

# 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 diode rectifiers



## Approvals



## Typical application

Schaffner ECOSine filter cabinets can be applied to virtually any kind of power electronics with front-end six-pulse 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.

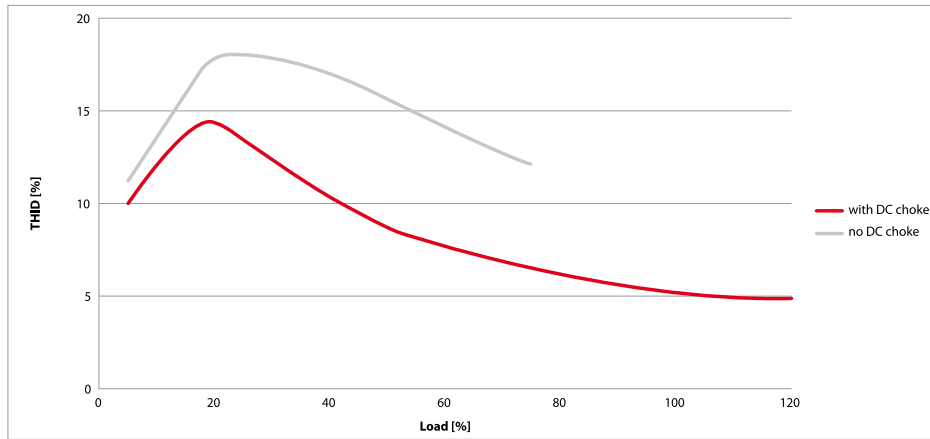
Typical applications include higher power AC and DC motor drives with either six diode used e.g. in HVAC, water/wastewater, oil & gas, or mission critical factory automation equipment. In addition, ECOSine filters can help to reduce thermal and electrical overload caused by harmonic currents in installations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

## Technical specifications

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

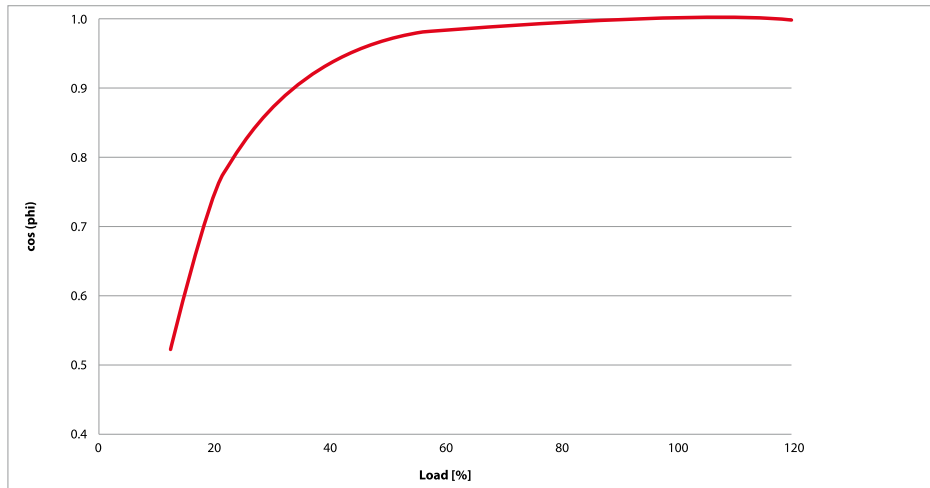
\* System requirements: THVD <2%, line voltage unbalance <1%  
 Note: performance specifications in this brochure refer to six-pulse diode rectifiers  
 \*\*  $I_{derated} = I_{nominal} * \sqrt{\frac{(T_{max}-T_{amb})}{(T_{max}-T_{nominal})}} = I_{nom} * \sqrt{\frac{(55°C-T_{amb})}{15°C}}$   
 \*\*\* External UL-rated fuses required

