

TECHNICAL CATALOG  
NOVEMBER 2019

# Power Quality Portfolio



# Active Harmonic Filter ecosine active sync



- Most effective harmonic mitigation up to the 50<sup>th</sup> order, parameter setting for even and odd harmonics

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- Compact active harmonic filter for 3-phase loads with and without neutral wire

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- <5% THDi achievable even on most complex mixed loads and changing load profiles

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- New modular design with intelligent system approach offering tailored solutions for different applications and customers

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- 3-Level IGBT inverter topology for reduced power losses

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- Extended temperature range of modules up to 50°C

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- Ultra-fast and dynamic reactive power compensation (inductive and capacitive)

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- Load balancing and unloading of neutral wires

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- Flicker compensation (if caused by reactive power)

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- Compliance with IEEE 519, EN 61000-3-12 and other power quality standards

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- User-friendly, easy to install and maintain



## Approvals



## Features and benefits

Based on the broad knowledge and experience in terms of solutions and applications in power quality the Schaffner Group has developed a new generation of active harmonic filters. The new modular ecosine active sync series offers fitted and economical solutions for the most demanding harmonic mitigation challenges with any kind of non-linear load involved. Ecosine active sync filter series provides a solution concept which is modular, compact and can be used as stand-alone modules or as system solution. The optional sync module offers a smart load Management of the filter's usage and allows redundancy which guarantees a smart power quality solution in the era of Industry 4.0. Schaffner provides active harmonic filters with excellent performance in solving power quality problems focusing on customer needs and application demands for cleaner and smarter energy.

## Typical applications

- Building technology

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- Automation industry

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- Data centers

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- Elevators

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- Cement industry

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- HVAC installations

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- Battery charges

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- Oil and gas exploration

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- Paper mills

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- Ship propulsion

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- Steel industry

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- Tunnel ventilation

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- UPS

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- Water/wastewater treatment

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- Welding equipment

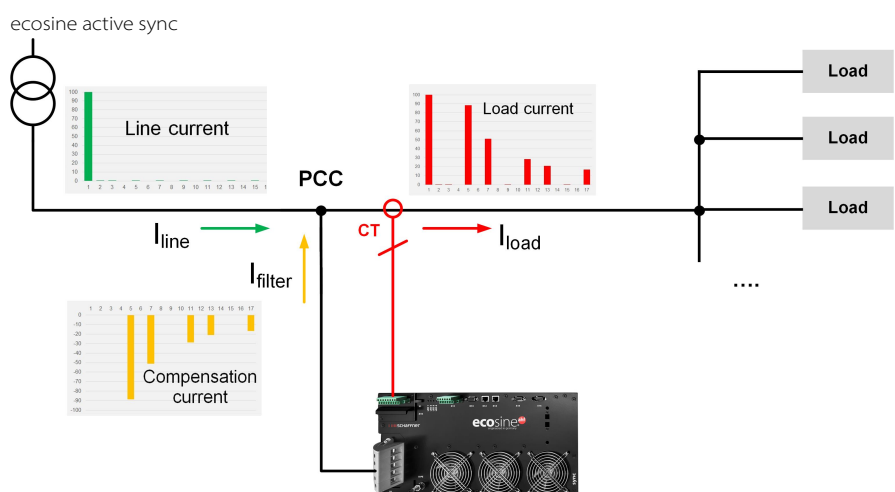
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- Wind turbines

