

Ecosine high power passive harmonic filter modules



- Compact cabinet filter for quick installation and easy commissioning
- Cost-effective enclosed passive harmonic filter
- Optimized for motor drives with DC-link chokes
- Helps to comply with international power quality standards
- Supports an efficient utilization of electrical system capacity
- Filters for thyristor (SCR) rectifiers



Approvals



Typical application

Schaffner ECOSine filter cabinets can be applied to virtually any kind of power electronics with front-end six thyristor rectifiers, where harmonic current distortion needs to be reduced to defined limits. The compact filter cabinets can be easily commissioned and quickly installed into existing designs without requiring an in-depth system analysis or highly trained specialists.

Typical applications include higher power AC and DC motor drives with either six thyristor used e.g. in HVAC, water/wastewater, oil & gas, or mission critical factory automation equipment. In addition, ECOSine filters can help to reduce thermal and electrical overload caused by harmonic currents in installations involving UPS, high power rectifiers and other non-linear three-phase power supplies.

Technical specifications

Nominal operating voltage	3x 380 to 500 VAC
Operating frequency	50 Hz +/- 1 Hz
Total harmonic current distortion THID*	~5% @ rated power with Ldc <15% @ de-rated power without Ldc
Total demand distortion TDD	According to IEEE-519
Voltage tolerance range	3x 342 to 550 VAC
Nominal motor drive input power rating	200 to 400 kW
Efficiency	≥99% @ nominal line voltage and power
High potential test voltage	P -> E 2500VAC (2 sec)
Protection category	IP 23 for -E2 type filters IP 54 for -E5 type filters
Cooling	Forced air
Overload capability	1.6x rated current for 1 minute, once per hour
Ambient temperature range	-25°C to +40°C fully operational +40°C to +55°C de-rated operation** -25°C to +80°C transport and storage
Flammability according to	UL 94V-2 or better
Design corresponding to	UL 508c, EN 61558-2-20, CE (LVD 2006/95/EC)
SCCR***	100 kA
Earthing System	TN, TT, IT

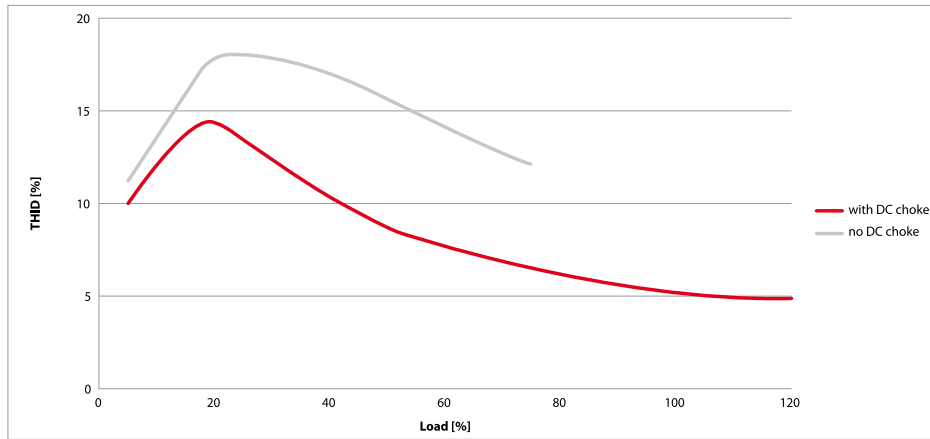
* System requirements: THVD <2%, line voltage unbalance <1%

Note: SCR rectifier front-end will produce different results, depending upon the firing angle of the thyristors

