nm

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.

# Compact EMC/RFI Filter for Industrial Motor Drive Applications

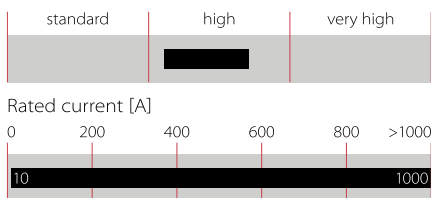


- Very compact and light weight design requiring minimum space
- Easy, time-saving installation and contacting
- Protective covers as optional accessory available
- Attenuation performance according to EN 61800-3/A11



### Performance indicators

Attenuation performance



## Technical specifications

<b>Maximum continuous operating voltage</b>	3x 520/300 VAC (480 VAC +10% possible)
<b>Operating frequency</b>	DC to 60 Hz
<b>Rated currents</b>	10 to 1000 A @ 50°C
<b>High potential test voltage</b>	P → E 2750 VDC for 2 sec P → P 2250 VDC for 2 sec
<b>Protection category</b>	IP 20 (10 to 100 A) IP 00 (150 to 1000 A)
<b>Overload capability</b>	4x rated current at switch on, 1.5x rated current for 1 minute, once per hour
<b>Temperature range (operation and storage)</b>	-25°C to +100°C (25/100/21)
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
<b>MTBF @ 50°C/400 V (Mil-HB-217F)</b>	>320,000 hours

### Approvals & Compliances



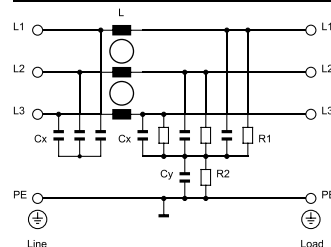
### Features and benefits

- An extremely compact and light weight filter design requiring minimum mounting space in installations and cabinets
- Simple and time-saving installation with good accessibility for automatic and hand tools
- Solid, touch-safe terminal blocks, for all filters from 10 to 100 A, offering sufficient contacting cross section according to the EN 60204-1 installation standard
- Optionally available transparent protective covers for all filters with busbars from 150 to 1000 A, to protect the installer, operator or inspector from accidental touching of live conductors. They can easily be retrofitted even if the filter is already installed and connected
- These EMC filters provide the attenuation performance needed to fulfill EN 61800-3/A11
- Guaranteed filter performance under fullload operating conditions
- 15 different filter models allow the specific choice and deployment for most industrial applications

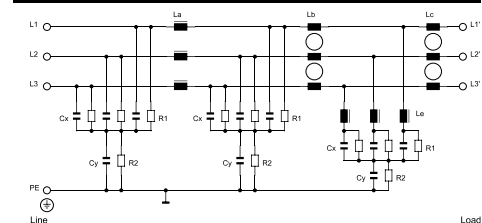
### Typical applications

- Variable speed electrical power drive systems/motor drives for mainly industrial purpose
- Various industrial applications comprising frequency inverters, motor drives and servo drives
















### Typical electrical schematic (up to 100 A)



### Typical electrical schematic (>100 A), for FN3271 refer to page 2



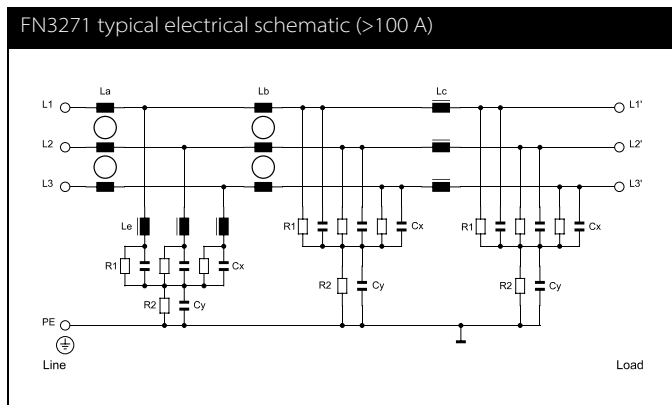
### Filter selection table

Filter	Buy	Rated current @ 50°C (40°C)	Typical drive power rating*	Leakage current @ 520 VAC/50 Hz	Power loss @ 25°C/50 Hz	Input/Output connections		Weight [kg]	Protective covers***	
						[A]	[kW]		[mA]**	[W]
FN3270H-10-44		10 (11)	5.5	3.1	2.4	-44		0.4		
FN3270H-20-44		20 (22)	11	3.1	4.1	-44		0.5		
FN3270H-35-33		35 (38)	22	3.4	6.8	-33		0.7		
FN3270H-50-34		50 (55)	30	3.4	12.8	-34		1.2		
FN3270H-65-34		65 (71)	37	3.4	13.5	-34		1.3		
FN3270H-80-35		80 (88)	45	3.4	13.5	-35		2.2		
FN3270H-100-35		100 (110)	55	3.4	17.1	-35		2.6		
FN3270H-150-99		150 (164)	75	6.9	7.5	-99		6.1		801916
FN3270H-200-99		200 (219)	110	6.9	13.2	-99		6.1		801916
FN3270H-250-99		250 (274)	132	6.9	20.6	-99		6.1		801916
FN3270H-320-99		320 (350)	160	6.9	12.2	-99		7.2		801916
FN3270H-400-99		400 (438)	220	6.9	19.2	-99		7.2		801916
FN3270H-600-99		600 (657)	315	6.9	35.6	-99		7.7		801916
FN3270H-800-99		800 (876)	400	6.9	51.8	-99		15.8		806275
FN3270H-1000-99		1000 (1095)	560	6.9	81.0	-99		15.8		806275
FN3271H-150-99		150 (164)	75	6.9	7.5	-99		6.1		801916
FN3271H-200-99		200 (219)	110	6.9	13.2	-99		6.1		801916
FN3271H-250-99		250 (274)	132	6.9	20.6	-99		6.1		801916
FN3271H-320-99		320 (350)	160	6.9	12.2	-99		7.2		801916
FN3271H-400-99		400 (438)	220	6.9	19.2	-99		7.2		801916
FN3271H-600-99		600 (657)	315	6.9	35.6	-99		7.7		801916
FN3271H-800-99		800 (876)	400	6.9	51.8	-99		15.8		806275
FN3271H-1000-99		1000 (1095)	560	6.9	81.0	-99		15.8		806275

\* Calculated at rated current, 480 VAC and cos phi=0.8. The exact value depends upon the efficiency of the drive, the motor and the entire application.

\*\* Standardized calculated leakage current acc. IEC60939 under normal operating conditions.

\*\*\* Please contact your local Schaffner partner to order the optional protective covers with the order code in the table above.



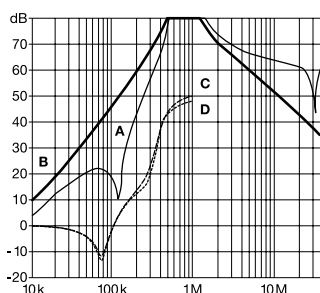
### FN3271H description

- FN3271H can be used for applications where a differential mode choke is needed on the load side.
- In general FN3271H is a mirrored version of the high current FN3270H (>100A).
- PE is not mirrored and is still available on line side, due to safety measures.
- In 50/50 Ohm measurement for insertion loss no difference can be detected.

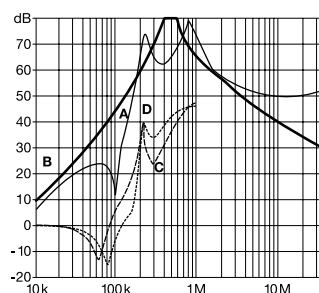
### Typical filter attenuation

Per CISPR 17; A=50 Ω/50 Ω sym; B=50 Ω/50 Ω asym; C=0.1 Ω/100 Ω sym; D=100 Ω/0.1 Ω sym

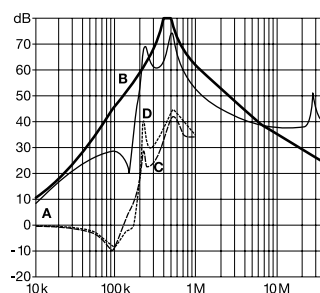
10 and 20 A types



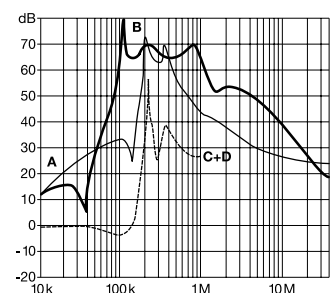
35 to 65 A types



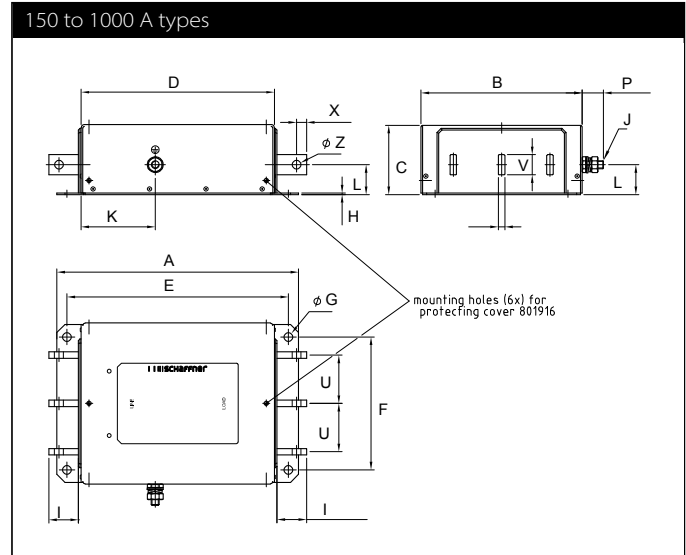
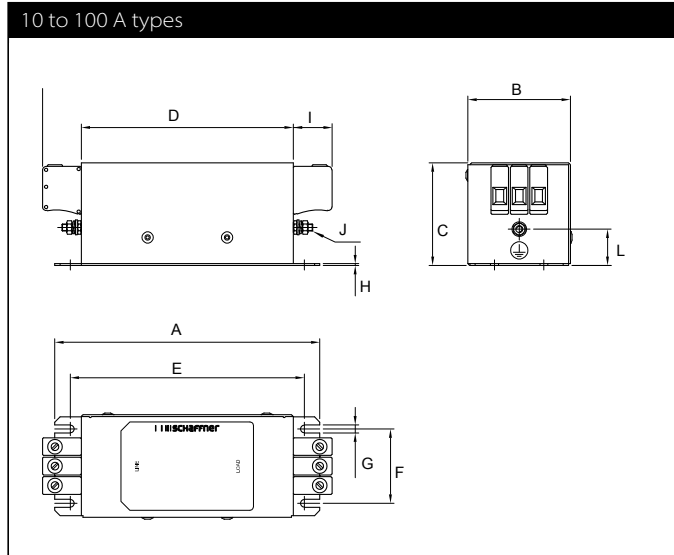
80 and 100 A types



150 to 1000 A types



## Mechanical data



## Dimensions

	10 A	20 A	35 A	50 A	65 A	80 A	100 A	150 A	200 A	250 A	320 A	400 A	600 A	800 A	1000 A
<b>A</b>	150	150	160	170	170	200	230	300	300	300	300	300	300	370	370
<b>B</b>	58	58	70	85	85	95	95	200	200	200	200	200	200	190	190
<b>C</b>	58	58	68	80	80	90	90	86	86	86	86	86	86	125	125
<b>D</b>	120	120	130	140	140	170	200	240	240	240	240	240	240	310	310
<b>E</b>	132.5	132.5	142.5	152.5	152.5	182.5	212.5	275	275	275	275	275	275	345	345
<b>F</b>	42	42	50	65	65	75	75	165	165	165	165	165	165	155	155
<b>G</b>	4.5	4.5	5.5	5.5	5.5	5.5	5.5	Ø11	Ø11	Ø11	Ø11	Ø11	Ø11	Ø11	Ø11
<b>H</b>	1	1	1	1	1	1.5	1.5	2	2	2	2	2	2	3	3
<b>I</b>	22	22	25	39	39	45	45	40	40	40	40	40	40	50	50
<b>J</b>	M4	M4	M5	M6	M6	M8	M8	M10	M10	M10	M10	M10	M10	M10	M12
<b>K</b>								92	92	92	92	92	92	138	138
<b>L</b>	20.5	20.5	20	15	15	16	16	37	37	37	37	37	37	67	67
<b>M</b>								380	380	380	380	380	380	610	610
<b>N</b>								211	211	211	211	211	211	201	201
<b>O</b>								93	93	93	93	93	93	132	132
<b>P</b>								26.5	26.5	26.5	26.5	26.5	26.5	29	29
<b>U</b>								60	60	60	60	60	60	60	60
<b>V</b>								20	20	20	25	25	25	40	40
<b>W</b>								3	3	3	6	6	8	8	8
<b>X</b>								10	10	10	12.5	12.5	12.5	20	20
<b>Y</b>								37	37	37	37	37	37	47	47
<b>Z</b>								Ø9	Ø9	Ø9	Ø11	Ø11	Ø11	Ø13.5	Ø13.5

All dimensions in mm; 1 inch = 25.4 mm  
Tolerances according to ISO 2768-m/EN 22768-m

## Filter input/output connector cross sections

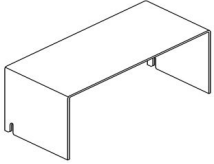
	-33	-34	-35	-44
<b>Solid wire</b>	16 mm <sup>2</sup>	35 mm <sup>2</sup>	50 mm <sup>2</sup>	10 mm <sup>2</sup>
<b>Flex wire</b>	10 mm <sup>2</sup>	25 mm <sup>2</sup>	50 mm <sup>2</sup>	6 mm <sup>2</sup>
<b>AWG type wire</b>	AWG 6	AWG 2	AWG 1/0	AWG 8
<b>Recommended torque</b>	1.5-1.8 Nm	4.0-4.5 Nm	7-8 Nm	1.0-1.2 Nm

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.

## Accessories

### Protective Cover for Busbar Filters

#### Construction schematic



#### Installation example



#### Applicable Busbar Filters

FN3359

FN3270



Transparent protective covers for FN3359 and FN3270 with busbars from 150 to 1000 A

Protection for the operator or inspector from accidental touching of live conductors.

Easily to be added after the filter has been installed and connected.

[Datasheet PDF >](#)

### Surge Protection Devices



SPD with a fail safe function to prevent short-circuit (separation of circuit and element is visually confirmable)

Compliance with IEC 61643-1 that meets the new JIS standards

Against indirect lightning surge for single phase / three phase power supplies Quick response for surge

Impulse current capacity 8/20 $\mu$ s-5,000A

Impulse test category: Class II (Type II)

Every pathway consists of same elements. Between line and line/between lines and ground can protect as the same level.

[Datasheet PDF >](#)

# High-end Line Filter for Machinery/Equipment

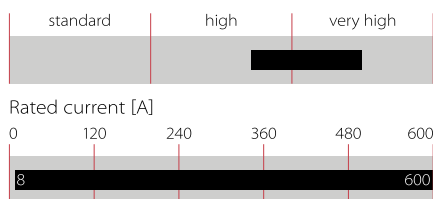


- Now available up to 600 A
- Compact, space-saving design, optimized for industrial machinery
- Combines exceptional attenuation with low leakage current
- Suitable for machines in mixed/domestic environments (Class A/B)
- Increases also the immunity if operated directly on the mains input



### Performance indicators

Attenuation performance



## Technical specifications

<b>Maximum continuous operating voltage</b>	3x 520/300 VAC (480 VAC + 10% possible)
<b>Operating frequency</b>	DC to 60 Hz
<b>Rated currents</b>	8 to 600 A @ 50°C
<b>High potential test voltage</b>	P/N → E 2750 VDC for 2 sec P → P 2250 VDC for 2 sec P → N 1300 VDC for 2 sec
<b>Protection category</b>	IP 20 (8 to 200 A types) IP 00 (300 to 600 A types)
<b>Overload capability</b>	4x rated current at switch on, 1.5x rated current for 1 minute, once per hour
<b>Temperature range (operation and storage)</b>	-25°C to +100°C (25/100/21)
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
<b>MTBF @ 50°C/400 V (Mil-HB-217F)</b>	>360,000 hours

### Approvals & Compliances



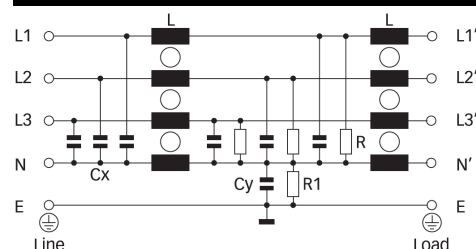
### Features and benefits

- A compact and light weight filter design with a „cubic“ shape, requiring minimum mounting space and thus taking the constructional conditions on the mains input of machinery into account
- Simple and time-saving installation with good accessibility for automatic and hand tools
- Solid, touch-safe terminal blocks (8 to 200 A types) offering sufficient contacting cross section according to the EN 60204-1 installation standard, which is very common in industrial applications
- As a mains input filter for three phases and neutral line, FN 3280 provides enough performance to ensure EMC compliance of machinery in mixed (Class A) or even domestic (Class B) environments. Further, its use will also increase the immunity of the entire installation significantly
- FN 3280 provides the attenuation performance needed to meet the requirements of various machine tools with up to 12 driving axes and ~10 to 20 m of motor cable each
- For easy selection and application, the filter current ratings are aligned with common fuse values
- R69 option for easy compliance to IEC 60204-1 (DIN VDE 0113): Suitable for complex machines, where the overall insulation resistance needs to be higher than 1 MOhm.

### Typical applications

Mainly industrial equipment, machinery, machine tools and diverse process automation systems with three-phase and neutral electricity supply. Due to the outstanding attenuation performance, FN 3280 is also the first choice for noisy power supplies, renewable energy applications, highpower office equipment and further three-phase and neutral devices. Because of the relatively low leakage current, FN 3280 may even be used for some medical devices.

### Typical electrical schematic



### Filter selection table

Filter	Buy	Rated current	Leakage current*	Power loss	Resistance**	Resistance**	Input/Output connections		Weight
		@ 50°C (40°C)	@ 520 VAC/50 Hz	@ 25°C/50 Hz	R	R1			
		[A]	[mA]	[W]	[kOhm]	[kOhm]			[kg]
FN3280H-8-29		8 (8.8)	10.7	2.7	1500	660	-29		0.8
FN3280H-16-29		16 (17.5)	10.7	6.0	1500	660	-29		0.8
FN3280H-25-33		25 (27)	10.7	11.6	820	660	-33		1.3
FN3280H-36-33		36 (39)	10.7	14.8	820	660	-33		1.6
FN3280H-64-34		64 (70)	10.7	18.4	820	660	-34		2.7
FN3280H-80-35		80 (88)	10.7	18.9	1000	660	-35		4.1
FN3280H-120-35		120 (131)	10.7	28.5	1000	660	-35		5.9
FN3280H-160-40		160 (175)	10.7	30.7	1000	660	-40		7.9
FN3280H-200-40		200 (219)	10.7	46.8	1000	660	-40		8.5
FN3280H-300-99		300 (328)	42.1	20.3	1000	680		-99	10.0
FN3280H-400-99		400 (438)	42.1	36.0	1000	680		-99	10.0
FN3280H-600-99		600 (657)	42.1	64.8	1000	680		-99	11.0
FN3280H-8-29-R69		8 (8.8)	10.7	2.7	1500	10000	-29		0.8
FN3280H-16-29-R69		16 (17.5)	10.7	6.0	1500	10000	-29		0.8
FN3280H-25-33-R69		25 (27)	10.7	11.6	1500	10000	-33		1.3
FN3280H-36-33-R69		36 (39)	10.7	14.8	1500	10000	-33		1.6
FN3280H-64-34-R69		64 (70)	10.7	18.4	1500	10000	-34		2.7
FN3280H-80-35-R69		80 (88)	10.7	18.9	1500	10000	-35		4.1
FN3280H-120-35-R69		120 (131)	10.7	28.5	1500	10000	-35		5.9
FN3280H-160-40-R69		160 (175)	10.7	30.7	1500	10000	-40		7.9
FN3280H-200-40-R69		200 (219)	10.7	46.8	1500	10000	-40		8.5
FN3280H-300-99-R69		300 (328)	42.1	20.3	1500	10000		-99	10.0
FN3280H-400-99-R69		400 (438)	42.1	36.0	1500	10000		-99	10.0
FN3280H-600-99-R69		600 (657)	42.1	64.8	1500	10000		-99	11.0

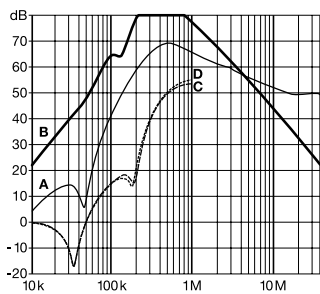
\* Standardized calculated leakage current acc. IEC60939 under normal operating conditions.

\*\* Tolerances apply: Inductance: -30/+50%, Capacitance: ±20%, Resistance: ±10%

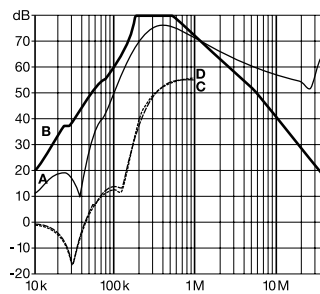
### Typical filter attenuation

Per CISPR 17; A=50 Ω/50 Ω sym; B=50 Ω/50 Ω asym; C=0.1 Ω/100 Ω sym; D=100 Ω/0.1 Ω sym

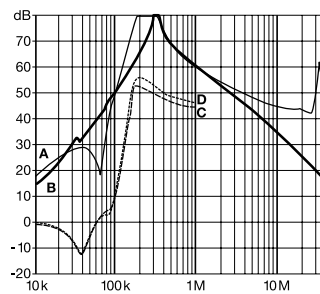
8 and 16 A types



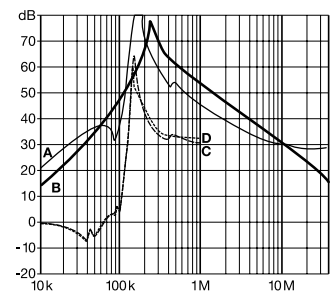
25 and 36 A types



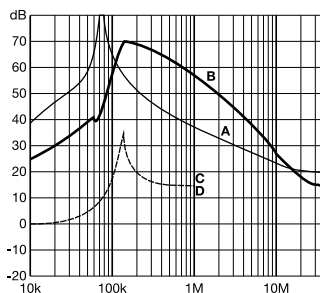
64 to 120 A types



160 and 200 A types



300 to 600 A types

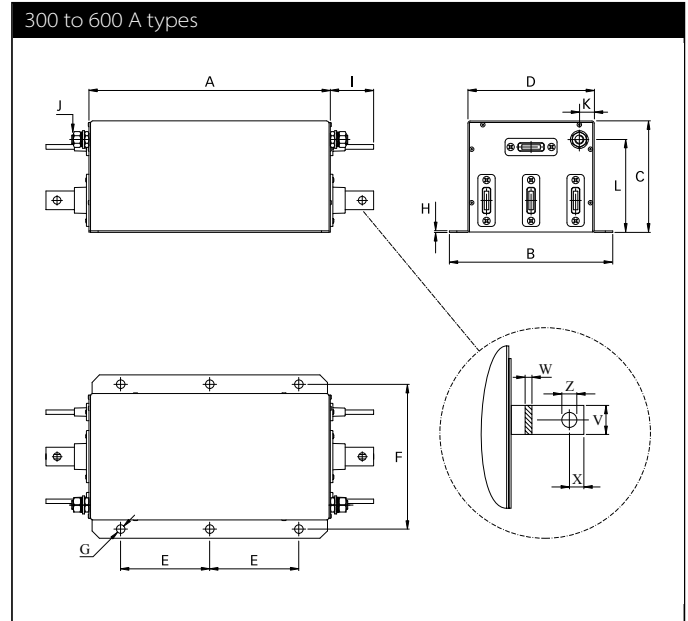
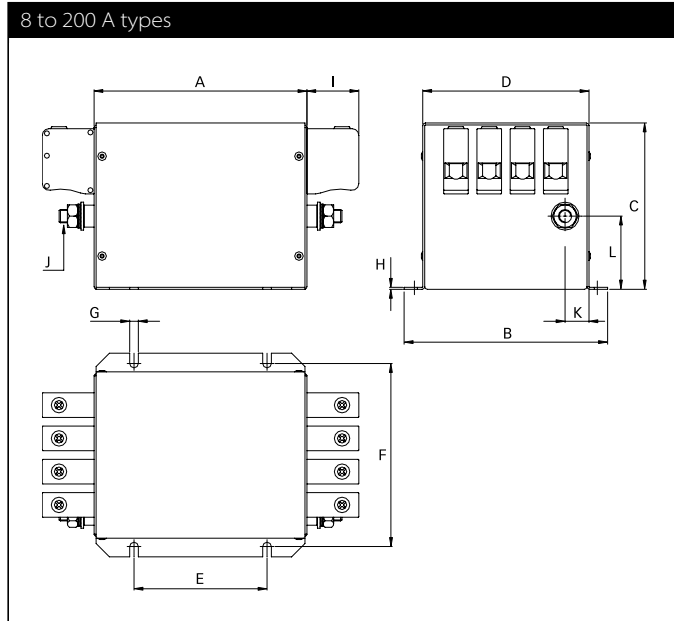


[Check distribution inventory](#)





## Mechanical data



## Dimensions

	8 A	16 A	25 A	36 A	64 A	80 A	120 A	160 A	200 A	300 A	400 A	600 A
<b>A</b>	120	120	130	130	160	230	250	280	280	325	325	325
<b>B</b>	143	143	153	153	153	163	170	170	170	220	220	220
<b>C</b>	80	80	115	115	125	125	140	170	170	150	150	150
<b>D</b>	115	115	125	125	125	135	140	140	140	170	170	170
<b>E</b>	80	80	90	90	100	120	200	230	230	120	120	120
<b>F</b>	127.5	127.5	137.5	137.5	137.5	147.5	153.5	153.5	153.5	195	195	195
<b>G</b>	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	12	12	12
<b>H</b>	1	1	1	1	1.5	1.5	1.5	1.5	1.5	2	2	2
<b>I</b>	10.9	10.9	25	25	39	45	45	51	51	58	58	58
<b>J</b>	M6	M6	M6	M6	M10	M10	M10	M10	M10	M12	M12	M12
<b>K</b>	12	12	12	12	18	18	17.5	17.5	17.5	20	20	20
<b>L</b>	33	33	50	50	55	45	55	55	55	125	125	125
<b>V</b>										25	25	25
<b>W</b>										6	6	8
<b>X</b>										15	15	15
<b>Z</b>										Ø10.5	Ø10.5	Ø10.5

All dimensions in mm; 1 inch = 25.4 mm  
Tolerances according to: ISO 2768-m/EN 22768-m

## Filter input/output connector cross sections

	-29	-33	-34	-35	-40
<b>Solid wire</b>	6 mm <sup>2</sup>	16 mm <sup>2</sup>	35 mm <sup>2</sup>	50 mm <sup>2</sup>	95 mm <sup>2</sup>
<b>Flex wire</b>	4 mm <sup>2</sup>	10 mm <sup>2</sup>	25 mm <sup>2</sup>	50 mm <sup>2</sup>	95 mm <sup>2</sup>
<b>AWG type wire</b>	AWG 10	AWG 6	AWG 2	AWG 1/0	AWG 4/0
<b>Recommended torque</b>	0.6-0.8 Nm	1.5-1.8 Nm	4.0-4.5 Nm	7-8 Nm	17-20 Nm

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.

# Smallest book-style EMC/RFI Filter for Inverter and Power Drive Systems

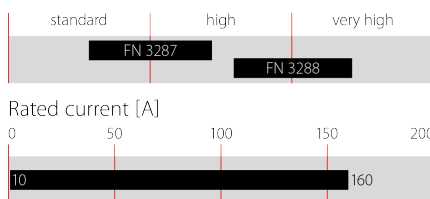


- Standard and high performance EMC solution
- Footprint space-saving book-style housing
- Solid safety connector blocks
- Standard attenuation performance FN3287
- High attenuation performance FN3288
- HV versions for 690 VAC applications
- HVIT- and IT versions for IT distribution networks
- Versions with low leakage current



### Performance indicators

Attenuation performance



### Approvals & Compliances



600 VAC

### Features and benefits

- FN 3287 and FN 3288 series of filters provides state-of-the-art EMI attenuation based on an innovative filter topology. They help to ensure compliance with Class C2 or even C1 limits.
- The slim book-style shape allows a convenient and space-saving installation next to inverters, converters or motor drives.
- The compact FN3287 and FN3288 filter from 10 to 160A are designed for the most diverse applications worldwide, including machinery and machine tools.
- FN 3288 HV filters up to 160 A are applicable for 690 VAC distribution networks.
- FN 3288IT and FN 3288HVIT filters up to 160 A meet the special requirements for IT distribution networks.
- Low leakage current filter versions help to fulfill tough requirements (e.g. 0.1 mA) in respect of leakage current limitation.

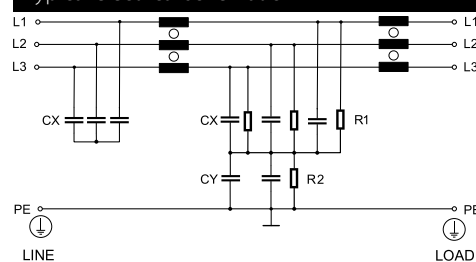
### Technical specifications

<b>Maximum continuous operating voltage</b>	3x 530/305 VAC (FN 3287, FN 3288) 3x 530 VAC (FN 3288 IT) 3x 760/440 VAC (FN 3288 HV) 3x 760 VAC (FN 3288 HVIT)
<b>Rated currents</b>	10 to 160 A @50°C
<b>Operating frequency</b>	DC to 60 Hz
<b>High potential test voltage</b>	P -> E 2260 VDC for 2 s (FN 3287, FN 3288) P -> E 2900 VDC for 2 s (FN 3288 IT) P -> P 2280 VDC for 2 s (FN 3287, FN 3288, FN 3288 IT) P -> E 2650 VDC for 2 s (FN 3288 HV) P -> E 3530 VDC for 2 s (FN 3288 HMIT) P -> P 3270 VDC for 2 s (FN 3288 HV)
<b>Pollution degree</b>	3 acc. IEC 60664-1
<b>Overload capability</b>	6x rated current for 1 sec, once per hour 1.5x rated current for 1 minute, once per hour
<b>Temperature range (operation and storage)</b>	-40°C to +100°C (with current derating >50°C)
<b>Climatic class</b>	40/100/21 acc. to IEC 60068-1
<b>Protection category</b>	IP 20 acc. to IEC 60529
<b>Vibration and shock</b>	3M4 (operation); 2M2 (transport) acc. to IEC 60721-3-3; IEC 60721-3-2
<b>Flammability according to</b>	UL 94 V-0
<b>Compliance with insulation requirement</b>	> 1MΩ acc. to IEC 60204-1
<b>Design corresponding to</b>	UL 60939-3, IEC 60939-3
<b>MTBF</b>	> 200,000 hours
<b>Overvoltage category</b>	III acc. IEC 60664-1

### Typical applications

- Three-phase variable speed drives and power drive systems (PDS)
- Machine tool and machinery equipment
- IT power distribution networks (FN 3288IT and FN 3288 HVIT)
- General energy conversion devices (inverters, converters)
- Process automation equipment
- Three-phase power supplies
- Low-leakage current requirements

### Typical electrical schematic



Note: IT and HVIT versions without discharge resistor to ground.