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- Machines and Automation

## Typical electrical schematic



## Technical specifications of ecosine active sync power module

<b>Number of phases (system input)</b>	3-phase 3-wire or 3-phase 4-wire
<b>Mains frequency</b>	50/60 Hz $\pm$ 3 Hz
<b>Mains voltage</b>	3-wire: 200 VAC - 480 VAC $\pm$ 10% 4-wire: 200 VAC - 415 VAC $\pm$ 10%
<b>Inverter topology</b>	3-level NPC topology, IGBT
<b>Switching frequency</b>	16 kHz
<b>Response time</b>	<100 $\mu$ s
<b>Harmonic mitigation performance</b>	Up to the 50 <sup>th</sup> harmonic
<b>Total harmonic current distortion THDi</b>	<5%
<b>Power factor correction</b>	$\cos \varphi = -0.7 \dots 1 \dots 0.7$ (inductive and capacitive compensation)
<b>Dimensions of a single unit</b>	440 mm $\times$ 420 mm $\times$ 222mm (w $\times$ d $\times$ h)
<b>Rated phase mitigation current</b>	60 A
<b>Rated neutral conductor mitigation current</b>	180 A
<b>Overload capability (Amp for 10 ms)</b>	150 A
<b>Current transformer placement</b>	Mains side or load side
<b>Current transformer ratio</b>	xx:5 A or xx:1 A
<b>Color</b>	NCS S9000-N matt
<b>Mounting</b>	Wall-mounting (book or flat) or 19"-rack mounting
<b>Weight of a single unit</b>	44 kg
<b>Cooling type</b>	Air cooling
<b>Required air flow per module</b>	270 m <sup>3</sup> /h
<b>Communication interface</b>	Ethernet TCP/IP, Modbus RTU RS 485
<b>Digital I/O</b>	2 DI + 2 DO (programmable)
<b>Ambient temperature of power modules</b>	0 ... 50°C full performance, up to 55°C with derating of 3% per Kelvin
<b>Power Losses</b>	<1100 W under full mitigation performance (<2.6%) <970 W in typical operation (<2.3%)
<b>Protection class</b>	IP 20 (optional IP 21)
<b>Noise level</b>	<56 to 63 dB A (depending on load situation)
<b>Self-protection</b>	Yes
<b>Overheat protection</b>	Yes
<b>Overvoltage and undervoltage protection</b>	Yes
<b>Recommended fuse protection</b>	100A, e.g. gL or gG
<b>Earthing system</b>	TT, TN-C, TN-S, TN-C-S, IT, corner grounded delta
<b>Altitude</b>	<1000 m without derating; Up to 4000 m with derating 1% / 100m
<b>Ambient conditions</b>	Pollution degree 2 Relative humidity <95% non-condensing, 3K3 Temperature: Storage 55°C, 1K3, 1K4, Transportation -25°C to 75°C, 2K3
<b>Approval</b>	CE, RoHS, UL
<b>Design standards</b>	IEC 61000-4-2, 4-4, 4-5, 4-6 EN 61000-3-11, 3-12 EN 61000-6-2 EN 55011 EN 62477-1 EN 61800-3

