

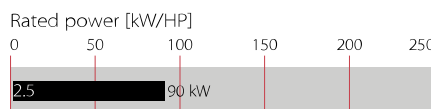
# Ecosine Low-Voltage Economy Line of Passive Harmonic Filters



- Economy line of passive harmonic filters for THID <7%
- Help to comply with EN 61000-3-12, IEEE-519 and other PQ standards
- Support an efficient utilization of electrical system capacity
- Ideal for AC or DC motor drives with 6-pulse rectifier front-end
- Suitable for 200-240 V diode and thyristor (SCR) rectifiers applications



### Performance indicators



### Approvals



### Features and benefits

FN 3416 LV (50 Hz) models of the ECOsine product family represent the very compact "economy line" with a THID performance of  $\leq 7\%$  (with Ldc). The performance is still sufficient to comply with EN 61000-3-12 or with IEEE-519 for  $I_{sc}/I_L < 50$ . Schaffner ECOsine filters help to unburden the electrical infrastructure from excess loading and heat caused by current harmonics, and therefore support a better utilization of electric system capacity. Lower harmonics also reduce the risk of system resonances and potential downtime of sensitive electronic equipment. FN 3416 LV filters upgrade standard motor drives to "low-harmonic drives" quickly and easily.

### Technical specifications

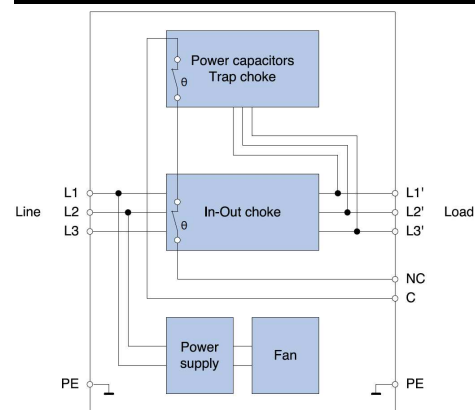
<b>Nominal operating voltage</b>	3x 200 to 240 VAC $\pm 10\%$
<b>Operating frequency</b>	50Hz $\pm 1$ Hz (FN 3416 LV)
<b>Total harmonic current distortion THID*</b>	<7% @ rated power (with DC-Link choke) <13% @ rated power (without DC-Link choke)
<b>Nominal motor drive input power rating</b>	2.5 to 90 kW
<b>Efficiency</b>	>98% @ nominal line voltage and power
<b>Total demand distortion TDD</b>	According to IEEE-519
<b>High potential test voltage</b>	P -> E 2500 VAC (2 sec)
<b>Protection category</b>	IP 20
<b>Cooling</b>	Internal fan cooling, unregulated
<b>Overload capability</b>	1.6x rated current for 1 minute, once per hour
<b>Ambient temperature range</b>	-25°C to +45°C fully operational -25°C to +70°C transport and storage +45°C to +55°C derated operation**
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	UL 508, EN 61558-2-20, CE (LVD 2006/95/EC)
<b>MTBF @ 45°C/500 V (Mil-HB-217F)</b>	200,000 hours
<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 datasheet refer to six-pulse diode rectifiers.  
 SCR rectifier front-end will produce different results, depending upon the firing angle of the thyristors.  
 \*\* Iderated =  $I_{nominal} \cdot \sqrt{(70^\circ\text{C} - T_{amb})/25^\circ\text{C}}$   
 \*\*\* External UL-rated fuses required.