## Filter selection table

Filter	Buy	Rated current @ 50°C (40°C) [A]	Typical drive Power rating** [kW]	Leakage current*** @ 530 VAC/50 Hz [mA]							Power loss @ 25°C [W]	Terminal Type	Weight [kg]	Frame	
				C35	C34	C33	C28	C27	C26	C21					C17
<b>Capacitor option *C..</b>															
<b>Standard performance:</b>															
FN3287-10-44-C..-R65		10 (11)	6				3.7		2.2	0.4		7.5	-44	0.7	Q
FN3287-16-44-C..-R65		16 (17)	9			4.3			2.4	0.4		9.5	-44	0.8	R
FN3287-20-33-C..-R65		20 (22)	12			4.9			2.5	0.4		10.0	-33	0.9	S
FN3287-25-33-C..-R65		25 (27)	15			4.9			2.5	0.4		11.4	-33	1.0	S
FN3287-40-33-C..-R65		40 (44)	24			4.9			2.5	0.4		22.6	-33	1.5	T
FN3287-50-53-C..-R65		50 (55)	29			4.9			2.5	0.4		25.5	-53	2.1	U
FN3287-63-53-C..-R65		63 (69)	38			4.9			2.5	0.4		32.1	-53	2.2	U
FN3287-80-34-C..-R65		80 (88)	47			5.6			2.7	0.4		32.6	-34	3.4	F
FN3287-100-35-C..-R65		100 (110)	59			5.6			2.7	0.4		33.0	-35	4.2	G
FN3287-125-35-C..-R65		125 (137)	74			5.6			2.7	0.4		37.5	-35	4.6	G
FN3287-160-40-C..-R65		160 (175)	94			5.6			2.7	0.4		38.4	-40	6.0	H
<b>High performance:</b>															
FN3288-10-44-C..-R65		10 (11)	6		5.9				2.5	0.4	0.1	7.1	-44	0.8	A
FN3288-16-44-C..-R65		16 (17)	9	6.0					2.5	0.4	0.1	10.5	-44	1.0	B
FN3288-20-33-C..-R65		20 (22)	12	6.0					2.5	0.4	0.1	10.7	-33	1.2	C
FN3288-25-33-C..-R65		25 (27)	15	6.0					2.5	0.4	0.1	17.8	-33	1.2	C
FN3288-40-33-C..-R65		40 (44)	24	6.0			3.5			0.4	0.1	21.6	-33	1.8	D
FN3288-50-53-C..-R65		50 (55)	29	6.6					2.6	0.4	0.1	29.3	-53	2.5	E
FN3288-63-53-C..-R65		63 (69)	38	6.6					2.6	0.4	0.1	34.5	-53	2.7	E
FN3288-80-34-C..-R65		80 (88)	47	7.1					2.7	0.4	0.1	28.8	-34	4.3	F
FN3288-100-35-C..-R65		100 (110)	59	7.1					2.7	0.4	0.1	36.0	-35	5.1	G
FN3288-125-35-C..-R65		125 (137)	74	7.1					2.7	0.4	0.1	42.2	-35	5.0	G
FN3288-160-40-C..-R65		160 (175)	94	7.1					2.7	0.4	0.1	46.1	-40	6.6	H
<b>HP for IT power networks****:</b>															
FN3288IT-10-44-C..-R60		10 (11)	11		5.9							6.2	-44	1.1	I
FN3288IT-16-44-C..-R60		16 (17)	17		5.9							9.7	-44	1.3	J
FN3288IT-20-33-C..-R60		20 (22)	22		5.9							13.2	-33	1.6	K
FN3288IT-25-33-C..-R60		25 (27)	27		5.9							15.6	-33	1.6	K
FN3288IT-40-33-C..-R60		40 (44)	45		5.9							18.7	-33	2.8	L
FN3288IT-50-53-C..-R60		50 (55)	56		6.5							24.0	-53	2.8	M
FN3288IT-63-53-C..-R60		63 (69)	70		6.5							29.8	-53	2.9	M
FN3288IT-80-34-C..-R60		80 (88)	89		7.0							28.8	-34	4.6	N
FN3288IT-100-35-C..-R60		100 (110)	112		7.0							33.0	-35	5.4	O
FN3288IT-125-35-C..-R60		125 (137)	139		7.0							42.2	-35	5.3	O
FN3288IT-160-40-C..-R60		160 (175)	178		7.0							46.1	-40	6.9	P

\* Replace C.. with corresponding listed C35, C34, C33, C28, C27, C26, C21 or C17.

\*\* Typical power rating at 400 VAC for FN3287 and FN3288 with  $\cos \phi = 0.85$ . The exact value depends upon the efficiency of the drive, the motor and the entire application.

\*\*\* Standardized calculated leakage current acc. IEC 60939 under normal operating conditions (FN3287, FN3288 and FN3288 IT at 530 VAC).

\*\*\*\* These filters may be operated in IT system as long as the operation conditions and possible short circuit/fault (earth connection of one conductor) occurs between the supply (line side) and the filter. The filters are not designed for short circuit/faults occurring between converter and motor.

## Filter selection table

Filter	Buy	Rated current @ 50°C (40°C) [A]	Typical drive Power rating** [kW]	Leakage current*** @ 760 VAC/50 Hz [mA]								Power loss @ 25°C [W]	Input/output Connections	Weight [kg]	Frame
				C44	C43	C42	C36	C34	C26	C25	C24				
<b>Capacitor option * C..</b>															
<b>High voltage versions:</b>															
FN3288HV-10-44-C..-R65	🛒	10 (11)	10					8.4			1.8	7.0	-44	1.2	I
FN3288HV-16-44-C..-R65	🛒	16 (17)	13					8.4		2.5		10.8	-44	1.5	J
FN3288HV-20-33-C..-R65	🛒	20 (22)	17			10.9				2.5		12.6	-33	1.8	K
FN3288HV-25-33-C..-R65	🛒	25 (27)	21			10.9				2.5		14.6	-33	1.9	K
FN3288HV-40-33-C..-R65	🛒	40 (44)	35			12.4				2.6		19.2	-33	2.9	L
FN3288HV-50-53-C..-R65	🛒	50 (55)	43			12.4				2.6		26.3	-53	3.3	M
FN3288HV-63-53-C..-R65	🛒	63 (69)	55			12.4				2.6		33.3	-53	3.5	M
FN3288HV-80-34-C..-R65	🛒	80 (88)	70			12.4				2.6		28.8	-34	4.9	N
FN3288HV-100-35-C..-R65	🛒	100 (110)	100			12.4				2.6		33.0	-35	5.8	O
FN3288HV-125-35-C..-R65	🛒	125 (137)	110			12.4				2.6		42.0	-35	5.9	O
FN3288HV-160-40-C..-R65	🛒	160 (175)	140			12.4				2.6		46.1	-40	7.2	P
<b>HV for IT power networks****:</b>															
FN3288HVIT-10-44-C..-R60	🛒	10 (11)	10		4.6			3.6				7.0	-44	1.2	I
FN3288HVIT-16-44-C..-R60	🛒	16 (17)	13	6.8				3.7				10.8	-44	1.5	J
FN3288HVIT-20-33-C..-R60	🛒	20 (22)	17	6.8				3.7				12.6	-33	1.8	K
FN3288HVIT-25-33-C..-R60	🛒	25 (27)	21	6.8				3.7				14.6	-33	1.9	K
FN3288HVIT-40-33-C..-R60	🛒	40 (44)	35	6.8				3.7				19.2	-33	2.9	L
FN3288HVIT-50-53-C..-R60	🛒	50 (55)	43	6.8				3.7				26.3	-53	3.3	M
FN3288HVIT-63-53-C..-R60	🛒	63 (69)	55	6.8				3.7				33.3	-53	3.5	M
FN3288HVIT-80-34-C..-R60	🛒	80 (88)	70	6.8				3.7				28.8	-34	4.9	N
FN3288HVIT-100-35-C..-R60	🛒	100 (110)	100	6.8				3.7				33.0	-35	5.8	O
FN3288HVIT-125-35-C..-R60	🛒	125 (137)	110	5.9				3.7				42.2	-35	5.9	O
FN3288HVIT-160-40-C..-R60	🛒	160 (175)	140	6.8				3.7				46.1	-40	7.2	P

\* Replace C.. with corresponding listed C44, C43, C42, C36, C34, C26, C25 or C24.

\*\* Typical power rating (400 VAC for FN3287 and FN3288 / 690 VAC for FN3288 HV and FN3288 HVIT) with  $\cos\phi=0.85$ . The exact value depends upon the efficiency of the drive, the motor and the entire application.

\*\*\* Standardized calculated leakage current acc. IEC 60939 under normal operating conditions (FN3288 HV and FN3288 HVIT at 760 VAC).

\*\*\*\* These filters may be operated in IT system as long as the operation conditions and possible short circuit/fault (earth connection of one conductor) occurs between the supply (line side) and the filter. The filters are not designed for short circuit/faults occurring between converter and motor.

## Distribution inventory

Up-to-date inventory levels for global distributors is available at

<https://products.schaffner.com/stock>

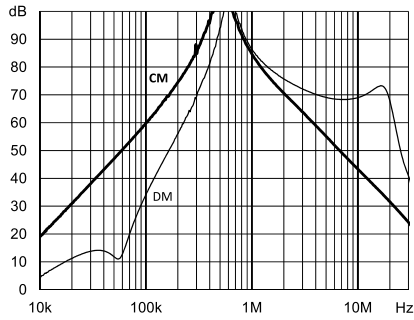


### Typical filter attenuation – FN 3287 standard performance

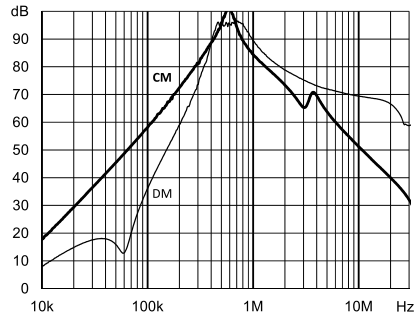
(FN 3287 standard performance version with standard leakage current)

Per CISPR 17: symmetrical 50 Ω/50 Ω -> Differential Mode (DM); asymmetrical 50 Ω/50 Ω -> Common Mode (CM)

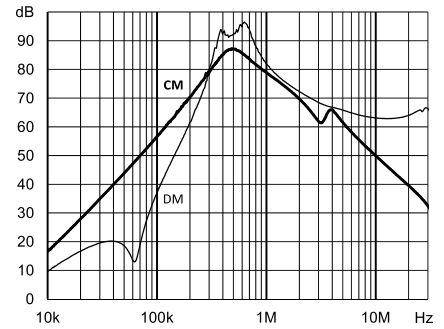
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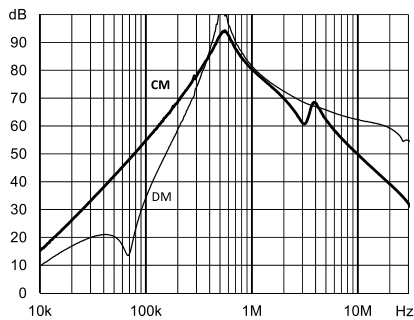
FN 3287-16-44-C33-R65



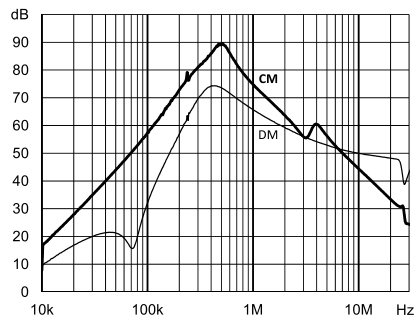
FN 3287-20-33-C33-R65



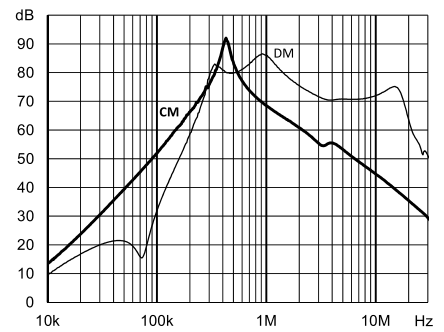
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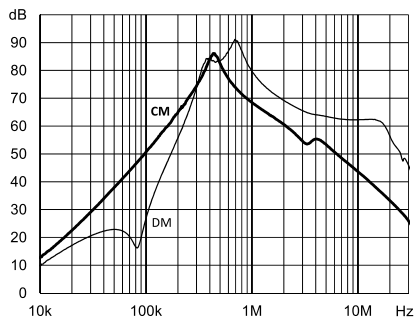
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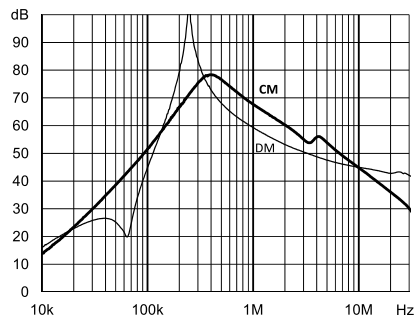
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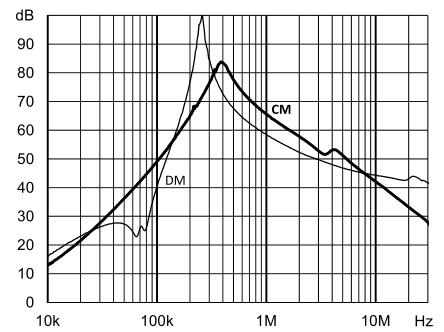
FN 3287-63-53-C33-R65



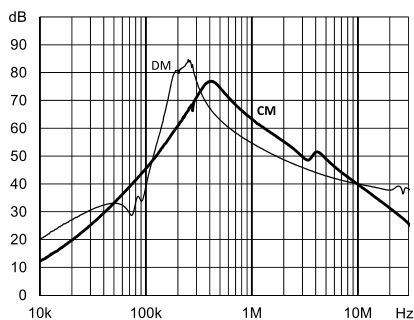
FN 3287-80-34-C33-R65



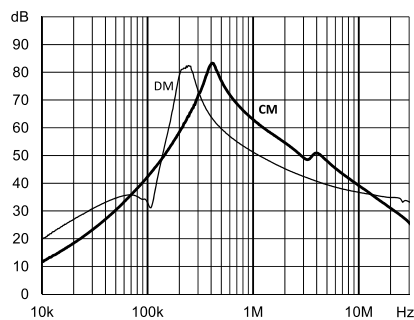
FN 3287-100-35-C33-R65



FN 3287-125-35-C33-R65



FN 3287-160-40-C33-R65

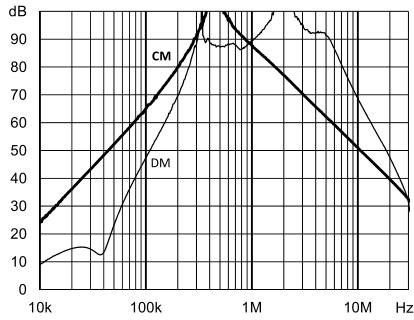


### Typical filter attenuation – FN 3288 high performance

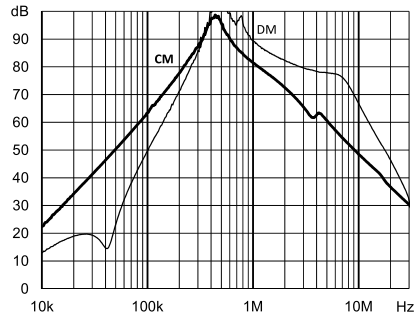
(FN 3288 high performance version with standard leakage current)

Per CISPR 17: symmetrical 50 Ω/50 Ω -> Differential Mode (DM); asymmetrical 50 Ω/50 Ω -> Common Mode (CM)

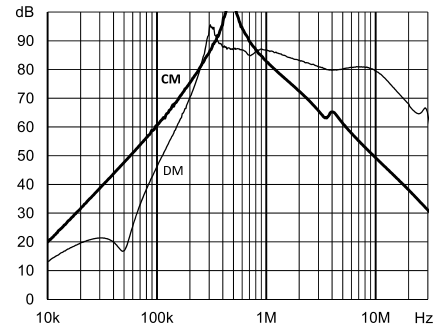
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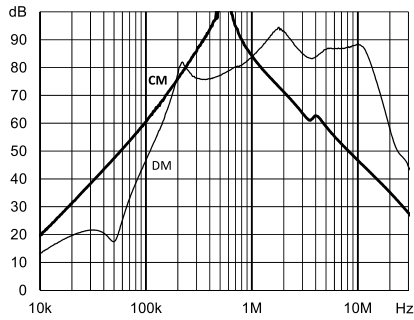
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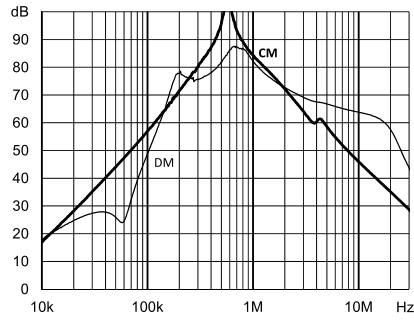
FN 3288-20-33-C35-R65



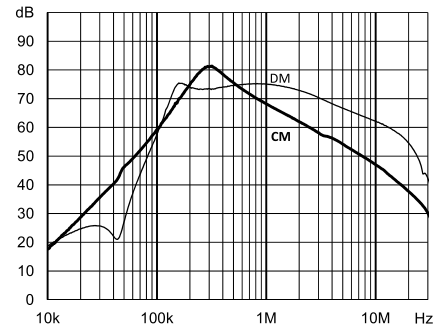
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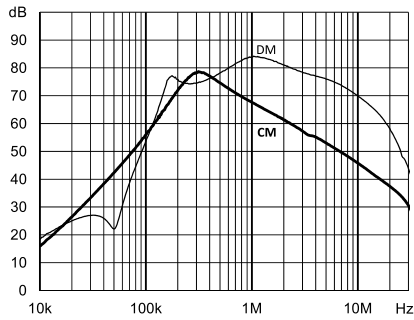
FN 3288-40-33-C35-R65



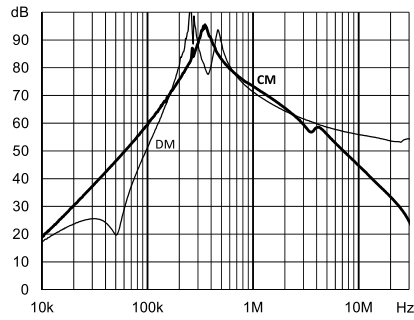
FN 3288-50-53-C35-R65



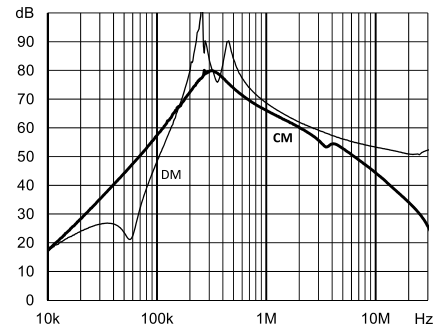
FN 3288-63-53-C35-R65



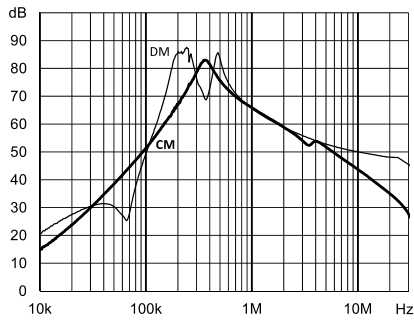
FN 3288-80-34-C35-R65



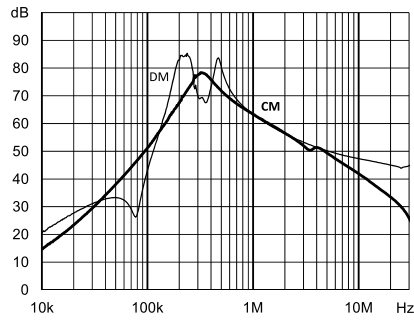
FN 3288-100-35-C35-R65



FN 3288-125-35-C35-R65



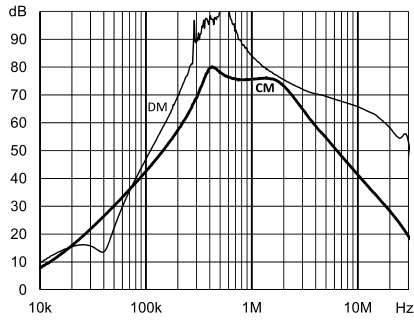
FN 3288-160-40-C35-R65



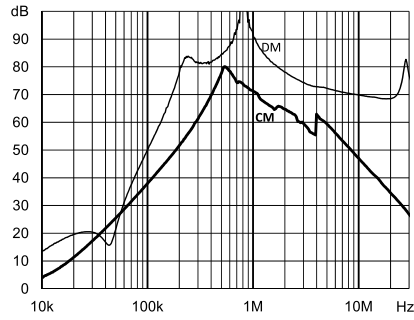
### Typical filter attenuation – FN 3288 low leakage current version

Per CISPR 17: symmetrical 50 Ω/50 Ω -> Differential Mode (DM); asymmetrical 50 Ω/50 Ω -> Common Mode (CM)

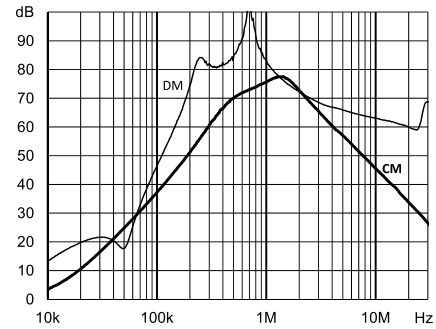
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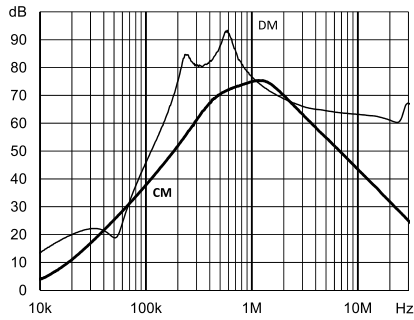
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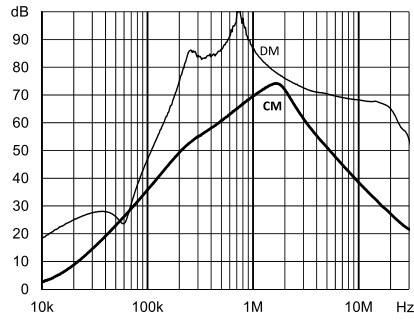
FN 3288-20-33-C21-R65



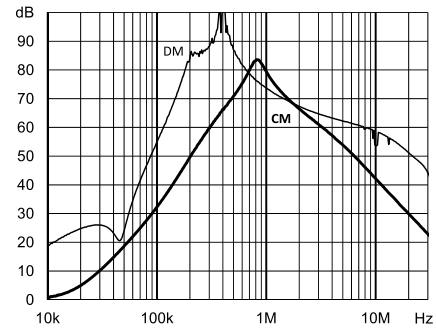
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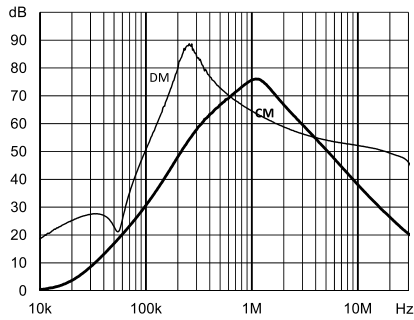
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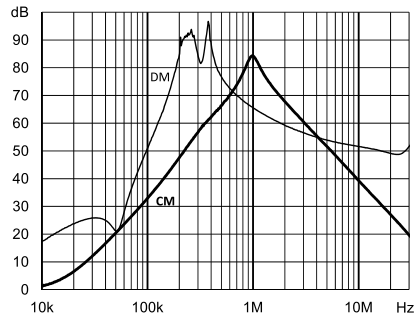
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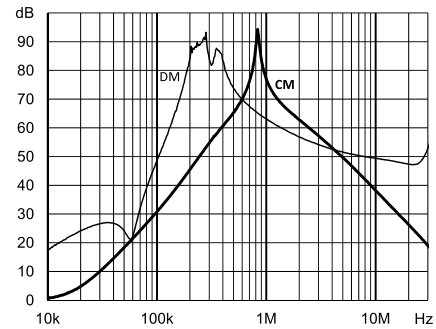
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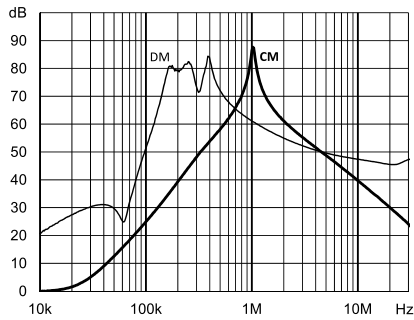
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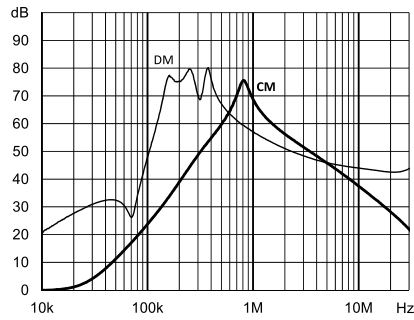
FN 3288-100-35-C21-R65



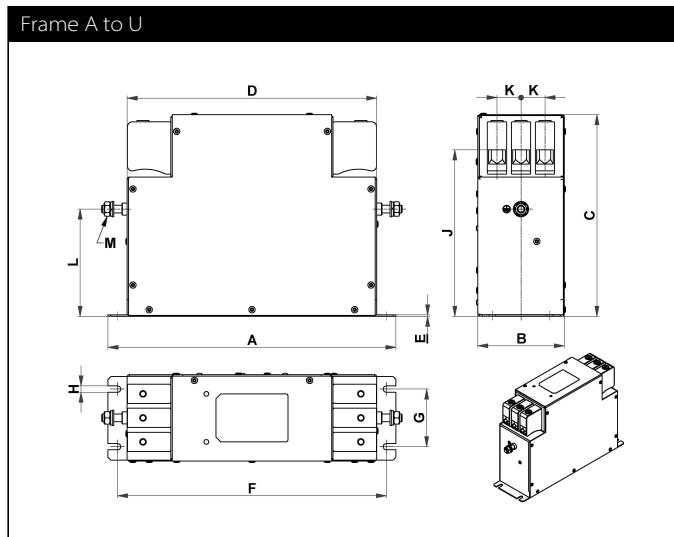
FN 3288-125-35-C21-R65



FN 3288-160-40-C21-R65



## Mechanical data



## Dimensions\*

Frame	A	B	C	D	E	F	G	H	J+/-2	K	L+/-1	M**
A	185	40	120	157	0.8	175	20	4.5	102	11	76	M5
B	195	45	140	164	0.8	180	25	5.4	122	11	93	M5
C	210	45	145	174	0.8	195	25	5.4	126	13	96	M5
D	235	50	168	207	1.0	220	30	5.4	149	13	115	M6
E	255	65	180	226	1.0	240	45	5.4	156	16	120	M6
F	290	80	205	250	1.2	270	50	6.5	172	22	110	M6
G	300	90	210	260	1.5	280	60	6.5	173	25	112	M8
H	310	100	225	270	1.5	290	70	6.5	183	28	110	M10
I	230	50	132	203	0.8	220	30	4.5	114	12.5	88	M5
J	230	55	159	198	0.8	215	35	5.4	141	13	112	M5
K	245	55	167	212	0.8	230	35	5.4	148	13	118	M5
L	265	60	191	237	1.0	250	40	5.4	172	13	135	M6
M	265	70	194	237	1.0	250	50	5.4	170	16	133	M6
N	310	95	220	270	1.2	290	65	6.5	187	22	125	M6
O	320	95	230	280	1.5	300	65	6.5	192	25	127	M8
P	330	100	240	290	1.5	310	70	6.5	198	30	127	M10
Q	180	40	112	153	0.8	170	20	4.5	94	11	68	M5
R	200	45	120	170	0.8	185	25	5.4	102	11	76	M5
S	205	45	132	173	0.8	190	25	5.4	113	13	83	M5
T	215	50	147	185	1.0	200	30	5.4	128	13	95	M6
U	220	65	180	186	1.0	205	45	5.4	156	16	120	M6

\* All dimensions in mm. For dimensions without stated tolerances: ISO 2768-m/EN 22768-m

\*\* Earth screw torque: M5 2.0-2.2 Nm; M6 3.5-4.0 Nm; M8 8.0-9.0 Nm; M10 15-17 Nm

## Filter input/output connector cross sections

	-44	-33	-53	-34	-35	-40
<b>Solid wire</b>	0.5-10 mm <sup>2</sup>	0.5-16 mm <sup>2</sup>	0.5-16 mm <sup>2</sup>	6-35 mm <sup>2</sup>	10-50 mm <sup>2</sup>	25-95 mm <sup>2</sup>
<b>Flex wire</b>	0.5-6 mm <sup>2</sup>	0.5-10 mm <sup>2</sup>	0.5-16 mm <sup>2</sup>	6-25 mm <sup>2</sup>	16-50 mm <sup>2</sup>	25-95 mm <sup>2</sup>
<b>Flex wire AWG</b>	AWG 20-8	AWG 22-6	AWG 20-4	AWG 6-2	AWG 6-1/0	AWG 0-4/0
<b>Recommended torque</b>	1.0-1.2 Nm	1.5-1.8 Nm	2.0-2.3 Nm	4.0-4.5 Nm	7.0-8.0 Nm	17-20 Nm

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.



## Accessories

### Surge Protection Devices



- | SPD with a fail safe function to prevent short-circuit (separation of circuit and element is visually confirmable)
- | Compliance with IEC 61643-1 that meets the new JIS standards
- | Against indirect lightning surge for single phase / three phase power supplies Quick response for surge
- | Impulse current capacity 8/20 $\mu$ s-5,000A
- | Impulse test category: Class II (Type II)
- | Every pathway consists of same elements. Between line and line/between lines and ground can protect as the same level.

[Datasheet PDF >](#)

# Compact power line AC EMC/EMI filter



- High current 3-phase filter up to 2300 A
- Extremely compact and light weight design
- Minimum installation foot print
- Performance optimised for standard purpose applications
- FN3310 series without Cy capacitors to ground
- FN3311 IT versions for use in IT power networks



### Performance indicators

Attenuation performance



Rated current [A]



## Technical specifications

<b>Maximum continuous operating voltage</b>	3x 520/300 VAC for FN 3311 3x 520 VAC for FN 3310
<b>Operating frequency</b>	DC to 60 Hz
<b>Rated currents</b>	250 to 2300 A @ 50°C
<b>High potential test voltage</b>	P → E 2 kVAC for 2 sec (FN 3311 IT 3 kVAC for 2 sec) P → P 2.25 kVDC for 2 sec (FN 3311 IT 2.68 kVDC for 2 sec)
<b>Protection category</b>	IP 00
<b>Overload capability</b>	4x rated current at switch on, max. 8 sec 1.5x rated current for 1 minute, once per hour
<b>Temperature range (operation and storage)</b>	-40°C to +100°C
<b>Climatic category</b>	40/100/21 acc. to IEC 60068-1
<b>Terminals/Housing</b>	Ni plated cu bars/Metal
<b>Flammability corresponding to</b>	UL 94V-0
<b>Design corresponding to</b>	UL 1283, CSA 22.2 No. 8, IEC/EN 60939, EN 60721-3
<b>MTBF @ Rated amb. Temp./Voltage (Mil-HB-217F)</b>	> 200,000 hours

### Approvals & Compliances



The FN 3311/FN 3310 product series of standard EMC/EMI filters are based on Schaffner's many years of expertise in filter design for all types of converter and inverter applications. Installed between the PV inverter and the power grid, the FN 3311/FN 3310 AC filters are used to influence positively the conducted emissions on the grid side to help to comply with the required emission standards.

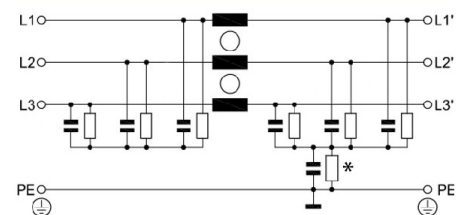
### Features and benefits

The FN 3311/FN 3310 series are the most compact dedicated high current AC filters, not only suitable for PV applications, but being an optimum fit with most modern PV inverter topologies. In addition the filters can be configured in a very flexible way to fulfil custom specific application requirements. All FN 3311/FN 3310 come in unsymmetrical housings, which help to prevent inverse installation and wrong electrical connection. Along with solar panel-side installed Schaffner DC EMC/EMI filters FN 2211/FN 2210, the AC filters FN 3311/FN 3310 are key to meet the stringent international standards for electro-magnetic compatibility and help to ensure a reliable and fault-free operation of the entire PV system.

### Typical applications

The FN 3311/FN 3310 series are primarily designed for all kind of power line connected converter and inverter applications between 250 and 2'300 A. However, they are optimised for PV inverter and can potentially also be applied for general purpose motor drives applications.

### Typical electrical schematic FN 3311



- \* - FN 3311 IT series without resistor to PE
- FN 3310 series without resistor and capacitor to PE

## Filter selection table

Filters */**	Rated current @ 50°C [A]	Typical inverter AC power rating*** [kVA]	Leakage current**** @ 520 VAC/50 Hz [mA]	Power loss @ 25°C/DC [W]	Weight [kg]
<b>FN 3311 with Cy caps</b>					
FN 3311-250-99-C16-R55 or FN 3311 IT-250-99-C18-R5	250	170	0.06	18	2.3
FN 3311-400-99-C16-R55 or FN 3311 IT-400-99-C18-R5	400	270	0.06	30	3.1
FN 3311-600-99-C16-R55 or FN 3311 IT-600-99-C18-R5	600	400	0.06	33	4.0
FN 3311-1000-99-C16-R55 or FN 3311 IT-1000-99-C18-R5	1000	670	0.06	70	5.5
FN 3311-1500-99-C16-R55 or FN 3311 IT-1500-99-C18-R5	1500	1000	0.06	133	9.9
FN 3311-2300-99-C16-R55 or FN 3311 IT-2300-99-C18-R5	2300	1500	0.06	201	18.2
<b>FN 3310 without Cy caps</b>					
FN 3310-250-99-R5	250	170		18	2.3
FN 3310-400-99-R5	400	270		30	3.1
FN 3310-600-99-R5	600	400		33	4.0
FN 3310-1000-99-R5	1000	670		70	5.5
FN 3310-1500-99-R5	1500	1000		133	9.9
FN 3310-2300-99-R5	2300	1500		201	18.2

\* Filters with higher current ratings available upon request.

\*\* Filters with reduced Cy capacitance to ground for high asymmetrical currents and higher voltages available upon request.

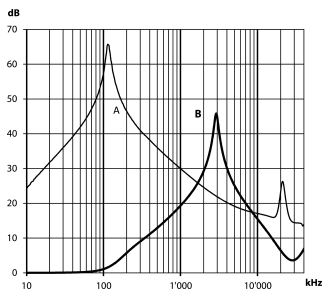
\*\*\* Calculated at rated current, 480 VAC (FN 3311)/690 VAC (FN 3311 HV) and  $\cos \phi=0.8$ . The exact value depends upon the efficiency of the drive, the motor and the entire application.