** I_{derated} = I_{nominal} * √((T_{max}-T_{amb})/(T_{max}-T_{nominal})) = I_{nom}*√((55°C-T_{amb})/15°C)

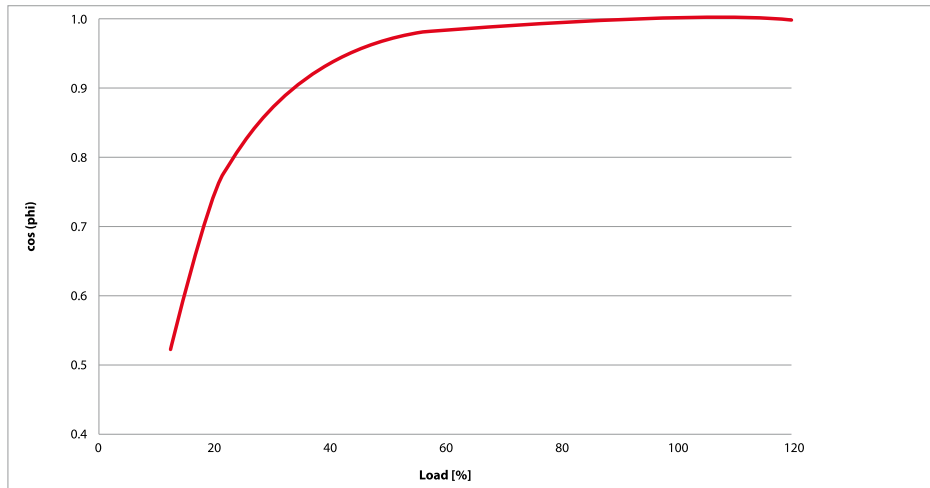
*** External UL-rated fuses required

Performance characteristics



THID – Total harmonic current distortion

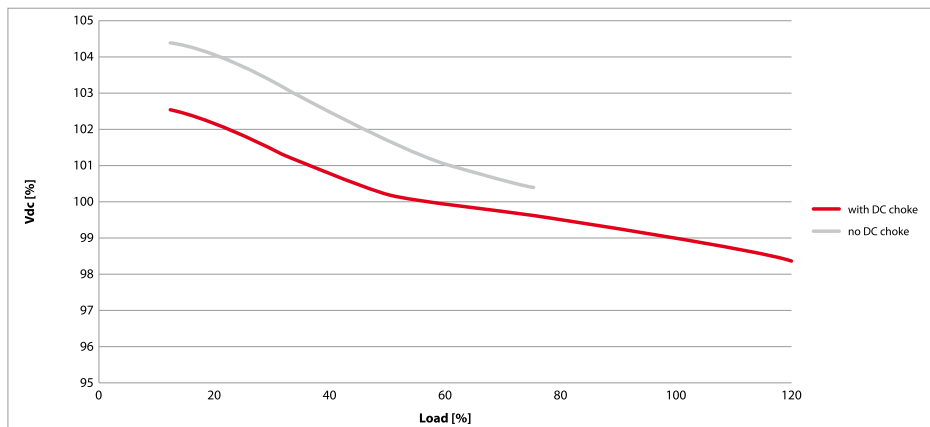
ECOsine high power passive harmonic filter performance is optimized for rectifiers/motor drives with a dc-link choke. In such applications, a THID of roughly 5% can be expected. The use of a dc-link choke is highly recommended. In a system without L_{dc} , the filter module has to be derated to max. 70% of its nominal power rating. In such applications, a THID of 10...15% can be expected.



Displacement power factor

At full load, ECOsine filters yield unity power factor. At lower load levels, the capacitive current into the power capacitors of the trap circuit cause a leading displacement power factor. This is the case with all types of passive filters with large capacitors. However, compared to traditional filters the useful range of Schaffner ECOsine is much extended (cos phi >0.9 from 35 to 100% of rated load).

ECOsine filters allow for trap disconnect at light load to avoid low DPF situations if required. This feature can be provided by the installer using a capacitor contactor of suitable size for the trap circuit.



DC-link voltage

ECOsine harmonic filters have a very low impact on the dc-link voltage of the motor drive. The voltage variation as function of the load is represented in the performance diagram beside. Tolerances are kept narrow in order to ensure that motor drives do not suffer from noise tripping because of under- or over-voltage conditions.