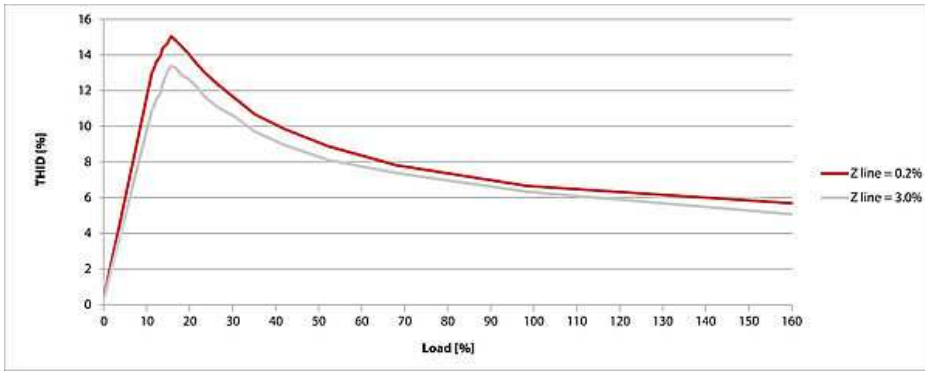
### Typical applications

- Three-phase power conversion equipment with front-end six-pulse rectifier (diode or SCR)
- Motor drives, like those used e.g. in pump and fan applications
- Battery chargers, incl. DC fast chargers for e-cars

### Typical electrical schematic

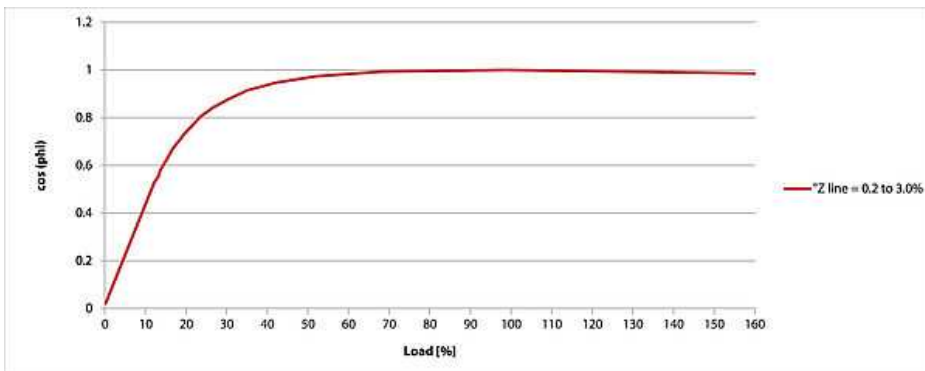


### Performance characteristics (for diode rectifiers)



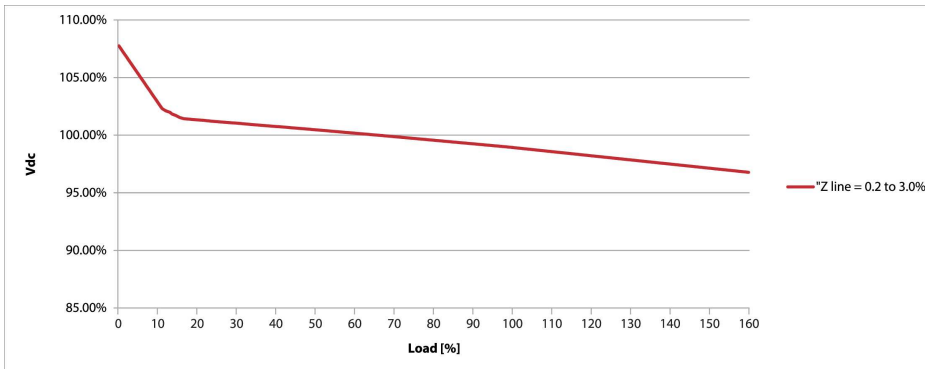
### THID – Total harmonic current distortion

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 7% can be expected. The use of a dc-link choke is highly recommended. In a system without  $L_{dc}$  a THID of 13% 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).



### DC-link voltage

ECOsine harmonic filters have a very low impact on the dc-link voltage of the motor drive. The voltage boost/buck as a function of load can be seen in the performance graph beside. Tolerances are kept narrow in order to ensure that motor drives do not suffer from nuisance tripping because of under- or over-voltage situations.