\*\*\*\* Leakage current according IEC 60939-1

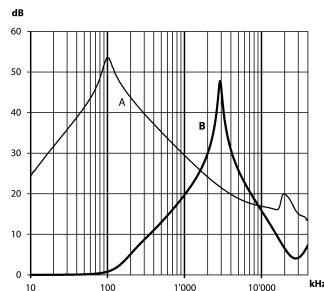
## Typical filter attenuation FN 3311-xxx-99-C16-R55

Per CISPR 17; A=50 Ω/50 Ω sym; B=50 Ω/50 Ω asym

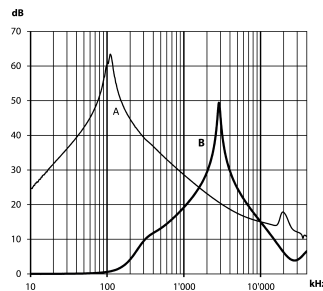
250/400 A types



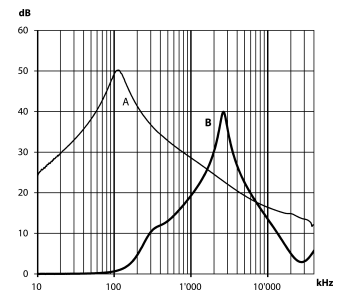
600 A types



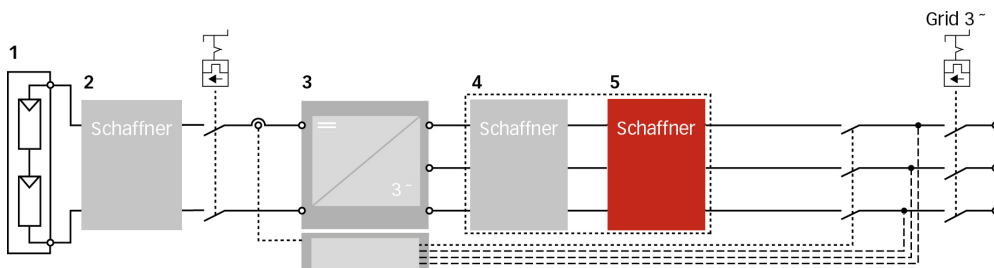
1'000/1'500 A types



2'300A types



## Typical block schematic



1 PV modules

2 Schaffner DC filter FN 22xx

3 Central Inverter

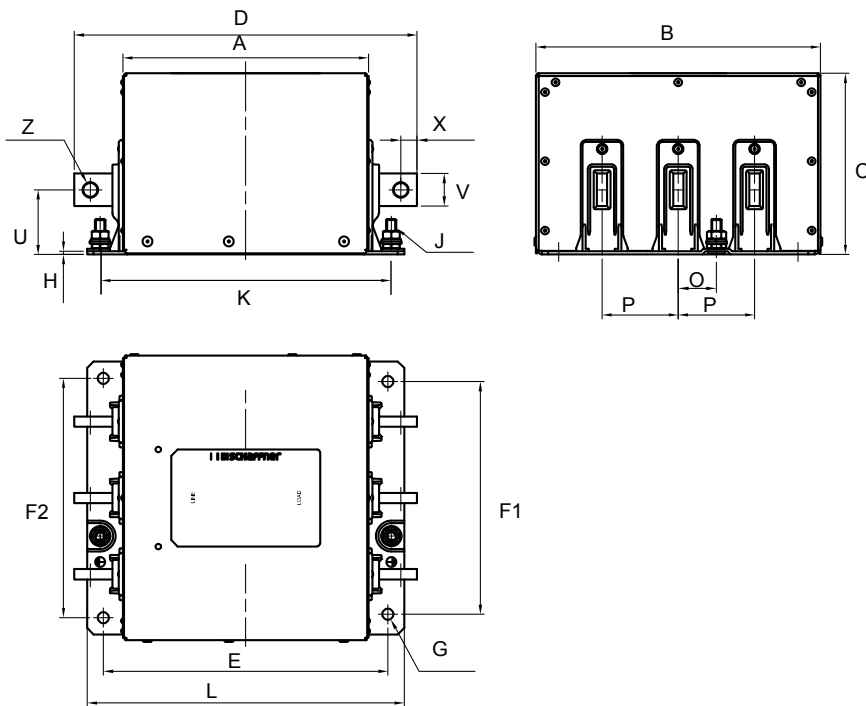
4 Schaffner magnetic components

5 Schaffner AC EMC/EMI filter FN 3xxx

Important note: depending on the grounding scheme of the solar power system, including the solar panel and the grid side transformer, the appropriate DC- and AC EMC/EMI filter version need to be selected. For support, please contact your local Schaffner sales office or partner.

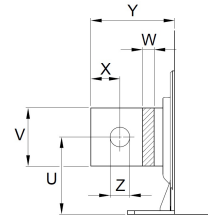
## Mechanical data

### 250 to 2'300 A types

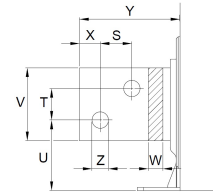


## Busbar connections

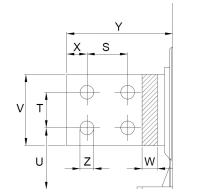
### 250 to 1'000 A types



### 1'500 A types



### 2'300 A types



**Note:** all FN 3311 and FN 3310 provide unsymmetrical mounting hole patterns to prevent inverse filter installation in the field.

## Dimensions (the FN 3311 IT versions have the same dimensions as the FN 3311)

	250 A	400 A	600 A	1'000 A	1'500 A	2'300 A
<b>A</b>	170	175	190	190	195	220
<b>B</b>	195	210	220	220	255	280
<b>C</b>	140	140	140	140	150	165
<b>D</b>	235	250	265	305	360	410
<b>E</b>	195	205	220	220	240	265
<b>F1</b>	155	170	180	180	215	235
<b>F2</b>	160	175	185	185	220	240
<b>G</b>	Ø7	Ø9	Ø9	Ø9	Ø11	Ø11
<b>H</b>	1.5	2	2.5	2.5	2.5	2.5
<b>J</b>	M6	M8	M8	M8	M10	M10
<b>K</b>	200 (+/- 1)	210 (+/- 1)	225 (+/- 1)	225 (+/- 1)	241 (+/- 1)	266 (+/- 1)
<b>L</b>	215	230	245	245	265	290
<b>O</b>	24.5	27	29.5	29.5	34.8	40
<b>P</b>	49 (+/- 0.5)	54 (+/- 0.5)	59 (+/- 0.5)	59 (+/- 0.5)	69.5 (+/- 0.5)	80 (+/- 0.5)
<b>S</b>					26	40
<b>T</b>					26	35
<b>U</b>	41	46	50	53	59	60.5
<b>V</b>	20	25	25	40	60	70
<b>W</b>	3	4	8	8	10	15
<b>X</b>	10	12.5	12.5	20	17	20
<b>Y</b>	32.5	37.5	37.5	57.5	82.5	95
<b>Z</b>	Ø9	Ø11	Ø11	Ø13.5	Ø13.5	Ø13.5

All dimensions in mm; 1 inch=25.4 mm

Tolerances according to: ISO 2768-m/EN 22768-m, if not stated otherwise

Please see the brochure "Basics in EMC and Power Quality" on our website [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.

# Compact 690 VAC power line EMC/EMI filter



- High current 3-phase filter up to 2300 A
- Extremely compact and light weight design
- Minimum installation foot print
- Performance optimised for standard purpose applications
- FN 3310 HV series without Cy capacitors to ground
- FN 3311 HVIT versions for use in IT power networks

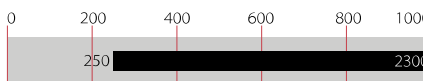


### Performance indicators

Attenuation performance



Rated current [A]



## Technical specifications

<b>Maximum continuous operating voltage</b>	3x 760/440 VAC for FN 3311 HV 3x 760 VAC for FN 3310 HV and FN 3311 HVIT
<b>Operating frequency</b>	DC to 60 Hz
<b>Rated currents</b>	250 to 2300 A @ 50°C
<b>High potential test voltage</b>	P → E 3.0 kVAC for 2 s (FN 3310 HV/FN 3311 HVIT 3.35 kVAC for 2 s) P → P 3.45 kVDC for 2 s
<b>Protection category</b>	IP 00
<b>Overload capability</b>	4x rated current at switch on, max. 8 sec 1.5x rated current for 1 minute, once per hour
<b>Temperature range (operation and storage)</b>	-40°C to +100°C
<b>Climatic category</b>	40/100/21 acc. to IEC 60068-1
<b>Terminals/Housing</b>	Ni plated cu bars/Metal
<b>Flammability corresponding to</b>	UL 94V-0
<b>Design corresponding to</b>	UL 1283, CSA 22.2 No. 8, IEC/EN 60939, EN 60721-3
<b>MTBF @ Rated amb. Temp./Voltage (Mil-HB-217F)</b>	> 200,000 hours

### Approvals & Compliances



The FN3311HV / FN3310HV product series of standard EMC/EMI filters are based on Schaffner's many years of expertise in filter design for all types of converter and inverter applications. Installed between the PV inverter and the power grid, the FN3311HV and FN3310HV AC filters are used to influence positively the conducted emissions on the grid side to help to comply with the required emission standards.

### Features and benefits

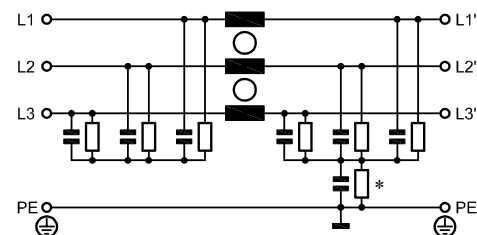
The FN3311HV / FN3310HV series are the most compact dedicated high current AC filters, not only suitable for PV applications, but being an optimum fit with most modern PV inverter topologies. In addition the filters can be configured in a very flexible way to fulfil custom specific application requirements.

All FN3311HV / FN3310HV come in unsymmetrical housings, which help to prevent inverse installation and wrong electrical connection. The AC filters FN3311HV / FN3310HV are key to meet the stringent international standards for electromagnetic compatibility and help to ensure a reliable and fault-free operation of the entire PV system.

### Typical applications

The FN3311HV / FN3310HV series are primarily designed for all kind of power line connected converter and inverter applications between 250 A and 2'300 A. However, they are optimised for PV inverter and can potentially also be applied for general purpose motor drives applications.

### Typical electrical schematic FN 3311 HV



- \* - FN3311HVIT series without resistor to PE
- FN3310HV series without resistor and capacitor to PE

## Filter selection table

Filters */**		Rated current @ 50°C	Typical inverter AC power rating***	Leakage current**** @ 760 VAC/50 Hz	Power loss @ 25°C/DC	Weight
		[A]	[kVA]	[mA]	[W]	[kg]
<b>FN3311HV with Cy caps</b>	<b>FN3311HVIT with Cy caps</b>					
<b>FN3311HV-250-99-C18-R55</b>	<b>FN3311HVIT-250-99-C18-R5</b>	250	240	0.09	18	2.7
<b>FN3311HV-400-99-C18-R55</b>	<b>FN3311HVIT-400-99-C18-R5</b>	400	380	0.09	30	3.3
<b>FN3311HV-600-99-C18-R55</b>	<b>FN3311HVIT-600-99-C18-R5</b>	600	570	0.09	33	4.5
<b>FN3311HV-1000-99-C18-R55</b>	<b>FN3311HVIT-1000-99-C18-R5</b>	1000	950	0.09	70	6.1
<b>FN3311HV-1500-99-C18-R55</b>	<b>FN3311HVIT-1500-99-C18-R5</b>	1500	1430	0.09	133	11.0
<b>FN3311HV-2300-99-C18-R55</b>	<b>FN3311HVIT-2300-99-C18-R5</b>	2300	2200	0.09	201	18.0
<b>FN3310 without Cy caps</b>						
<b>FN3310HV-250-99-R5</b>		250	240		18	2.7
<b>FN3310HV-400-99-R5</b>		400	380		30	3.3
<b>FN3310HV-600-99-R5</b>		600	570		33	4.5
<b>FN3310HV-1000-99-R5</b>		1000	950		70	6.1
<b>FN3310HV-1500-99-R5</b>		1500	1430		133	11.0
<b>FN3310HV-2300-99-R5</b>		2300	2200		201	18.0

\* Filters with higher current ratings available upon request.

\*\* Filters with reduced Cy capacitance to ground for high asymmetrical currents and higher voltages available upon request.

\*\*\* Calculated at rated current, 690 VAC and  $\cos \phi = 0.8$ . The exact value depends upon the efficiency of the drive, the motor and the entire application.£

\*\*\*\* Leakage current according IEC 60939-1

## Typical filter attenuation curves

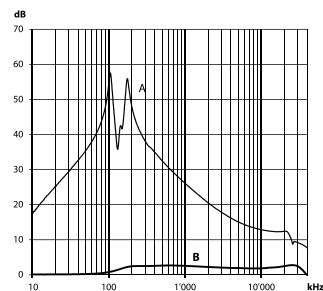
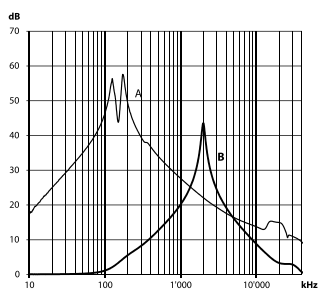
Per CISPR 17; A=50 Ω/50 Ω sym; B=50 Ω/50 Ω asym

FN3311HV-250...2300-99-C18-R5

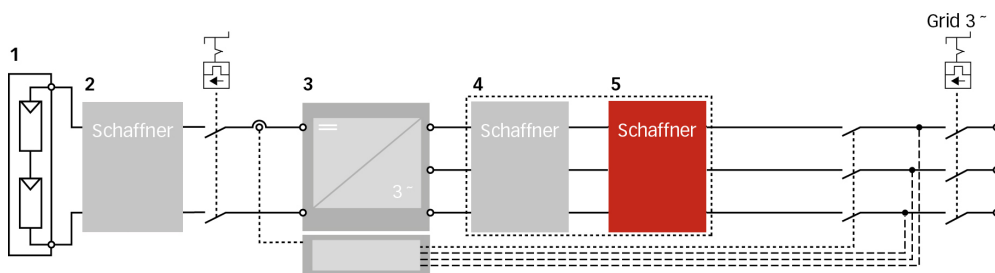
FN3310HV-250...2300-99-R5

and

FN3311HVIT-250...2300-99-C18-R55



## Typical block schematic



1 PV modules

2 Schaffner DC filter FN 22xx

3 Central Inverter

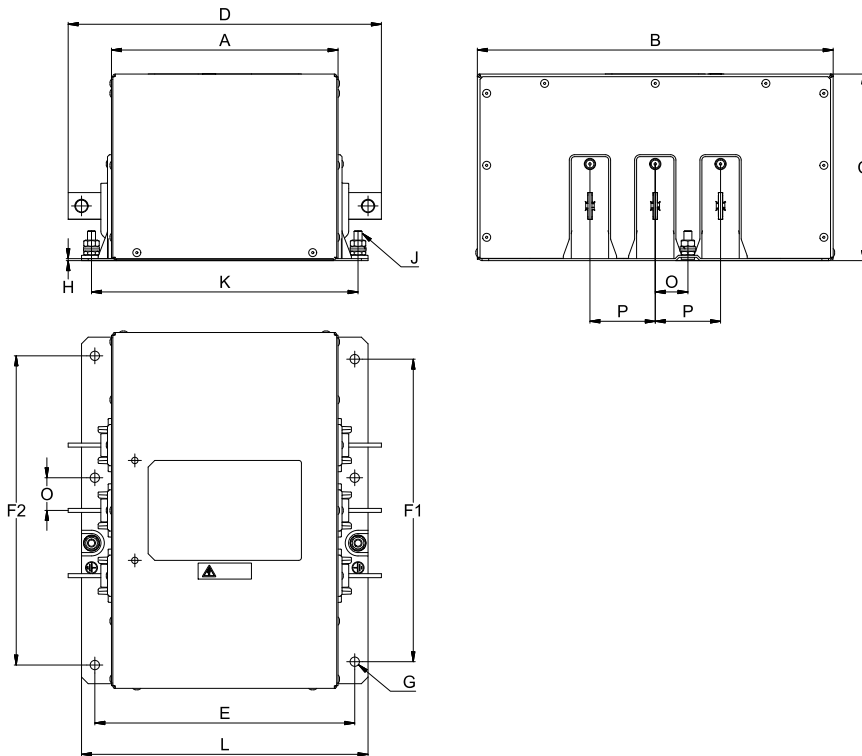
4 Schaffner magnetic components

5 Schaffner AC EMC/EMI filter FN 3xxx

Important note: depending on the grounding scheme of the solar power system, including the solar panel and the grid side transformer, the appropriate DC- and AC EMC/EMI filter version need to be selected. For support, please contact your local Schaffner sales office or partner.

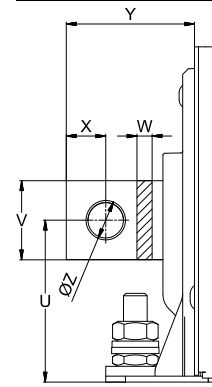
## Mechanical data

### 250 to 2'300 A types

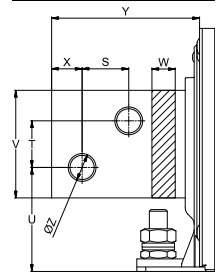


## Busbar connections

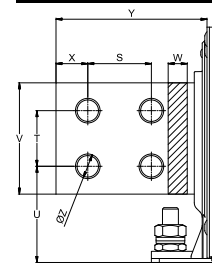
### 250 to 1'000 A types



### 1'500 A types



### 2'300 A types



**Note:** all FN3311 and FN3310 provide unsymmetrical mounting hole patterns to prevent inverse filter installation in the field.

## Dimensions of FN3311HV and FN3310HV series

(the FN3311HVIT versions have the same dimensions as the FN3311HV)

	250 A	400 A	600 A	1'000 A	1'500 A	2'300 A
<b>A</b>	170	175	190	190	195	220
<b>B</b>	267	280	290	290	310	320
<b>C</b>	140	140	140	140	150	165
<b>D</b>	235	250	265	305	360	410
<b>E</b>	195	205	220	220	240	265
<b>F1</b>	227	240	250	250	270	275
<b>F2</b>	232	245	255	255	275	280
<b>G</b>	Ø7 (6x)	Ø9 (6x)	Ø9 (6x)	Ø9 (6x)	Ø11 (6x)	Ø11 (6x)
<b>H</b>	1.5	2	2.5	2.5	2.5	2.5
<b>J</b>	M6 (2x)	M8 (2x)	M8 (2x)	M8 (2x)	M10 (2x)	M10 (2x)
<b>K</b>	200 (+/- 1)	210 (+/- 1)	225 (+/- 1)	225 (+/- 1)	241 (+/- 1)	266 (+/- 1)
<b>L</b>	215	230	245	245	265	290
<b>O</b>	24.5	27	29.5	29.5	34.8	40
<b>P</b>	49 (+/- 0.5)	54 (+/- 0.5)	59 (+/- 0.5)	59 (+/- 0.5)	69.5 (+/- 0.5)	80 (+/- 0.5)
<b>S</b>					26	40
<b>T</b>					26	35
<b>U</b>	41	46	50	53	58	60.5
<b>V</b>	20	25	25	40	60	70
<b>W</b>	3	4	8	8	10	15
<b>X</b>	10	12.5	12.5	20	17	20
<b>Y</b>	32.5	37.5	37.5	57.5	82.5	95
<b>Z</b>	Ø9	Ø11	Ø11	Ø13.5	Ø13.5	Ø13.5

All dimensions in mm; 1 inch = 25.4 mm

Tolerances according: ISO 2768-m/EN 22768-m, if not stated otherwise

Please see the brochure "Basics in EMC and Power Quality" on our website [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.

# High-current EMC/RFI Filter

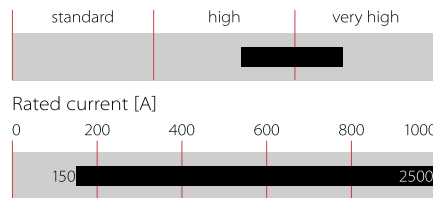


- Off-the-shelf high power filter for rated currents up to 2500 A
- HV versions applicable for IT power networks
- Busbars for convenient and universal electrical connection
- Protective plastic covers optionally available for unsurpassed safety



### Performance indicators

Attenuation performance



## Technical specifications

<b>Maximum continuous operating voltage</b>	3x 520/300 VAC (FN 3359) 3x 760/440 VAC (FN 3359 HV)
<b>Operating frequency</b>	DC to 60 Hz
<b>Rated currents</b>	150 to 2500 A @ 50°C
<b>High potential test voltage</b>	P → E 2750 VDC for 2 sec (FN 3359) P → P 2250 VDC for 2 sec (FN 3359) P → E 3200 VDC for 2 sec (FN 3359 HV) P → P 3270 VDC for 2 sec (FN 3359 HV)
<b>Protection category</b>	IP 00
<b>Overload capability</b>	4x rated current at switch on, 1.5x rated current for 1 minute, once per hour
<b>Temperature range (operation and storage)</b>	-25°C to +100°C (25/100/21)
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
<b>MTBF @ 45°C/480 V (Mil-HB-217F)</b>	130,000 hours

### Approvals & Compliances



UL: 600/400 VAC for 1600A and 2500A @ 40°C ambient temp.; ENEC up to 1600A: 690/400 VAC

### Features and benefits

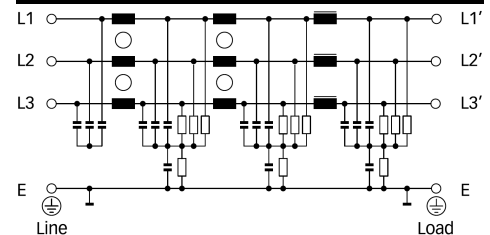
- High-power filter for Class A compliance. With approval measurement also Class B compliance possible for some applications
- Extremely compact high-current filter solution with minimum space requirement
- FN 3359 HV versions are applicable for IT power networks
- Optionally available transparent protective covers for all filters up to 1000 A, to protect the installer, operator or inspector from undeliberate touching of life conductors. They can easily be retrofitted even if the filter is already installed and connected
- FN 3359 also improves conducted immunity of installations

### Typical applications

- High-power motor drives, inverters and converters
- Industrial three-phase systems
- Entire factories, plants and installations
- Large UPS
- Machinery
- Mining equipment
- Photovoltaic systems with galvanic isolation\*
- Wind turbines

\* For EMI solutions for PV system without galvanic isolation, please contact your local Schaffner partner.























### Typical electrical schematic



Note: HV versions without discharge resistor to ground.



### Filter selection table

Filter	Buy	Rated current	Typical drive	Leakage current**	Power loss	Input/Output	Weight	Protective
		@ 50°C (40°C)	power rating*	@ 520/760 VAC/50 Hz	@ 25°C/50 Hz	connections		covers***
		[A]	[kW]	[mA]	[W]	 	[kg]	Order code
FN3359-150-28		150 (164)	75	5.1	24	-28	5.8	801917
FN3359-180-28		180 (197)	90	5.1	34	-28	5.8	801917
FN3359-250-28		250 (250****)	132	5.1	49	-28	9.0	801918
FN3359-320-99		320 (350)	160	5.1	19	-99	10.5	801919
FN3359-400-99		400 (438)	220	5.1	29	-99	10.5	801919
FN3359-600-99		600 (657)	315	5.1	44	-99	11.0	801920
FN3359-800-99		800 (876)	400	5.3	39	-99	20.0	806276
FN3359-1000-99		1000 (1095)	560	5.3	60	-99	20.0	806276
FN3359-1600-99		1600 (1600)	900	5.1	131	-99	27.0	n.a.
FN3359-2500-99		2500 (2500)	1320	5.1	300	-99	69.0	n.a.
FN3359HV-150-28		150 (164)	110	7.5	24	-28	6.0	801917
FN3359HV-180-28		180 (197)	132	7.5	34	-28	6.0	801917
FN3359HV-250-28		250 (250)	200	7.5	49	-28	9.5	801918
FN3359HV-320-99		320 (350)	250	7.5	19	-99	10.5	801919
FN3359HV-400-99		400 (438)	315	7.5	29	-99	10.5	801919
FN3359HV-600-99		600 (657)	500	7.5	44	-99	11.0	801920
FN3359HV-800-99		800 (876)	630	7.5	39	-99	21.0	806276
FN3359HV-1000-99		1000 (1095)	710	7.5	60	-99	21.0	806276
FN3359HV-1600-99		1600 (1600)	1320	7.5	131	-99	27.0	n.a.
FN3359HV-2500-99		2500 (2500)	2000	7.7	300	-99	69.0	n.a.

\* Calculated at rated current, 480 VAC (FN 3359)/690 VAC (FN 3359 HV) and cos phi=0.8. The exact value depends upon the efficiency of the drive, the motor and the entire application.

\*\* Standardized calculated leakage current acc. IEC60939 under normal operating conditions (FN 3359 at 520 VAC and FN 3359 HV at 760 VAC).

\*\*\* Please contact your local Schaffner partner to order the optional protective covers with the order code in the table above (n.a.: not available)

\*\*\*\* For terminal type -28 the max. current is limited to 250A, therefore no uprating possible at lower temperatures.

### Distribution inventory

Up-to-date inventory levels for global distributors is available at

<https://products.schaffner.com/stock>

or via the QR code printed on the right side



### Typical filter attenuation

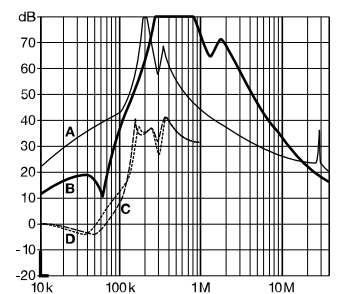
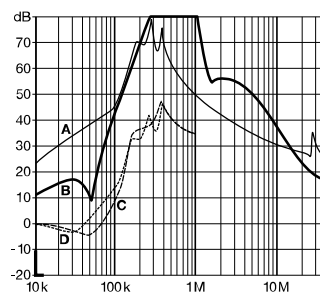
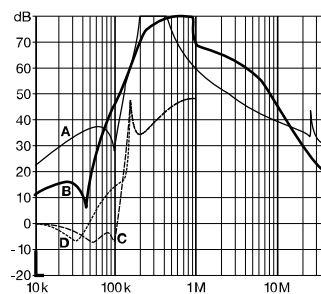
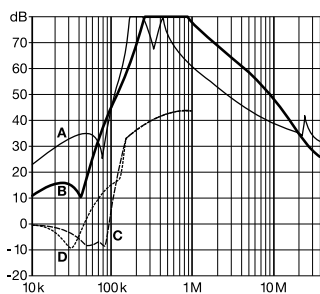
Per CISPR 17; A=50 Ω/50 Ω sym; B=50 Ω/50 Ω asym; C=0.1 Ω/100 Ω sym; D=100 Ω/0.1 Ω sym

150 to 180 A types

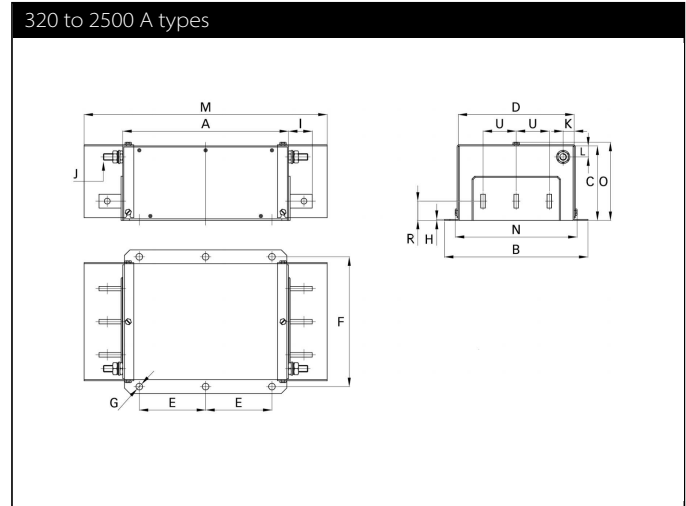
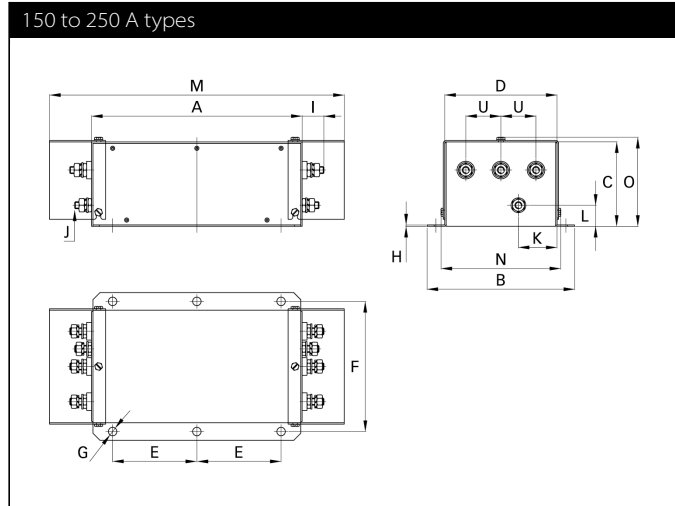
250 to 600 A types

800 and 1000 A types

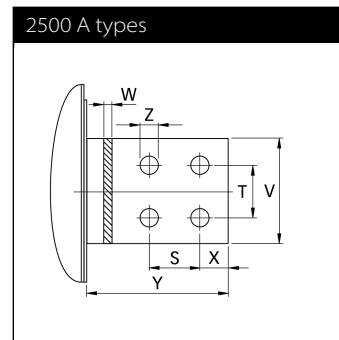
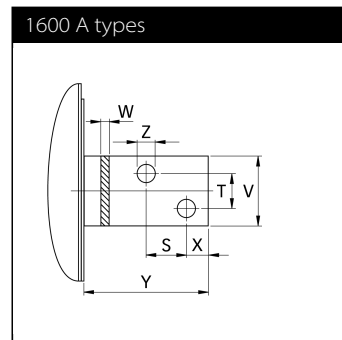
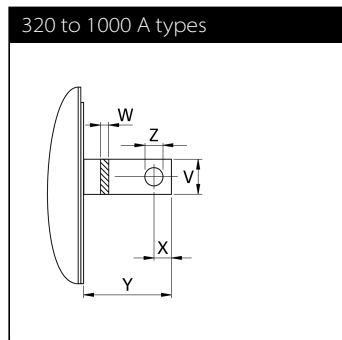
1600 and 2500 A types



## Mechanical data



## Busbar connections



## Dimensions

	150 A	180 A	250 A	320 A	400 A	600 A	800 A	1000 A	1600 A	2500 A
<b>A</b>	300	300	300	300	300	300	350	350	400	450
<b>B</b>	210	210	230	260	260	260	280	280	300	370
<b>C</b>	120	120	125	115	115	135	170	170	160	220
<b>D</b>	160	160	180	210	210	210	230	230	250	300
<b>E</b>	120	120	120	120	120	120	145	145	170	200
<b>F</b>	185	185	205	235	235	235	255	255	275	330
<b>G</b>	Ø12	Ø12	Ø12	Ø12	Ø12	Ø12	Ø12	Ø12	Ø12	Ø14
<b>H</b>	2	2	2	2	2	2	3	3	3	3
<b>I</b>	33	33	33	43	43	43	53	53	93	110
<b>J</b>	M10	M10	M10	M12	M12	M12	M12	M12	M12	M12
<b>K</b>	55	55	62.5	20	20	20	25	25	25	25
<b>L</b>	30	30	35	20	20	20	25	25	25	25
<b>M</b>	420	420	420	440	440	440	510	510	n.a.	n.a.
<b>N</b>	171	171	191	221	221	221	241	241	n.a.	n.a.
<b>O</b>	127	127	132	122	122	142	177	177	n.a.	n.a.
<b>R</b>				37	37	37	68	68	68	85
<b>S</b>									26	35
<b>T</b>									26	35
<b>U</b>	50	50	55	60	60	60	60	60	60	100
<b>V</b>				25	25	25	40	40	60	80
<b>W</b>				6	6	8	8	8	10	15
<b>X</b>				15	15	15	20	20	17	20
<b>Y</b>				40	40	40	50	50	93	110
<b>Z</b>				Ø10.5	Ø10.5	Ø10.5	Ø14	Ø14	Ø14	Ø14

All dimensions in mm; 1 inch = 25.4 mm

Tolerances according: ISO 2768-m/EN 22768-m

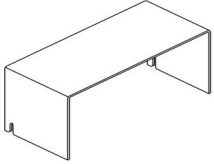
(n.a.: not applicable)

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.

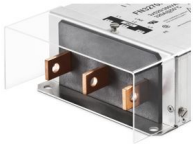
## Accessories

### Protective Cover for Busbar Filters

#### Construction schematic



#### Installation example



#### Applicable Busbar Filters

FN3359

FN3270



Transparent protective covers for FN3359 and FN3270 with busbars from 150 to 1000 A

Protection for the operator or inspector from accidental touching of live conductors.

Easily to be added after the filter has been installed and connected.

[Datasheet PDF >](#)

### Surge Protection Devices



SPD with a fail safe function to prevent short-circuit (separation of circuit and element is visually confirmable)

Compliance with IEC 61643-1 that meets the new JIS standards

Against indirect lightning surge for single phase / three phase power supplies Quick response for surge

Impulse current capacity 8/20 $\mu$ s-5,000A

Impulse test category: Class II (Type II)

Every pathway consists of same elements. Between line and line/between lines and ground can protect as the same level.

