

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

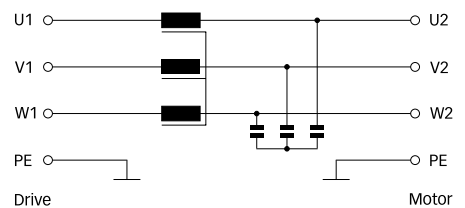
UL US LISTED
(in preparation)

RoHS

Technical specifications

Nominal operating voltage:	3x 500VAC ±10%
Motor frequency:	0 to 70Hz (up to 200Hz with derating (see graph))
Switching frequency:	See filter selection table
Rated currents:	4.5 to 1200A @ 45°C
Motor cable length:	Up to 2,000m (see graph)
Impedance (uk):	8 to 10% @ 400V, 50Hz and rated current
Residual ripple voltage:	<5%
High potential test voltage:	P → E 3000VAC, 1 minute P → P 2500VAC, 1 minute
Protection category:	IP00 (FN5040) IP20 (FN5045)
Overload capability:	1.5x 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) @ 1m
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 60034-17* 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

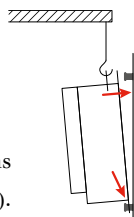
Filter selection table

Filter	Rated current @ 45°C/50Hz	Rated current @ 45°C/100Hz	Typical motor drive rating	Nominal inductance	Nominal capacitance	Capacitance connection	Min. switching frequency	Typical power loss	Input/Output connections	Weight
	[A]	[A]	[kW]	[mH]	[μF]		[kHz]	[W]	 	[kg]
FN5040-4.5-82	4.5	4.05	1.1/1.5	13	2.2	Y	4	65	-82	3.3
FN5040-8-82	8	7.2	2.2/3	6.9	4.7	Y	4	80	-82	4.6
FN5040-10-83	10	9	4	5.2	6.8	Y	4	90	-83	6.1
FN5040-17-83	17	15.3	5.5/7.5	3.1	10	Y	4	115	-83	7.8
FN5040-24-84	24	21.6	11	2.4	10	Y	4	150	-84	14.4
FN5040-38-84	38	34.2	15/18.5	1.6	10	Y	4	170	-84	25.0
FN5040-48-85	48	43.2	22	1.1	14.7	Y	4	260	-85	33.0
FN5040-62-85	62	55.8	30	0.85	30	Y	3	280	-85	36.0
FN5040-75-87	75	67.5	37	0.75	30	Y	3	330	-87	42.0
FN5040-115-87	115	103.5	45/55	0.5	20	Δ	3	500	-87	68.0
FN5040-180-99	180	162	75/90	0.3	33	Δ	3	680	-99	86.0
FN5040-260-99	260	234	110/132	0.2	47	Δ	3	880	-99	125.0
FN5040-410-99	410	369	160/200	0.13	66	Δ	3	1100	-99	184.0
FN5040-480-99	480	432	250	0.11	94	Δ	3	1350	-99	235.0
FN5040-660-99	660	594	315/355	0.14	141	Δ	2	2000	-99	310.0
FN5040-750-99	750	675	400	0.12	165	Δ	2	2800	-99	470.0
FN5040-880-99	880	792	450/500	0.11	188	Δ	2	3400	-99	640.0
FN5040-1200-99	1200	1080	560/630	0.075	282	Δ	2	3800	-99	680.0
FN5045-4.5-44	4.5	4.05	1.1/1.5	13	2.2	Y	4	65	-44	4.1
FN5045-8-44	8	7.2	2.2/3	6.9	4.7	Y	4	80	-44	5.4
FN5045-10-44	10	9	4	5.2	6.8	Y	4	90	-44	6.9
FN5045-17-33	17	15.3	5.5/7.5	3.1	10	Y	4	115	-33	9.0
FN5045-24-33	24	21.6	11	2.4	10	Y	4	150	-33	15.6
FN5045-38-33	38	34.2	15/18.5	1.6	10	Y	4	170	-33	18.9
FN5045-48-34	48	43.2	22	1.1	14.7	Y	4	260	-34	35.8
FN5045-62-34	62	55.8	30	0.85	30	Y	3	280	-34	37.8
FN5045-75-35	75	67.5	37	0.75	30	Y	3	330	-35	60.0
FN5045-115-35	115	103.5	45/55	0.5	20	Δ	3	500	-35	70.0
FN5045-180-99	180	162	75/90	0.3	33	Δ	3	680	-99	92.0
FN5045-260-99	260	234	110/132	0.2	47	Δ	3	880	-99	131.0
FN5045-410-99	410	369	160/200	0.13	66	Δ	3	1100	-99	198.0
FN5045-480-99	480	432	250	0.11	94	Δ	3	1350	-99	243.0
FN5045-660-99	660	594	315/355	0.14	141	Δ	2	2000	-99	425.0
FN5045-750-99	750	675	400	0.12	165	Δ	2	2800	-99	482.0
FN5045-880-99	880	792	450/500	0.11	188	Δ	2	3400	-99	652.0
FN5045-1200-99	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).

