

## LC Sine Wave Filter for Motor Drives

**SCHAFNER**  
energy efficiency and reliability



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

### Approvals

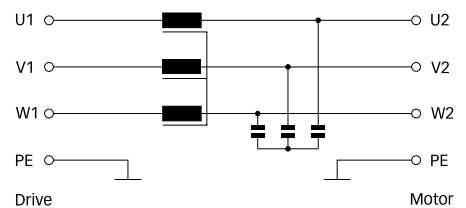


**ROHS**

### Technical specifications

Nominal operating voltage:	3× 500 VAC ±10%
Motor frequency:	0 to 70 Hz (up to 200Hz with derating (see graph))
Switching frequency:	See filter selection table
Rated currents:	4.5 to 1200 A @ 45°C
Motor cable length:	Up to 2,000 m (see graph)
Impedance (uk):	8 to 10% @ 400 V, 50 Hz and rated current
Residual ripple voltage:	<5%
High potential test voltage:	P → E 3000 VAC, 1 minute P → P 2500 VAC, 1 minute
Protection category:	IP00 (FN 5040) IP20 (FN 5045)
Overload capability:	1.5× rated current for 1 minute, once per hour
Temperature range (operation and storage):	-25°C to +70°C (25/070/21)
Acoustic noise level:	<70dB(A) @ 1 m
Insulation class:	EIS 200
Flammability corresponding to:	UL 94V-2 or better
Design corresponding to:	IEC 61558-2-20
Environmental reliability:	IEC 60068-2-1
MTBF:	>100,000 hours
Approvals:	UL 508 pending
Declaration of conformity:	CE / LVD

### Typical electrical schematic




### 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 60054-17\* and NEMA-MG1 requirements for general purpose motors.
- Optional with NEMA 1 protective cover.

### 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

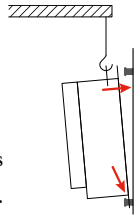
Filter selection table

Filter	Rated current @ 45°C/50Hz	Rated current @ 45°C/100Hz	Typical motor drive rating	Nominal inductance	Nominal capacitance	Capacitance connection	Min. switching frequency [kHz]	Typical power loss [W]	Input/Output connections 	Weight [kg]
	[A]	[A]	[kW]	[mH]	[µF]					
FN 5040-4.5-82	4.5	4.05	1.1/1.5	13	2.2	Y	4	65	-82	3.3
FN 5040-8-82	8	7.2	2.2/3	6.9	4.7	Y	4	80	-82	4.6
FN 5040-10-83	10	9	4	5.2	6.8	Y	4	90	-83	6.1
FN 5040-17-83	17	15.3	5.5/7.5	3.1	10	Y	4	115	-83	7.8
FN 5040-24-84	24	21.6	11	2.4	10	Y	4	150	-84	14.4
FN 5040-38-84	38	34.2	15/18.5	1.6	10	Y	4	170	-84	25.0
FN 5040-48-85	48	43.2	22	1.1	14.7	Y	4	260	-85	33.0
FN 5040-62-86	62	55.8	30	0.85	30	Y	3	280	-85	36.0
FN 5040-75-87	75	67.5	37	0.75	30	Y	3	330	-87	42.0
FN 5040-115-87	115	103.5	45/55	0.5	20	Δ	3	500	-87	68.0
FN 5040-180-99	180	162	75/90	0.3	33	Δ	3	680	-99	86.0
FN 5040-260-99	260	234	110/132	0.2	47	Δ	3	880	-99	125.0
FN 5040-410-99	410	369	160/200	0.13	66	Δ	3	1100	-99	184.0
FN 5040-480-99	480	432	250	0.11	94	Δ	3	1350	-99	235.0
FN 5040-660-99	660	594	315/355	0.14	141	Δ	2	2000	-99	310.0
FN 5040-750-99	750	675	400	0.12	165	Δ	2	2800	-99	470.0
FN 5040-880-99	880	792	450/500	0.11	188	Δ	2	3400	-99	640.0
FN 5040-1200-99	1200	1080	560/630	0.075	282	Δ	2	3800	-99	680.0
FN 5045-4.5-44	4.5	4.05	1.1/1.5	13	2.2	Y	4	65	-44	4.1
FN 5045-8-44	8	7.2	2.2/3	6.9	4.7	Y	4	80	-44	5.4
FN 5045-10-44	10	9	4	5.2	6.8	Y	4	90	-44	6.9
FN 5045-17-33	17	15.3	5.5/7.5	3.1	10	Y	4	115	-33	9.0
FN 5045-24-33	24	21.6	11	2.4	10	Y	4	150	-33	15.6
FN 5045-38-33	38	34.2	15/18.5	1.6	10	Y	4	170	-33	18.9
FN 5045-48-34	48	43.2	22	1.1	14.7	Y	4	260	-34	35.8
FN 5045-62-34	62	55.8	30	0.85	30	Y	3	280	-34	37.8
FN 5045-75-35	75	67.5	37	0.75	30	Y	3	330	-35	60.0
FN 5045-115-35	115	103.5	45/55	0.5	20	Δ	3	500	-35	70.0
FN 5045-180-99	180	162	75/90	0.3	33	Δ	3	680	-99	92.0
FN 5045-260-99	260	234	110/132	0.2	47	Δ	3	880	-99	131.0
FN 5045-410-99	410	369	160/200	0.13	66	Δ	3	1100	-99	198.0
FN 5045-480-99	480	432	250	0.11	94	Δ	3	1350	-99	243.0
FN 5045-660-99	660	594	315/355	0.14	141	Δ	2	2000	-99	425.0
FN 5045-750-99	750	675	400	0.12	165	Δ	2	2800	-99	482.0
FN 5045-880-99	880	792	450/500	0.11	188	Δ	2	3400	-99	652.0
FN 5045-1200-99	1200	1080	560/630	0.075	282	Δ	2	3800	-99	692.0