## Technical specifications of ecosine active sync cabinet version

<b>Number of phases (system input)</b>	3-phase 3-wire or 3-phase 4-wire					
<b>Mains frequency</b>	50/60Hz ±3 Hz					
<b>Mains voltage</b>	3-wire: 200 VAC - 480 VAC ±10% 4-wire: 200 VAC - 415 VAC ±10%					
<b>Inverter topology</b>	3-level NPC topology, IGBT					
<b>Switching frequency</b>	16 kHz					
<b>Response time</b>	<100 µs					
<b>Harmonic mitigation performance</b>	Up to the 50 <sup>th</sup> harmonic					
<b>Total harmonic current distortion THDi</b>	<5%					
<b>Power factor correction</b>	cos φ = -0.7 ... 1 ... 0.7 (inductive and capacitive compensation)					
<b>Dimensions cabinet</b>	600 mm × 600 mm × 2328 mm (w × d × h)					
<b>Number of Modules</b>	0*	1	2	3	4	5
<b>Rated phase mitigation current</b>	0 A	60 A	120 A	180 A	240 A	300 A
<b>Rated neutral conductor mitigation current</b>	0 A	180 A	360 A	540 A	720 A	900 A
<b>Overload capability (for 10 ms)</b>	0 A	150 A	300 A	450 A	600 A	750 A
<b>Weight</b>	180 kg	224 kg	268 kg	312 kg	356 kg	400 kg
<b>Power losses full mitigation performance</b>	200 W	<1300 W	<2400 W	<3500 W	<4600 W	<5700 W
<b>Power losses typical operation</b>	200 W	<1170 W	<2100 W	<3100 W	<4000 W	<5000 W
<b>Current transformer placement</b>	Mains side or load side					
<b>Current transformer ratio</b>	xx:5 A or xx:1 A					
<b>Color</b>	RAL 7035					
<b>Mounting</b>	Floor mounting					
<b>Cooling type</b>	Air cooling					
<b>Required air flow</b>	270 m <sup>3</sup> /h × nb of modules + 100 m <sup>3</sup> /h					
<b>Communication interface</b>	Ethernet TCP/IP, Modbus RTU RS485					
<b>Digital I/O</b>	2 DI + 2 DO (programmable), more I/O with sync module					
<b>Ambient temperature</b>	0 ... 40°C full performance, up to 50°C with derating of 3% per Kelvin					
<b>Protection class</b>	IP 54					
<b>Noise level</b>	<75 dB A (depending on load situation)					
<b>Self-protection</b>	Yes					
<b>Overheat protection</b>	Yes					
<b>Overvoltage and undervoltage protection</b>	Yes					
<b>Earthing system</b>	TT, TN-C, TN-S, TN-C-S, IT, corner grounded delta					
<b>Altitude</b>	<1000 m without derating; Up to 4000m with derating 1% / 100m					
<b>Ambient conditions</b>	Pollution degree 2 Relative humidity <95% non-condensing, 3K3 Temperature: Storage 55°C, 1K3, 1K4, Transportation -25°C to 75°C, 2K3					
<b>Approval</b>	CE, RoHS, UL (pending)					
<b>Design standards</b>	IEC 61000-4-2, 4-4, 4-5, 4-6 EN 61000-3-11, 3-12 EN 61000-6-2 EN 55011 EN 62477-1 EN 61800-3					

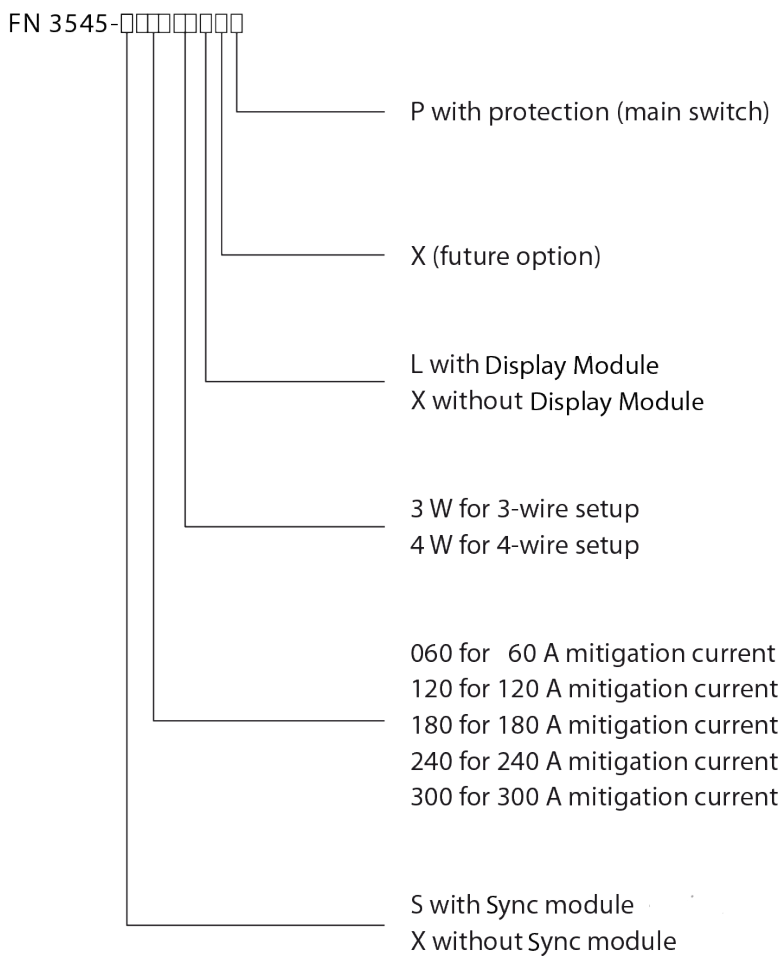
\*parameters of cabinet only configuration