[Datasheet PDF >](#)

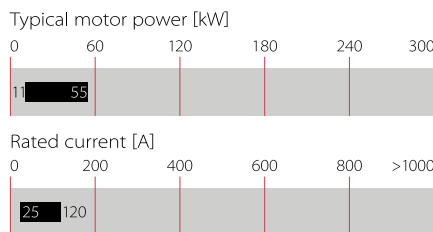
# Sine wave output filter for high-speed motor drives



- ▮ Smoothing of PWM drive output voltages
- ▮ Increased service life of expensive high-speed motors
- ▮ Reduction of audible motor noise
- ▮ Improvement of system reliability
- ▮ Production up-time for mission critical applications



### Performance indicators



## Technical specifications

<b>Maximum continuous operating voltage dc link voltage</b>	3x 500/288 VAC
<b>Motor frequency</b>	0 to 600 Hz
<b>Switching frequency</b>	6 to 15 kHz
<b>Rated currents</b>	25 to 120 A @ 50°C
<b>Motor cable length</b>	200 m max.
<b>Residual ripple voltage</b>	<5%
<b>High potential test voltage</b>	P → E 2000 VAC for 2 sec P → P 1000 VDC for 2 sec
<b>Protection category</b>	IP 20
<b>Overload capability</b>	1.5x rated current for 1 minute, once per hour
<b>Temperature range (operation and storage)</b>	-25°C to +100°C (25/100/21)
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	UL 1283, CSA 22.2 No. 8 1986
<b>MTBF @ 50°C/400 V (Mil-HB-217F)</b>	>100,000 hours
<b>Lifetime (calculated)</b>	>10 years (25, 55 A) ~5 years (75, 120 A)

### Approvals

### ROHS

## Features and benefits

- ▮ Suitable for fast rotating fields up to 600 Hz
- ▮ Conversion of the PWM output signal (symmetrical voltage components) of motor drives into a smooth sine wave with low residual ripple
- ▮ Elimination of premature motor damage caused by high dv/dt, overvoltages, motor overheating and eddy current losses
- ▮ Significantly increased service life of expensive (high-speed) motors
- ▮ Reduction of the pulse load of motor drive IGBTs and the parasitic losses on long shielded motor cables
- ▮ Less interference propagation towards neighboring equipment or lines
- ▮ Advanced choke design to minimize filter losses and voltage drop
- ▮ IP 20 protection, touch-safe terminals and temperature monitoring function to increase overall equipment safety

## Typical applications

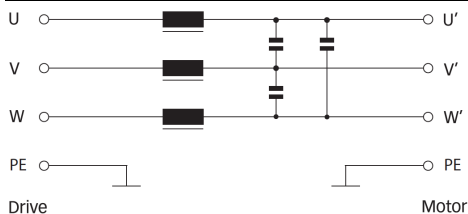
Motor drives and motors in high-speed applications, like:

- ▮ High-speed spindles
- ▮ Textile machinery
- ▮ Lasers
- ▮ Military appliances (400 Hz)


Motor drive applications with medium to long motor cables and/or with multiple motors in parallel, like:

- ▮ Pumps
- ▮ Conveyors

### Typical electrical schematic



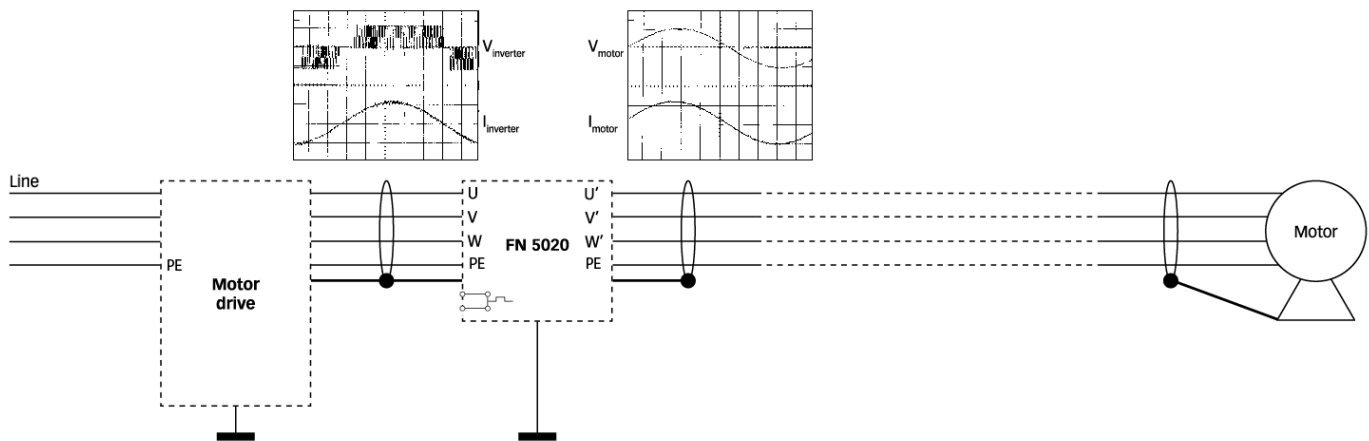
## Filter selection table

Filter	Rated current	Typical motor	Typical	Output	Weight
	@ 50°C	power rating*	power loss**	connections	
	[A]	[kW]	[W]		[kg]
FN 5020-25-33	25	15	n.a.	-33	13
FN 5020-55-34	55	30	n.a.	-34	29
FN 5020-75-35	75	45	n.a.	-35	49
FN 5020-120-35	120	75	n.a.	-35	57

\* General purpose four-pole (1500 r/min) AC induction motor rated 480 V/50 Hz.

\*\* Exact value highly depends upon the motor cable type and length, switching frequency, motor frequency and further stray parameters within the system. Please contact your local Schaffner partner for individual application support.

## Typical block schematic



## Temperature monitoring function

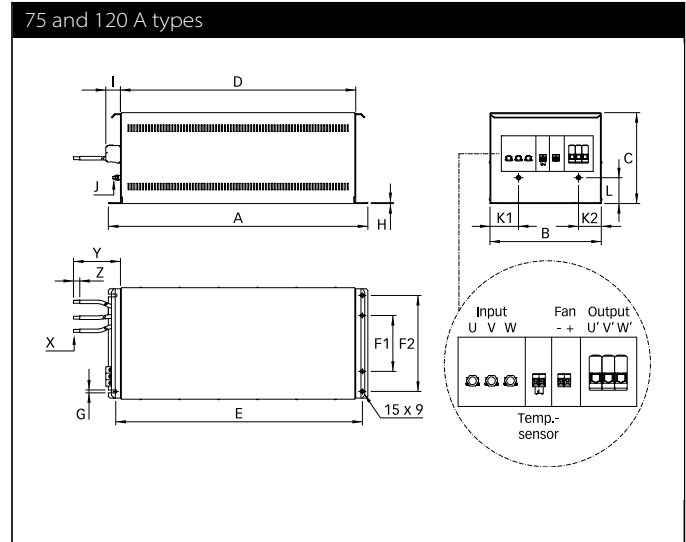
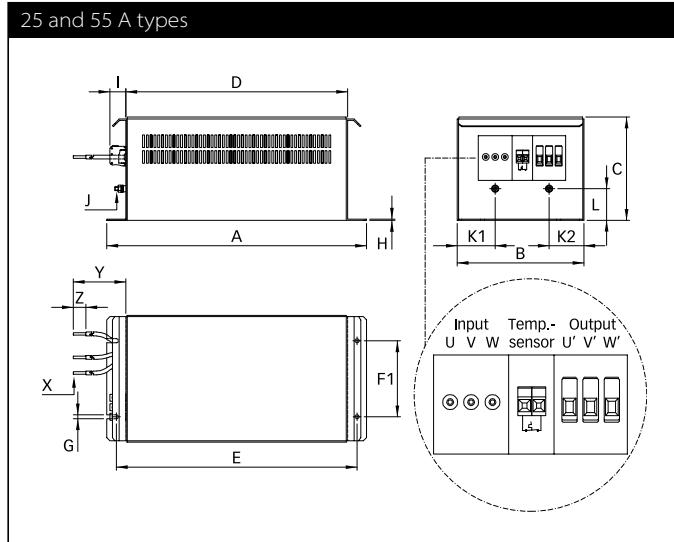
All filters of this range are equipped with a temperature monitoring function. The built-in temperature sensor opens a potential-free contact in the case of filter overtemperature (>120°C). The maximum switching capability is 6 A/250 V. This function can be used, for example, in the input of a CNC controller or as the trip of a circuit breaker in order to interrupt the mains power supply. Connections are located next to the phase connectors (see mechanical data for details).

## Forced cooling

The 75 A and 120 A filters provide internal cooling fans which require external power supply (24 VDC/~4 W). Connections are located next to the connectors of the temperature sensor (see mechanical data for details).

For additional information please consult the Schaffner application note „Sinus Plus – New Output Filter Concept for Power Drive Systems“.

## Mechanical data



## Dimensions

	25 A	55 A	75 A	120 A
<b>A</b>	410	554	799	799
<b>B</b>	200	250	343	343
<b>C</b>	163	203	280	280
<b>D</b>	350	500	725	725
<b>E</b>	380	524	760	760
<b>F1</b>	120	170	172	172
<b>F2</b>			296	296
<b>G</b>	6.5	9	9	9
<b>H</b>	2	3	3	3
<b>I</b>	25	39	45	45
<b>J</b>	M6	M6	M8	M8
<b>K1</b>	60	70	88	88
<b>K2</b>	55	55	70	70
<b>L</b>	50	69	80	80
<b>X</b>	AWG 10	AWG 6	25mm <sup>2</sup>	35mm <sup>2</sup>
<b>Y</b>	1000 +20/-0	1000 +20/-0	1000 +20/-0	1000 +20/-0
<b>Z</b>	20	20	20	20

All dimensions in mm; 1 inch = 25.4 mm  
Tolerances according: ISO 2768-m / EN 22768-m

## Filter output connector cross sections

	-29	-33	-34	-35
<b>Solid wire</b>	6 mm <sup>2</sup>	16 mm <sup>2</sup>	35 mm <sup>2</sup>	50 mm <sup>2</sup>
<b>Flex wire</b>	4 mm <sup>2</sup>	10 mm <sup>2</sup>	25 mm <sup>2</sup>	50 mm <sup>2</sup>
<b>AWG type wire</b>	AWG 10	AWG 6	AWG 2	AWG 1/0
<b>Recommended torque</b>	0.6-0.8 Nm	1.5-1.8 Nm	4.0-4.5 Nm	7-8 Nm

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.

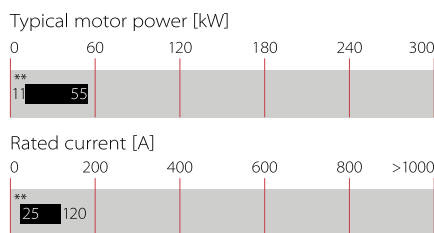
# Add-on Sine Wave Module for Common-mode Voltage Improvement



- Additional module for use with FN 5020 and FN5040/45 sine wave filters
- Reduction of common-mode interferences on motor cables
- Improvement of EMC environment
- Elimination of motor bearing damages
- Possibility to use very long unshielded motor cables
- Improvement of system reliability



### Performance indicators



### Approvals

### ROHS

### Features and benefits

- Add-on output filter module for the use with FN 5040/45 or FN 5020 sine wave output filters with corresponding current rating
- Elimination of premature motor failure caused by bearing damage
- Eliminates interference propagation towards components or conductors in the vicinity
- Restricts pulse currents to ground and hence limits leakage currents in the PE
- Allows the use of extremely long unshielded motor cables without causing radiation problems (EN 55014, MDS clamp)
- Reduces the required EMI suppression efforts on the line side
- Allows the use of lower rated drives with long motor cables due to lower losses in the IGBTs and in the motor cable
- Suitable for rotating fields up to 600 Hz

### Technical specifications

<b>Maximum continuous operating voltage</b>	3x 500/288 VAC
<b>dc link voltage</b>	1000 VDC max.
<b>Motor frequency</b>	0 to 600 Hz
<b>Switching frequency</b>	6 to 15 kHz
<b>Rated currents</b>	25 to 120 A @ 50°C
<b>Motor cable length</b>	1000 m max. (in combination with FN 5020 only)
<b>High potential test voltage</b>	P → E 2000 VAC for 2 sec P → P 1100 VDC for 2 sec
<b>Protection category</b>	IP 20
<b>Overload capability</b>	1.5x rated current for 1 minute, once per hour
<b>Temperature range (operation and storage)</b>	-25°C to +100°C (25/100/21)
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
<b>MTBF @ 50°C/400 V (Mil-HB-217F)</b>	>100,000 hours
<b>Lifetime (calculated)</b>	>10 years (25, 55 A) ~5 years (75, 120 A)


### Typical applications

- Motor drive applications with extremely long motor cables
- Motor drive applications with unshielded motor cables
- Motor drives and motors in high-speed applications
- Mission critical applications
- Applications with multiple parallel motors
- Retrofit of motor drives into existing installations with old wiring and motors

### Important note

FN 5030 are additional common-mode modules. They can NOT work alone! FN 5030 have to be operated downstream of a regular (symmetrical) sine wave output filter. Possible combinations are FN 5020/FN 5030 for motor frequencies up to 600 Hz, or FN 5040/45/FN 5030 for max. 70 Hz. For additional information please consult the Schaffner application note „Sinus Plus – New Output Filter Concept for Power Drive Systems“.

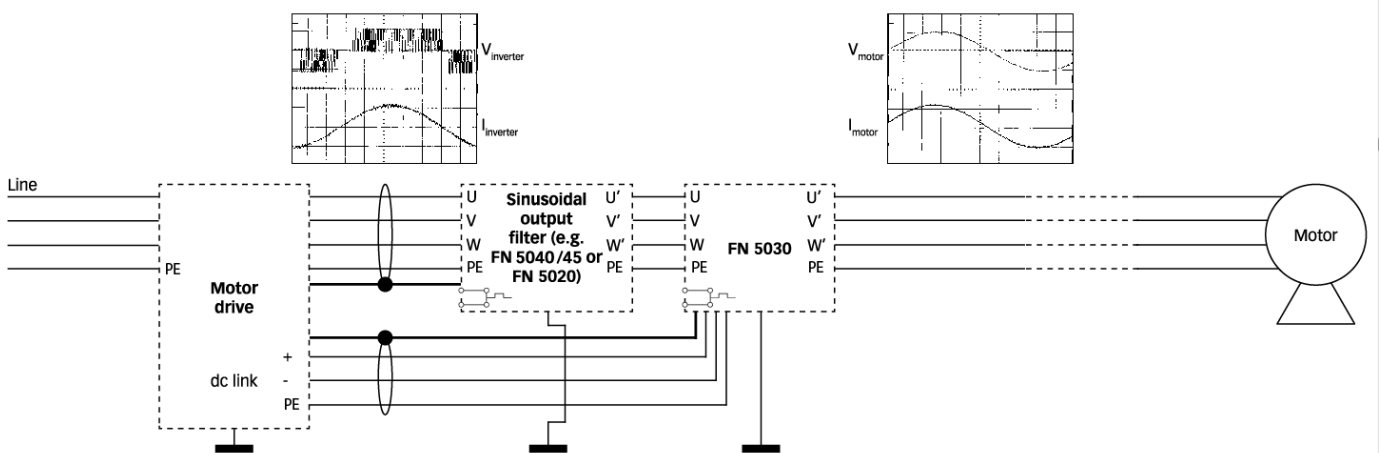
## Filter selection table

Filter	Rated current	Typical motor power rating*	Typical power loss**	Output connections	Weight
	@ 50°C				
	[A]	[kW]	[W]		[kg]
FN 5030-25-33	25	15	n.a.	-33	13
FN 5030-55-34	55	30	n.a.	-34	14
FN 5030-75-35	75	45	n.a.	-35	27
FN 5030-120-35	120	75	n.a.	-35	40

\* General purpose four-pole (1500 r/min) AC induction motor rated 480 V/50 Hz.

\*\* Exact value highly depends upon the motor cable type and length, switching frequency, motor frequency and further stray parameters within the system. Please contact your local Schaffner partner for individual application support.

## Typical block schematic



## Temperature monitoring function

All filters of this range are equipped with a temperature monitoring function. The built-in temperature sensor opens a potential-free contact in the case of filter overtemperature ( $>120^{\circ}\text{C}$ ).

The maximum switching capability is 6 A/250 V. This function can be used, for example, in the input of a CNC controller or as the trip of a circuit breaker in order to interrupt the mains power supply. Connections are located next to the phase connectors (see mechanical data for details).

## Forced cooling

The 75 A and 120 A filters provide internal cooling fans which require external power supply (24 VDC/~4 W). Connections are located next to the connectors of the temperature sensor (see mechanical data for details).

## Connection to the dc link

For best results, the connection to the dc link of the motor drive is required with this series of filters.

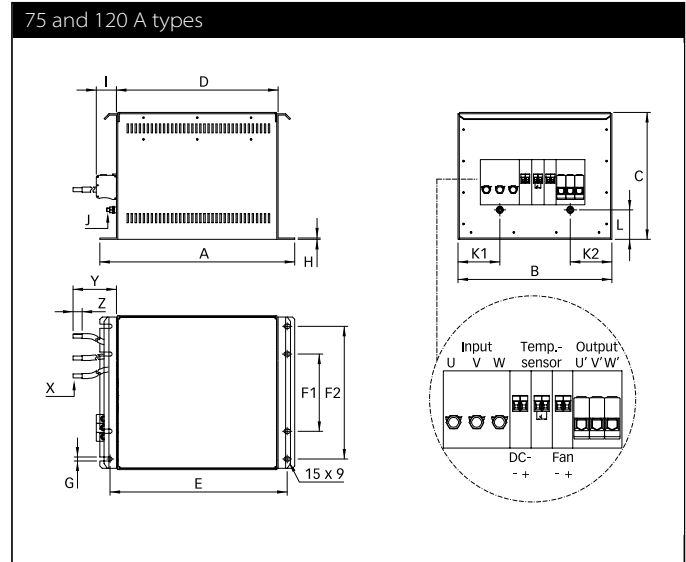
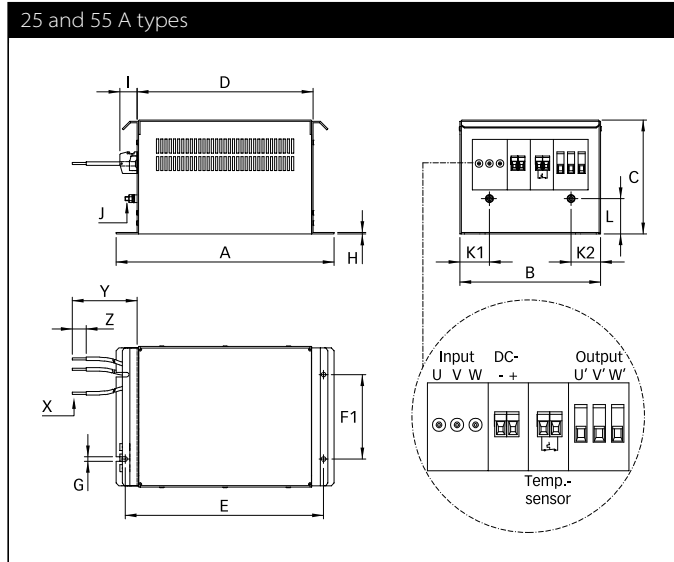
If only one connection to the dc link is brought out of the drive («+» or «-») then the dc link cable connections from the filter (identified by «DC+» and «DC-») must be connected together to the «+» or «-» motor drive connection.

The operation of the add-on sine wave output filter is not seriously affected as a result. The «+» and «-» connections on the motor drive must never be connected together. Otherwise a short-circuit will result.

The PWM switching frequency must lie within the range from 6 to 15 kHz in order to ensure satisfactory operation of the filter. A lower switching frequency or a pure square wave is unsuitable and will result in the motor drive switching off with the error message «overcurrent» or «short to earth».



## Mechanical data







## Dimensions

	25 A	55 A	75 A	120 A
<b>A</b>	310	354	434	434
<b>B</b>	200	250	343	343
<b>C</b>	162	200	283	283
<b>D</b>	246	300	360	360
<b>E</b>	280	324	395	395
<b>F1</b>	120	170	172	172
<b>F2</b>			296	296
<b>G</b>	6.5	9	9	9
<b>H</b>	2	3	3	3
<b>I</b>	25	39	45	45
<b>J</b>	M6	M6	M8	M8
<b>K1</b>	42	70	93	93
<b>K2</b>	42	55	93	93
<b>L</b>	50	66	66	66
<b>X</b>	AWG 10	AWG 6	25 mm <sup>2</sup>	35 mm <sup>2</sup>
<b>Y</b>	1000 +20/-0	1000 +20/-0	1000 +20/-0	1000 +20/-0
<b>Z</b>	20	20	20	20

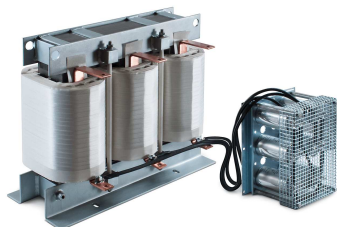
All dimensions in mm; 1 inch = 25.4 mm  
Tolerances according: ISO 2768-m / EN 22768-m

## Filter output connector cross sections

	-29	-33	-34	-35
<b>Solid wire</b>	 6 mm <sup>2</sup>	 16 mm <sup>2</sup>	 35 mm <sup>2</sup>	 50 mm <sup>2</sup>
<b>Flex wire</b>	4 mm <sup>2</sup>	10 mm <sup>2</sup>	25 mm <sup>2</sup>	50 mm <sup>2</sup>
<b>AWG type wire</b>	AWG 10	AWG 6	AWG 2	AWG 1/0
<b>Recommended torque</b>	0.6-0.8 Nm	1.5-1.8 Nm	4.0-4.5 Nm	7-8 Nm

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.

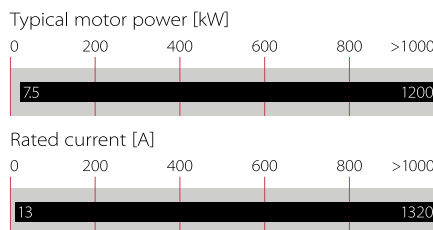
# LC Sine Wave Filter for 600 VAC and 690 VAC Motor Drives Applications



- Smooth sine wave without voltage peaks
- Motor protection against pulse pattern stress
- Improvement of system reliability
- Reduces bearing currents
- Ideal for retrofit installations
- Fits for long motor cable lengths ( $\leq 2000$  m)
- Motor drive power range up to 1,200 kW



### Performance indicators



## Technical specifications

<b>Nominal operating voltage</b>	3x690 VAC (UL: 3x600 VAC)
<b>Motor frequency</b>	0..70 Hz (up to 200 Hz with derating according graph)
<b>Rated currents</b>	13 to 1320 A
<b>Temperature range (operation and storage)</b>	-25°C to 70°C (25/070/21) 13 to 45 A: -25 to +30°C 75 to 1320 A: -25 to +45°C
<b>Motor cable length</b>	Up to 2,000 m (see graph)
<b>Impedance (uk)</b>	8 to 10% @ 690 V, 50 Hz and rated current
<b>Residual ripple voltage</b>	<5%
<b>High potential test voltage</b>	P → E 3600 VAC, 1 minute P → P 3600 VAC (without Caps), 1 minute P → P 2600 VDC, 1 minute
<b>Protection category</b>	IP 00
<b>Overload capability</b>	1.5 × rated current for 1 minute, once per hour
<b>Insulation class</b>	EIS 200
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	IEC 61558-2-20
<b>Environmental reliability</b>	IEC 60068-2-1
<b>Capacitor class</b>	UL 810 approved
<b>Creepage and clearance distances</b>	According UL 61800-5-1
<b>Inductors</b>	UL-approved Electrical Insulation System (EIS) class 200 (N)
<b>Rated currents</b>	13 to 1320 A @ 45°C
<b>Switching frequency</b>	See filter selection table

### Approvals



(UL up to 300 A)

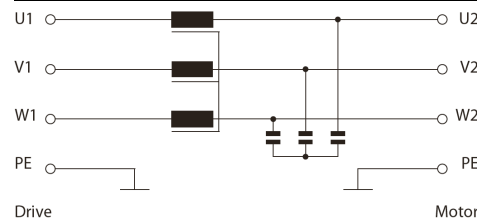
### Features and benefits

- Converts the rectangular PWM output voltage of motor drives into a smooth sine wave with low residual ripple
- Elimination of premature motor damage caused by high dv/dt, overvoltages, cable ringing, motor overheating, and eddy current losses
- Improves bearing life time because of bearing currents caused by circulating currents
- Reduces electromagnetic emissions and acoustic noise levels
- Eliminates pulse reflections in the motor cable

### Typical applications

- HVAC applications
- Pumps
- Ventilators
- Conveyors
- Compressors
- Elevators
- Cranes
- Medium voltage applications, deployed in front of the step-up transformer
- Retrofit installations with motor drives
- Motor drive with long motor cable
- Motor drive with multiple motors in parallel

### Typical electrical schematic



## Filter selection table

Filter****	Rated temp. [°C]	Rated current	Typical motor drive power rating	Typical motor drive power rating	Nominal inductance [mH]	Nominal capacitance *** [µF]	Min. switching frequency ** [kHz]	Typical power loss [W]	Input/Output connections	Weight [kg]
		@ rated temp. / 50 Hz [A]	690 V/50 Hz* [kW]	600 V/60 Hz* [HP]						
FN 5040 HV-13-83	30	13	7.5	10	11.7	4.7	2	170	-83	18.2
FN 5040 HV-28-84	30	28	22	25	5.5	10	2	280	-84	25.4
FN 5040 HV-45-86	30	45	37	40	3.4	20	2	360	-86	38.2
FN 5040 HV-75-99	45	75	55	60	2	33	2	500	-99	75
FN 5040 HV-115-99	45	115	90	100	1.3	47	2	850	-99	110
FN 5040 HV-165-99	45	165	132	150	0.9	66	2	1100	-99	160
FN 5040 HV-260-99	45	260	200	250	0.6	94	2	1200	-99	200
FN 5040 HV-300-99	45	300	250	300	0.5	136	2	1600	-99	240
FN 5040 HV-430-99	45	430	355	400	0.35	272	1.5	2000	-99	330
FN 5040 HV-530-99	45	530	450	500	0.28	340	1.5	2400	-99	420
FN 5040 HV-660-99	45	660	630	650	0.23	408	1.5	2900	-99	530
FN 5040 HV-765-99	45	765	710	750	0.2	476	1.5	3800	-99	560
FN 5040 HV-940-99	45	940	900	1000	0.16	612	1.5	3400	-99	685
FN 5040 HV-1320-99	45	1320	1200	1300	0.12	816	1.5	4700	-99	1010

\* At rated current, voltage and frequency. The proper power selection depends on the drive specification, the motor and the application requirements.

\*\* With reduced motor cable length, the max. switching frequency is 16 kHz.

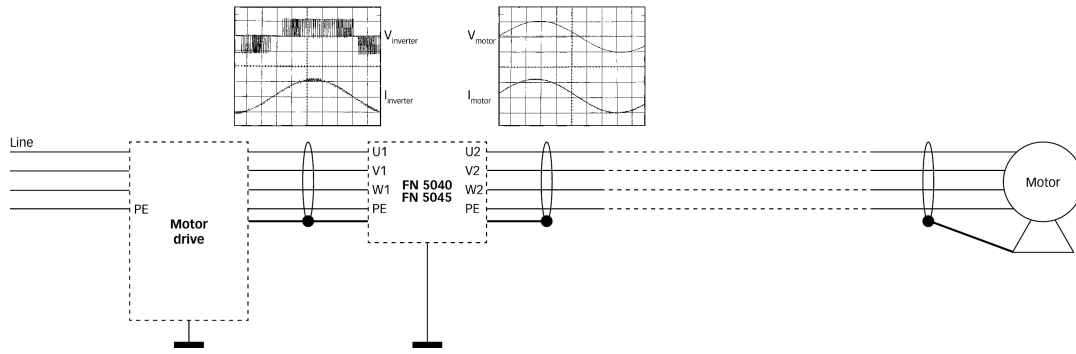
\*\*\* The capacitance connection is Y

\*\*\*\* Filters up to 300 A are with UL approval. 430 A ... 1320 A are without UL approval.

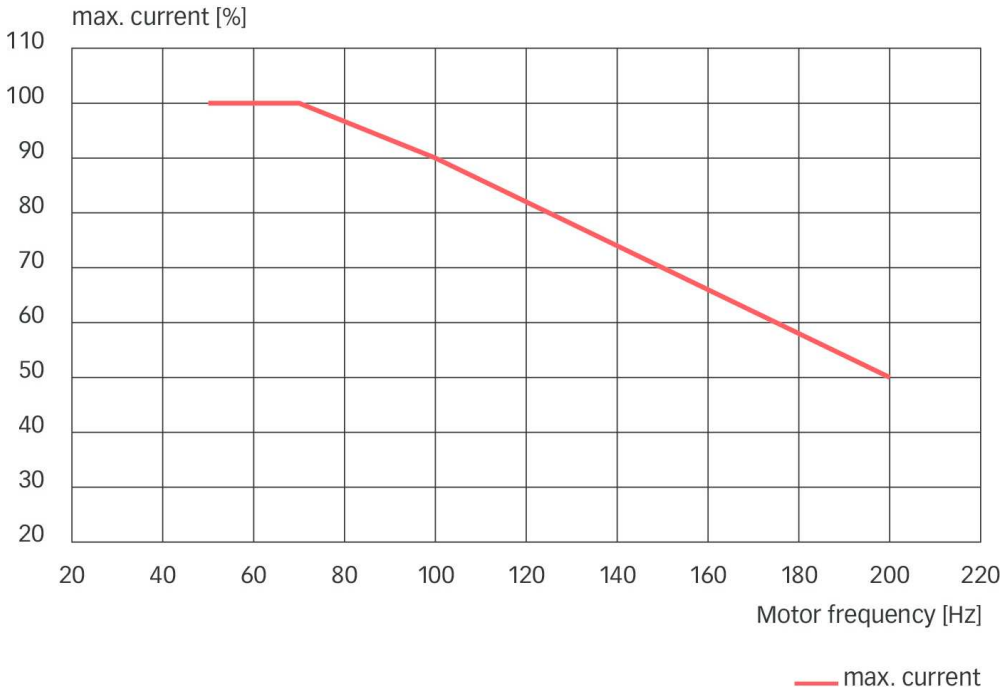
## Required drives settings

Ensure the drive's switching frequency is set to the required minimum switching frequency (see filter selection table). The mode of operation must be "scalar" (V/Hz) with a fixed switching frequency. Check the drives manufacturer manual whether special settings are necessary. In any doubt contact the drives manufacturer. **CAUTION: If the motor drives settings are not correct the filter may be damaged.**

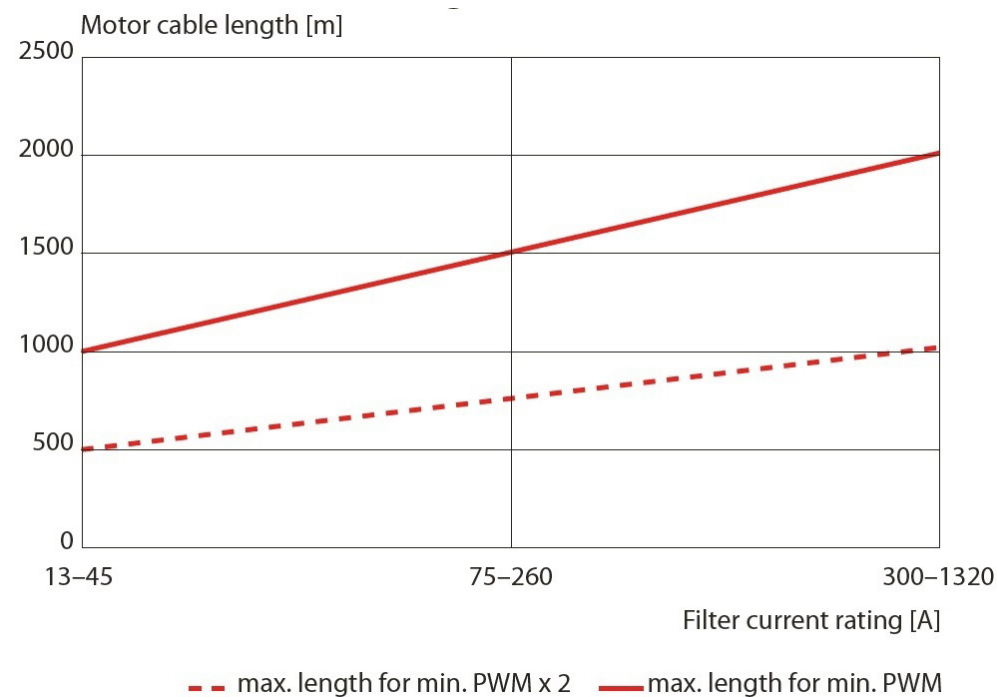
### Typical block schematic



### Motor frequency derating



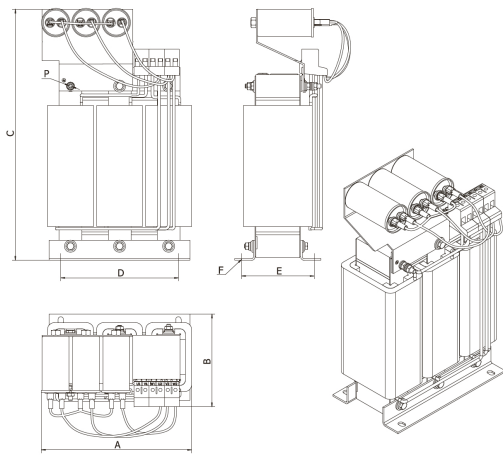
### Max. motor cable length\*



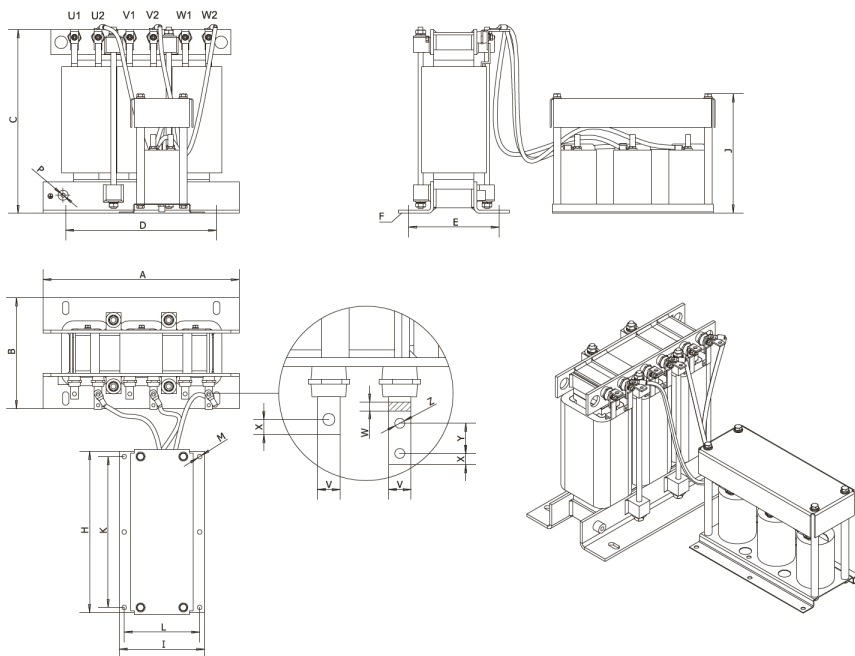
\*In case a step-up transformer is used, then the length is meant to be between the filter and transformer.