## Filter selection table

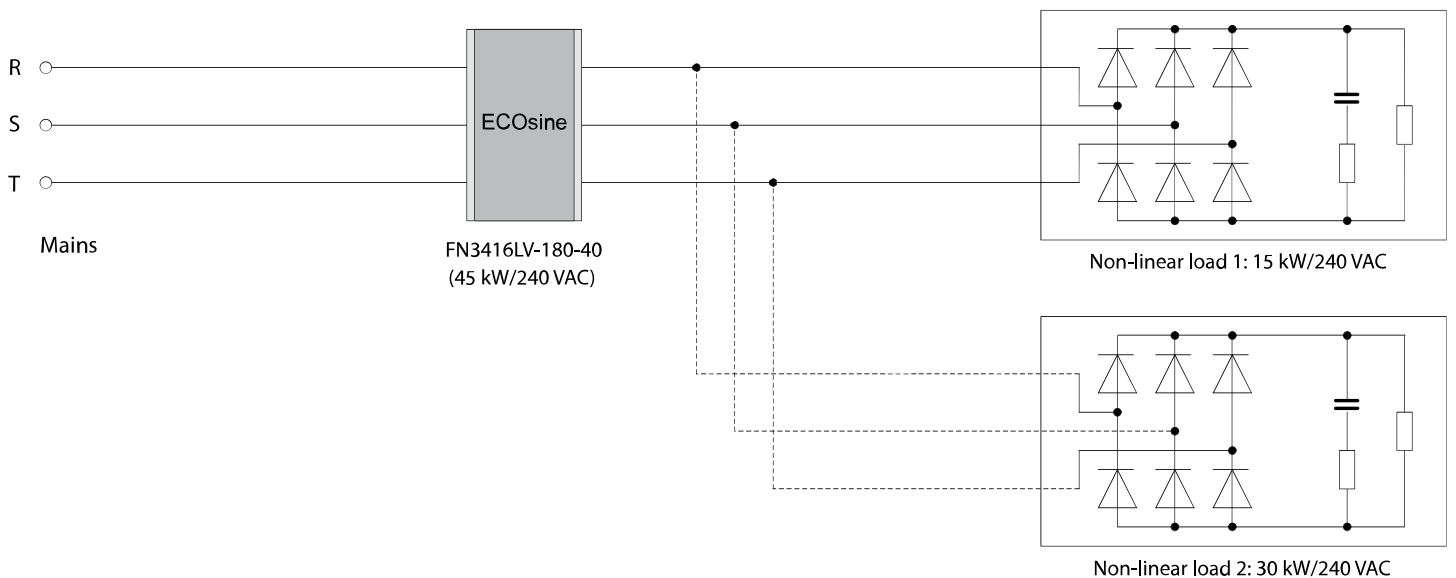
Filter*	Rated load power	Power loss**	Input /output connections		Weight
	@ 220 VAC/50 Hz [kW]	@ 25°C/50 Hz [W]			[kg]
FN 3416 LV-10-44	2.5	63	-44		10
FN 3416 LV-13-44	3	82	-44		10
FN 3416 LV-16-44	4	105	-44		15
FN 3416 LV-24-33	5.5	153	-33		20
FN 3416 LV-32-33	7.5	294	-33		22
FN 3416 LV-38-33	11	256	-33		25
FN 3416 LV-45-33	15	306	-33		29
FN 3416 LV-60-34	18.5	408	-34		37
FN 3416 LV-75-34	22	410	-34		43
FN 3416 LV-90-35	26	493	-35		47
FN 3416 LV-110-35	30	546	-35		50
FN 3416 LV-150-40	37	784	-40		86
FN 3416 LV-180-40	45	817	-40		92
FN 3416 LV-210-40	55	887	-40		100
FN 3416 LV-260-99	75	947		-99	125
FN 3416 LV-320-99	90	988		-99	135

\* Filter to be selected by system voltage and load (motor drive) power. Note: the harmonic filter will reduce RMS input current. Therefore, filter selection by current rating, as it is common for EMC/EMI filters, is not recommended.

