

Ecosine high power passive harmonic filter modules for system integration



- Modular and highly compact filter concept
- Cost-effective open panel design for cabinet integration
- 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 filters 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 high power filter modules are particularly suitable when no room for packaged filters is available. The Schaffner solution can conveniently be incorporated into cabinets, which allow the filter components to be wired along with the overall electrical wiring job and to be cooled by jointly utilizing the overall cooling concept.

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 480 VAC
Voltage tolerance range	3x 342 to 528 VAC
Operating frequency	60 Hz +/-1 Hz
Nominal motor drive input power rating	300 to 500 HP
Total harmonic current distortion THID*	~5% @ rated power with L _{DC} <15% @ de-rated power without L _{DC}
Total demand distortion TDD	According to IEEE-519
Efficiency	≥ 99% @ nominal line voltage and power
High potential test voltage	P → E 2500 VAC (2 sec)
Protection category	IP 00
Cooling	Forced air, to be provided by the installer/integrator
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 corresponding 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

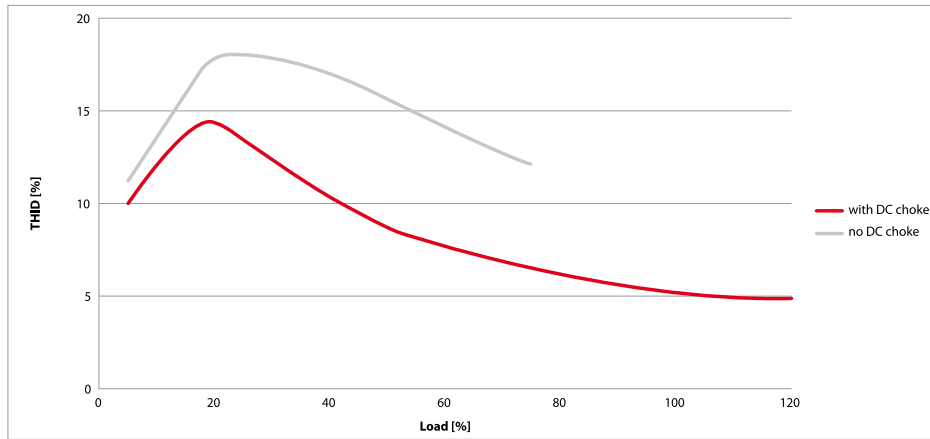
* System requirements: THVD <2%, line voltage unbalance <1%

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)