## Ecosine active sync power module versions and options

Designation	Description
<b>FN 3530</b>	Power module 60A, 200-480 VAC, 3-wire
<b>FN 3531</b>	Power module 60A, 200-480 VAC, 3-wire with CT module
<b>FN 3540</b>	Power module 60A, 200-415 VAC, 4-wire
<b>FN 3541</b>	Power module 60A, 200-415 VAC, 4-wire with CT module
<b>FN 3532</b>	DPP Double Power Pack 120A, 200-480 VAC, 3-wire
<b>FN 3542</b>	DPP Double Power Pack 120 A, 200-415 VAC, 4-wire
<b>CTM</b>	CT module
<b>LCD</b>	Display module
<b>Patch Cable Set</b>	Patch cable set sync module
<b>KITIP21 400V</b>	Ecosine active sync IP 21 cover KIT
<b>SYNC300A</b>	Sync module for ecosine active sync - connecting up to 5 power modules

## Ecosine active sync cabinet versions and options



## Ecosine active sync cabinet version selection table

### Cabinet selection without sync module

Designation	Voltage	Sync module	Mitigation Current	3-/4-wire Setup	Power module	LCD	Protection (Main Switch)
FN 3545-X0603WXXP	200-480 VAC	No	60 A	3-wire	1 x FN 3531	No	Yes
FN 3545-X0603WLXP	200-480 VAC	No	60 A	3-wire	1 x FN 3531	Yes	Yes
FN 3545-X0604WXXP	200-415 VAC	No	60 A	4-wire	1 x FN 3541	No	Yes
FN 3545-X0604WLXP	200-415 VAC	No	60 A	4-wire	1 x FN 3541	Yes	Yes
FN 3545-X1203WXXP	200-480 VAC	No	120 A	3-wire	2 x FN 3531	No	Yes
FN 3545-X1203WLXP	200-480 VAC	No	120 A	3-wire	2 x FN 3531	Yes	Yes
FN 3545-X1204WXXP	200-415 VAC	No	120 A	4-wire	2 x FN 3541	No	Yes
FN 3545-X1204WLXP	200-415 VAC	No	120 A	4-wire	2 x FN 3541	Yes	Yes
FN 3545-X1803WXXP	200-480 VAC	No	180 A	3-wire	3 x FN 3531	No	Yes
FN 3545-X1803WLXP	200-480 VAC	No	180 A	3-wire	3 x FN 3531	Yes	Yes
FN 3545-X1804WXXP	200-415 VAC	No	180 A	4-wire	3 x FN 3541	No	Yes
FN 3545-X1804WLXP	200-415 VAC	No	180 A	4-wire	3 x FN 3541	Yes	Yes
FN 3545-X2403WXXP	200-480 VAC	No	240 A	3-wire	4 x FN 3531	No	Yes
FN 3545-X2403WLXP	200-480 VAC	No	240 A	3-wire	4 x FN 3531	Yes	Yes
FN 3545-X2404WXXP	200-415 VAC	No	240 A	4-wire	4 x FN 3541	No	Yes
FN 3545-X2404WLXP	200-415 VAC	No	240 A	4-wire	4 x FN 3541	Yes	Yes
FN 3545-X3003WXXP	200-480 VAC	No	300 A	3-wire	5 x FN 3531	No	Yes
FN 3545-X3003WLXP	200-480 VAC	No	300 A	3-wire	5 x FN 3531	Yes	Yes
FN 3545-X3004WXXP	200-415 VAC	No	300 A	4-wire	5 x FN 3541	No	Yes
FN 3545-X3004WLXP	200-415 VAC	No	300 A	4-wire	5 x FN 3541	Yes	Yes