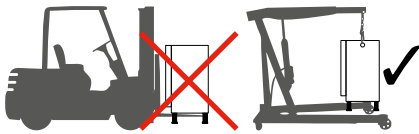
## Installation

### Filter placement

Lift the filter with appropriate crane using lifting eye bolts – smaller types may be lifted manually by two persons (no lifting eye bolt applicable).

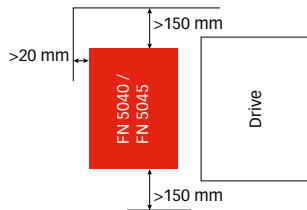


**Never attempt to handle the filter with a forklift!**



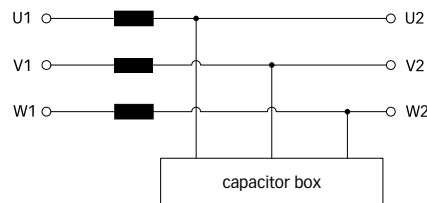
In order to ensure sufficient air flow, keep a distance of 150 mm above and below the filter to walls or other components.

A 20 mm distance on either side is recommended.



### Wiring and connection

The filter rating has to be compatible with the inverter to which it is to be connected. All inverter manufacturer installation and safety instructions must be fulfilled. The typical block schematic is shown for a motor load but the load can be also multiple motors or a transformer. Inverter and load cable selection/placement should be in accordance with all local electrical standards and regulations. Filters with separate capacitor bank must be connected as follows:

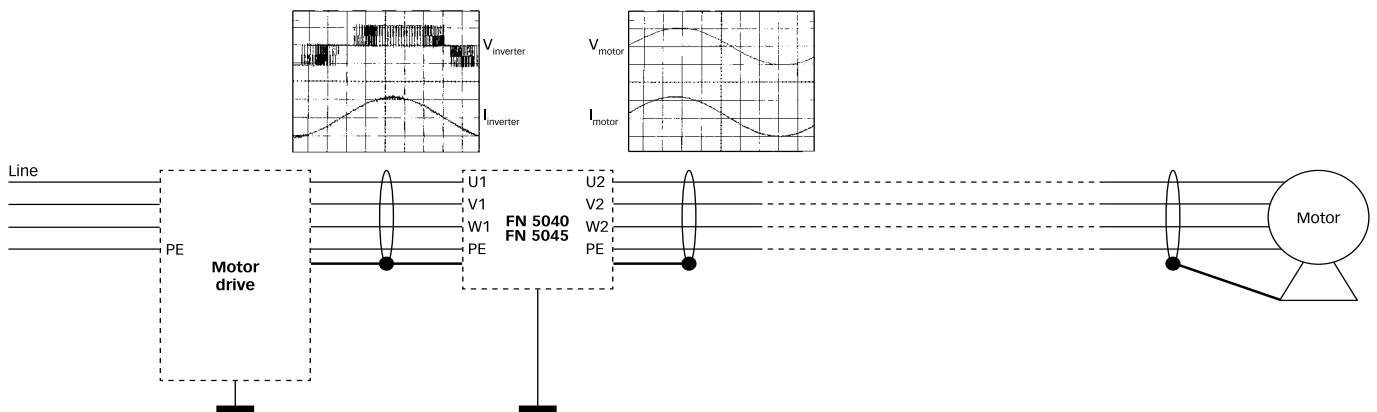


### Required settings

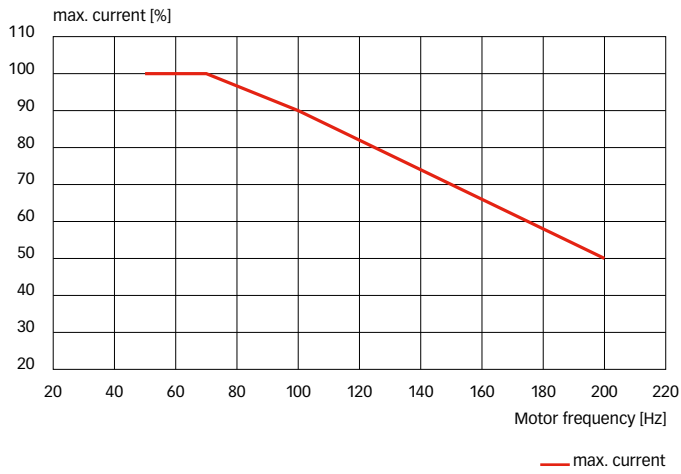
Ensure the drive's switching frequency is set to the required minimum switching frequency (see filter selection table). Higher frequencies are allowed. The mode of operation must be "scalar" (V/Hz). Check the inverter manual whether special settings are necessary. In any doubt contact the inverter manufacturer.