## Mechanical data FN 5040 HV

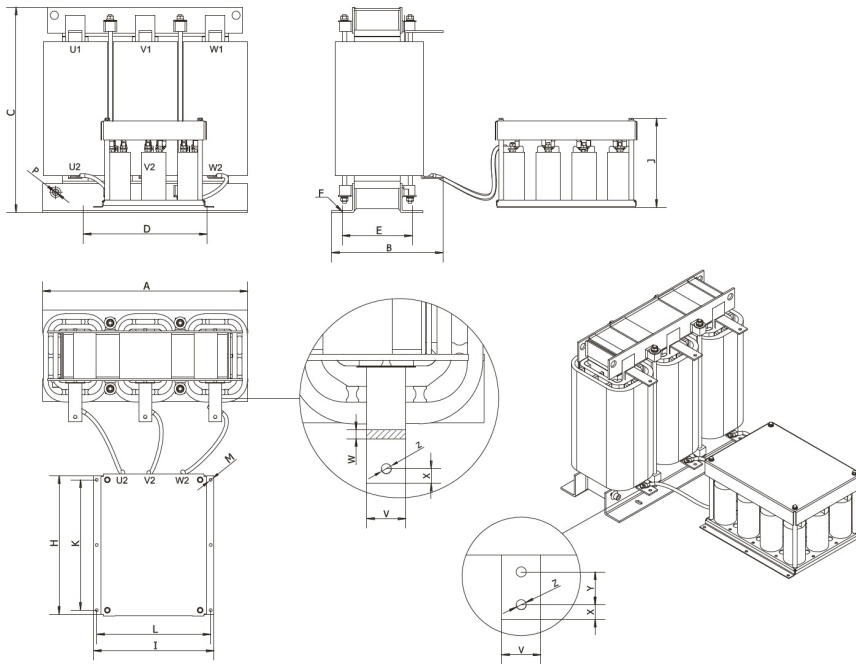
13 to 45 A types



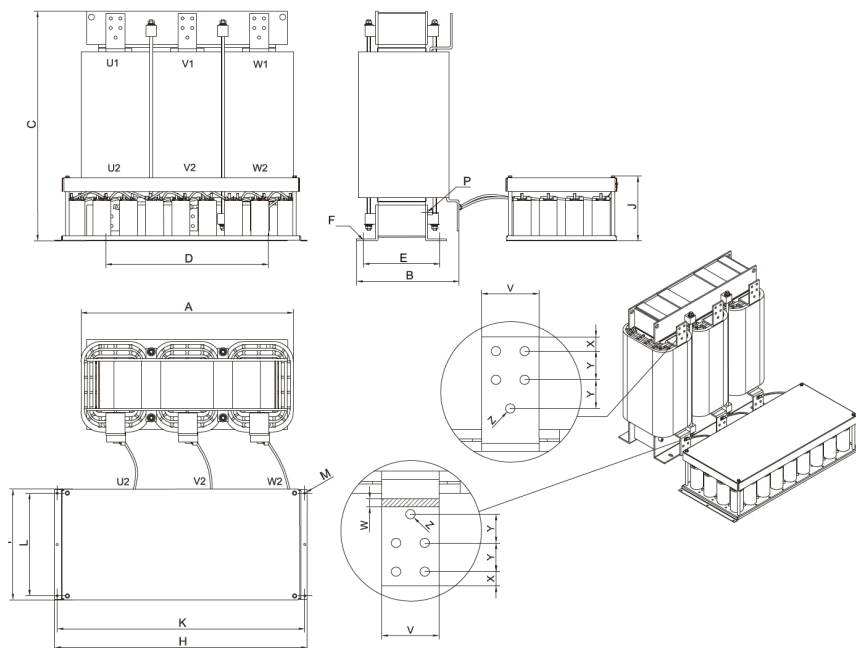
75 to 165 A types



## 260 to 940 A types






## 1320 A type



## Dimensions FN 5040 HV

	13 A	28 A	45 A	75 A	115 A	165 A	260 A	300 A	430 A	530 A	660 A	765 A	940 A	1320 A
<b>A</b>	235	225	267	392	465	512	583	540	645	680	740	725	765	895
<b>B</b>	160	165	190	235	275	275	318	315	347	348	430	402	435	445
<b>C</b>	290	375	425	375	425	482	484	625	633	761	775	875	925	965
<b>D</b>	180	175	215	300	300	300	300	300	380	380	560	560	580	680
<b>E</b>	101	108	127	180	180	180	180	20	215	215	245	245	245	320
<b>F</b>	8x12	8x12	11x15	13x27	13x27	13x27	13x27	13x27	13x27	13x27	13x28	13x28	17x30	17x30
<b>H</b>				330	330	330	330	330	425	705	705	760	1055	1055
<b>I</b>				170	170	270	270	270	370	328	328	463	463	463
<b>J</b>				240	240	240	240	275	275	275	275	275	275	275
<b>K</b>				300	300	300	300	300	400	685	685	740	1035	1035
<b>L</b>				150	150	250	250	250	350	300	300	430	430	430
<b>M</b>				Ø9	Ø9	Ø9	Ø9	Ø9	Ø9	Ø9	Ø9	Ø9	Ø9	Ø9
<b>P</b>	M6	M6	M6	M6	M8	M10	M10	M10	M12	M12	M12	M12	M12	M12
<b>V</b>				15	20	25	30	30	40	40	60	60	80	80
<b>W</b>				3	3	4	5	5	5	6	6	8	8	8
<b>X</b>				7.5	10	12.5	15	15	20	20	20	20	20	20
<b>Y</b>				30	30	30	30	30	40	40	40	40	40	40
<b>Z</b>				6.6	9	11	11	11	13.5	13.5	13.5	13.5	13.5	13.5
<b>Capacitor bank cable length [m]</b>				1 m	1 m	1 m	1.5 m	1.5 m	1.5 m	1.5 m	2 m	2 m	2 m	2 m

## Filter input/output connector cross sections

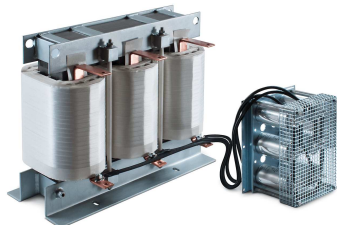
	-83	-84	-86
			
<b>Solid wire</b>	0.75 - 4 mm <sup>2</sup>	2.5 - 10 mm <sup>2</sup>	0.75 - 50 mm <sup>2</sup>
<b>Flex wire</b>	1 - 4 mm <sup>2</sup>	4 - 10 mm <sup>2</sup>	0.75 - 35 mm <sup>2</sup>
<b>AWG type wire</b>	AWG 16 - 10	AWG 18 - 6	AWG 18 - 0/1
<b>Recommended torque</b>	1.24 Nm (11 lb-in)	1.24-2.26 Nm (11-20 lb-in)	3.4-5.6 Nm (30-50 lb-in)

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.

### Note:

For additional information please consult the documents „Basis in EMC and Power Quality“ and the sine wave filter „Mounting and Installation Guidelines“, published in the download section „Installation Instructions“ of [www.schaffner.com](http://www.schaffner.com)

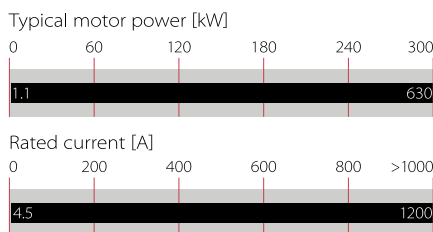
# LC Sine Wave Filter for Motor Drives



- Smooth sine wave without voltage peaks
- Perfect motor protection
- Reduce bearing currents
- Motor frequency up to 200 Hz
- Extended motor cable length capability



### Performance indicators



### Approvals



UL 61800-5-1 up to 750 A for FN 5040, 480 A for FN 5045. For use with AC or DC drives (power conversion equipment) only

### Features and benefits

- Converts the rectangular PWM output voltage of motor drives into a smooth sine wave with low residual ripple
- Elimination of premature motor damage caused by high dv/dt, overvoltages, cable ringing, motor overheating, and eddy current losses
- Improves bearing life time because of bearing currents caused by circulating currents
- Complies with IEC 60034-17\* and NEMA-MG1 requirements for general purpose motors
- Optional with NEMA 1 protective cover

## Technical specifications

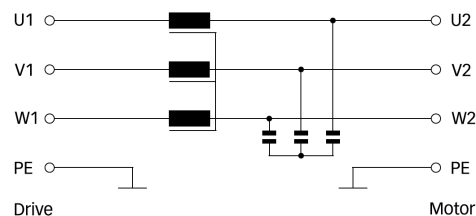
<b>Nominal operating voltage</b>	3x480 VAC
<b>Rated operating voltage</b>	3x525 VAC
<b>Motor frequency</b>	0...70 Hz (up to 200Hz with derating (see graph))
<b>Switching frequency</b>	See filter selection table
<b>Rated currents</b>	4.5 to 1200 A @ 45°C
<b>Motor cable length</b>	Up to 2,000 m (see graph)
<b>Impedance (uk)</b>	8 to 10% @ 400 V, 50 Hz and rated current
<b>Residual ripple voltage</b>	<5%
<b>High potential test voltage</b>	P → E 3000 VAC, 1 minute P → P 2500 VAC, 1 minute
<b>Protection category</b>	IP 00 (FN 5040) IP 20 (FN 5045)
<b>Overload capability</b>	1.5x rated current for 1 minute, once per hour
<b>Ambient temperature range</b>	-25°C to +45°C fully operation +45°C to 70°C derated operation* -25°C to +85°C transport and storage
<b>Insulation class</b>	EIS 200
<b>Flammability corresponding to</b>	UL 94 V-2
<b>Design corresponding to</b>	Chokes: EN 61558-2-20 or EN 60076-6 Filter: UL 61800-5-1, EN 61800-5-1
<b>MTBF</b>	>100,000 hours
<b>Rated currents</b>	4.5 to 1200 A @50°C (480 V filters)

\* I<sub>derated</sub> = I<sub>nominal</sub> \* √((T<sub>max</sub>-T<sub>amb</sub>)/(T<sub>max</sub>-T<sub>nominal</sub>)) = I<sub>nom</sub> \* √((70°C-T<sub>amb</sub>)/25°C)

## Typical applications

- HVAC applications
- Pumps
- Ventilators
- Conveyors
- Compressors
- Elevators
- Cranes
- Medium voltage applications, deployed in front of the step-up transformer
- Retrofit installations with motor drives
- Motor drive with long motor cable
- Motor drive with multiple motors in parallel

### Typical electrical schematic





## Filter selection table

Filter	Rated current @ 45°C/50Hz	Rated current @ 45°C/100Hz	Typical motor drive power rating @ 400 V*	Typical motor drive power rating @ 480 V**	Nominal inductance	Nominal capacitance	Capacitance connection	Min. switching frequency	Typical power loss***	Input/Output connections		Weight
	[A]	[A]	[kW]	[kW]	[mH]	[μF]				[kHz]	[W]	
FN 5040-4.5-82	4.5	4.05	1.1/1.5	1.3/1.8	13	2.2	Y	4	65	-82		3.3
FN 5040-8-82	8	7.2	2.2/3	2.64/3.6	6.9	4.7	Y	4	80	-82		4.6
FN 5040-10-83	10	9	4	4.8	5.2	6.8	Y	4	90	-83		6.1
FN 5040-17-83	17	15.3	5.5/7.5	6.6/9.0	3.1	10	Y	4	115	-83		7.8
FN 5040-24-84	24	21.6	11	13.2	2.4	10	Y	4	150	-84		14.4
FN 5040-38-84	38	34.2	15/18.5	18/22.2	1.6	10	Y	4	170	-84		25.0
FN 5040-48-85	48	43.2	22	26.4	1.1	14.7	Y	4	260	-85		33.0
FN 5040-62-86	62	55.8	30	36	0.85	30	Y	3	280	-86		36.0
FN 5040-75-87	75	67.5	37	44.4	0.75	30	Y	3	330	-87		42.0
FN 5040-115-87	115	103.5	45/55	52.8/66	0.5	20	Δ	3	500	-87		68.0
FN 5040-180-99	180	162	75/90	90/108	0.3	33	Δ	3	680		-99	86.0
FN 5040-260-99	260	234	110/132	132/158.4	0.2	47	Δ	3	880		-99	125.0
FN 5040-410-99	410	369	160/200	192/240	0.13	66	Δ	3	1100		-99	184.0
FN 5040-480-99	480	432	250	300	0.11	94	Δ	3	1350		-99	235.0
FN 5040-660-99	660	594	315/355	378/426	0.14	141	Δ	2	2000		-99	310.0
FN 5040-750-99	750	675	400	480	0.12	165	Δ	2	2800		-99	470.0
FN 5040-880-99	880	792	400/500	480/600	0.11	188	Δ	2	3400		-99	640.0
FN 5040-1200-99	1200	1080	560/630	672/756	0.075	282	Δ	2	3800		-99	680.0
FN 5045-4.5-44	4.5	4.05	1.1/1.5	1.3/1.8	13	2.2	Y	4	65	-44		4.1
FN 5045-8-44	8	7.2	2.2/3	2.64/3.6	6.9	4.7	Y	4	80	-44		5.4
FN 5045-10-44	10	9	4	4.8	5.2	6.8	Y	4	90	-44		6.9
FN 5045-17-33	17	15.3	5.5/7.5	6.6/9.0	3.1	10	Y	4	115	-33		9.0
FN 5045-24-33	24	21.6	11	13.2	2.4	10	Y	4	150	-33		15.6
FN 5045-38-33	38	34.2	15/18.5	18/22.2	1.6	10	Y	4	170	-33		18.9
FN 5045-48-34	48	43.2	22	26.4	1.1	14.7	Y	4	260	-34		35.8
FN 5045-62-34	62	55.8	30	36	0.85	30	Y	3	280	-34		37.8
FN 5045-75-35	75	67.5	37	44.4	0.75	30	Y	3	330	-35		60.0
FN 5045-115-35	115	103.5	45/55	52.8/66	0.5	20	Δ	3	500	-35		70.0
FN 5045-180-99	180	162	75/90	90/108	0.3	33	Δ	3	680		-99	92.0
FN 5045-260-99	260	234	110/132	132/158.4	0.2	47	Δ	3	880		-99	131.0
FN 5045-410-99	410	369	160/200	192/240	0.13	66	Δ	3	1100		-99	198.0
FN 5045-480-99	480	432	250	300	0.11	94	Δ	3	1350		-99	243.0
FN 5045-660-99	660	594	315/355	378/426	0.14	141	Δ	2	2000		-99	425.0
FN 5045-750-99	750	675	400	480	0.12	165	Δ	2	2800		-99	482.0
FN 5045-880-99	880	792	400/500	480/600	0.11	188	Δ	2	3400		-99	652.0
FN 5045-1200-99	1200	1080	560/630	672/756	0.075	282	Δ	2	3800		-99	692.0

\* General purpose four-pole (1500 r/min) AC induction motor rated 400 V/50 Hz.

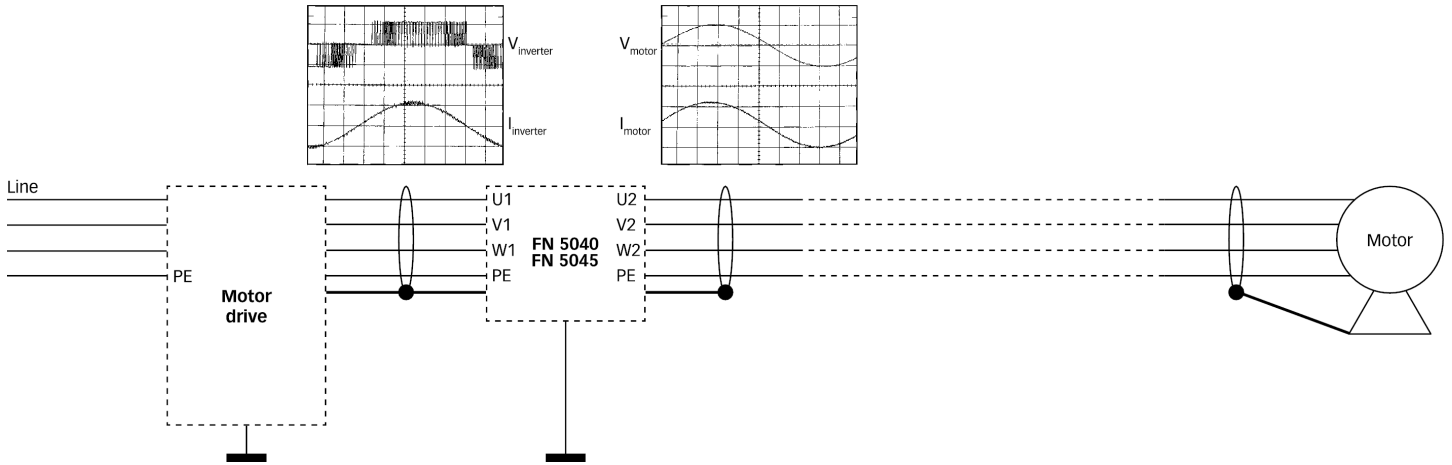
\*\* General purpose four-pole (1500 r/min) AC induction motor rated 480 V/50 Hz.

\*\*\* Exact value depends on the motor cable length and type, switching frequency and further stray parameters of the system.

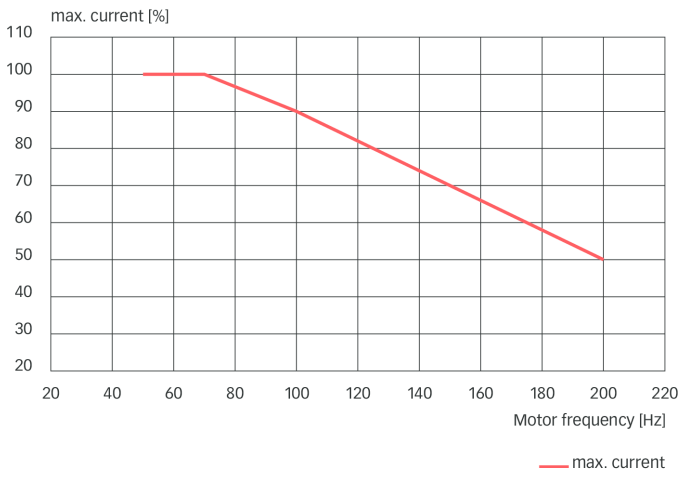
## Required drive settings

Ensure the drive's switching frequency is set to the required minimum switching frequency (see filter selection table). The mode of operation must be "scalar" (V/Hz) with a fixed switching frequency. Check the drives manufacturer manual whether special settings are necessary. In any doubt contact the drives manufacturer. CAUTION: If the motor drives settings are not correct the filter may be damaged.

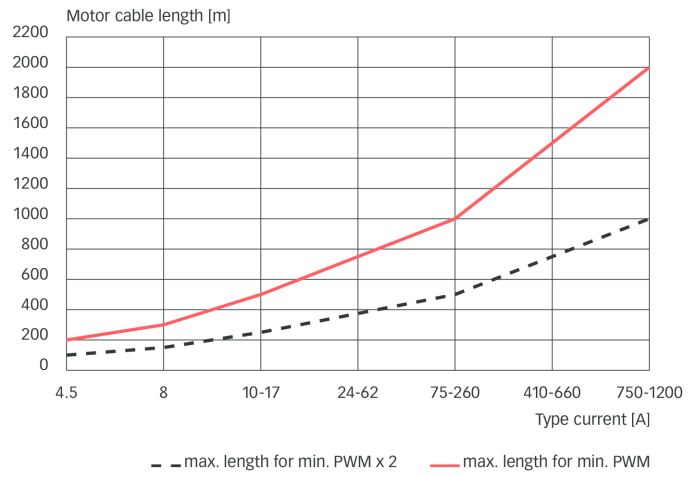
### Typical block schematic



### Motor frequency derating

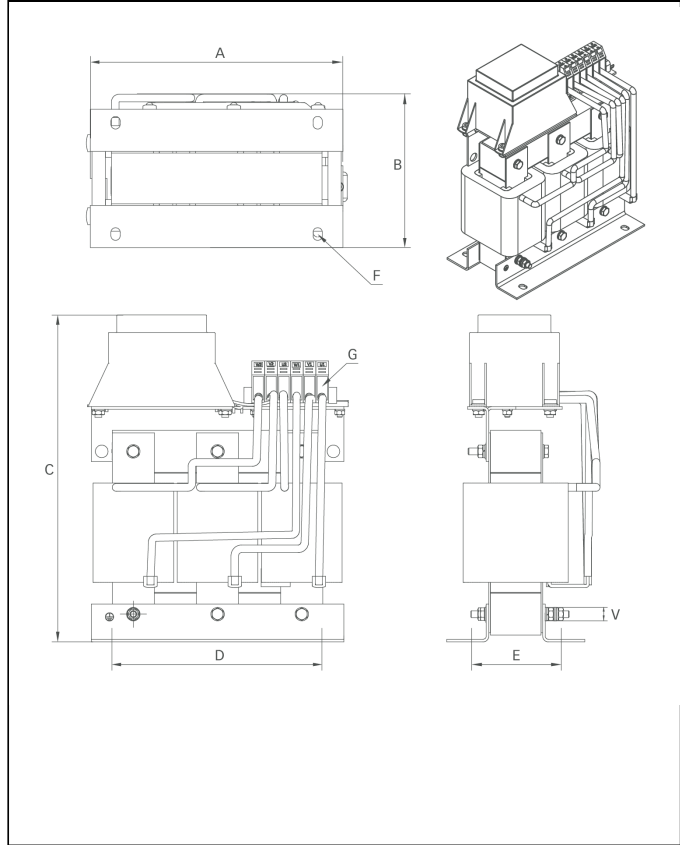


### Max. motor cable length

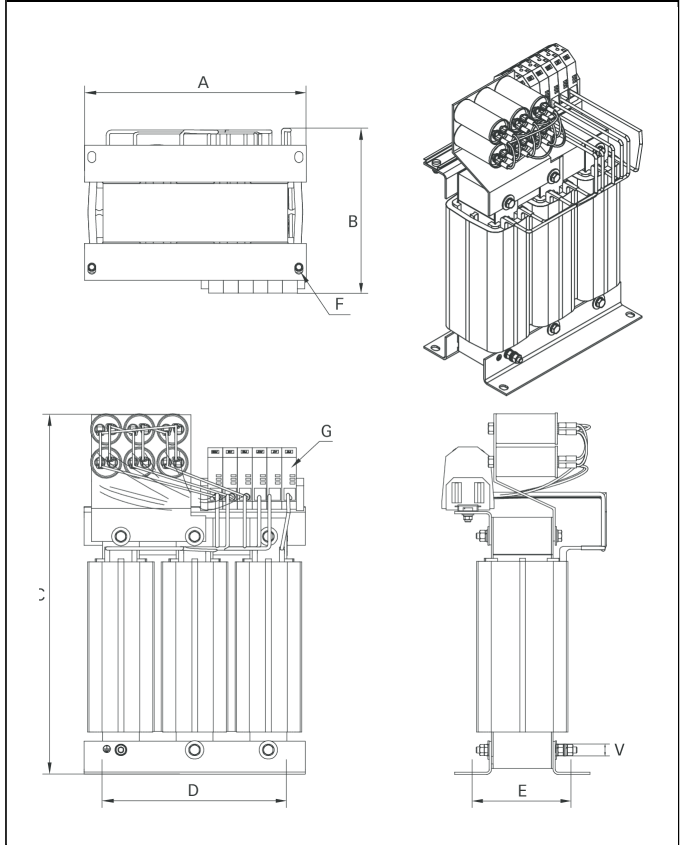


**Mechanical data FN 5040**

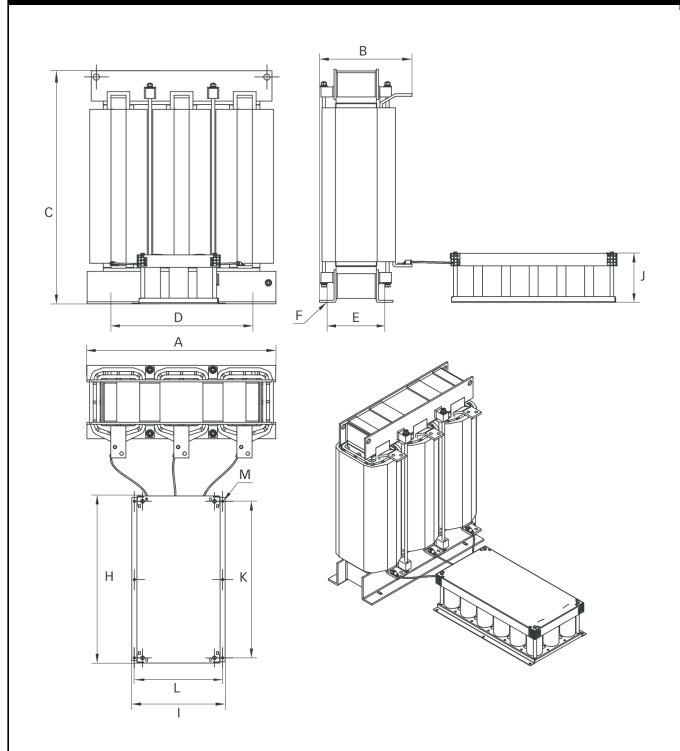
**4.5 to 75 A types**



**115 A types**



**180 to 1200 A types\***



Cable length of capacitor box:  
 180 to 410 A = 1000 mm  
 480 A to 1200 A = 1500 mm

## Dimensions FN 5040

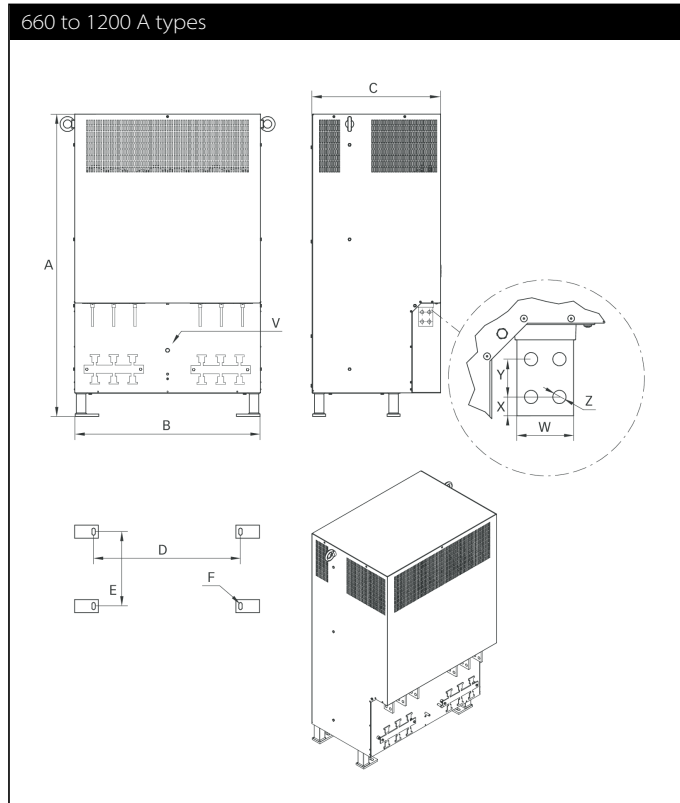
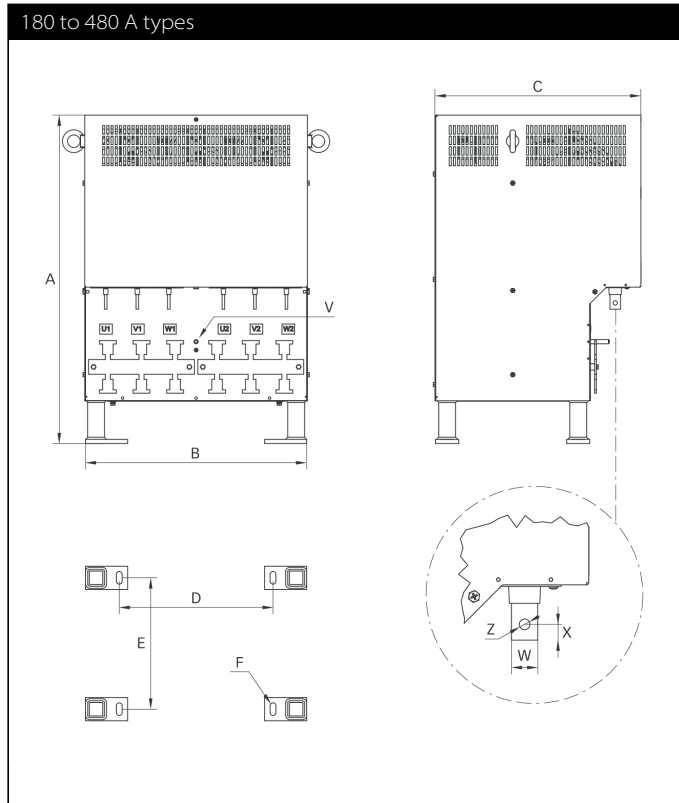
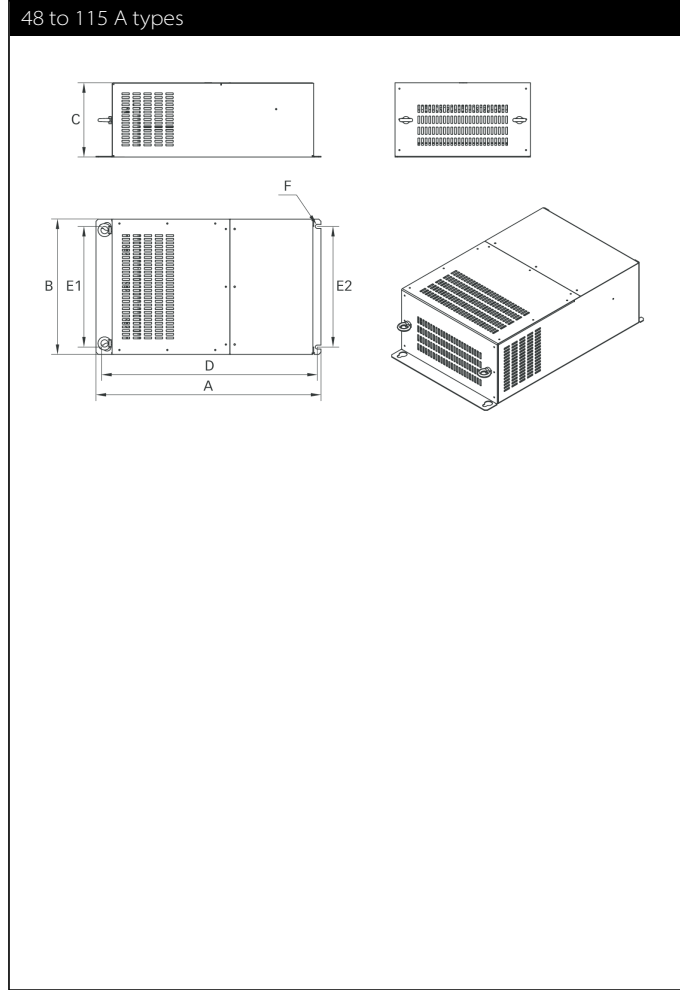
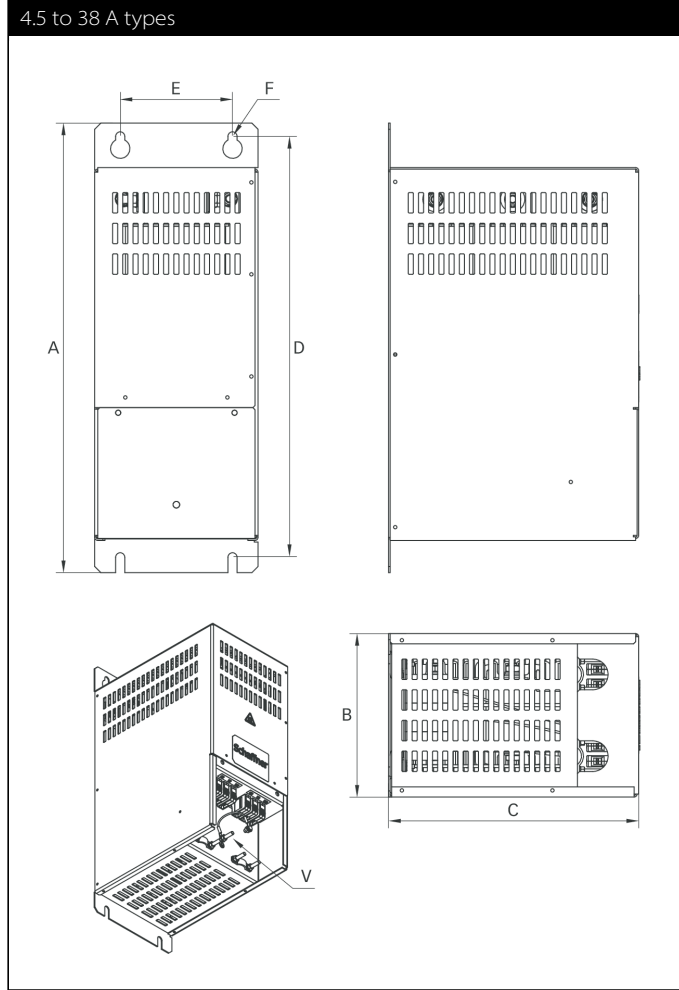
	<b>4.5 A</b>	<b>8 A</b>	<b>10 A</b>	<b>17 A</b>	<b>24 A</b>	<b>38 A</b>	<b>48 A</b>	<b>62 A</b>	<b>75 A</b>	<b>115 A</b>
<b>A</b>	125	155	155	190	190	230	300	320	305	305
<b>B</b>	77	84	94	115	116	151	171	190	240	236
<b>C</b>	171	212	208	224	224	275	355	395	395	495
<b>D</b>	100	130	123	170	170	180	240	240	240	280
<b>E</b>	55	56	71.5	57.5	77.5	122	137	132	162	151
<b>F</b>	5x8	8x12	8x12	8x12	8x12	8x12	11x15	11x15	11x15	11x15
<b>G</b>	2.5 mm <sup>2</sup>	2.5 mm <sup>2</sup>	4 mm <sup>2</sup>	4 mm <sup>2</sup>	10 mm <sup>2</sup>	10 mm <sup>2</sup>	16 mm <sup>2</sup>	35 mm <sup>2</sup>	50 mm <sup>2</sup>	50 mm <sup>2</sup>
<b>V</b>	M3	M4	M4	M6	M6	M8	M8	M8	M8	M8