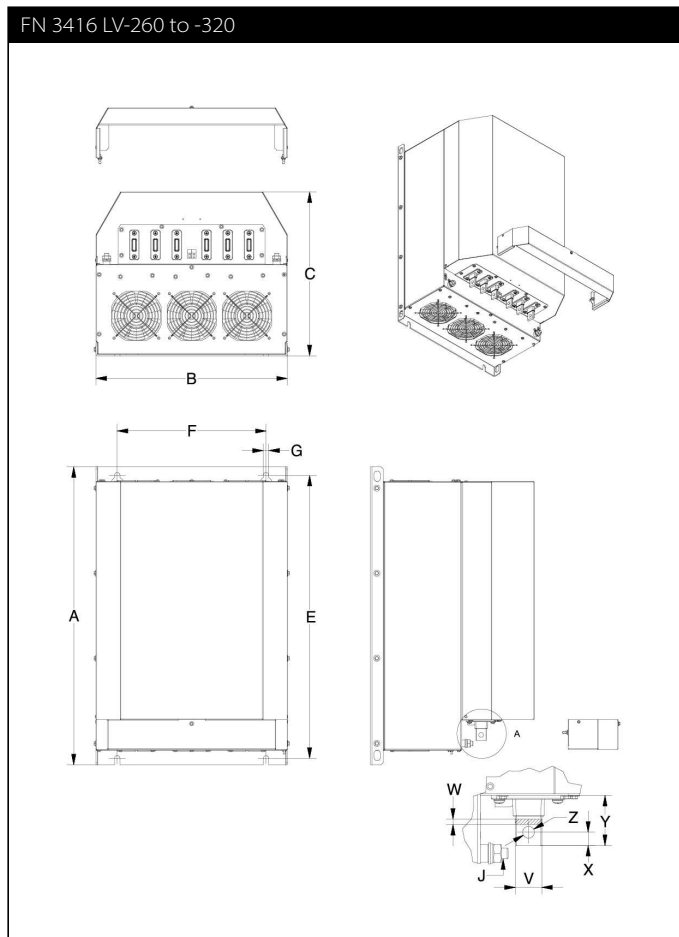
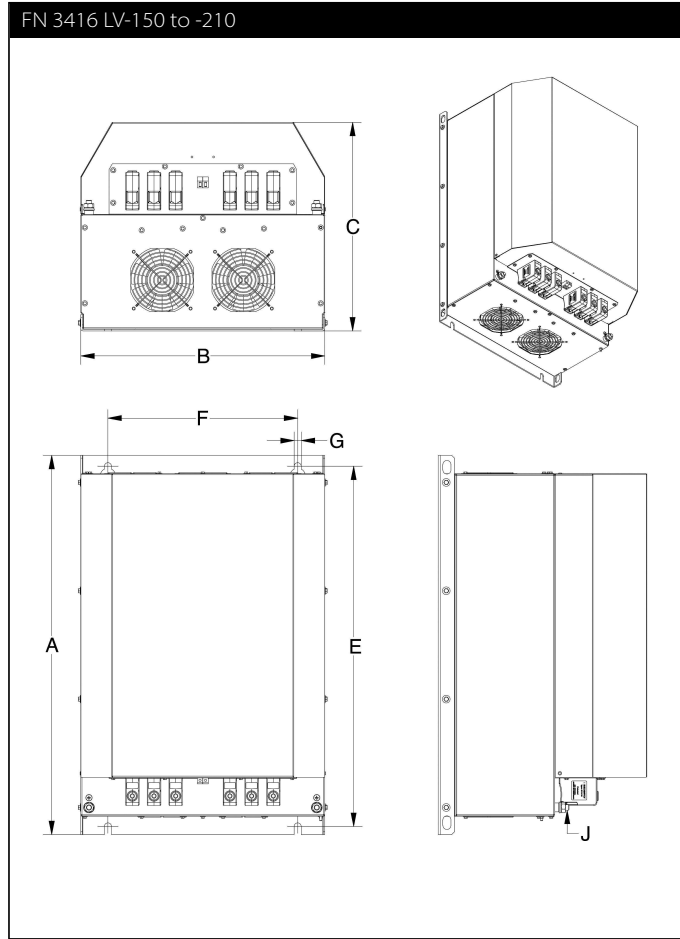
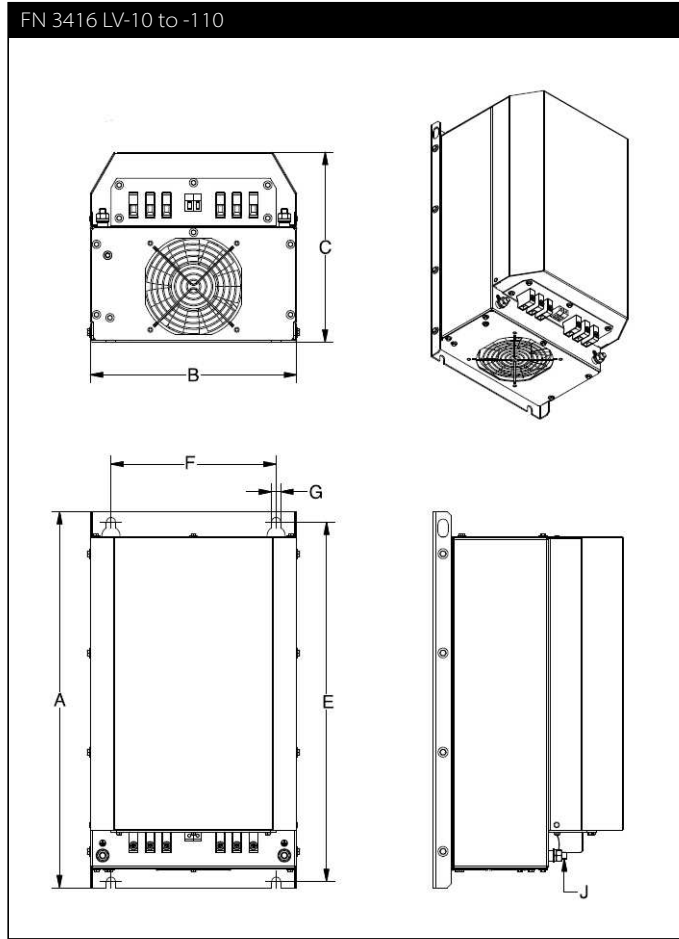
\*\* Calculated power loss at rated load power.