**CAUTION:** If the inverter settings are not in accordance the filter may be damaged.

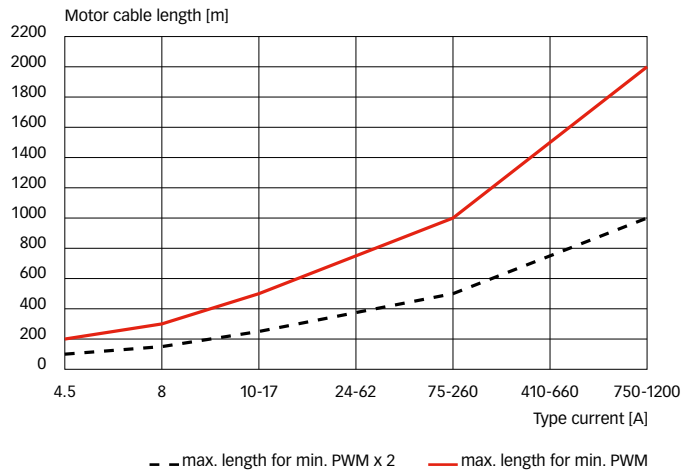
## Typical block schematic



**Motor frequency derating**

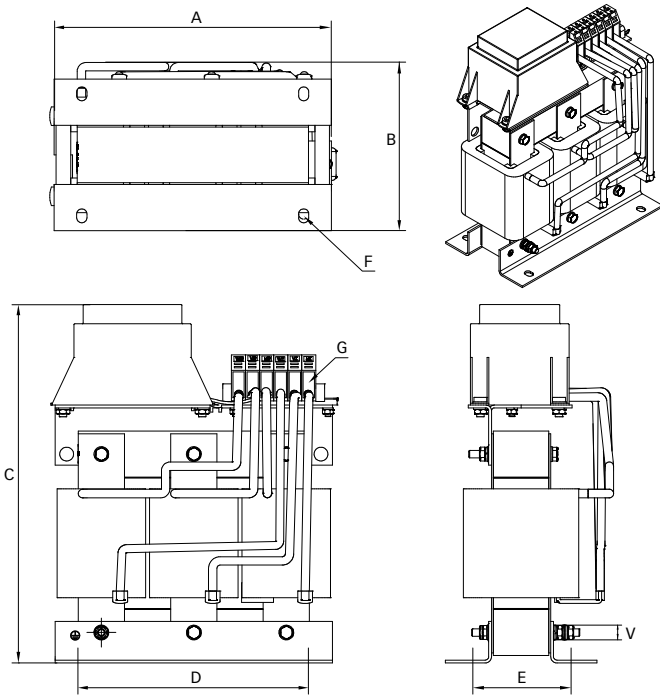


**Max. motor cable length**

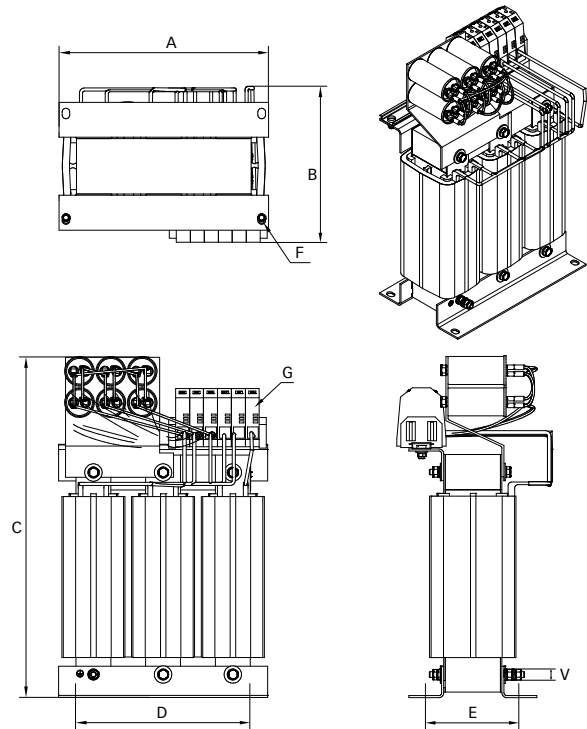


**Mechanical data FN 5040**

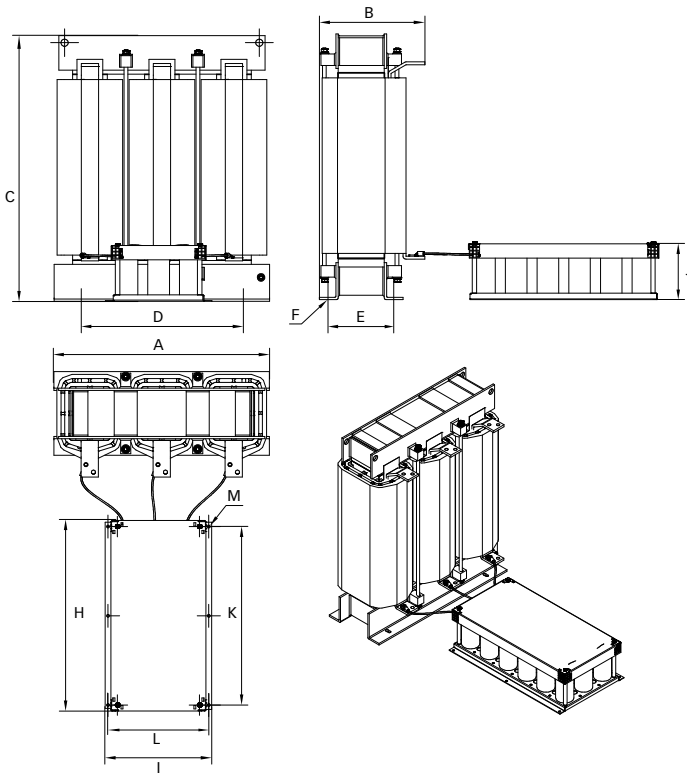
4.5 to 75A types



115A types



180 to 1200A types\*



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

**Dimensions FN 5040**

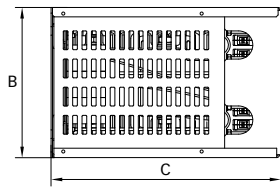
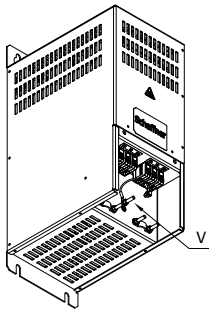
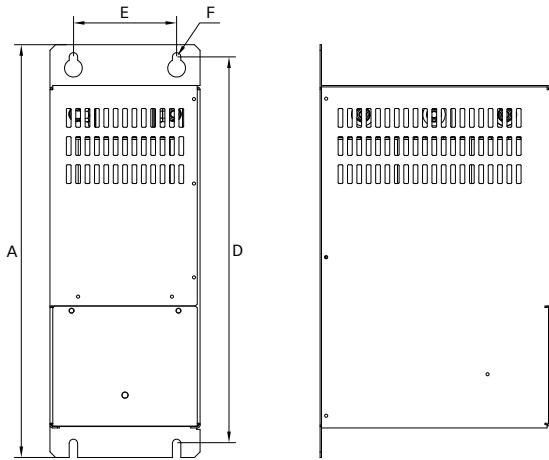
	4.5A	8A	10A	17A	24A	38A	48A	62A	75A	115A
<b>A</b>	125	155	155	190	190	230	300	320	305	305
<b>B</b>	77	84	94	115	116	151	171	190	240	236