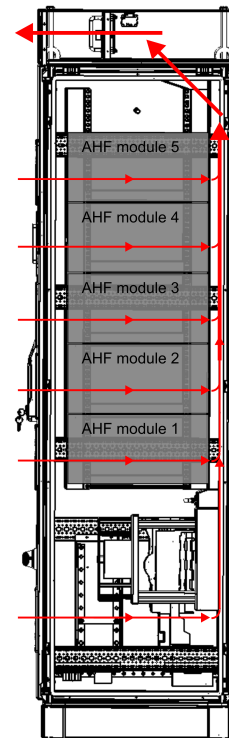
### Cabinet selection with sync module

Designation	Voltage	Sync module	Mitigation Current	3-/4-wire Setup	Power module	LCD	Protection (Main Switch)
FN 3545-S0603WXXP	200-480 VAC	Yes	60 A	3-wire	1 x FN 3530	No	Yes
FN 3545-S0603WLXP	200-480 VAC	Yes	60 A	3-wire	1 x FN 3530	Yes	Yes
FN 3545-S0604WXXP	200-415 VAC	Yes	60 A	4-wire	1 x FN 3540	No	Yes
FN 3545-S0604WLXP	200-415 VAC	Yes	60 A	4-wire	1 x FN 3540	Yes	Yes
FN 3545-S1203WXXP	200-480 VAC	Yes	120 A	3-wire	2 x FN 3530	No	Yes
FN 3545-S1203WLXP	200-480 VAC	Yes	120 A	3-wire	2 x FN 3530	Yes	Yes
FN 3545-S1204WXXP	200-415 VAC	Yes	120 A	4-wire	2 x FN 3540	No	Yes
FN 3545-S1204WLXP	200-415 VAC	Yes	120 A	4-wire	2 x FN 3540	Yes	Yes
FN 3545-S1803WXXP	200-480 VAC	Yes	180 A	3-wire	3 x FN 3530	No	Yes
FN 3545-S1803WLXP	200-480 VAC	Yes	180 A	3-wire	3 x FN 3530	Yes	Yes
FN 3545-S1804WXXP	200-415 VAC	Yes	180 A	4-wire	3 x FN 3540	No	Yes
FN 3545-S1804WLXP	200-415 VAC	Yes	180 A	4-wire	3 x FN 3540	Yes	Yes
FN 3545-S2403WXXP	200-480 VAC	Yes	240 A	3-wire	4 x FN 3530	No	Yes
FN 3545-S2403WLXP	200-480 VAC	Yes	240 A	3-wire	4 x FN 3530	Yes	Yes
FN 3545-S2404WXXP	200-415 VAC	Yes	240 A	4-wire	4 x FN 3540	No	Yes
FN 3545-S2404WLXP	200-415 VAC	Yes	240 A	4-wire	4 x FN 3540	Yes	Yes
FN 3545-S3003WXXP	200-480 VAC	Yes	300 A	3-wire	5 x FN 3530	No	Yes
FN 3545-S3003WLXP	200-480 VAC	Yes	300 A	3-wire	5 x FN 3530	Yes	Yes
FN 3545-S3004WXXP	200-415 VAC	Yes	300 A	4-wire	5 x FN 3540	No	Yes
FN 3545-S3004WLXP	200-415 VAC	Yes	300 A	4-wire	5 x FN 3540	Yes	Yes

### Cooling specification of ecosine active sync cabinet

Parameter	Values
Protection category	IP 54
Default color	RAL 7035
Required air flow per module	270 m <sup>3</sup> /h
Maximum air flow per cabinet	1400 m <sup>3</sup> /h
Air flow through fuse section	100 m <sup>3</sup> /h
Area - air inlet per module	Min. 450 cm <sup>2</sup>
Area - air duct channel behind power modules	Min. 370 cm <sup>2</sup>
Max. length of air duct channel behind power modules	Max. 1200 mm
Min. space in air duct channel behind modules	Min. 70 mm
Area - air duct channel in the roof	Min. 900 cm <sup>2</sup>
Max. length of air duct channel in the roof	Max. 800 mm
Distance air inlet filter rear to front of power module	Min. 45 mm