## Filter application

ECOsine filters are best installed directly at the input of 6-pulse rectifiers. 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 drives connected to it. The use of a (built-in) DC-link choke is recommended for best harmonics mitigation performance. If the expected input power exceeds the rating of the largest available filter, and a custom solution is not desired, then two or more filters can be wired in parallel. In this mode of operation, it is recommended to use filters with equal power ratings to ensure proper current sharing.








**Mechanical Data**



## Dimensions

FN 3416 LV-...	10	13	16	24	32	38	45	60	75	90	110	150	180	210	260	320
<b>A</b>	390	390	390	455	455	455	455	520	520	580	580	700	700	700	700	700
<b>B</b>	185	185	185	250	250	250	280	280	280	280	280	450	450	450	450	450
<b>C</b>	190	190	190	230	230	230	230	248	248	248	248	385	385	385	385	385
<b>E</b>	370	370	370	435	435	435	435	500	500	555	555	665	665	665	665	665
<b>F</b>	140	140	140	200	200	200	200	225	225	225	225	350	350	350	350	350
<b>G</b>	9	9	9	11	11	11	11	11	11	11	11	13	13	13	13	13
<b>J</b>	M6	M6	M6	M8	M8	M8	M8	M8	M8	M10	M10	M10	M10	M10	M10	M10
<b>V</b>																25
<b>W</b>																6
<b>X</b>																12.5
<b>Y</b>																47
<b>Z</b>																11

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

Filter connector cross sections	-33	-34	-35	-40	-44
					
<b>Solid wire</b>	16 mm <sup>2</sup>	35 mm <sup>2</sup>	50 mm <sup>2</sup>	95 mm <sup>2</sup>	10 mm <sup>2</sup>
<b>Flex wire</b>	10 mm <sup>2</sup>	25 mm <sup>2</sup>	50 mm <sup>2</sup>	95 mm <sup>2</sup>	6 mm <sup>2</sup>
<b>AWG type wire</b>	AWG 6	AWG 2	AWG 1/0	AWG 4/0	AWG 8
<b>Recommended torque</b>	1.5–1.8 Nm	4.0–4.5 Nm	7–8 Nm	17–20 Nm	1.0–1.2 Nm

Please visit [www.schaffner.com](http://www.schaffner.com) to find more details on filter connectors.

## Installation

For more detailed information and step by step installation guidelines, please consult the user manual at [www.schaffner.com](http://www.schaffner.com) or the installation instructions (delivered with each filter).



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