### Performance characteristics



### THID – Total harmonic current distortion

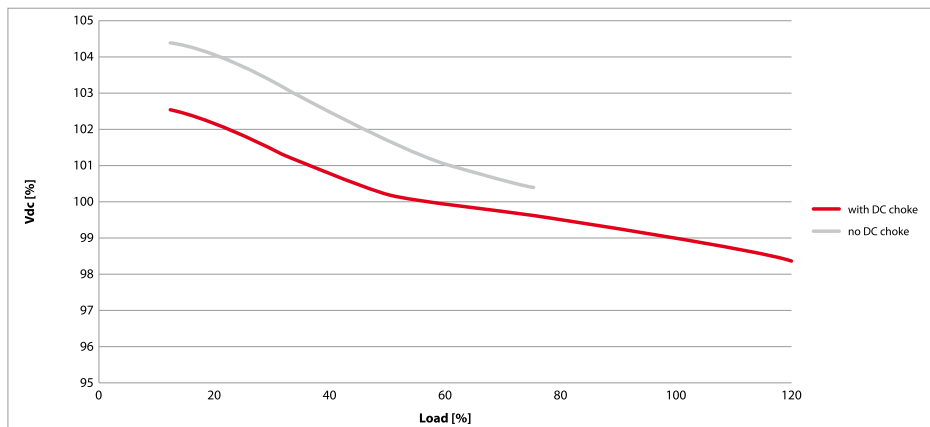
ECOsine high power passive harmonic filter performance is optimized for rectifiers/motor drives with a dc-link choke. In such applications, a THID of roughly 5% can be expected. The use of a dc-link choke is highly recommended. In a system without  $L_{dc}$ , the filter module has to be derated to max. 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 <sub>DC</sub> [mH]	Min. required L <sub>AC</sub> [mH]	Typ. power loss @ rated load [W]	Weight choke module [kg]	Weight total [kg]
FN 3410-380-99-E2	200	0.205	0.073	1040	120	241
FN 3410-470-99-E2	250	0.164	0.058	1370	135	265
FN 3410-580-99-E2	315	0.131	0.049	1540	160	292
FN 3410-650-99-E2	355	0.115	0.043	1550	215	373
FN 3410-710-99-E2	400	0.102	0.037	1680	250	410

### Filter selection table (-E2)@ 500VAC

Filter	Rated load power* @ 500 VAC/50 Hz [kW]	Min. required L <sub>DC</sub> [mH]	Min. required L <sub>AC</sub> [mH]	Typ. power loss @ rated load [W]	Weight choke module [kg]	Weight total [kg]
FN 3410-380-99-E2	250	0.257	0.097	1040	120	241
FN 3410-470-99-E2	315	0.203	0.078	1370	135	265
FN 3410-580-99-E2	355	0.180	0.063	1540	160	292
FN 3410-650-99-E2	400	0.160	0.057	1550	215	373
FN 3410-710-99-E2	450	0.142	0.052	1680	250	410

### Filter selection table (-E5)@ 400VAC

Filter	Rated load power* @ 400 VAC/50 Hz [kW]	Min. required L <sub>DC</sub> [mH]	Min. required L <sub>AC</sub> [mH]	Typ. power loss @ rated load [W]	Weight choke module [kg]	Weight total [kg]
FN 3410-380-99-E5	200	0.205	0.073	1040	120	244
FN 3410-470-99-E5	250	0.164	0.058	1370	135	268
FN 3410-580-99-E5	315	0.131	0.049	1540	160	295
FN 3410-650-99-E5	355	0.115	0.043	1550	215	376
FN 3410-710-99-E5	400	0.102	0.037	1680	250	413

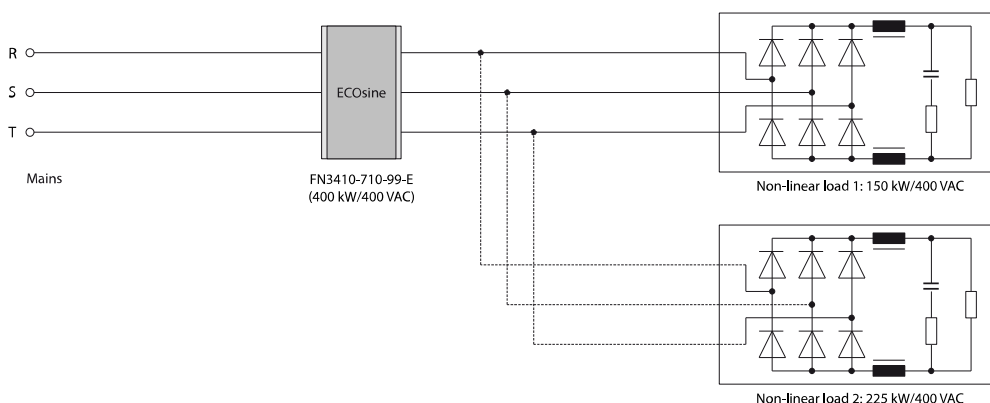
### Filter selection table (-E5)@ 500VAC