Side view into cabinet with direction of air flow



### Ecosine active sync cabinet options

Designation	Description
Cabinet 380-480 VAC IP54 3W	IP 54 Cabinet 600 x 600 x 2328 3-wire (w/o modules) 480 V
Cabinet 380-415 VAC IP54 4W	IP 54 Cabinet 600 x 600 x 2328 4-wire (w/o modules) 415 V
Plinth panel 100	Cabinet plinth panel 100 mm
Plinth panel 200	Cabinet plinth panel 200 mm

### Technical specification for sync module

Input voltage	22,0...27,0 VDC
Nominal current	<1 A
Dimensions	440 mm x 200 mm x 87 mm (w x d x h)
Weight	3.0 kg
Protection class	IP 20 (optional IP 21)
Digital I/O	3 DI, 2 DO, 4 DI/O (programmable) 2 relays NO/NC - 2 relays NO with common COM (250 VAC/3A)
Ambient conditions	Pollution degree 2 Relative humidity < 95%, non-condensing, 3K3 Temperature: storage 55°C, 1K3, 1K4, transportation -25°C to 75°C, 2K3
Approval	CE, RoHS

Front view of cabinet with SYNC300A



### Ecosine active sync - Display Module LCD

#### Function

The display module is used to monitor the measured values of the three-phase network and to change the filter parameters. One display module fits for all power modules and can be used in any of the system setups, whether it is single power module, Double Power Pack or cabinet version.

Picture of Display Module



Mounting types



## Ecosine active sync - modular system approach

The intelligent and modular system approach of ecosine active sync series offers tailored and most efficient filter system solutions:



### Ecosine active sync – 60 A – IP 20

- | 1 ecosine active sync power module incl. CT module

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- | 1 display module

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- | Wall-mount (book or flat mounting possible) or rack-mount (inside slide-in-technology cabinet)

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### Ecosine active sync Double Power Pack (DPP) – 120 A – IP 20

- | 2 ecosine active sync power modules

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- | 1 CT module

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- | 1 High Speed Bus patch cable

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- | Master-Slave architecture

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- | 1 display module

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- | Wall-mount (book or flat mounting possible) or Rack-mount (inside slide-in-technology cabinet)

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### Sync module SYNC300A – master communication module – IP 20

- | Flexible installation with current transformers on mains or load side; one simple CT connection point for all modules

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- | Intelligent load and energy management

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- | Simple and modular installation (wall-mount or rack-mount); recommended for 180 A and more

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- | Easy filter scalability and extension of mitigation current beyond 300 A; one sync module can connect and coordinate up to 5 power modules (5x60 A) in parallel; higher mitigation current rates are possible by paralleling the sync modules, e.g. for 480 A active harmonic filter, 2 sync modules and 8 power modules are required

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- | Available as part of the ecosine active sync cabinet (see selection table on page 5) or as an option for later upgrade

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### Ecosine active sync – 60 A – IP 54

- | 1 ecosine active sync power module

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- | 1 display module

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- | 1 sync module SYNC300A (option)

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### Ecosine active sync – 120 A – IP 54

- | 2 ecosine active sync power modules

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- | 1 display module

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- | 1 sync module SYNC300A (option)

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### Ecosine active sync – 180 A – IP 54

- | 3 ecosine active sync power modules

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- | 1 display module

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- | 1 sync module SYNC300A (option)

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### Ecosine active sync – 240 A – IP 54

- | 4 ecosine active sync power modules

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- | 1 display module

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- | 1 sync module SYNC300A (option)

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### Ecosine active sync – 300 A – IP 54