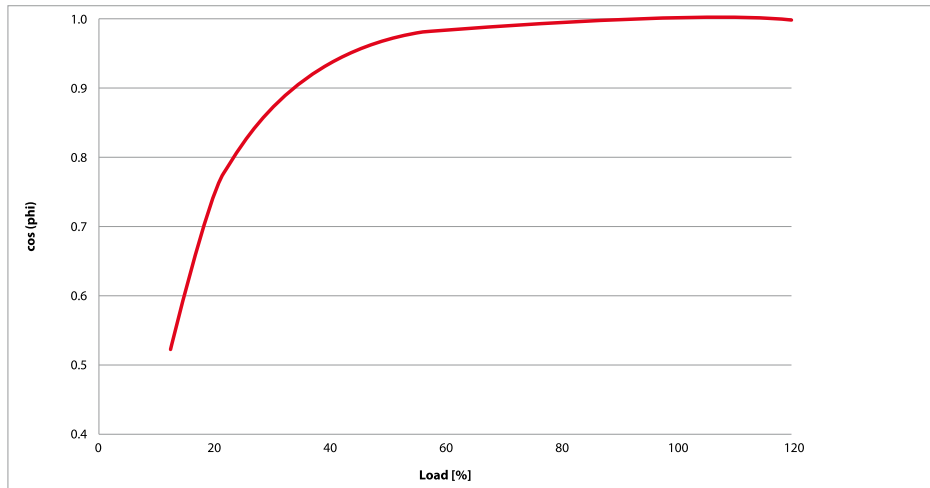
*** External UL-rated fuses required

Performance characteristics



THID – Total harmonic current distortion

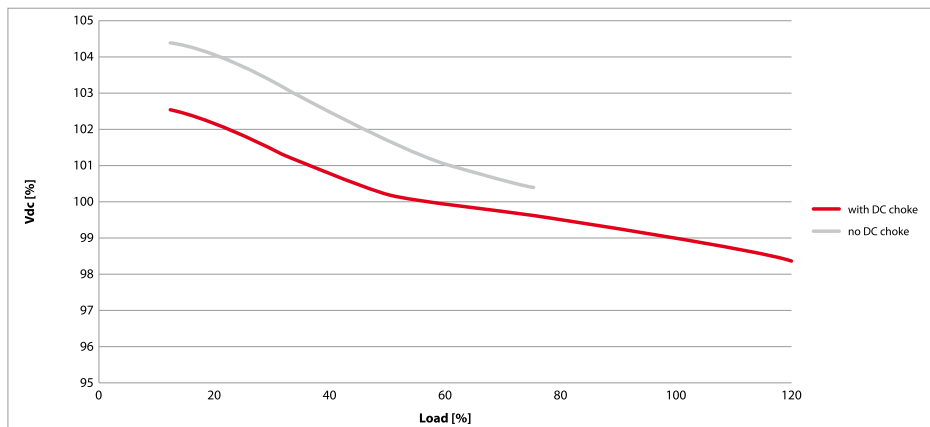
Ecosine high power passive harmonic filter performance is optimized for rectifiers/motor drives with a dc-link choke. In such applications, a THID of roughly 5% can be expected. The use of a dc-link choke is highly recommended. In a system without L_{DC} , the filter module has to be derated to max. 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 (60 Hz)

Filter	Rated load power* @ 460 VAC/60 Hz [HP]	Min. required L _{DC} [mH]	Min. required L _{AC} [mH]	Typ. power loss @ rated load [W]	Weight choke module [kg]	Weight total [kg]
FN 3413-380-99-O	300	0.202	0.074	1090	120	135
FN 3413-440-99-O	350	0.173	0.081	1400	135	155
FN 3413-490-99-O	400	0.151	0.058	1480	150	170
FN 3413-540-99-O	450	0.134	0.052	1500	195	218
FN 3413-590-99-O	500	0.121	0.048	1520	235	260

* Power rating for motor drives with dc-link chokes or ac line chokes, the minimum required L_{DC} and L_{AC} are specified in the table. If the minimum required L_{DC} or L_{AC} 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%.