Filter selection table (-E2)@ 400VAC

Filter	Rated load power* @ 400 VAC/50 Hz [kW]	Min. required L _{DC} [mH]	Min. required L _{AC} [mH]	Typ. power loss @ rated load [W]	Weight choke module [kg]	Weight total [kg]
FN 3411-380-99-E2	200	0.205	0.073	1040	120	240
FN 3411-470-99-E2	250	0.164	0.058	1370	135	264
FN 3411-580-99-E2	315	0.131	0.049	1540	160	291
FN 3411-650-99-E2	355	0.115	0.043	1550	215	371
FN 3411-710-99-E2	400	0.102	0.037	1680	250	408

Filter selection table (-E2)@ 500VAC

Filter	Rated load power* @ 500 VAC/50 Hz [kW]	Min. required L _{DC} [mH]	Min. required L _{AC} [mH]	Typ. power loss @ rated load [W]	Weight choke module [kg]	Weight total [kg]
FN 3411-380-99-E2	250	0.257	0.097	1040	120	240
FN 3411-470-99-E2	315	0.203	0.078	1370	135	264
FN 3411-580-99-E2	355	0.180	0.063	1540	160	291
FN 3411-650-99-E2	400	0.160	0.057	1550	215	371
FN 3411-710-99-E2	450	0.142	0.052	1680	250	408

Filter selection table (-E5)@ 400VAC

Filter	Rated load power* @ 400 VAC/50 Hz [kW]	Min. required L _{DC} [mH]	Min. required L _{AC} [mH]	Typ. power loss @ rated load [W]	Weight choke module [kg]	Weight total [kg]
FN 3411-380-99-E5	200	0.205	0.073	1040	120	243
FN 3411-470-99-E5	250	0.164	0.058	1370	135	267
FN 3411-580-99-E5	315	0.131	0.049	1540	160	294
FN 3411-650-99-E5	355	0.115	0.043	1550	215	374
FN 3411-710-99-E5	400	0.102	0.037	1680	250	411