	<b>180 A</b>	<b>260 A</b>	<b>410 A</b>	<b>480 A</b>	<b>660 A</b>	<b>750 A</b>	<b>880 A</b>	<b>1200 A</b>
<b>A</b>	450	453	490	510	645	665	660	750
<b>B</b>	260	255	355	355	410	468	450	375
<b>C</b>	385	485	600	618	732	670	885	925
<b>D</b>	400	370	430	430	570	570	570	570
<b>E</b>	130	150	194	195	210	220	220	220
<b>F</b>	9x13	11x15	10.5x18.5	13x27	13x27	13x26	13x26	13x26
<b>H</b>	328	328	328	328	463	555	463	665
<b>I</b>	170	170	170	270	370	375	370	375
<b>J</b>	200	220	240	220	220	200	220	220
<b>K</b>	300 (150)	300 (150)	300 (150)	300 (150)	400 (200)	510 (255)		620 (310)
<b>L</b>	150	150	150	250	350	350	350	350
<b>M</b>	9	9	9	9	9	9	9	9
<b>V</b>	M10	M10	M10	M10	M10	M10	M10	M10
<b>W</b>	25	25	40	40	40	40	50	60
<b>X</b>	13/15	13/15	13/16	13/20	20	20	14	17
<b>Y</b>	21	20	25	23	40	40	22	26
<b>Z</b>	10.3	10.3	10.3	10.3	14	14	14	14

All dimensions in mm; 1 inch = 25.4 mm

Tolerances according: ISO 2768-m / EN 22768-m

### Mechanical data FN 5045













## Dimensions FN 5045

	4.5 A	8 A	10 A	17 A	24 A	38 A	48 A	62 A	75 A	115 A	180 A	260 A	410 A	480 A	660 A	750 A	880 A	1200 A
<b>A</b>	330	330	330	440	440	440	515	515	615	615	650	650	780	780	1280	1280	1280	1280
<b>B</b>	100	100	100	160	160	160	320	320	370	370	508	508	538	538	794	794	794	794
<b>C</b>	165	165	165	245	245	245	153	153	203	203	400	400	494	494	498	498	550	550
<b>D</b>	310	310	310	412	412	412	488	488	590	590	336	336	336	336	622	622	622	622
<b>E</b>	60	60	60	110	110	110	280	280	330	330	243	243	312	312	315	315	315	315
<b>F</b>	7	7	7	9	9	9	9	9	11	11	14x30	14x30	14x30	14x30	14x30	14x30	14x30	14x30
<b>J</b>	M5	M5	M5	M5	M5	M5	M5	M5	M8	M8	M10	M10	M10	M10	M10	M10	M10	M10
<b>W</b>											20	20	25	40	40	40	40	60
<b>X</b>											15	15	15	15	20	20	20	20
<b>Y</b>															40	40	40	30/40
<b>Z</b>											9	9	10.2	10.2	14	14	14	14

All dimensions in mm; 1 inch = 25.4 mm

Tolerances according to: ISO 2768-m / EN 22768-m

## Filter output connector cross sections

	-33	-34	-35	-44	-82
					
<b>Solid wire</b>	16 mm <sup>2</sup>	35 mm <sup>2</sup>	50 mm <sup>2</sup>	10 mm <sup>2</sup>	0.75 - 2.5 mm <sup>2</sup>
<b>Flex wire</b>	10 mm <sup>2</sup>	25 mm <sup>2</sup>	50 mm <sup>2</sup>	6 mm <sup>2</sup>	1.0 - 2.5 mm <sup>2</sup>
<b>AWG type wire</b>	AWG 6	AWG 2	AWG 1/0	AWG 8	AWG 18 - 12
<b>Recommended torque</b>	1.5-1.8 Nm	4.0-4.5 Nm	7-8 Nm	1.5-1.8 Nm	1.0-1.2 Nm
					
<b>Solid wire</b>	0.75-4.0 mm <sup>2</sup>	2.5-10.0 mm <sup>2</sup>	2.5-25.0 mm <sup>2</sup>	0.75-50 mm <sup>2</sup>	16.0-50.0 mm <sup>2</sup>
<b>Flex wire</b>	1.0-4.0 mm <sup>2</sup>	4.0-10.0 mm <sup>2</sup>	4.0-16.0 mm <sup>2</sup>	0.75-35 mm <sup>2</sup>	25.0-50.0 mm <sup>2</sup>
<b>AWG type wire</b>	AWG 18-10	AWG 18-6	AWG 22-4	AWG 18-0/1	AWG 6-0
<b>Recommended torque</b>	1.5-1.8 Nm	4.0-4.5 Nm	1.5-1.8 Nm	3.2-3.7 Nm	6.0-8.0 Nm

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.

# Output Filter for Motor Drives



- Reduction of drive output voltage dv/dt
- Reduction of voltage stress at motor windings
- Protect AC motors from destructive effect of peak voltages
- Increase of motor service life
- Improvement of system reliability



### Performance indicators

Typical motor rating [kW]					
0	100	200	300	400	>500
5.5					630

Rated current [A]					
0	200	400	600	800	>1000
12					1100

### Approvals



UL recognized up to 700 A

### Features and benefits

- Efficient reduction of high output voltage dv/dt from IGBT motor drives (as per IEC 60034-17/25)
- Restriction of overvoltages caused by line reflections on motor cables (as per IEC 60034-17/25)
- Protection of motor winding insulation from premature aging and destruction
- Increase service life of electric motors
- High reliability and production up time for mission critical applications
- Less interference propagation towards neighbouring equipment or lines
- Output filter with low impedance, ideal for processes requiring exceptional precision and reproducibility of movements

### Technical specifications

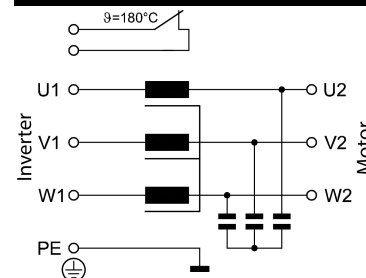
<b>Nominal operating voltage</b>	3x500 VAC
<b>Rated operating voltage</b>	3x550 VAC
<b>Rated currents</b>	12 to 1100 A @ 40°C
<b>Motor frequency</b>	0..60 Hz (with derating up to 120 Hz)
<b>Switching frequency</b>	2..16 kHz, depending on motor cable length and motor frequency -> refer graph on page 2
<b>Typical dv/dt reduction</b>	Factor 8 to 12
<b>Max. peak voltage</b>	≤1000 V
<b>Voltage drop</b>	<3 V @ 50 Hz
<b>Ambient temperature range</b>	-25°C to +40°C fully operational +40°C to +100°C with derating* -25°C to +100°C transport and storage
<b>Overload capability</b>	1.5 x rated current for 1 minute, ones per hour
<b>Protection category</b>	IP 00
<b>Flammability corresponding to</b>	UL 94V-2
<b>Design corresponding to</b>	UL 61800-5-1, EN 61800-5-1, EN 61558-2-20 or EN 60076-6

\* I<sub>derated</sub> = I<sub>nominal</sub> \* √((T<sub>max</sub>-T<sub>amb</sub>)/(T<sub>max</sub>-T<sub>nominal</sub>)) = I<sub>nom</sub> \* √((100°C-T<sub>amb</sub>)/60°C)

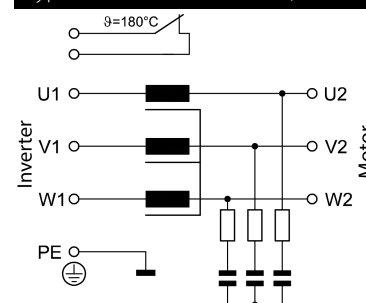
### Typical applications

- Motor drive applications with short to medium motor cable length
- Machinery comprising servo or torque motors
- Conveyers
- HVAC equipment, incl. pumps, fans and compressors
- Elevators, hoisting and cranes
- Motor drives for process lines
- Applications where sine wave filters are not suited (e.g. high dynamic operation)

### Typical electrical schematic



### Typical electrical schematic (1100 A only)



## Filter selection table

Filter	Rated current @ 40°C/50 Hz [A]	Typical motor drive power rating @ 400 V* [kW]	Typical motor drive power rating @ 480 V** [kW]	Nominal inductance [mH]	Nominal capacitance [nF]	Typical power loss*** [W]	Voltage drop**** [V]	Input/ Output connections	Weight [kg]
FN 5060-12-84	12	5.5	6.6	0.095	4.7	53	0.4	-84	1
FN 5060-24-84	24	11	13.2	0.098	4.7	55	0.7	-84	1.6
FN 5060-30-99	30	15	18	0.254	33	143	2.4	-99	6.3
FN 5060-45-99	45	22	26.4	0.17	33	182	2.4	-99	6.3
FN 5060-60-99	60	30	36	0.127	33	189	2.4	-99	7.4
FN 5060-70-99	70	37	44.4	0.109	33	214	2.4	-99	8.6
FN 5060-90-99	90	45	52.8	0.085	33	254	2.4	-99	10.4
FN 5060-110-99	110	55	66	0.069	33	316	2.4	-99	11.5
FN 5060-150-99	150	75	90	0.051	68	449	2.4	-99	14.6
FN 5060-180-99	180	90	108	0.042	68	464	2.4	-99	18.0
FN 5060-250-99	250	132	158.4	0.031	68	508	2.4	-99	22.1
FN 5060-320-99	320	160	192	0.024	68	604	2.4	-99	29.6
FN 5060-400-99	400	200	240	0.019	68	637	2.4	-99	32.2
FN 5060-500-99	500	250	300	0.015	68	471	2.4	-99	54.5
FN 5060-600-99	600	315	378	0.013	100	437	2.5	-99	63.5
FN 5060-700-99	700	400	480	0.011	100	486	2.4	-99	74.0
FN 5060-900-99	900	500	600	0.008	100	597	2.3	-99	86.5
FN 5060-1100-99	1100	630	756	0.007	100	695	2.4	-99	114.0

\* General purpose four-pole (1500 r/min) AC induction motor rated 400 V/50 Hz.

\*\* General purpose four-pole (1500 r/min) AC induction motor rated 480 V/50 Hz.

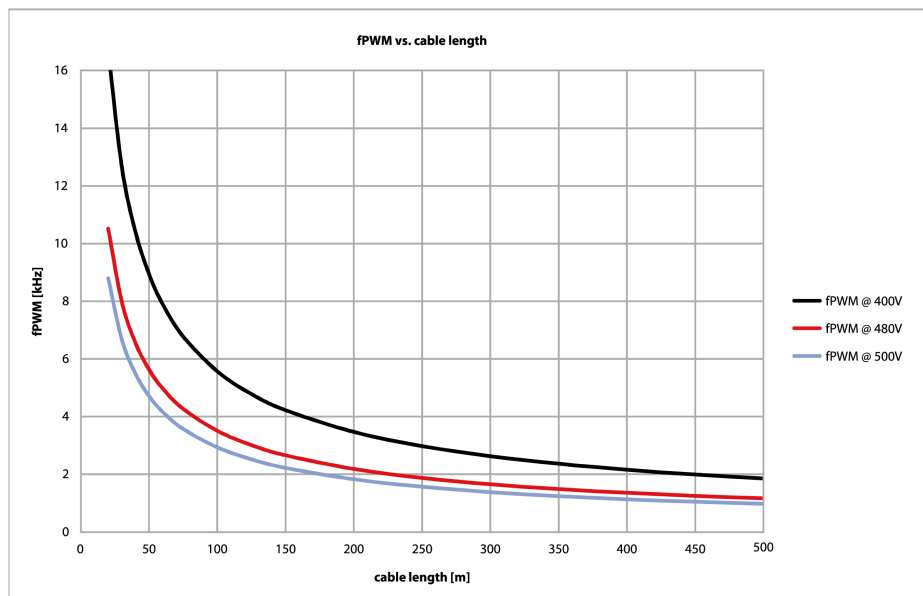
\*\*\* Power loss at 2 kHz switching frequency/80 m motor cable length. Exact value depends upon the motor cable type and length, switching frequency and further stray parameters within the system.

\*\*\*\* Voltage drop at rated current and 50 Hz.

## Switching frequency vs. motor cable length

Ensure the motor drive switching frequency is set to the required switching frequency (see filter selection table). Check the drives manual whether special settings are necessary. For any questions please contact the drives manufacturer.

Refer also to the "fPWM/cable length" diagram below:

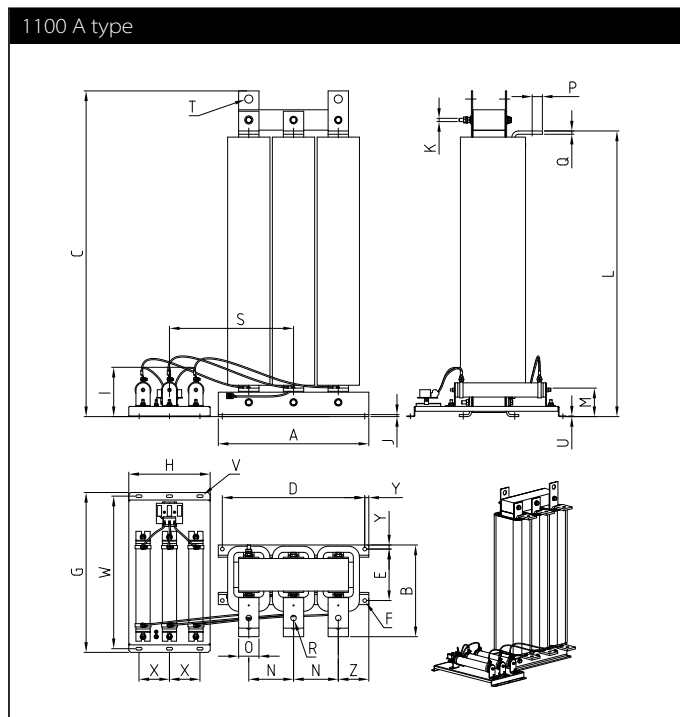
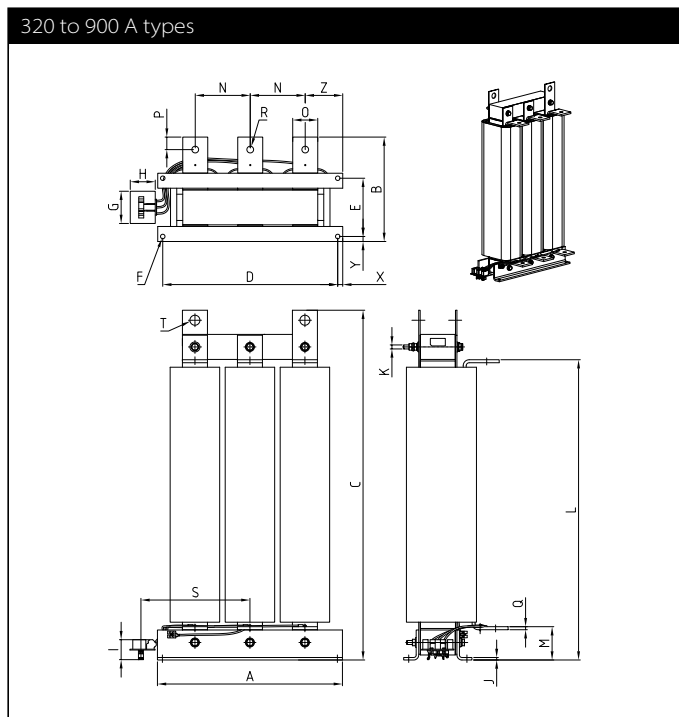
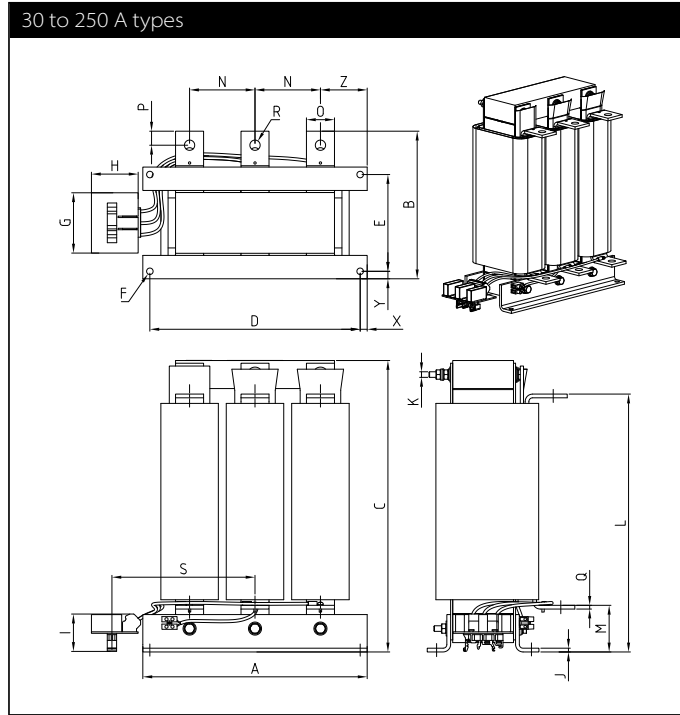
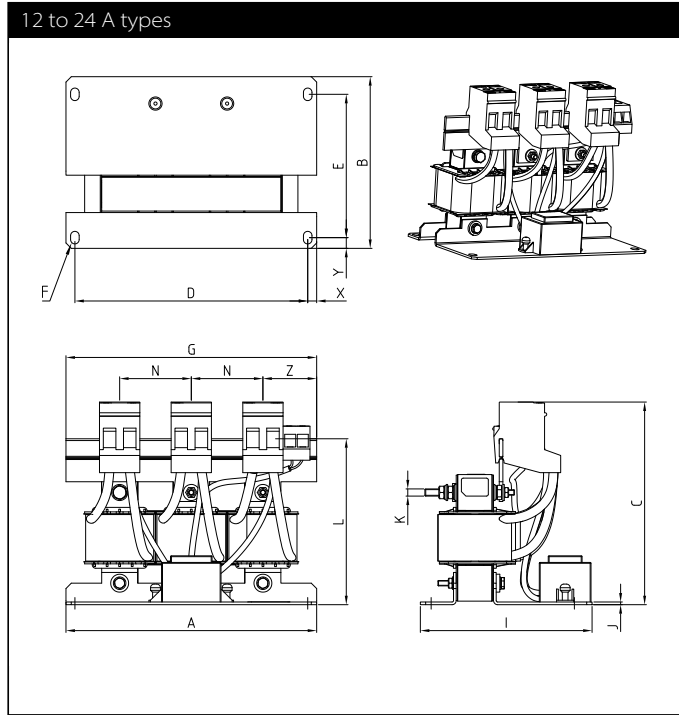


## Temperature monitoring function

The temperature monitoring device opens a potential-free contact in the case of filter overtemperature (>180°C). The maximum switching capability is 5 A/240 V. The switch can be used, for example, in the input of a CNC controller or as the trip of a circuit breaker in order to interrupt the mains power supply.



**Mechanical data**



**Dimensions (12 - 250 A)**

	<b>12 A</b>	<b>24 A</b>	<b>30 A</b>	<b>45 A</b>	<b>60 A</b>	<b>70 A</b>	<b>90 A</b>	<b>110 A</b>	<b>150 A</b>	<b>180 A</b>	<b>250 A</b>
<b>A</b>	125	140	240	240	240	240	240	240	240	240	240
<b>B</b>	85.5	96	109	110	110	121	130	136	141.5	142.5	158
<b>C</b>	104	113	151	151	181	222	221	221	254	310	312
<b>D</b>	115	130	225	225	225	225	225	225	225	225	225
<b>E</b>	70	80	66.5	66.5	66.5	66.5	76.5	81.5	86.5	88.5	103.5
<b>F</b>	7x4.8	7x4.8	Ø7(4x)	Ø7(4x)	Ø7(4x)	Ø7(4x)	Ø7(4x)	Ø7(4x)	Ø7(4x)	Ø7(4x)	Ø7(4x)
<b>G</b>	120	140	64.5	64.5	64.5	64.5	64.5	64.5	64.5	64.5	64.5
<b>H</b>			50	50	50	50	50	50	50	50	50
<b>I</b>			40	40	40	40	40	40	40	40	40
<b>J</b>			4	4	4	4	4	4	4	4	4
<b>K</b>	M4	M4	M6	M6	M6	M6	M6	M6	M6	M6	M6
<b>L</b>	84	93	120	121	148	181	181	181	222	275	276
<b>M</b>			43	44	46	54	54	54	46	49	50
<b>N</b>	34.5	40	70	70	70	70	70	70	70	70	70
<b>O</b>			20	20	20	30	30	30	30	30	30
<b>P</b>											
<b>Q</b>			3	3	3	3	3	3	4	4	4
<b>R</b>			Ø9(6x)	Ø9(6x)	Ø9(6x)	Ø11(6x)	Ø11(6x)	Ø11(6x)	Ø11(6x)	Ø11(6x)	Ø11(6x)
<b>S</b>	max. 360	max. 360	max. 360	max. 360	max. 360	max. 360	max. 360	max. 360	max. 360	max. 360	
<b>T</b>											
<b>U</b>											
<b>V</b>											
<b>W</b>											
<b>X</b>	5	5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
<b>Y</b>	6	6	8	8	8	8	8	8	8	8	8
<b>Z</b>	27.5	30									

All dimensions in mm; 1 inch = 25.4 mm  
Tolerances according: ISO 2768-m/EN 22768-m

## Dimensions (320 -1100 A)

	320 A	400 A	500 A	600 A	700 A	900 A	1100 A
<b>A</b>	240	240	370	370	370	370	370
<b>B</b>	165	174	197	199	209	209	225
<b>C</b>	438	438	499	598	599	700	801
<b>D</b>	225	225	350	350	350	350	350
<b>E</b>	103.5	108.5	106.5	106.5	116.5	116.5	126.5
<b>F</b>	Ø7(4x)	Ø7(4x)	Ø9(4x)	Ø9(4x)	Ø9(4x)	Ø9(4x)	Ø9(4x)
<b>G</b>	64.5	64.5	64.5	64.5	64.5	64.5	393
<b>H</b>	50	50	50	50	50	50	200
<b>I</b>	40	40	40	40	40	40	120
<b>J</b>	4	4	5	5	5	5	5
<b>K</b>	M6	M6	M8	M8	M8	M8	M8
<b>L</b>	375	375	401	500	501	601	702
<b>M</b>	51	51	66	65	67	67	70
<b>N</b>	70	70	110	110	110	110	110
<b>O</b>	30	30	50	50	50	50	50
<b>P</b>	15	15	25	25	25	25	25
<b>Q</b>	6	6	5	5	6	6	8
<b>R</b>	Ø11(6x)	Ø11(6x)	Ø13.5(6x)	Ø13.5(6x)	Ø13.5(6x)	Ø13.5(6x)	Ø13.5(6x)
<b>S</b>	max. 360	max. 360	max. 420	max. 420	max. 420	max. 420	max. 550
<b>T</b>	Ø18(2x)	Ø18(2x)	Ø20(2x)	Ø20(2x)	Ø20(2x)	Ø20(2x)	Ø20(2x)
<b>U</b>							1.5
<b>V</b>							6.5
<b>W</b>							375
<b>X</b>	7.5	7.5	10	10	10	10	75
<b>Y</b>	8	8	10	10	10	10	10
<b>Z</b>							

All dimensions in mm; 1 inch = 25.4 mm  
Tolerances according: ISO 2768-m/EN 22768-m

## Filter input/output cross sections

	-84
<b>Solid wire</b>	6 mm <sup>2</sup>
<b>Flex wire</b>	4 mm <sup>2</sup>
<b>AWG type wire</b>	AWG 10
<b>Recommended torque</b>	0.6-0.8 Nm

Please note:

The input/output cross sections have to be of equal or bigger size as the cross section of the filter bus bar terminals.

Make sure to consult and respect local, national and international safety codes.

Connect the protective earth terminal(s) first, before attempting to connect phase terminals.

Please consult the documents „Mounting and Installation Guidelines“ being shipped with the product.

For additional information please consult the document „Basis in EMC and Power Quality“, published in the download section of [www.schaffner.com](http://www.schaffner.com).

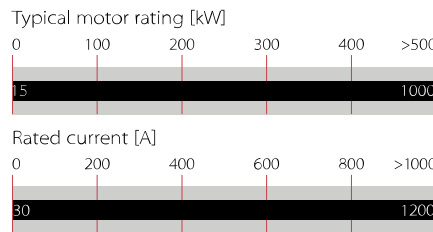
# Output Filter for Motor Drives



- Reduction of drive output voltage dv/dt
- Reduction of voltage stress at motor windings
- Protect AC motors from destructive effect of peak voltages
- Increase of motor service life
- Improvement of system reliability



### Performance indicators



### Approvals



UL recognized up to 320 A

### Features and benefits

- Efficient reduction of high output voltage dv/dt from IGBT motor drives (as per IEC 60034-17/25)
- Restriction of overvoltages caused by line reflections on motor cables (as per IEC 60034-17/25)
- Protection of motor winding insulation from premature aging and destruction
- Increase service life of electric motors
- Patented solution without capacitors and resistors for ease of installation and increased reliability
- Less interference propagation towards neighbouring equipment or lines
- Output filter with low impedance, ideal for processes requiring exceptional precision and reproducibility of movements

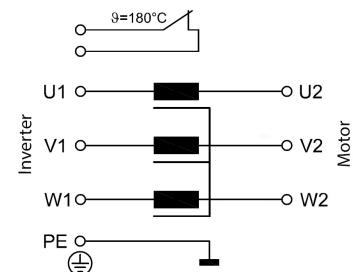
### Technical specifications

<b>Max. operating voltage</b>	3 ph 760 VAC
<b>Rated currents</b>	30 to 1200 A @ 40°C
<b>Motor frequency</b>	0..60 Hz (with derating up to 120 Hz)
<b>Switching frequency</b>	up to 16 kHz, depending on motor cable length and motor frequency -> refer graph on page 2
<b>Typical dv/dt reduction</b>	Factor 8 to 12
<b>Max. peak voltage</b>	≤1850 V (according EN 60034-25B)
<b>Voltage drop</b>	<3 V @ 50 Hz
<b>Rated temperature</b>	+40°C without derating up to 100°C
<b>Operation temperature</b>	-25°C to +100°C (25/100/21)
<b>Transportation and storage temperature</b>	-40°C to +100°C (25/100/21)
<b>Overload capability</b>	1.5 x rated current for 1 minute, once per hour
<b>Protection category</b>	IP 00
<b>Flammability corresponding to</b>	UL 94V-2
<b>Design corresponding to</b>	UL 61800-5-1, CSA 22.2 No.14, EN 61558-2-20

### Typical applications

- Motor drive applications with short to medium motor cable length
- Machinery comprising servo or torque motors
- Submersible- and irrigation pumps
- HVAC equipment, incl. pumps, fans and compressors
- Elevators, hoisting and cranes
- Motor drives for process lines
- Applications where sine wave filters are not suited (e.g. high dynamic operation)

### Typical electrical schematic



## Filter selection table

Filter	Rated current @ 40°C/50 Hz [A]	Nominal inductance [mH]	**Typical power loss [W]	Input/ Output connections	Weight [kg]
FN 5060 HV-30-99	30	0.17	641	-99	12
FN 5060 HV-45-99	45	0.17	653	-99	12.5
FN 5060 HV-75-99	75	0.1	478	-99	23
FN 5060 HV-115-99	115	0.069	394	-99	27
FN 5060 HV-165-99	165	0.051	301	-99	36
FN 5060 HV-220-99	220	0.035	371	-99	44
FN 5060 HV-320-99	320	0.023	383	-99	59
FN 5060 HV-450-99	450	0.019	376	-99	68
FN 5060 HV-660-99	660	0.012	455	-99	100
FN 5060 HV-900-99	900	0.009	550	-99	111
FN 5060 HV-1200-99	1200	0.007	670	-99	139

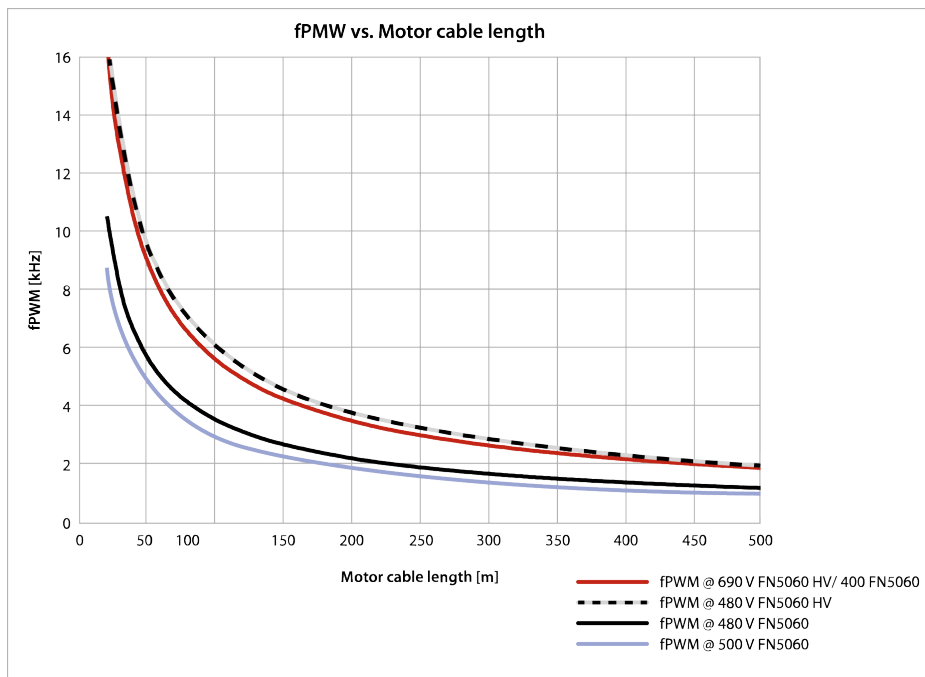
\* General purpose four-pole (1500 r/min) AC induction motor rated 690 V/50 Hz.

\*\* Power loss at 2 kHz switching frequency/80 m motor cable length. Exact value depends upon the motor cable type and length, switching frequency and further stray parameters within the system.

## Switching frequency vs. motor cable length

Ensure the motor drive switching frequency is set to the required switching frequency (see filter selection table). Check the drives manual whether special settings are necessary. For any questions please contact the drives manufacturer.