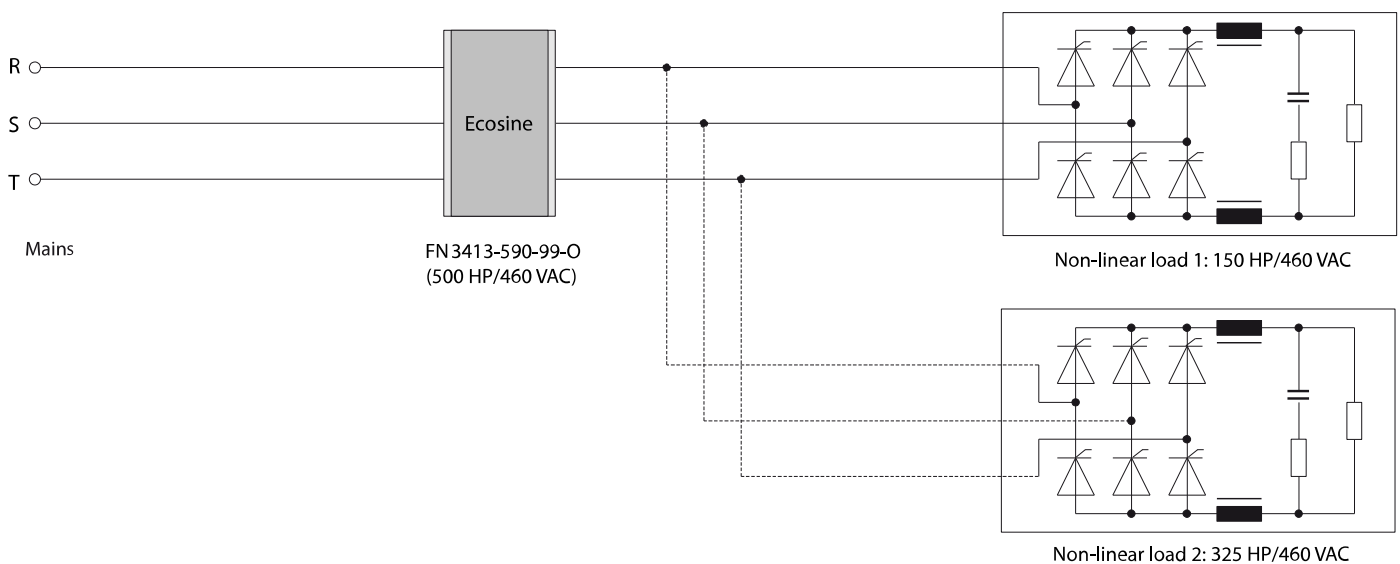
Scope of delivery

Filter	Power [HP]	Freq. [Hz]	Rectifier	Chokes module	Capacitor modules Caps	Installation manual
FN 3413-380-99-O	300	60	SCR	1	4	√
FN 3413-440-99-O	350	60	SCR	1	5	√
FN 3413-490-99-O	400	60	SCR	1	5	√
FN 3413-540-99-O	450	60	SCR	1	6	√
FN 3413-590-99-O	500	60	SCR	1	7	√

Remark: wiring material, cabinet/enclosure and fan(s) are not included in the scope of delivery.