Filter	Rated load power* @ 500 VAC/50 Hz [kW]	Min. required L <sub>DC</sub> [mH]	Min. required L <sub>AC</sub> [mH]	Typ. power loss @ rated load [W]	Weight choke module [kg]	Weight total [kg]
FN 3410-380-99-E5	250	0.257	0.097	1040	120	244
FN 3410-470-99-E5	315	0.203	0.078	1370	135	268
FN 3410-580-99-E5	355	0.180	0.063	1540	160	295
FN 3410-650-99-E5	400	0.160	0.057	1550	215	376
FN 3410-710-99-E5	450	0.142	0.052	1680	250	413

\* 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%.

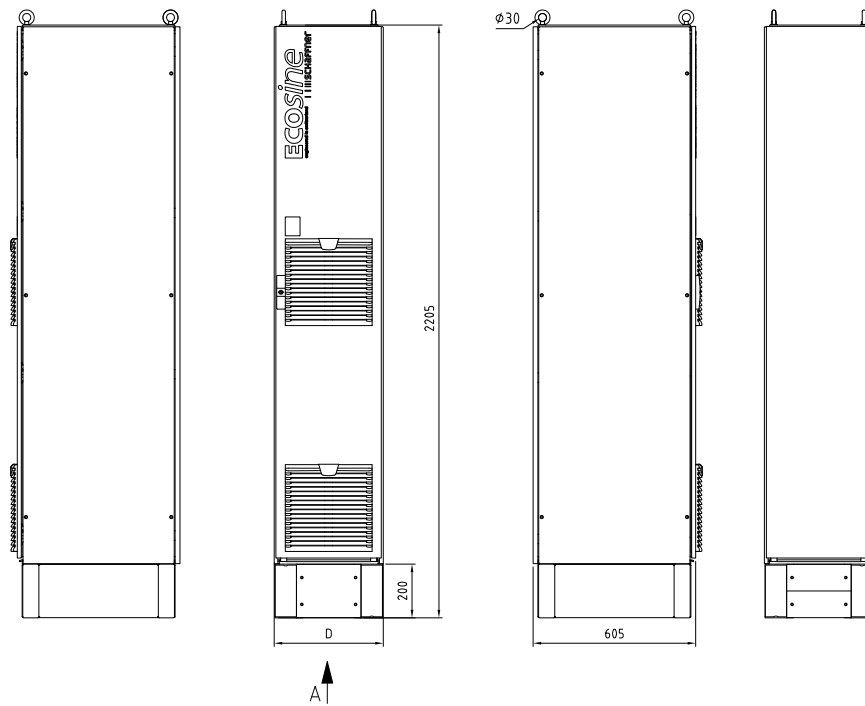
## Application

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.

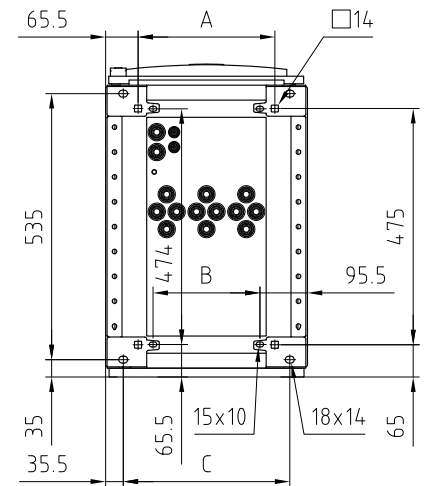


## Mechanical data

### Filter cabinet



### Detail of basis



## Dimensions of filter cabinets

Filter cabinet (IP 23)	A	B	C	D
FN 3410-380-99-E2	275	215	335	406
FN 3410-470-99-E2	275	215	335	406
FN 3410-580-99-E2	275	215	335	406
FN 3410-650-99-E2	475	415	535	606
FN 3410-710-99-E2	475	415	535	606

Filter cabinet (IP 54)	A	B	C	D
FN 3410-380-99-E5	275	215	335	406
FN 3410-470-99-E5	275	215	335	406
FN 3410-580-99-E5	275	215	335	406
FN 3410-650-99-E5	475	415	535	606
FN 3410-710-99-E5	475	415	535	606

All dimensions in mm; 1 inch = 25.4 mm  
Tolerances according to ISO 2768-c (EN 22768-c)



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