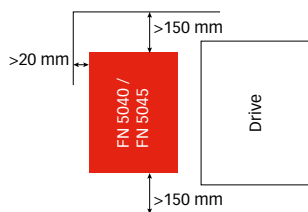


Never attempt to handle the filter with a forklift!



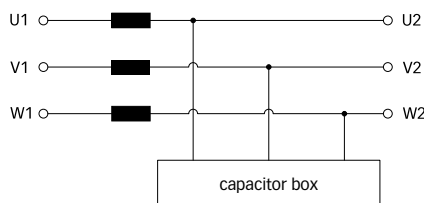
In order to ensure sufficient air flow, keep a distance of 150mm above and below the filter to walls or other components.

A 20mm distance on either side is recommended.



■ Wiring and connections

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:

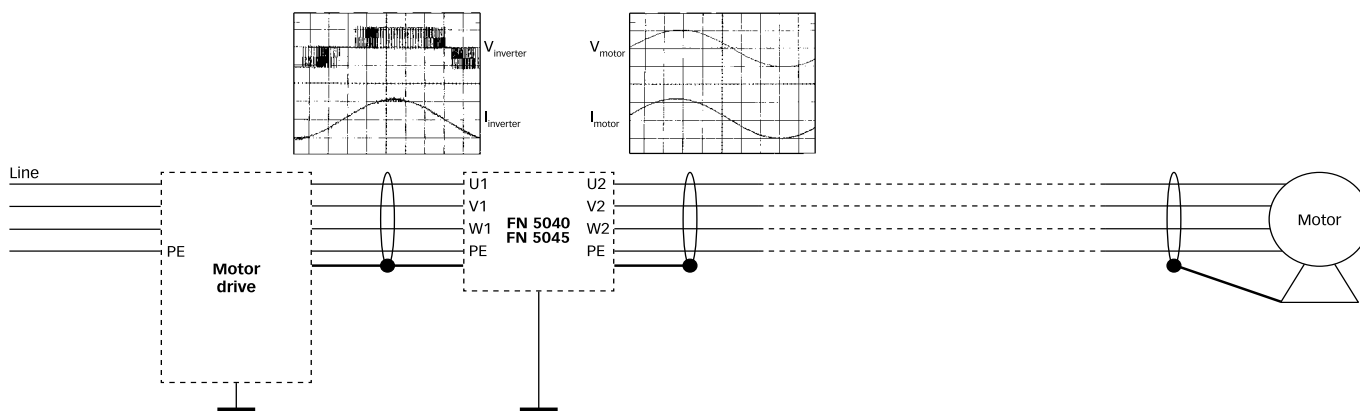


■ Required settings

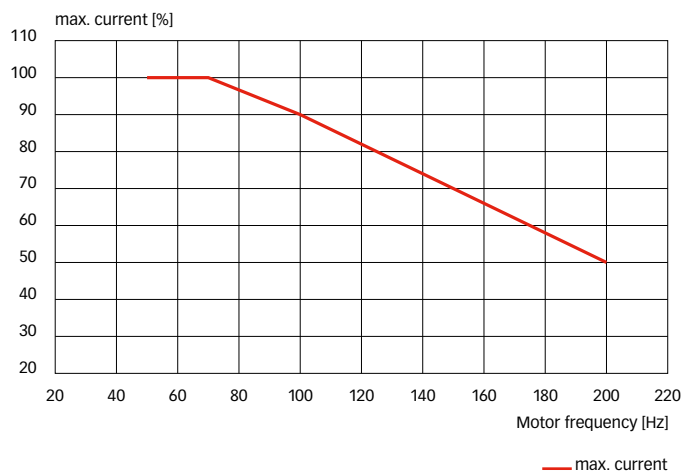
Ensure the drive's switching frequency is set to the required minimum switching frequency (see filter selection table). Higher frequencies are allowed. The mode of operation must be "scalar" (V/Hz). Check the inverter manual whether special settings are necessary. In any doubt contact the inverter manufacturer.