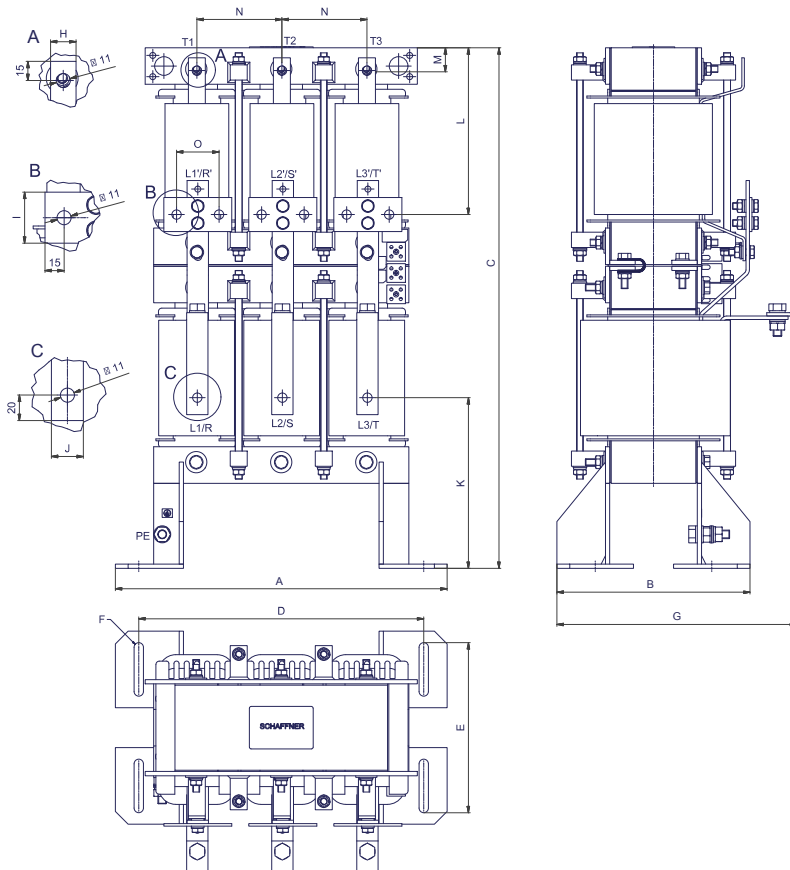
Application

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

Chokes module



Dimensions of chokes module

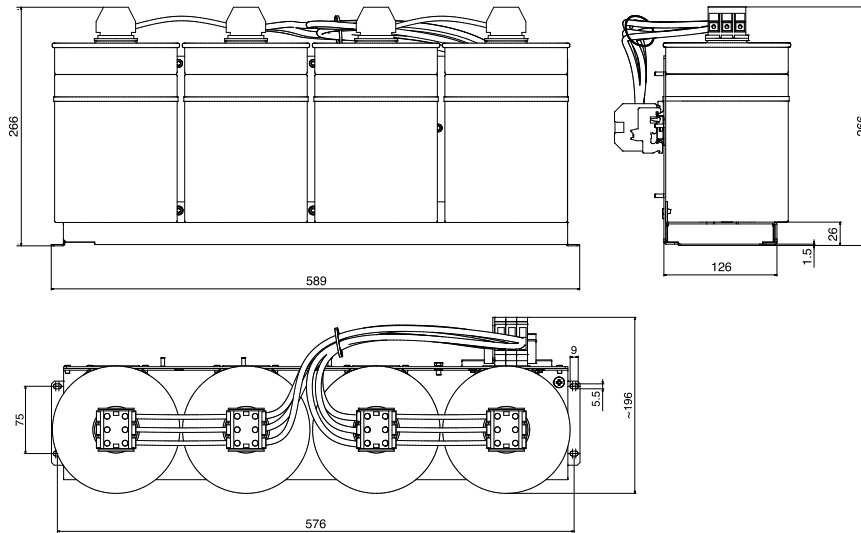
	300 HP	350 HP	400 HP	450 HP	500 HP
A	390 ±1	390 ±1	390 ±1	590 ±1	590 ±1
B	227 ±2	212 ±2	227 ±2	238 ±2	258 ±2
C	<620	<725	<725	<750	<750
D	335 ±1	335 ±1	335 ±1	535 ±1	535 ±1
E	175	175	175	200	200
F	M10 +1	M10 +1	M10 +1	M10 +1	M10 +1
G	<300	<300	<300	<300	<300
H	20	20	20	20	20
I	40	40	40	40	40
J	25	25	25	25	30
K	200 ±5	240 ±5	240 ±5	290 ±5	290 ±5
L	195 ±5	240 ±5	240 ±5	210 ±5	210 ±5
M	25 ±3	35 ±3	35 ±3	35 ±3	35 ±3
N	100	120	120	140	140
O	50	50	50	70	70
Weight	~120 kg	~135 kg	~150 kg	~195 kg	~235 kg

All dimensions in mm; 1 inch = 25.4 mm

PE bolt M10

Tolerances according: ISO 2768-m (EN 22768-m)

Capacitor modules



Filters 60 Hz

	H
FN 3413-380-99-O	< 145
FN 3413-440-99-O	< 145
FN 3413-490-99-O	< 145
FN 3413-540-99-O	< 160
FN 3413-590-99-O	< 160

Installation

Detailed installation and wiring instructions as well as cooling requirements can be found in the Installation Manual available from every Schaffner sales point or from www.myeosine.com.

Important

Forced cooling is required for the thermal management of the magnetic components. Needed fan(s) are not in the scope of delivery. Cooling devices have to be properly selected and installed by the systems integrator. Please consult the Schaffner installation manual for cooling requirement details

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



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