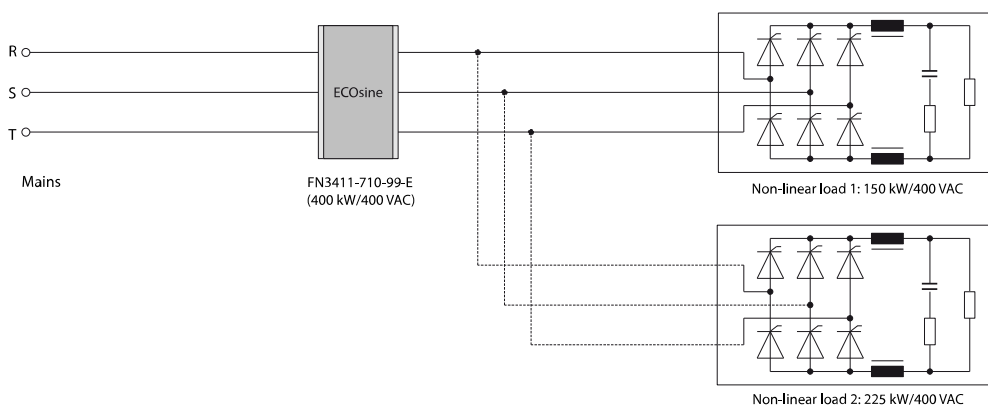
Filter selection table (-E5)@ 500VAC

Filter	Rated load power* @ 500 VAC/50 Hz [kW]	Min. required L _{DC} [mH]	Min. required L _{AC} [mH]	Typ. power loss @ rated load [W]	Weight choke module [kg]	Weight total [kg]
FN 3411-380-99-E5	250	0.257	0.097	1040	120	243
FN 3411-470-99-E5	315	0.203	0.078	1370	135	267
FN 3411-580-99-E5	355	0.180	0.063	1540	160	294
FN 3411-650-99-E5	400	0.160	0.057	1550	215	374
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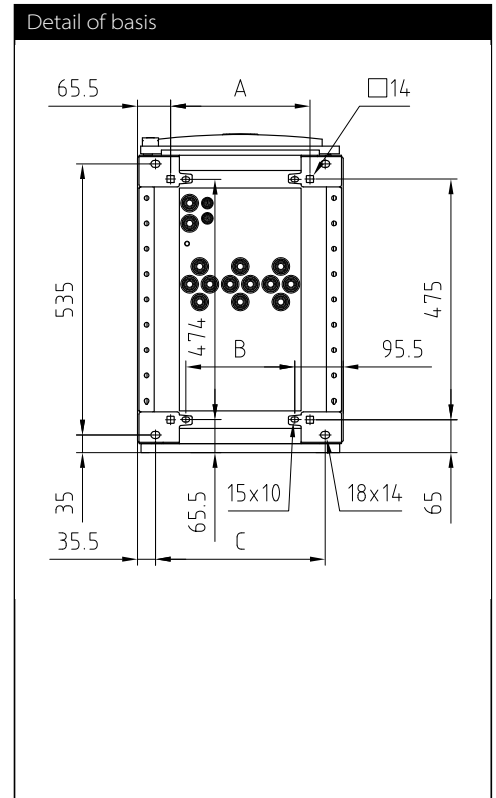
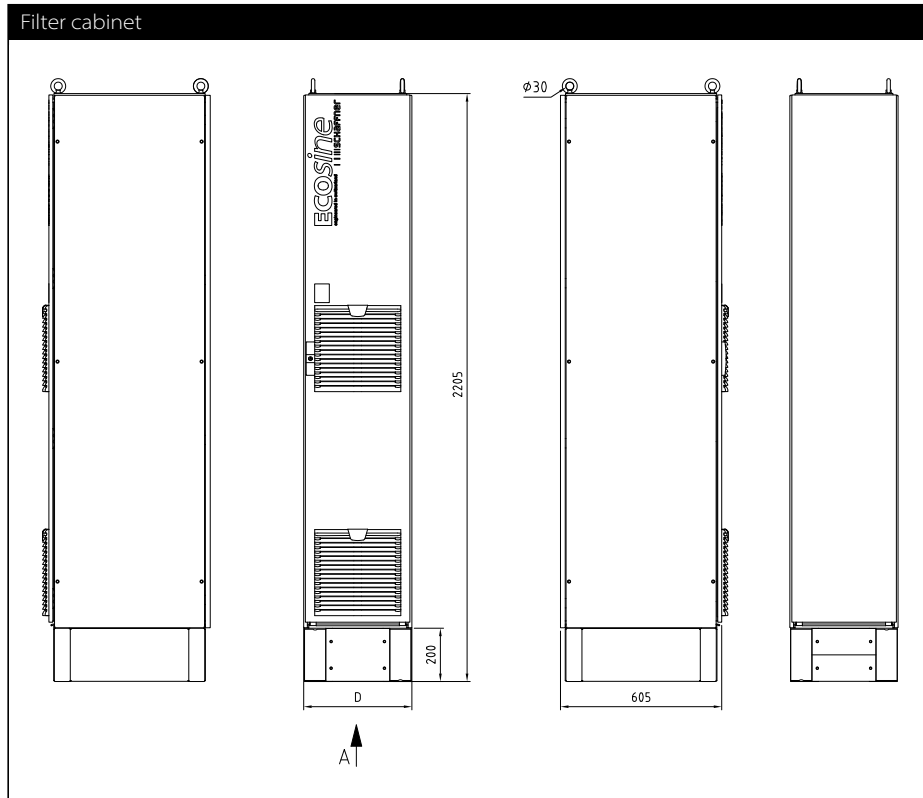
* Power rating for motor drives with dc-link chokes or ac line chokes, the minimum required LDC and LAC are specified in the table. If the minimum required LDC or LAC are not available, load power of the filter has to be de-rated to 70% of the specified value above. In this case, the THID will be between 10-15%.