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

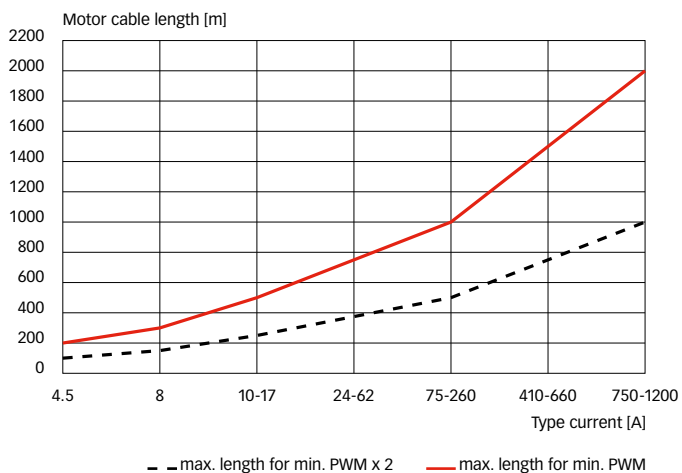
Typical block schematic



Motor frequency derating

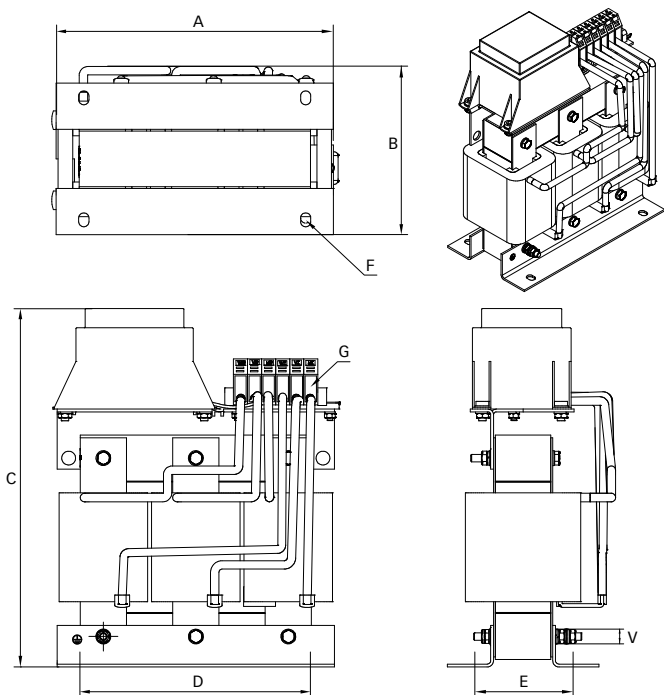


Max. motor cable length

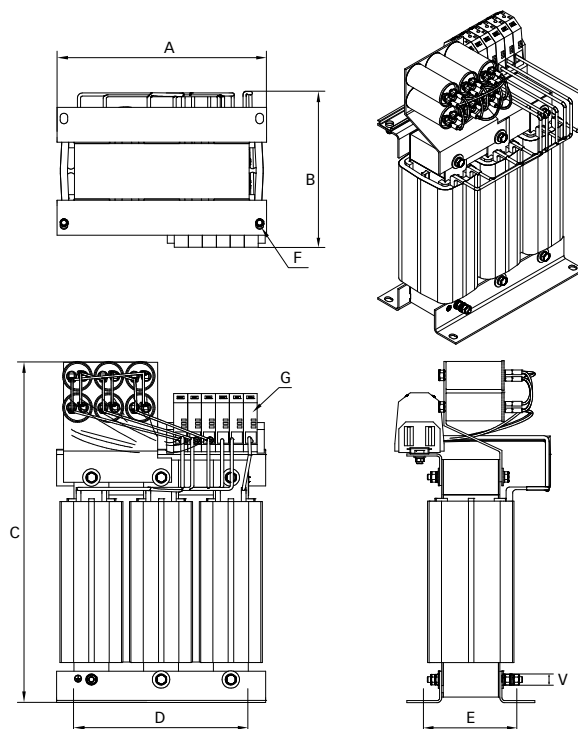


Mechanical data FN5040

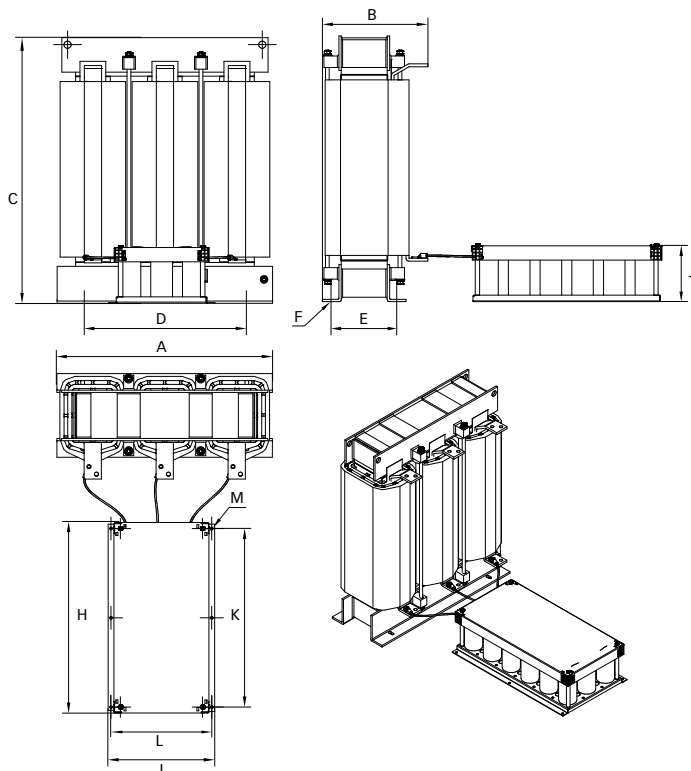
4.5 to 75A types



115A types



180 to 1200A types*



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

Dimensions FN5040

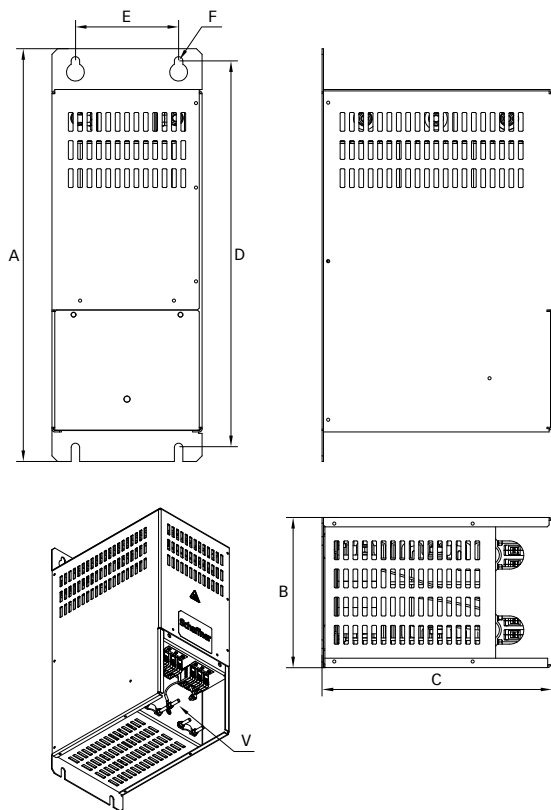
	4.5A	8A	10A	17A	24A	38A	48A	62A	75A	115A