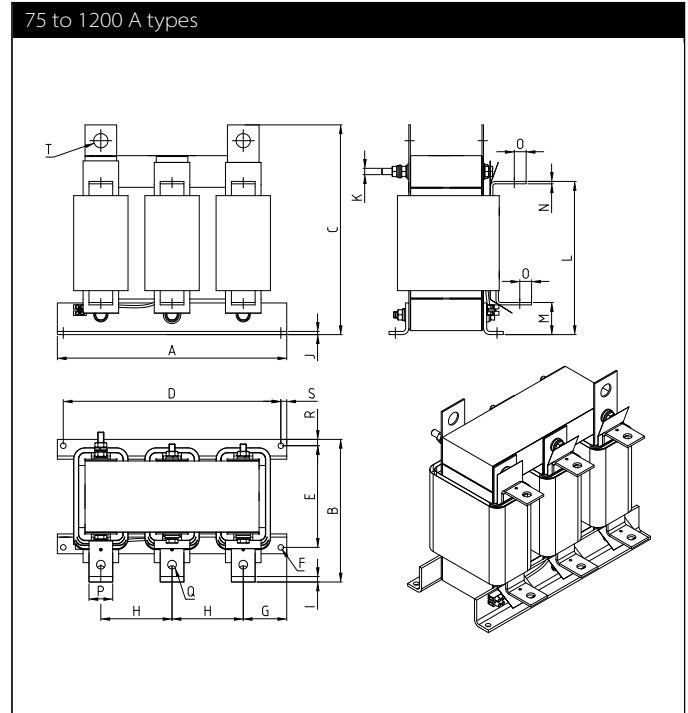
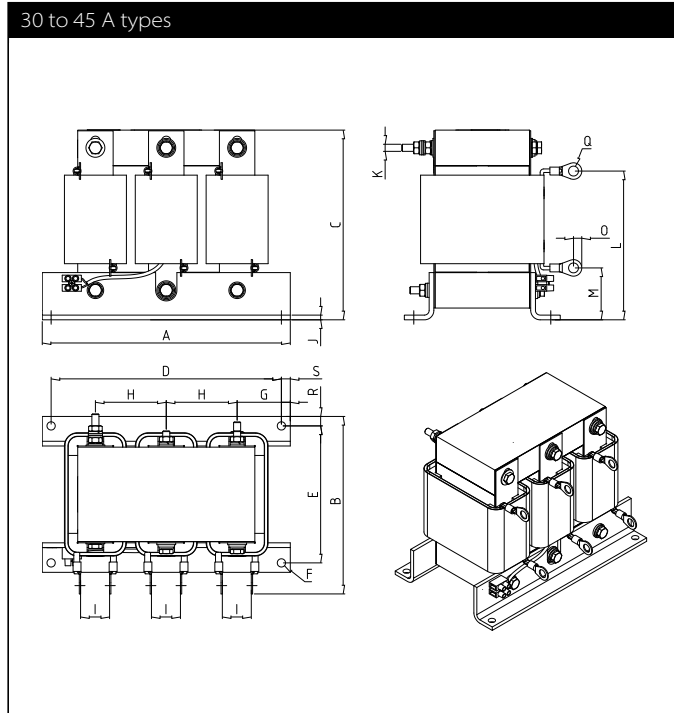
Refer also to the "fPWM/cable length" diagram below:



## Temperature monitoring function

The temperature monitoring device opens a potential-free contact in the case of filter overtemperature (>180°C). The maximum switching capability is 5 A/240 V. The switch can be used, for example, in the input of a CNC controller or as the trip of a circuit breaker in order to interrupt the mains power supply.

## Mechanical data



## Dimensions

	30 A	45 A	75 A	115 A	165 A	220 A	320 A	450 A	660 A	900 A	1200 A
<b>A</b>	210	210	290	290	290	290	390	390	390	390	390
<b>B</b>	138	143	168	180	191	211	187	209	220	229	260
<b>C</b>	161	161	265	265	314	314	444	496	546	595	642
<b>D +/-0.7</b>	195	195	275	275	275	275	366	366	366	366	366
<b>E +/-0.7</b>	111	116	113.5	128.5	138.5	158.5	120.5	120.5	130.5	140.5	160.5
<b>160.5F</b>	Ø7(4x)	Ø7(4x)	Ø7(4x)	Ø7(4x)	Ø7(4x)	Ø7(4x)	Ø9(4x)	Ø9(4x)	Ø9(4x)	Ø9(4x)	Ø9(4x)
<b>G</b>	45	45	55	55	55	55	75	75	75	75	75
<b>H</b>	60	60	90	90	90	90	120	120	120	120	120
<b>I</b>	25	25	9	7	8	8	10	10	11	10	17
<b>J</b>	4	4	4	4	4	4	5	5	5	5	5
<b>K</b>	M6	M6	M8	M8	M8	M8	M8	M8	M8	M8	M8
<b>L</b>	126	126	194	194	245	244	331	381	432	481	533
<b>M</b>	44	44	41	41	41	40	75	76	76	75	75
<b>N</b>			3	3	4	4	6	5	6	6	8
<b>O</b>	7	7	15	15	15	15	15	25	25	25	25
<b>P</b>			30	30	30	30	30	50	50	50	50
<b>Q</b>	Ø8(6x)	Ø8(6x)	Ø11(6x)	Ø11(6x)	Ø11(6x)	Ø11(6x)	Ø11(6x)	Ø13.5(6x)	Ø13.5(6x)	Ø13.5(6x)	Ø13.5(6x)
<b>R</b>	8	8	8	8	8	8	12	12	12	12	12
<b>S</b>	7.5	7.5	7.5	7.5	7.5	7.5	12	12	12	12	12
<b>T</b>			Ø18(2x)	Ø18(2x)	Ø18(2x)	Ø18(2x)	Ø20(2x)	Ø20(2x)	Ø20(2x)	Ø20(2x)	Ø20(2x)

All dimensions in mm; 1 inch = 25.4 mm

Tolerances according: ISO 2768-v/EN 22768-v, if not stated otherwise

Please note:

Make sure to consult and respect local, national and international safety codes.

Connect the protective earth terminal(s) first, before attempting to connect phase terminals.

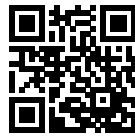
Please consult the documents „Mounting and Installation Guidelines“ being shipped with the product.

For additional information please consult the document „Basis in EMC and Power Quality“, published in the download section of [www.schaffner.com](http://www.schaffner.com).

# LCL Filter for Active Front End Motor Drives / Active Infeed Converter



- Line side LCL filtering for AFE/AIC applications
- Mandatory interface to connect the AFE/AIC-system to the grid
- Helps to improve the power quality on the grid side
- Reduces ripple currents and voltage distortions
- All LCL components in one package
- Compact design and ready to be connected



## Approvals & Compliances



## Features and benefits

- Improves the power quality for AFE (Active Front End) / AIC (Active Infeed Converter)
- Effective attenuation of converter switching frequency to the grid/line side
- Reduces the current and voltage ripples to acceptable levels for the grid/line side
- Version with passive RLC damping module for system stability
- Compact and user friendly design for ease of installation

## Technical specifications

<b>Nominal operating voltage</b>	3 x 380...480 VAC
<b>Rated operating voltage</b>	3 x 340...530 VAC
<b>Nominal line frequency</b>	50/60 Hz
<b>Switching frequency fPWM</b>	min. 3 kHz up to max. 10 kHz
<b>Rated currents</b>	25A @ 50°C available Other current ratings on request
<b>Rated inductance L2 (inverter/converter side)</b>	8% @ 400V, 50 Hz and rated current
<b>Rated inductance L1 (grid/line side)</b>	4% @ 400V, 50 Hz and rated current
<b>Overload capability</b>	1.6 x rated current for 1 min., ones per hour
<b>Protection category</b>	IP00 (IP20 on request)
<b>Ambient temperature range</b>	-25°C to +50°C full operation >50°C to 70°C derated operation -25°C to 85°C storage and transportation
<b>Insulation class</b>	EIS 200
<b>Flammability corresponding to</b>	UL 94 V-0
<b>Design corresponding to</b>	Filter: UL61800-5-1, EN61800-5-1 Chokes: EN61558-2-20 or EN60076-6
<b>Creepage and clearance distances</b>	According UL 61800-5-1

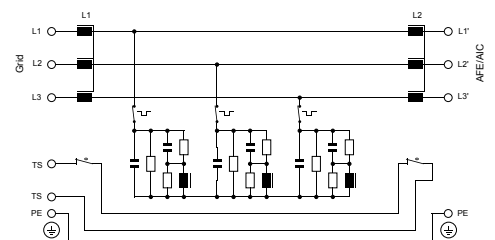
\* Note: for detailed resulting ripple current, please contact your local Schaffner office or partner.

## Typical applications

- Hoists and cranes
- Elevators
- Test stands
- Winder/Unwinder
- Multiple motor drive systems with AFE/AIC
- Motor drives and -systems with braking energy
- Special machines with high inertia
- Centrifuges
- Transportation systems, e.g. chair lifts etc

## Typical RLC electrical schematic

With RLC damping module:



Note: Versions without damping module only to be used with motor drive active damping in function.

## Filter selection table

Filter*	Rated current @ 50°C [A]	Typical motor drive** 400 V/50 Hz [kVA]	Frame size	Nominal inductance		Nominal C capacity [μF]	Typical power loss*** [W]	Input/ Output connections	Weight [kg]
				L2 [mH]	L1 [mH]				
<b>with RLC damping module:</b>									
<b>FN 6840-25-113-E0XXR</b>	25	17	D	2.35	1.22	30	510	-113	26
<b>without damping module:</b>									
<b>FN 6840-25-113-E0XXX</b>	25	17	D	2.35	1.22	30	360	-113	24

\* Other current ratings on request.

\*\* Rated current @ 400 VAC/50 Hz. The proper power selection depends upon the drive specification, the motor and the application requirements.

\*\*\* Losses calculated at 400 VAC/50 Hz and 3 kHz switching frequency.

Product selector	
FN 6840 -uuu -vvv -ww -yy -z	
X:	without damping module
R:	with RLC damping module
XX:	without fan and power supply (not for 380 A)
FA:	with fan and power supply
E0:	IP00 version
E2:	IP20 version (on request)
	Terminal style
	Rated AC current

## Temperature monitoring function

The temperature monitoring device opens a potential-free contact in the case of filter overtemperature (>180°C). The maximum switching capability is 5 A/240 V. **Important Note:** The switch **MUST** be used, for example, as an input of a logic controller (e.g. PLC, CNC etc.) or as the trip of a circuit breaker in order to interrupt the mains power supply.

## Required drive settings and grid considerations

Ensure the drive's switching frequency is set between the required minimum and maximum switching frequency.

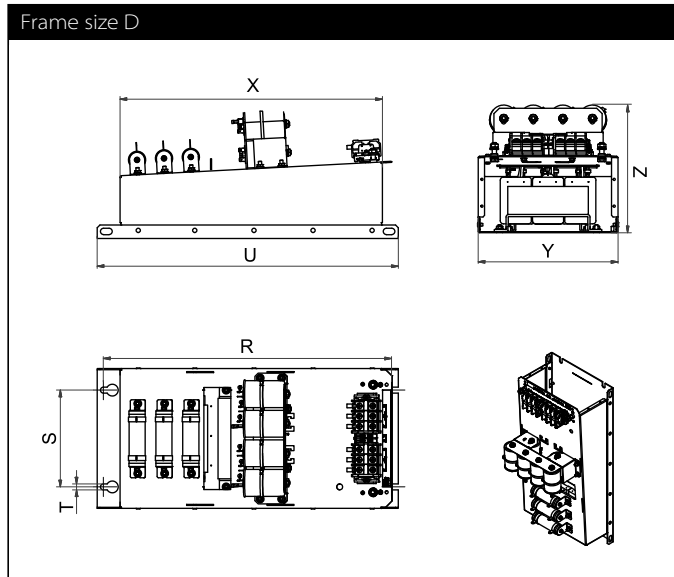
The max. permissible motor drive DC link voltage is 850 VDC.

Check the drive manufacturer manual whether special settings are necessary. In any doubt contact the drive manufacturer.

**CAUTION:** There is a risk of damaging the filter if the settings are not correct on the Active Front End (AFE) motor drive, also called Active Infeed Converter (AIC).



## FN 6840 Mechanical data of IP00 design



### Dimensions

	R	S	T	U	X	Y	Z
Frame size D	540	180	11	560	489	260	238

All dimensions in mm

Tolerances according: ISO 2768-m/EN 22768-m, if not stated otherwise

### Filter power terminals

	Screw thread	Cross section [mm <sup>2</sup> ]	Flex wire AWG	Screw torque value [Nm]	Max width** cable lug [mm]	Frame size
-113*	M6	0.75-16	6-18	3	16	D

\* Recommended connector type: wire or cable lug for 110 to 115, only cable lug for 115 to 118

\*\* Proof final installation for clearance and creepage

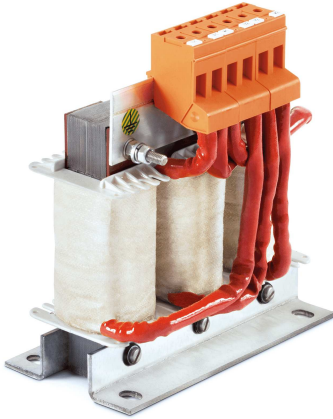
### Filter signal and earth terminals

Terminal type	Screw thread	Screw torque value [Nm]	Frame size
Signal	M3*	0.5	All
Earth (PE)	M8	9	D

\* Max width cable lug = 7 mm

**Note:** For additional information please contact your local Schaffner office or partner.

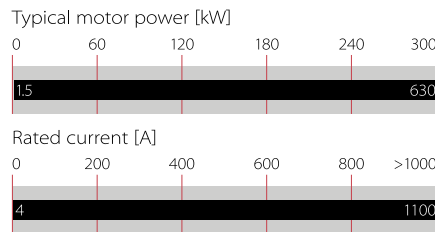
# Three-phase dv/dt Reactor for Efficient Motor Protection



- Reduction of drive output voltage dv/dt
- Reduction of motor temperature
- Increase of motor service life
- Compact and economic open frame design
- Standard catalog reactors up to 1100 A
- UL rated materials used



### Performance indicators



### Approvals



UL 508C up to 182 A. For use with AC or DC drives (power conversion equipment) only

### Features and benefits

- Efficient reduction of high output voltage dv/dt from IGBT motor drives
- Protection of motor coil insulation from premature aging and destruction
- Significantly increased service life of electric motors
- High reliability and secured production up time for mission critical applications
- Reduced converter pulse load
- Less interference propagation towards neighboring equipment of lines
- „Output filter“ with low impedance, ideal for processes requiring exceptional precision and reproducibility of movements
- Vacuum impregnation for reduced humming noise and high durability

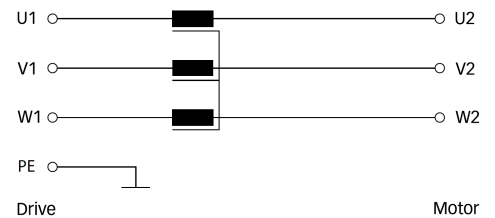
### Technical specifications

<b>Maximum continuous operating voltage</b>	3 x 500/288 VAC
<b>Motor frequency</b>	60 Hz
<b>Switching frequency</b>	2 to 16 kHz
<b>Rated currents</b>	4 to 1100 A @ 40°C
<b>Motor cable length</b>	30 m max. @ 16 kHz (derating curve next page)
<b>Impedance (uk)</b>	0.8% @ 400 VAC, 50 Hz & rated current
<b>Typical dv/dt reduction</b>	≥factor 5
<b>High potential test voltage</b>	P → E 3000 VAC for 3 sec P → P 3000 VAC for 3 sec
<b>Protection category</b>	IP 00 (KL types according to VBG 4)
<b>Overload capability</b>	2 x rated current at switch on for 30 seconds 1.5 x rated current for 1 minute, once per hour
<b>Temperature range (operation and storage)</b>	-25°C to +100°C (25/100/21)
<b>Insulation class</b>	T40/N (200°C) for ≤182 A types T40/F (155°C) for ≥230 A types
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	EN 61558-2-20 (VDE 0570-2-20), UL 508C, CSA C22.2 NO. 14
<b>MTBF @ 40°C/400 V (Mil-HB-217F)</b>	>500,000 hours



### Typical applications

- Servo drives
- Close loop vector drives
- Motor drive applications with short motor cables
- Machinery comprising servo or torque motors
- Robots
- Pick and place machines

### Typical electrical schematic



## Reactor selection table

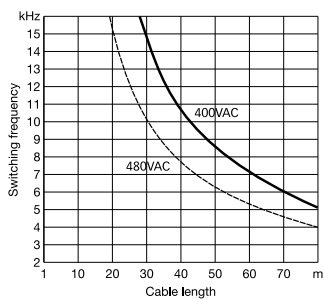
Reactor	Rated current @ 40°C	Typical motor power rating*	Nominal inductance	Typical power loss**	Input/Output connections			Weight Total
	[A]	[kW]	[mH]	[W]				[kg]
RWK 305-4-KL	4	1.5	1.47	22	KL			1.2
RWK 305-7.8-KL	7.8	3	0.754	25	KL			1.2
RWK 305-10-KL	10	4	0.588	30	KL			1.8
RWK 305-14-KL	14	5.5	0.42	34	KL			2.2
RWK 305-17-KL	17	7.5	0.346	38	KL			2.5
RWK 305-24-KL	24	11	0.245	45	KL			2.5
RWK 305-32-KL	32	15	0.184	55	KL			3.9
RWK 305-45-KL	45	22	0.131	60	KL			6.1
RWK 305-60-KL	60	30	0.098	65	KL			6.1
RWK 305-72-KL	72	37	0.082	70	KL			6.1
RWK 305-90-KL	90	45	0.065	75	KL			7.4
RWK 305-110-KL	110	55	0.053	90	KL			8.2
RWK 305-124-KS	124	55	0.047	110		KS		8.2
RWK 305-143-KS	143	75	0.041	115		KS		10.7
RWK 305-156-KS	156	75	0.038	120		KS		10.7
RWK 305-170-KS	170	90	0.035	130		KS		10.7
RWK 305-182-KS	182	90	0.032	140		KS		16
RWK 305-230-KS	230	132	0.026	180		KS		22
RWK 305-280-KS	280	160	0.021	220		KS		29
RWK 305-330-KS	330	160	0.018	240		KS		32
RWK 305-400-S	400	200	0.015	330			S	34
RWK 305-500-S	500	250	0.012	340			S	35
RWK 305-600-S	600	355	0.01	380			S	37
RWK 305-680-S	680	400	0.009	410			S	38
RWK 305-790-S	790	450	0.007	590			S	43
RWK 305-910-S	910	500	0.006	740			S	49
RWK 305-1100-S	1100	630	0.005	760			S	66

\* General purpose four-pole (1500 r/min) AC induction motor rated 400 V/50 Hz.

\*\* Exact value depends upon the motor cable type and length, switching frequency, motor frequency and further stray parameters within the system.

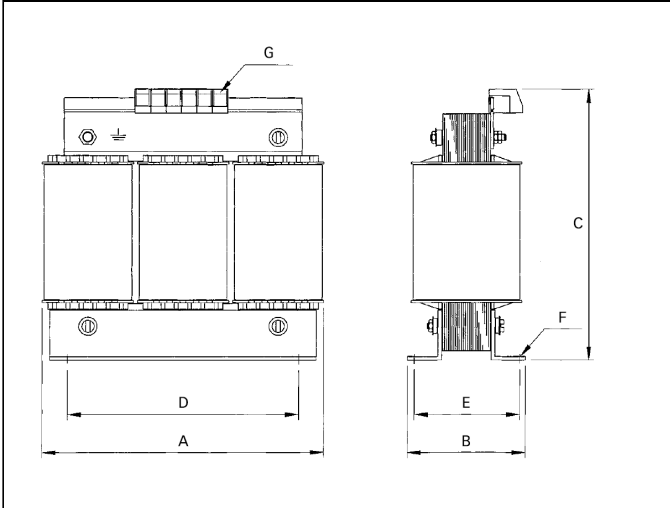
## Reactor derating

The maximum admissible motor cable length depends mainly on the switching frequency and the drive output voltage. The applicable value for a given application can be found in the derating curve below.

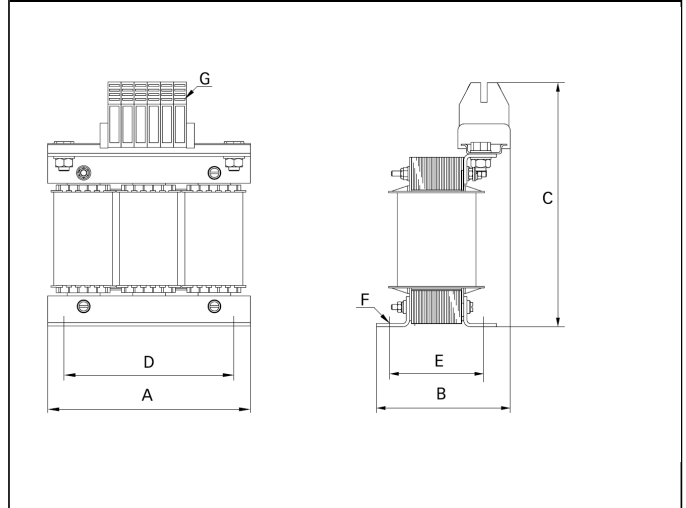


## Mechanical data

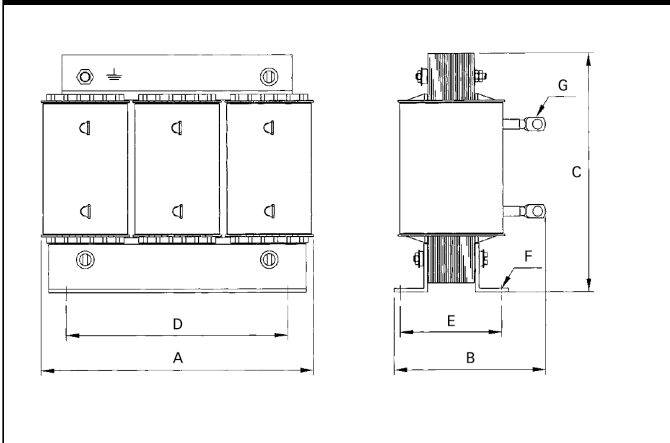
4 to 45A types



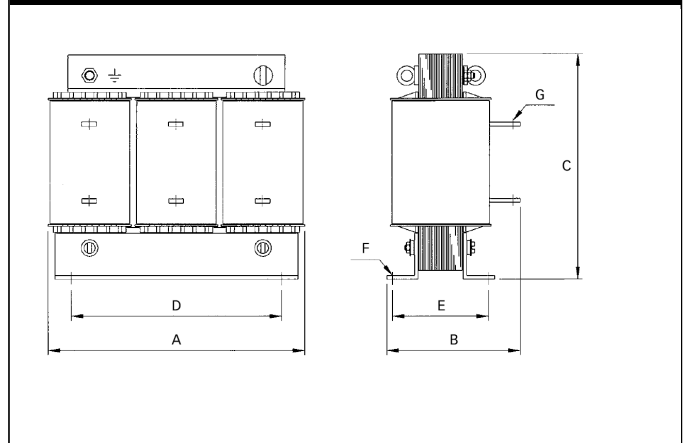
60 to 110 A types



124 to 330 A types



400 to 1100 A types



## Dimensions

	A	B	C	D	E	F	G
<b>4 and 7.8 A</b>	100	max. 60	max. 115	56	34	4.8 x 9	2.5 mm <sup>2</sup>
<b>10 A</b>	100	max. 70	max. 115	56	43	4.8 x 9	2.5 mm <sup>2</sup>
<b>14 A</b>	125	max. 70	max. 135	100	45	5 x 8	2.5 mm <sup>2</sup>
<b>17 A</b>	125	max. 75	max. 135	100	55	5 x 8	2.5 mm <sup>2</sup>
<b>24 A</b>	125	max. 75	max. 135	100	55	5 x 8	4 mm <sup>2</sup>
<b>32 A</b>	155	max. 95	max. 170	130	56	8 x 12	10 mm <sup>2</sup>
<b>45 A</b>	155	max. 110	max. 190	130	72	8 x 12	10 mm <sup>2</sup>
<b>60 and 72 A</b>	155	max. 125	max. 190	130	70	8 x 12	16 mm <sup>2</sup>
<b>90 A</b>	190	max. 115	max. 225	170	57	8 x 12	35 mm <sup>2</sup>
<b>110 A</b>	190	max. 130	max. 220	170	67	8 x 12	35 mm <sup>2</sup>
<b>124 A</b>	190	max. 180	max. 160	170	67	8 x 12	Ø 8
<b>143 A</b>	190	max. 180	max. 160	170	77	8 x 12	Ø 8
<b>156 AND 170 A</b>	190	max. 180	max. 160	170	77	8 x 12	Ø 10
<b>182 A</b>	210	max. 180	max. 185	175	95	8 x 12	Ø 10
<b>230 A</b>	240	220	220	190	119	11 x 15	Ø 12
<b>280 A</b>	240	235	220	190	133	11 x 15	Ø 12
<b>330 A</b>	240	240	220	190	135	11 x 15	Ø 12
<b>400 and 500 A</b>	240	220	325	190	119	11 x 15	Ø 11
<b>600 and 680 A</b>	240	230	325	190	128	11 x 15	Ø 14
<b>790 A</b>	300	218	355	240	136	11 x 15	2 x Ø 11
<b>910 A</b>	300	228	355	240	148	11 x 15	2 x Ø 11
<b>1100 A</b>	360	250	380	310	144	11 x 15	2 x Ø 11

All dimensions in mm; 1 inch = 25.4 mm  
Tolerances according: ISO 2768-m / EN 22768-m

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.

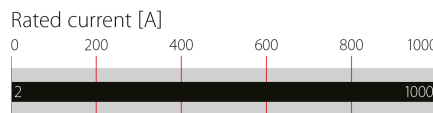
## 3-phase Line Reactor to reduce mains disturbances



- 4% 3-phase line reactor for 400 V network
- Reducing harmonics on the mains side
- Reducing commutation notches
- Limiting inrush current
- Reliable and economical solution for mitigating mains disturbances



### Performance indicators



### Approvals



(UL recognized up to 640 A)

### Features and benefits

- Ensure reliability, performance and a long service life of electrical consumers
- Reduction of mains harmonics and commutation notches
- Help to meet international power quality standards
- Protection of motor drive electronics and dc link capacitors against mains transients
- Reduction of inrush and peak currents
- Improvement of conducted LF immunity
- Prevention from nuisance tripping caused by power line voltage spikes
- Improvement of true power factor

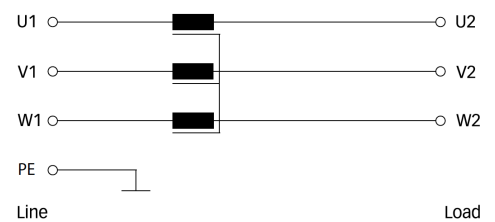
### Technical specifications

<b>Nominal operating voltage</b>	3x 380 to 480 VAC
<b>Rated operating voltage</b>	3x 340 to 530 VAC
<b>Impedance</b>	4% @ 400 V, 50 Hz and rated rms current
<b>Insulation class</b>	UL electrical insulation system SCH-200(N)
<b>Protection category</b>	IP 00
<b>Cooling</b>	Natural cooling AN
<b>Overload capability</b>	1.6x rated current for 1 minute, once per hour
<b>Ambient temperature range</b>	-40°C to +45°C fully operational +45°C to +100°C derated operation* Note: derating according NEC 310-15(C)
<b>Transportation and storage temperature</b>	-40°C to +100°C transport and storage
<b>Flammability corresponding to</b>	UL 94V-0
<b>Design corresponding to</b>	UL 61800-5-1, EN 61558-2-20, EN 60076-6
<b>Lifetime (calculated)</b>	20 years
<b>Earthing System</b>	TN, TT, IT
<b>Climatic category</b>	40/100/21 (IEC 60068-1)
<b>Pollution degree</b>	PD3
<b>Overvoltage category</b>	OV III (IEC 60664-1 / UL 61800-5-1)

### Typical applications

- Motor drives and various adjustable speed drive systems, such as:
- HVAC
- Robots
- Machinery
- Process automation equipment

### Typical electrical schematic



\*I<sub>derated</sub> = I<sub>nominal</sub> \* √((T<sub>max</sub>-T<sub>amb</sub>)/(T<sub>max</sub>-T<sub>nominal</sub>)) = I<sub>nom</sub> \* √((100°C-T<sub>amb</sub>)/55°C)

## Reactor selection table

Reactor	Rated current	Rated Power *		Rated Power**	Inductance value	Typical power losses	Terminal	Weight	
	@ 45°C	@ 400V	[kW]	@ 480V				[kg]	[lbs]
	[A]	[kW]	[kW]	[HP]	[mH]	[W]		[kg]	[lbs]
RWK 3044-2-88-E0XXX	1.76	1.1	1.1/1.5	1.5/1.6	16.7	23	88	0.49	2.1
RWK 3044-3.5-88-E0XXX	3.53	2.2	2.2/3	2.9/4	8.3	32	88	0.89	2
RWK 3044-6.5-88-E0XXX	6.42	4	4/5.5	5.4/7.4	4.6	47	88	1.2	2.6
RWK 3044-9-88-E0XXX	8.82	5.5	5.5/7.5	7.4/10.1	3.3	61	88	1.7	3.7
RWK 3044-12-88-E0XXX	12.0	7.5	7.5/11	10.1/14.8	2.44	69	88	2.4	5.3
RWK 3044-18-89-E0XXX	17.6	11	11/15	14.8/20.1	1.67	103	89	3.4	7.5
RWK 3044-24-89-E0XXX	24.1	15	19	25.5	1.22	106	89	4.9	10.8
RWK 3044-30-92-E0XXX	29.7	18.5	22	29.5	0.99	124	92	5.1	11.2
RWK 3044-35-92-E0XXX	35.3	22	30	40.2	0.83	151	92	5.4	11.9
RWK 3044-48-92-E0XXX	48.1	30	37	49.6	0.61	172	92	8.8	19.4
RWK 3044-59-92-E0XXX	59.3	37	45	60.34	0.50	206	92	10.2	22.5
RWK 3044-72-99-E0XXX	72.2	45	55	73.8	0.41	294	99	10.3	22.7
RWK 3044-88-99-E0XXX	88.2	55	55/75	73.8/100.6	0.33	257	99	11.4	25.1
RWK 3044-120-99-E0XXX	120	75	90	120.7	0.24	324	99	13.8	30.4
RWK 3044-140-99-E0XXX	144	90	110	147.5	0.20	399	99	15.7	34.6
RWK 3044-180-99-E0XXX	176	110	132	177	0.17	456	99	20.0	44.1
RWK 3044-210-99-E0XXX	212	132	160	214.6	0.14	553	99	24.5	54
RWK 3044-260-99-E0XXX	257	160	200	268.2	0.11	593	99	27.5	60.6
RWK 3044-320-99-E0XXX	321	200	250	335.3	0.092	747	99	34.5	76.1
RWK 3044-400-99-E0XXX	401	250	315	422.4	0.073	1055	99	45.5	100.3
RWK 3044-510-99-E0XXX	505	315	355	476.1	0.058	1069	99	49.5	109.1
RWK 3044-570-99-E0XXX	569	355	400	536.4	0.052	1181	99	67.5	148.8
RWK 3044-640-99-E0XXX	642	400	450	603.5	0.046	1116	99	68.5	151
RWK 3044-800-99-E0XXX	802	500	550/630	737.6/844.8	0.037	1280	99	103	227.1
RWK 3044-1000-99-E0XXX	1010	630	750	1005.77	0.029	1167	99	110	242.5

\* Calculated at rated current, 400VAC and  $\cos \phi=0.90$

\*\* Calculated at rated current, 480VAC and  $\cos \phi=0.89$

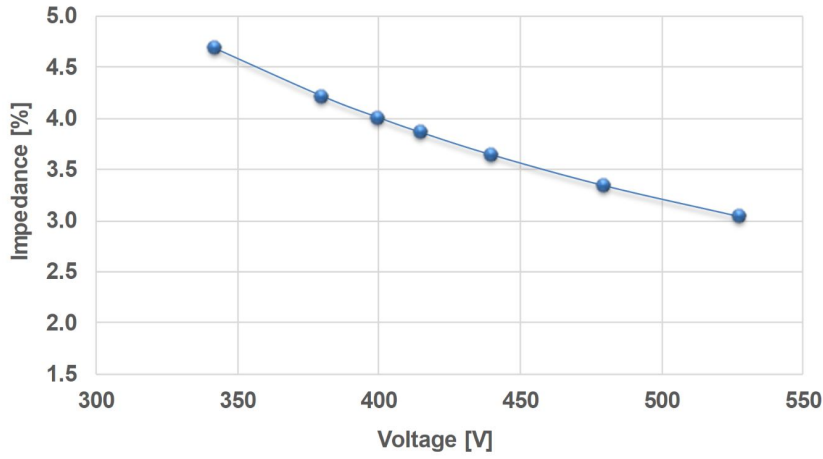
## Terminals

Type	-88	-89	-92	-99
Ring cable shoe	-	-	M6	M8/M10/M12
Fork cable shoe	M3.5 width max. 6.4mm	M4 width max. 8.0mm	-	-
Flex wire AWG	22-16	16-14	-	-
Rec. torque	0.78 Nm	1.76 Nm	-	-

## Earth Screw

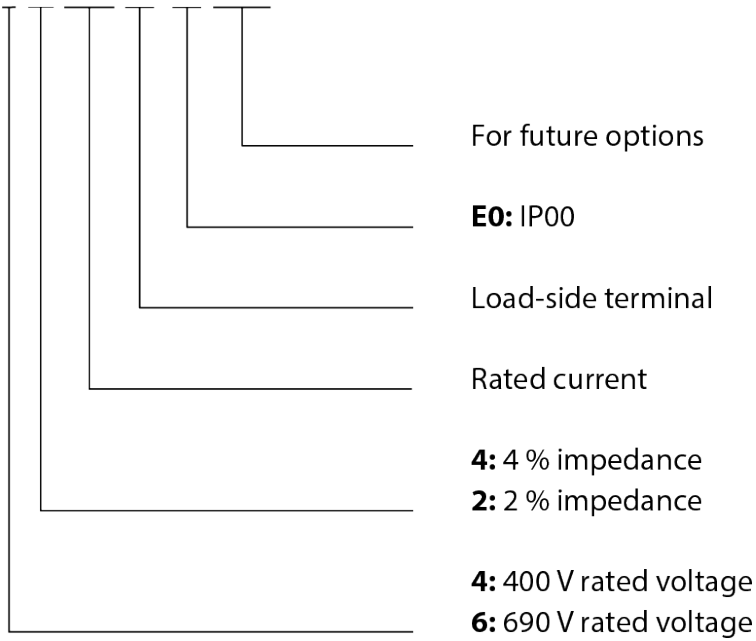
Type	Size	Torque
		[Nm]
2A	M2.5	0.3
3.5-12A	M3	0.6
18-35A	M4	1.7
48-120A	M6	4
140-1000A	M8	9