<b>C</b>	171	212	208	224	224	275	355	395	395	495
<b>D</b>	100	130	130	170	170	180	240	240	240	280
<b>E</b>	55	56	71.5	57.5	77.5	122	137	132	162	151
<b>F</b>	5×8	8×12	8×12	8×12	8×12	8×12	11×15	11×15	11×15	11×15
<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

	180A	260A	410A	480A	660A	750A	880A	1200A
<b>A</b>	450	453	490	510	632	665	660	750
<b>B</b>	260	245	292	321	360	415	385	372
<b>C</b>	385	485	600	618	730	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>	9×13	11×15	10.5×18.5	13×27	13×27	13×26	13×26	13×26
<b>H</b>	328	328	328	328	436	555	436	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

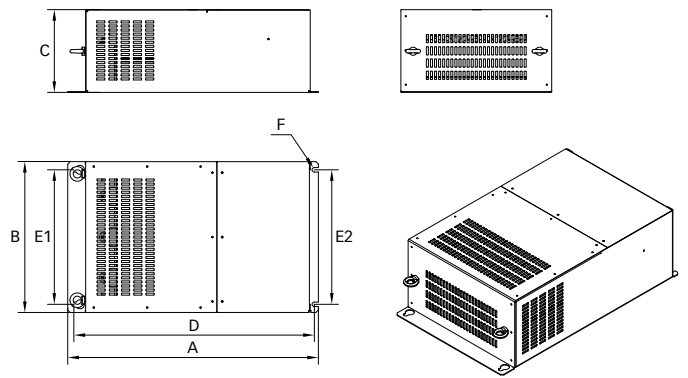
All dimensions in mm; 1 inch = 25.4mm  
 Tolerances according: ISO 2768-m / EN 22768-m