A	125	155	155	190	190	230	300	320	305	305
B	77	84	94	115	116	151	171	190	240	236
C	171	212	208	224	224	275	355	395	395	495
D	100	130	130	170	170	180	240	240	240	280
E	55	56	71.5	57.5	77.5	122	137	132	162	151
F	5x8	8x12	8x12	8x12	8x12	8x12	11x15	11x15	11x15	11x15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

	180A	260A	410A	480A	660A	750A	880A	1200A
A	450	453	490	510	632	665	660	750
B	260	245	292	321	360	415	385	372
C	385	485	600	618	730	670	885	925
D	400	370	430	430	570	570	570	570
E	130	150	194	195	210	220	220	220
F	9x13	11x15	10.5x18.5	13x27	13x27	13x26	13x26	13x26
H	328	328	328	328	436	555	436	665
I	170	170	170	270	370	375	370	375
J	200	220	240	220	220	200	220	220
K	300 (150)	300 (150)	300 (150)	300 (150)	400 (200)	510 (255)		620 (310)
L	150	150	150	250	350	350	350	350
M	9	9	9	9	9	9	9	9
V	M10	M10	M10	M10	M10	M10	M10	M10
W	25	25	40	40	40	40	50	60
X	13/15	13/15	13/16	13/20	20	20	14	17
Y	21	20	25	23	40	40	22	26
Z	10.3	10.3	10.3	10.3	14	14	14	14

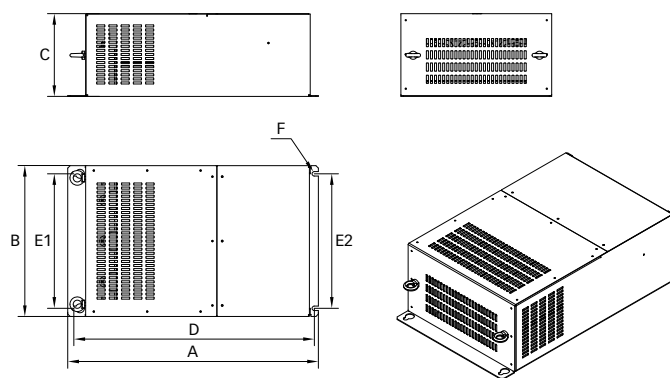
All dimensions in mm; 1 inch = 25.4mm
Tolerances according: ISO 2768-m / EN 22768-m