### RWK 3044 Impedance vs. Voltage



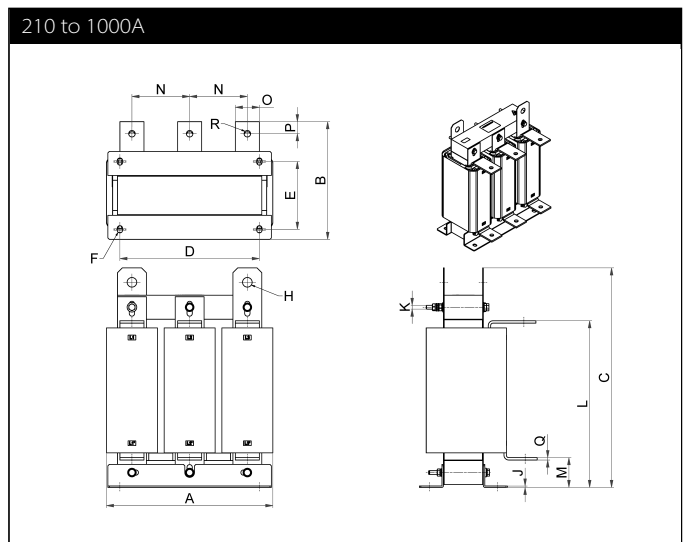
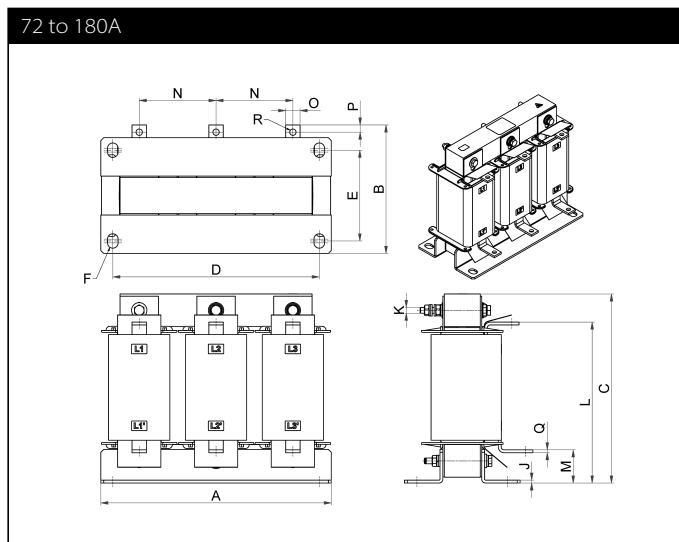
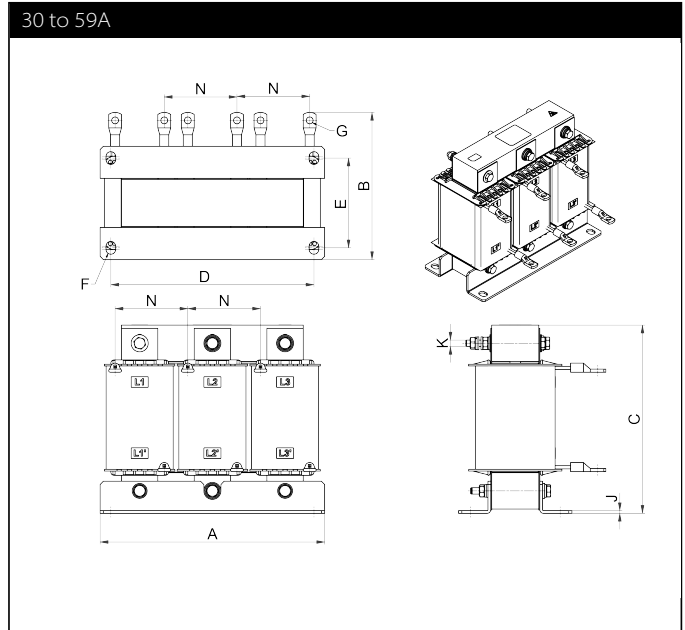
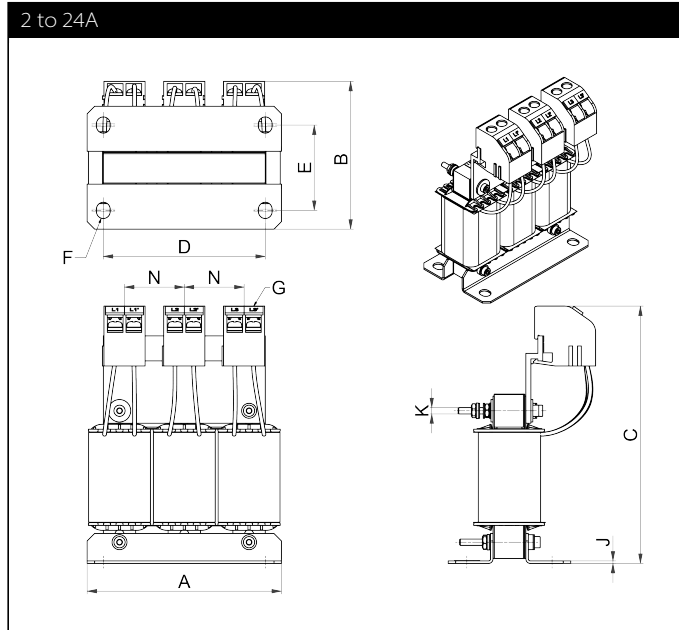
Product selector

### RWK 30n m-xxx-yy-E0 XXX





**Mechanical data**



## Dimensions in mm\*

RWK 3044	A	B±5	C±3	D	E	F	G	H	J	K	L±5	M±5	N±5	O	P	Q	R
2	78	59	103.1	65	34.2	6.5x5.5	-88		1	M2.5			24±1				
3.5	96	62.5	117.9	77	37.5	6.5x5.5	-88		1.5	M3			31±1				
6.5	125	69	136.1	110	44.8	8x5.5	-88		2	M3			41.5±1				
9	125	69	136.8	110	44.8	8x5.5	-88		2	M3			41.5±1				
12	125	78.5	136.4	110	54.5	8x5.5	-88		2	M3			41.5±1				
18	155	79	159.7	130	56.1	12x9	-89		2.5	M4			50±1				
24	155	94	159	130	71	12x9	-89		2.5	M4			50±1				
30	155	128	132	130	71	12x9	ø6.4		2.5	M4			50±4				
35	155	128	132.7	130	71	12x9	ø6.4		2.5	M4			50±4				
48	190	140	156.6	170	77.5	12x9	ø6.4		2.5	M6			60±4				
59	210	143	176	190	84	12x9	ø6.4		2.5	M6			68±4				
72	230	122.7	191	210	77.5	12x9			2.5	M6	163	30	76±4	15	7.5	3	ø6.6
88	240	133.9	196.7	215	94.5	15x11			3	M6	167.5	34.5	80±4	15	7.5	3	ø6.6
120	240	152.3	196.7	215	104.5	15x11			3	M6	168.5	34.5	80±4	20	10	4	ø9
140	265	148.9	217.5	240	99.7	15x11			3	M8	183	39	88±4	20	10	4	ø9
180	291	171.1	235	260	117.5	15x11			3	M8	198.5	39.5	96±4	25	12.5	4	ø11
210	290	189.4	234.2	260	131	15x11		n/a	3	M8	201.7	42.7	96	25	12.5	4	ø11
260	290	194.6	287.2	260	136	15x11		ø20	3	M8	206.2	42.2	100	25	12.5	4	ø11
320	340	198.9	333.5	290	121	15x11		ø20	3	M8	237.5	52.5	112	30	15	5	ø11
400	360	190.4	422.2	310	121	15x11		ø20	3	M8	297	62	125	30	15	5	ø11
510	360	203.7	422.6	310	121	15x11		ø20	3	M8	297	62	125	40	20	5	ø13.5
570	346±5	244	457	290	141	15x11		ø20	3	M8	347	62	120	50	25	5	ø13.5
640	347±5	244.8	457	290	141	15x11		ø20	3	M8	347	62	120	50	25	5	ø13.5
800	365±5	296.3	474	310	185	15x11		ø20	3	M8	373.5	55.5	130	50	25	8	ø13.5
1000	376±5	309	474	310	185	15x11		ø20	3	M8	379	61	130	50	25	8	ø13.5

\* General tolerance: ISO 2768-v

## Dimensions in inches\*

RWK 3044	A	B±0.2	C±0.12	D	E	F	G	H	J	K	L±0.2	M±0.2	N±0.2	O	P	Q	R
2	3.07	2.32	4.06	2.56	1.35	0.26x0.22	-3.46		0.04	M2.5			0.94±0.04				
3.5	3.78	2.46	4.64	3.03	1.48	0.26x0.22	-3.46		0.06	M3			1.22±0.04				
6.5	4.92	2.72	5.36	4.33	4.76	0.31x0.22	-3.46		0.08	M3			1.63±0.04				
9	4.92	2.72	5.39	4.33	1.76	0.31x0.22	-3.46		0.08	M3			1.63±0.04				
12	4.92	3.09	5.37	4.33	2.15	0.31x0.22	-3.46		0.08	M3			1.63±0.04				
18	6.1	3.11	6.29	5.12	2.21	0.47x0.35	-3.5		0.1	M4			1.97±0.04				
24	6.1	3.7	6.26	5.12	2.8	0.47x0.35	-3.5		0.1	M4			1.97±0.04				
30	6.1	5.04	5.2	5.12	2.8	0.47x0.35	±6.4		0.1	M4			1.97±0.16				
35	6.1	5.04	5.22	5.12	2.8	0.47x0.35	±6.4		0.1	M4			1.97±0.16				
48	7.48	5.51	6.17	6.69	3.05	0.47x0.35	±6.4		0.1	M6			2.36±0.16				
59	8.27	5.63	6.93	7.48	3.31	0.47x0.35	±6.4		0.1	M6			2.68±0.16				
72	9.06	4.83	7.52	8.27	3.05	0.47x0.35			0.1	M6	6.42	1.18	2.99±0.16	0.59	0.3	0.12	±6.6
88	9.45	5.27	7.74	8.46	3.72	0.59x0.43			0.12	M6	6.59	1.36	3.15±0.16	0.59	0.3	0.12	±6.6
120	9.45	6	7.74	8.46	4.11	0.59x0.43			0.12	M6	6.63	1.36	1.15±0.16	0.79	0.39	0.16	±9
140	10.43	5.86	8.56	9.45	3.93	0.59x0.43			0.12	M8	7.2	1.54	3.46±0.16	0.79	0.39	0.16	±9
180	11.46	6.74	9.25	10.24	4.63	0.59x0.43			0.12	M8	7.81	1.56	3.78±0.16	0.98	0.49	0.16	±11
210	11.42	7.46	9.22	10.24	5.16	0.59x0.43		n/a	0.12	M8	7.94	1.68	1.54	0.98	0.49	0.16	±11
260	11.42	7.66	11.31	10.24	5.35	0.59x0.43		±20	0.12	M8	8.12	1.66	1.56	0.98	0.49	0.16	±11
320	13.39	7.83	13.13	11.42	4.76	0.59x0.43		±20	0.12	M8	9.35	2.07	1.68	1.18	0.59	0.2	±11
400	14.17	7.5	16.62	12.2	4.76	0.59x0.43		±20	0.12	M8	11.69	2.44	1.66	1.18	0.59	0.2	±11
510	14.17	8.02	16.64	12.2	4.76	0.59x0.43		±20	0.12	M8	11.69	2.44	2.07	1.57	0.79	0.2	±13.5
570	13.62±0.2	9.61	17.99	11.42	5.55	0.59x0.43		±20	0.12	M8	13.66	2.44	2.44	1.97	0.98	0.2	±13.5
640	13.66±0.2	9.64	17.99	11.42	5.55	0.59x0.43		±20	0.12	M8	13.66	2.44	2.44	1.97	0.98	0.2	±13.5
800	14.37±0.2	11.67	18.66	12.2	7.28	0.59x0.43		±20	0.12	M8	14.7	2.19	2.44	1.97	0.98	0.31	±13.5
1000	14.8±0.2	12.17	18.66	12.2	7.28	0.59x0.43		±20	0.12	M8	14.92	2.4	2.44	1.97	0.98	0.31	±13.5

\* General tolerance: ISO 2768-v

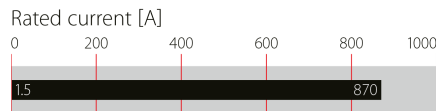
## 3-phase Line Reactor to reduce mains disturbances



- 2% 3-phase line reactor for 690 V network
- Reducing harmonics on the mains side
- Reducing commutation notches
- Limiting inrush current
- Reliable and economical solution for mitigating mains disturbances



### Performance indicators



### Approvals



(UL recognized up to 280 A)

### Features and benefits

- Ensure reliability, performance and a long service life of electrical consumers
- Reduction of mains harmonics and commutation notches
- Help to meet international power quality standards
- Protection of motor drive electronics and dc link capacitors against mains transients
- Reduction of inrush and peak currents
- Improvement of conducted LF immunity
- Prevention from nuisance tripping caused by power line voltage spikes
- Improvement of true power factor

### Technical specifications

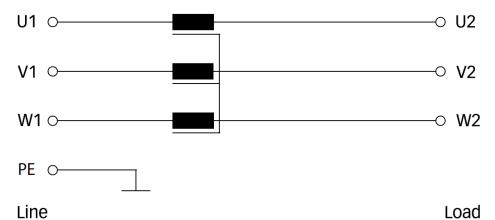
<b>Nominal operating voltage</b>	3x 500 to 690 VAC
<b>Rated operating voltage</b>	3x 450 to 760 VAC
<b>Impedance</b>	2% @ 690 V, 50 Hz and rated rms current
<b>Insulation class</b>	UL electrical insulation system SCH-200(N)
<b>Protection category</b>	IP 00
<b>Cooling</b>	Natural cooling AN
<b>Overload capability</b>	1.6x rated current for 1 minute, once per hour
<b>Ambient temperature range</b>	-40°C to +45°C fully operational +45°C to +100°C derated operation* Note: derating according NEC 310-15(C)
<b>Transportation and storage temperature</b>	-40°C to +100°C transport and storage
<b>Flammability corresponding to</b>	UL 94V-0
<b>Design corresponding to</b>	UL 61800-5-1, EN 61558-2-20, EN 60076-6
<b>Lifetime (calculated)</b>	20 years
<b>Earthing System</b>	TN, TT, IT
<b>Climatic category</b>	40/100/21 (IEC 60068-1)
<b>Pollution degree</b>	PD3
<b>Overvoltage category</b>	OV III (IEC 60664-1 / UL 61800-5-1)

\*I<sub>derated</sub> = I<sub>nominal</sub> \* √((T<sub>max</sub>-T<sub>amb</sub>)/(T<sub>max</sub>-T<sub>nominal</sub>)) = I<sub>nom</sub> \* √((100°C-T<sub>amb</sub>)/55°C)

### Typical applications

- Motor drives and various adjustable speed drive systems, such as:
- Oil and gas
- Robots
- Machinery
- Process automation equipment

### Typical electrical schematic



## Reactor selection table

Reactor	Rated current	Rated power*	Rated Power**	Inductance value	Typical	Terminal		Weight
	@ 45°C [A]	@ 690 V [kW]	@ 600 V [HP]		power losses [W]			
RWK 3062-1.5-88-E0XXX	1.52	1.6	1.9	16.7	23	88	0.49	1
RWK 3062-3-88-E0XXX	3.04	3.1	3.6	8.3	32	88	0.89	1.9
RWK 3062-5.5-88-E0XXX	5.53	5.7	6.6	4.6	47	88	1.2	2.6
RWK 3062-7.5-88-E0XXX	7.61	7.9	9.2	3.3	61	88	1.7	3.7
RWK 3062-10-88-E0XXX	10.4	11	12.8	2.44	69	88	2.4	5.3
RWK 3062-15-89-E0XXX	15.2	16	18.7	1.67	103	89	3.4	7.5
RWK 3062-21-89-E0XXX	20.7	21	24.5	1.22	106	89	4.9	10.8
RWK 3062-26-92-E0XXX	25.6	26	30.3	0.99	124	92	5.1	11.2
RWK 3062-30-92-E0XXX	30.4	31	36	0.83	151	92	5.4	11.9
RWK 3062-41-92-E0XXX	41.5	43	50	0.61	172	92	8.8	19.4
RWK 3062-51-92-E0XXX	51.2	53	62	0.50	206	92	10.2	22.5
RWK 3062-62-99-E0XXX	62.2	64	75	0.41	294	99	10.3	22.7
RWK 3062-76-99-E0XXX	76.1	79	92	0.33	257	99	11.4	25.1
RWK 3062-100-99-E0XXX	104	108	126	0.24	324	99	13.8	30.4
RWK 3062-120-99-E0XXX	124	128	149	0.20	399	99	15.7	34.6
RWK 3062-150-99-E0XXX	152	157	183	0.17	456	99	20.0	44.1
RWK 3062-180-99-E0XXX	183	189	220	0.14	553	99	24.5	54
RWK 3062-220-99-E0XXX	221	228	266	0.11	593	99	27.5	60.6
RWK 3062-280-99-E0XXX	277	286	334	0.092	747	99	34.5	76.1
RWK 3062-350-99-E0XXX	346	358	417	0.073	1055	99	45.5	100.3
RWK 3062-440-99-E0XXX	436	451	526	0.058	1069	99	49.5	109.1
RWK 3062-490-99-E0XXX	491	508	592	0.052	1181	99	67.5	148.8
RWK 3062-550-99-E0XXX	553	572	667	0.046	1116	99	68.5	151
RWK 3062-690-99-E0XXX	692	715	834	0.037	1280	99	103	227.1
RWK 3062-870-99-E0XXX	871	900	1049	0.029	1167	99	110	242.5

\* Calculated at rated current, 690 V and  $\cos \phi = 0.865$ .

\*\* Calculated at rated current, 600 V and  $\cos \phi = 0.865$ .

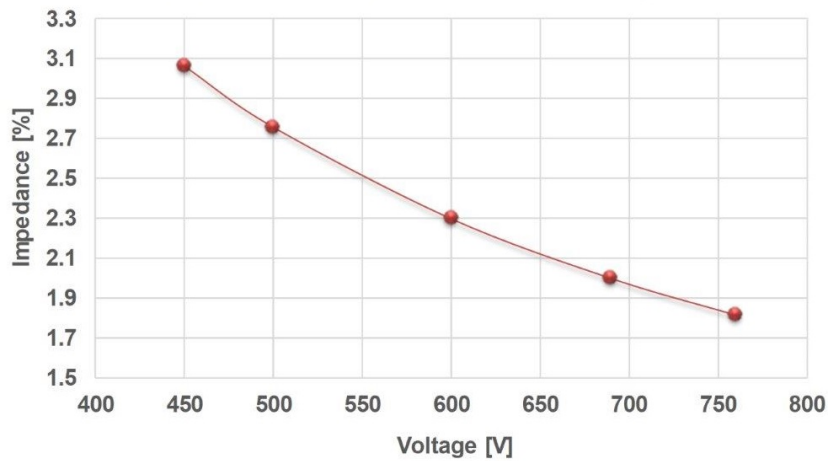
## Terminals

Type	-88	-89	-92	-99
Ring cable shoe	-	-	M6	M8/M10/M12
Fork cable shoe	M3.5 width max. 6.4mm	M4 width max. 8.0mm	-	-
Flex wire AWG	22-16	16-14	-	-
Rec. torque	0.78 Nm	1.76 Nm	-	-

## Earth Screw

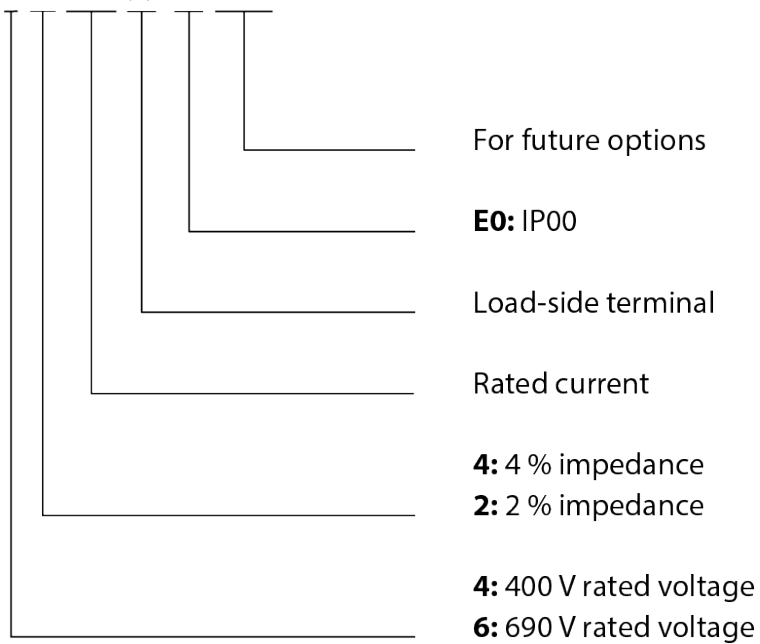
Type	Size	Torque
		[Nm] [lbs-in]
1.5A	M2.5	0.3 2.7
3-10A	M3	0.6 5.3
15-30A	M4	1.7 15
41-100A	M6	4 35.4
120-870A	M8	9 79.7

## RWK 3062 Impedance vs. Voltage

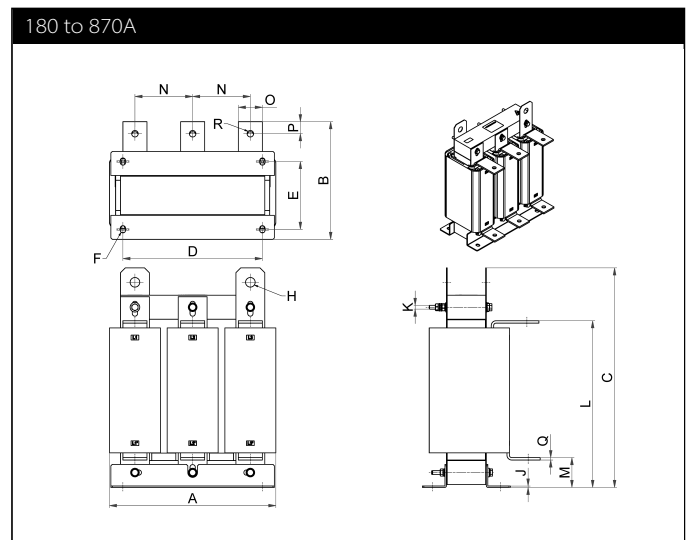
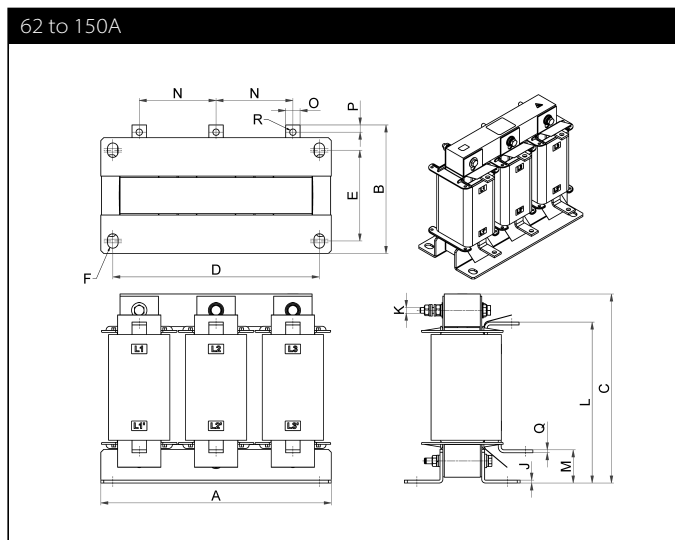
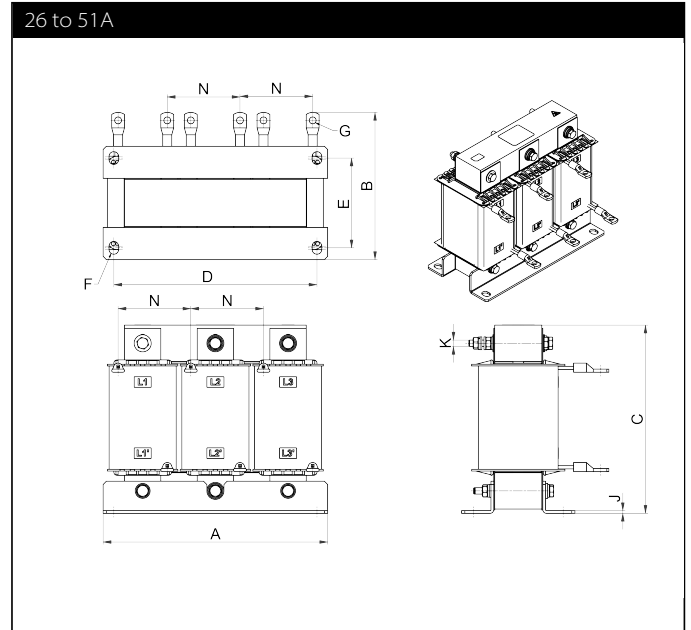
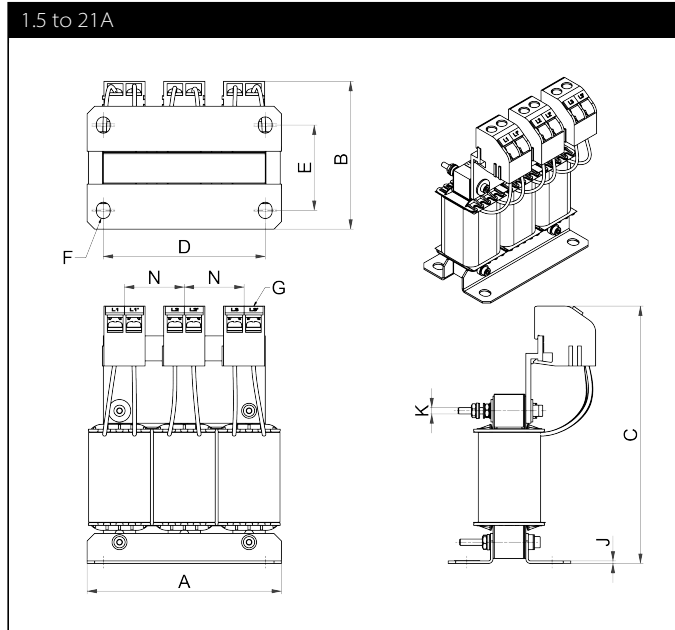


### Product selector

#### RWK 30n m-xxx-yy-E0 XXX



**Mechanical data**



## Dimensions in mm\*

RWK 3062	A	B±5	C±3	D	E	F	G	H	J	K	L±5	M±5	N±5	O	P	Q	R
1.5	78	59	103.1	65	34.2	6.5x5.5	-88		1	M2.5			24±1				
3	96	62.5	117.9	77	37.5	6.5x5.5	-88		1.5	M3			31.1±1				
5.5	125	69	136.1	110	44.8	8x5.5	-88		2	M3			41.5±1				
7.5	125	69	136.8	110	44.8	8x5.5	-88		2	M3			41.5±1				
10	125	78.5	136.4	110	54.5	8x5.5	-88		2	M3			41.5±1				
15	155	79	159.7	130	56.1	12x9	-89		2.5	M4			50±1				
21	155	94	159	130	71	12x9	-89		2.5	M4			50±1				
26	155	128	132	130	71	12x9	ø6.4		2.5	M4			50±4				
30	155	128	132.7	130	71	12x9	ø6.4		2.5	M4			50±4				
41	190	140	156.6	170	77.5	12x9	ø6.4		2.5	M6			60±4				
51	210	143	176	190	84	12x9	ø6.4		2.5	M6			68±4				
62	230	122.7	191	210	77.5	12x9			2.5	M6	163	30	76±4	15	7.5	3	ø6.6
76	240	133.9	196.7	215	94.5	15x11			3	M6	167.5	34.5	80±4	15	7.5	3	ø6.6
100	240	152.3	196.7	215	104.5	15x11			3	M6	168.5	34.5	80±4	20	10	4	ø9
120	265	148.9	217.5	240	99.7	15x11			3	M8	183	39	88±4	20	10	4	ø9
150	291	171.1	235	260	117.5	15x11			3	M8	198.5	39.5	96±4	25	12.5	4	ø11
180	290	189.4	234.2	260	131	15x11		n/a	3	M8	201.7	42.7	96	25	12.5	4	ø11
220	290	194.6	287.2	260	136	15x11		ø20	3	M8	206.2	42.2	100	25	12.5	4	ø11
280	340	198.9	333.5	290	121	15x11		ø20	3	M8	237.5	52.5	112	30	15	5	ø11
350	360	190.4	422.2	310	121	15x11		ø20	3	M8	297	62	125	30	15	5	ø11
440	360	203.7	422.6	310	121	15x11		ø20	3	M8	297	62	125	40	20	5	ø13.5
490	346±5	244	457	290	141	15x11		ø20	3	M8	347	62	120	50	25	5	ø13.5
550	347±5	244.8	457	290	141	15x11		ø20	3	M8	347	62	120	50	25	5	ø13.5
690	365±5	296.3	474	310	185	15x11		ø20	3	M8	373.5	55.5	130	50	25	8	ø13.5
870	376±5	309	474	310	185	15x11		ø20	3	M8	379	61	130	50	25	8	ø13.5

\* General tolerance: ISO 2768-v

## Dimensions in inches\*

RWK 3062	A	B±0.2	C±3	D	E	F	G	H	J	K	L±5	M±0.2	N±0.2	O	P	Q	R
1.5	3.07	2.32	4.06	2.56	1.35	0.26x0.22	-3.46		0.04	M2.5			0.94±0.04				
3	3.78	2.46	4.64	3.03	1.48	0.26x0.22	-3.46		0.06	M3			1.22±0.04				
5.5	4.92	2.72	5.36	4.33	4.76	0.31x0.22	-3.46		0.08	M3			1.63±0.04				
7.5	4.92	2.72	5.39	4.33	1.76	0.31x0.22	-3.46		0.08	M3			1.63±0.04				
10	4.92	3.09	5.37	4.33	2.15	0.31x0.22	-3.46		0.08	M3			1.63±0.04				
15	6.1	3.11	6.29	5.12	2.21	0.47x0.35	-3.5		0.1	M4			1.97±0.04				
21	6.1	3.7	6.26	5.12	2.8	0.47x0.35	-3.5		0.1	M4			1.97±0.04				
26	6.1	5.04	5.2	5.12	2.8	0.47x0.35	ø6.4		0.1	M4			1.97±0.16				
30	6.1	5.04	5.22	5.12	2.8	0.47x0.35	ø6.4		0.1	M4			1.97±0.16				
41	7.48	5.51	6.17	6.69	3.05	0.47x0.35	ø6.4		0.1	M6			2.36±0.16				
51	8.27	5.63	6.93	7.48	3.31	0.47x0.35	ø6.4		0.1	M6			2.68±0.16				
62	9.06	4.83	7.52	8.27	3.05	0.47x0.35			0.1	M6	6.42	1.18	2.99±0.16	0.59	0.3	0.12	ø6.6
76	9.45	5.27	7.74	8.46	3.72	0.59x0.43			0.12	M6	6.59	1.36	3.15±0.16	0.59	0.3	0.12	ø6.6
100	9.45	6	7.74	8.46	4.11	0.59x0.43			0.12	M6	6.63	1.36	1.15±0.16	0.79	0.39	0.16	ø9
120	10.43	5.86	8.56	9.45	3.93	0.59x0.43			0.12	M8	7.2	1.54	3.46±0.16	0.79	0.39	0.16	ø9
150	11.46	6.74	9.25	10.24	4.63	0.59x0.43			0.12	M8	7.81	1.56	3.78±0.16	0.98	0.49	0.16	ø11
180	11.42	7.46	9.22	10.24	5.16	0.59x0.43		n/a	0.12	M8	7.94	1.68	1.54	0.98	0.49	0.16	ø11
220	11.42	7.66	11.31	10.24	5.35	0.59x0.43		ø20	0.12	M8	8.12	1.66	1.56	0.98	0.49	0.16	ø11
280	13.39	7.83	13.13	11.42	4.76	0.59x0.43		ø20	0.12	M8	9.35	2.07	1.68	1.18	0.59	0.2	ø11
350	14.17	7.5	16.62	12.2	4.76	0.59x0.43		ø20	0.12	M8	11.69	2.44	1.66	1.18	0.59	0.2	ø11
440	14.17	8.02	16.64	12.2	4.76	0.59x0.43		ø20	0.12	M8	11.69	2.44	2.07	1.57	0.79	0.2	ø13.5
490	13.62±0.2	9.61	17.99	11.42	5.55	0.59x0.43		ø20	0.12	M8	13.66	2.44	2.44	1.97	0.98	0.2	ø13.5
550	13.66±0.2	9.64	17.99	11.42	5.55	0.59x0.43		ø20	0.12	M8	13.66	2.44	2.44	1.97	0.98	0.2	ø13.5
690	14.37±0.2	11.67	18.66	12.2	7.28	0.59x0.43		ø20	0.12	M8	14.7	2.19	2.44	1.97	0.98	0.31	ø13.5
870	14.8±0.2	12.17	18.66	12.2	7.28	0.59x0.43		ø20	0.12	M8	14.92	2.4	2.44	1.97	0.98	0.31	ø13.5

\* General tolerance: ISO 2768-v



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