**Mechanical data FN 5045**

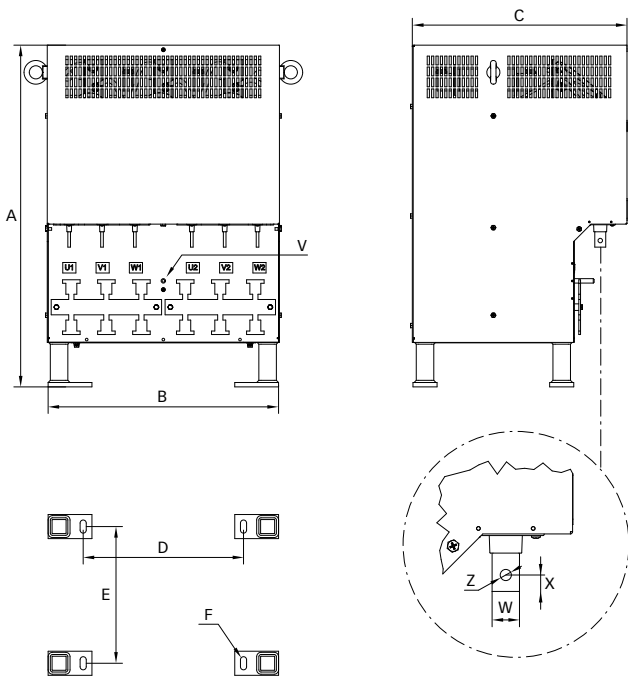
4.5 to 38A types



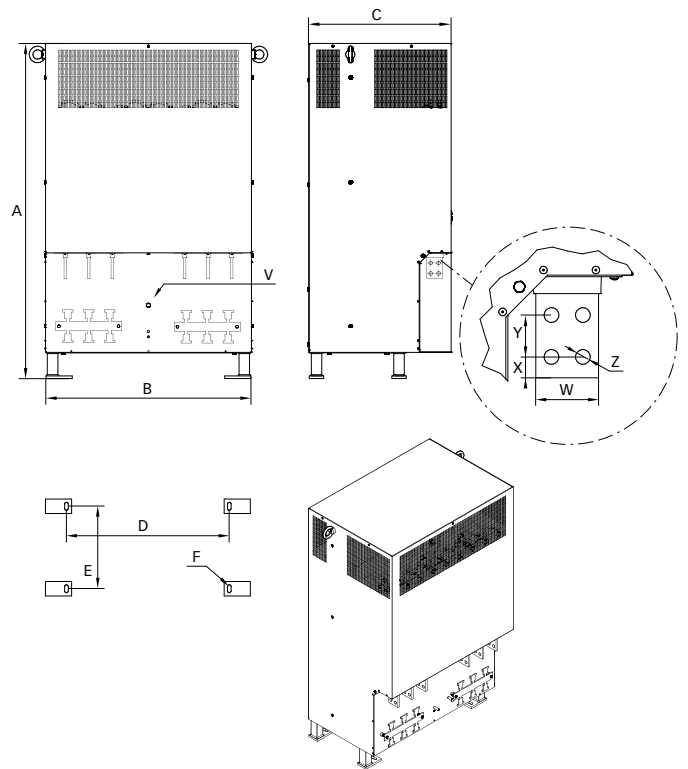
48 to 115A types



180 to 480A types



660 to 1200A types








Dimensions FN 5045






	4.5A	8A	10A	17A	24A	38A	48A	62A	75A	115A	180A	260A	410A	480A	660A	750A	880A	1200A
<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	156	156	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	25	40	40	40	60
<b>X</b>											15	15	15	15	20	20	20	20
<b>Y</b>														40	40	40	40	30/40
<b>Z</b>											9	9	10.2	10.2	14	14	14	14

All dimensions in mm; 1 inch = 25.4mm  
Tolerances according: 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

	-83	-84	-85	-86	-87
					
<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.

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