Mechanical data FN5045

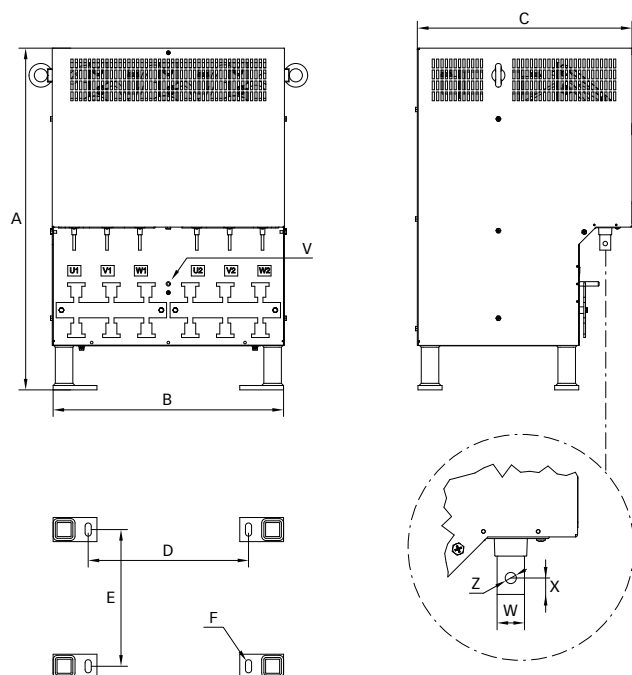
4.5 to 38A types



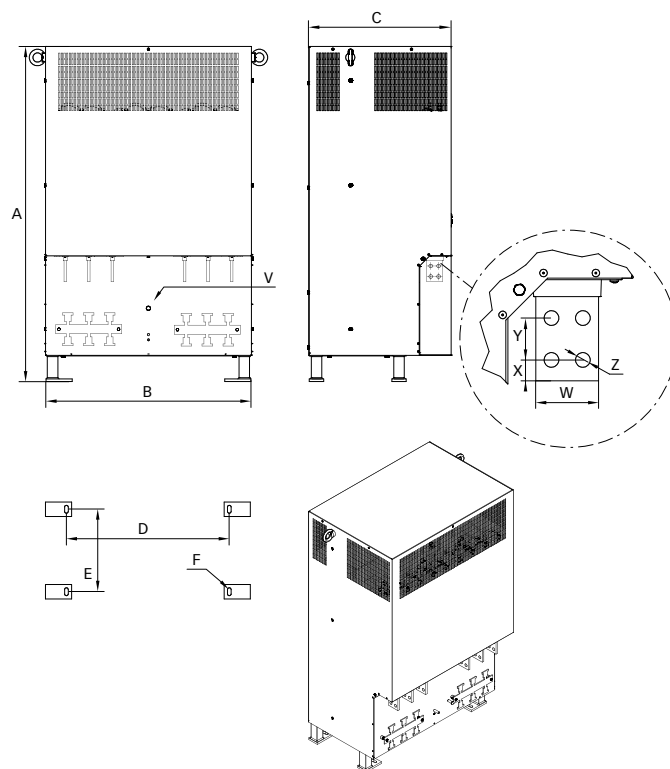
48 to 115A types



180 to 480A types



660 to 1200A types



Dimensions FN5045

	4.5A	8A	10A	17A	24A	38A	48A	62A	75A	115A	180A	260A	410A	480A	660A	750A	880A	1200A
A	330	330	330	440	440	440	515	515	615	615	650	650	780	780	1280	1280	1280	1280
B	100	100	100	160	160	160	320	320	370	370	508	508	538	538	794	794	794	794
C	165	165	165	245	245	156	156	153	203	203	400	400	494	494	498	498	550	550
D	310	310	310	412	412	412	488	488	590	590	336	336	336	336	622	622	622	622
E	60	60	60	110	110	110	280	280	330	330	243	243	312	312	315	315	315	315
F	7	7	7	9	9	9	9	9	11	11	14x30	14x30	14x30	14x30	14x30	14x30	14x30	14x30
J	M5	M5	M5	M5	M5	M5	M5	M5	M8	M8	M10	M10	M10	M10	M10	M10	M10	M10
W											20	20	25	25	40	40	40	60
X											15	15	15	15	20	20	20	20
Y															40	40	40	30/40
Z											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
				
Solid wire	16mm ²	35mm ²	50mm ²	10mm ²
Flex wire	10mm ²	25mm ²	50mm ²	6mm ²
AWG type wire	AWG 6	AWG 2	AWG 1/0	AWG 8
Recommended torque	1.5 - 1.8Nm	4.0 - 4.5Nm	7 - 8Nm	1.5 - 1.8Nm

	-82	-83	-84	-85	-87
					
Solid wire	0.75 - 2.5mm ²	0.75 - 4.0mm ²	2.5 - 10.0mm ²	2.5 - 25.0mm ²	16.0 - 50.0mm ²
Flex wire	1.0 - 2.5mm ²	1.0 - 4.0mm ²	4.0 - 10.0mm ²	4.0 - 16.0mm ²	25.0 - 50.0mm ²
AWG type wire	AWG 18 - 12	AWG 18 - 10	AWG 18 - 6	AWG 22 - 4	AWG 6 - 0
Recommended torque	1.0 - 1.2Nm	1.5 - 1.8Nm	4.0 - 4.5Nm	1.5 - 1.8Nm	6.0 - 8.0Nm

Please visit www.schaffner.com to find more details on filter connectors.