Application

ECOSine® filters are best installed directly at the input of 6 thyristor (SCR). It is possible to connect several non-linear loads (e.g. motor drives) in parallel. In this case the rating of the filter must match the sum of the power ratings of loads connected to it.



Mechanical data



Dimensions of filter cabinets

Filter cabinet (IP 23)	A	B	C	D
FN 3411-380-99-E2	275	215	335	406
FN 3411-470-99-E2	275	215	335	406
FN 3411-580-99-E2	275	215	335	406
FN 3411-650-99-E2	475	415	535	606
FN 3411-710-99-E2	475	415	535	606

Filter cabinet (IP 54)	A	B	C	D
FN 3411-380-99-E5	275	215	335	406
FN 3411-470-99-E5	275	215	335	406
FN 3411-580-99-E5	275	215	335	406
FN 3411-650-99-E5	475	415	535	606
FN 3411-710-99-E5	475	415	535	606

All dimensions in mm; 1 inch = 25.4 mm

Tolerances according to ISO 2768-c (EN 22768-c)



Headquarters, global innovation and development

Switzerland

Schaffner Group

Nordstrasse 11
4542 Luterbach
T +41 32 681 66 26
info@schaffner.com
www.schaffner.com



Sales and application centers

China

Schaffner EMC Ltd. Shanghai

T20-3 C, No 565 Chuangye Road,
Pudong district
201201 Shanghai
T +86 21 3813 9500
cschina@schaffner.com
www.schaffner.com.cn

Finland

Schaffner Oy

Sauvonrinne 19 H
08500 Lohja
T +358 50 468 7284
finlandsales@schaffner.com

France

Schaffner EMC S.A.S.

16-20 Rue Louis Rameau
95875 Bezons
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

India

Schaffner India Pvt. Ltd

REGUS WORLD TRADE CENTRE
WTC, 22nd Floor Unit No 2238, Brigade
Gateway Campus, 26/1, Dr. Rajkumar Road
Malleswaram (W)
560055 Bangalore
T +91 80 67935355
indiasales@schaffner.com

Italy

Schaffner EMC S.r.l.

Via Ticino, 30
20900 Monza (MB)
T +39 039 21 41 070
italysales@schaffner.com

Japan

Schaffner EMC K.K.

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

Singapore

Schaffner EMC Pte Ltd.

#05-09, Kg Ubi Ind. Estate
408705 Singapore
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 Moraleja, Alcobendas
28109 Madrid
T +34 917 912 900
F +34 917 912 901
spainsales@schaffner.com

Sweden

Schaffner EMC AB

Tegeluddsvägen 76, 2tr
115 28 Stockholm
T +46 8 5050 2425
swedensales@schaffner.com
www.schaffner.com

Switzerland

Schaffner EMV AG

Nordstrasse 11
4542 Luterbach
T +41 32 681 66 26
switzerlandsales@schaffner.com

Taiwan R.O.C.

Schaffner EMV Ltd.

20 Floor-2, No 97, Section 1, XinTai 5th Road
22175 XiZhi District New Taipei City 22175
T +886 2 2697 5500
F +886 2 2697 5533
taiwansales@schaffner.com
www.schaffner.com.tw

Thailand

Schaffner EMC Co. Ltd.

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

United Kingdom

Schaffner Ltd.

5 Ashville Way, Molly Millars Lane
Wokingham
RG41 2PL Berkshire
T +44 118 9770070
F +44 118 9792969
uksales@schaffner.com

USA

Schaffner EMC Inc.

52 Mayfield Avenue
08837 Edison, New Jersey
T +1 800 367 5566
T +1 732 225 9533
F +1 732 225 4789
usasales@schaffner.com
www.schaffnerusa.com

Schaffner North America

6722 Thirlane Road
24019 Roanoke, Virginia
T +1 276 228 7943
F +1 276 228 7953

Schaffner North America

823 Fairview Road
24382 Wytheville, Virginia
T +1 276 228 7943
F +1 276 228 7258

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