**Headquarters and
global innovation and
development center**

Schaffner Group
Nordstrasse 11
4542 Luterbach
Switzerland
T +41 32 681 66 26
F +41 32 681 66 30
info@schaffner.ch
www.schaffner.com

Sales and application centers

China
Schaffner EMC Ltd. Shanghai
T20-3, No 565 Chuangye Road
Pudong New Area
Shanghai 201201/China
T +86 21 3813 9500
F +86 21 3813 9501/02
cschina@schaffner.com
www.schaffner.com

Finland
Schaffner Oy
Tynninkuja 7
08700 Lohja
T +358 19 35 72 71
F +358 19 32 66 10
finlandsales@schaffner.com

France
Schaffner EMC S.A.S.
112, Quai de Bezons
95103 Argenteuil
T +33 1 34 34 30 60
F +33 1 39 47 02 28
francesales@schaffner.com

Germany
Schaffner Deutschland GmbH
Schoemperlenstrasse 12B
76185 Karlsruhe
T +49 721 56910
F +49 721 569110
germanysales@schaffner.com

Italy
Schaffner EMC S.r.l.
Via Galileo Galilei, 47
20092 Cinisello Balsamo (MI)
T +39 02 66 04 30 45/47
F +39 02 61 23 943
italysales@schaffner.com

Japan
Schaffner EMC K.K.
Mitsui-Seimei Sangenjaya Bldg. 7F
1-32-12, Kamiyama, Setagaya-ku
Tokyo 154-0011
T +81 3 5712 3650
F +81 3 5712 3651
japansales@schaffner.com
www.schaffner.jp

Sweden
Schaffner EMC AB
Turebergstorg 1, 6
19147 Sollentuna
T +46 8 5792 1121/22
F +46 8 92 96 90
swedensales@schaffner.com

Switzerland
Schaffner EMV AG
Nordstrasse 11
4542 Luterbach
T +41 32 681 66 26
F +41 32 681 66 41
sales@schaffner.ch

Singapore
Schaffner EMC Pte Ltd.
Blk 3015A Ubi Road 1
05-09 Kampong Ubi Industrial
Estate
T +65 6377 3283
F +65 6377 3281
singaporesales@schaffner.com

Spain
Schaffner EMC España
Calle Caléndula 93,
Miniparc III, Edificio E
El Soto de la Moraleja,
Alcobendas
28109 Madrid
T +34 618 176 133
spainsales@schaffner.com

Taiwan
Schaffner EMV Ltd.
6th Floor, No 413
Rui Guang Road
Neihu District
Taipei City 114
T +886 2 87525050
F +886 2 87518086
taiwansales@schaffner.com

Thailand
Schaffner EMC Co. Ltd.
Northern Region Industrial Estate
67 Moo 4 Tambon Ban Klang
Amphur Muang P.O. Box 14
Lamphun 51000
T +66 53 58 11 04
F +66 53 58 10 19
thailandsales@schaffner.com

UK
Schaffner Ltd.
5 Ashville Way
Molly Millars Lane
Wokingham
Berkshire RG41 2PL
T +44 118 9770070
F +44 118 9792969
uksales@schaffner.com
www.schaffner.uk.com

USA
Schaffner EMC Inc.
52 Mayfield Avenue
Edison, New Jersey 08837
T +1 732 225 9533
F +1 732 225 4789
usasales@schaffner.com
www.schaffner.com/us

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