- | 5 ecosine active sync power modules

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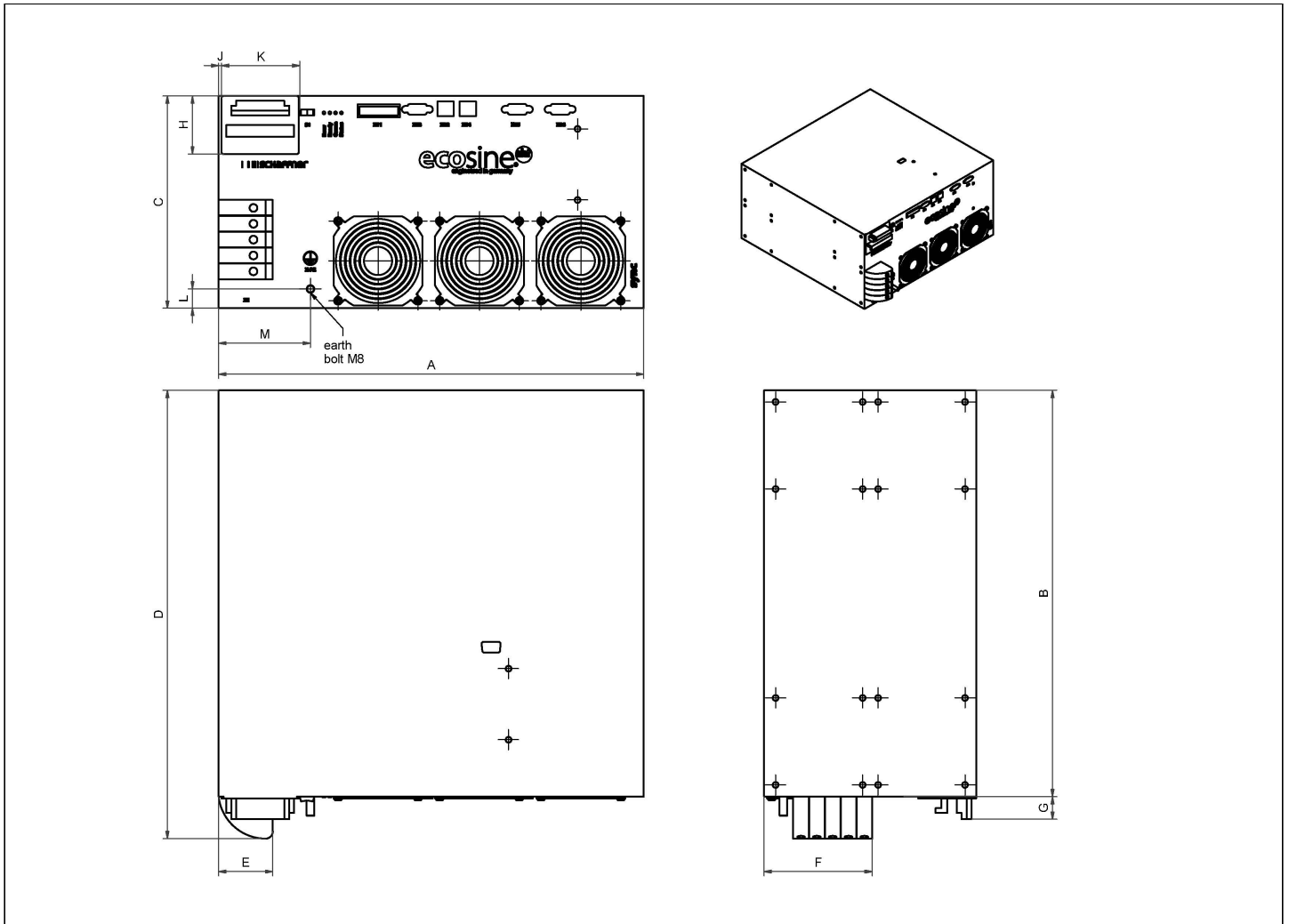
- | 1 display module

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- | 1 sync module SYNC300A (option)

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## Mechanical data of power module

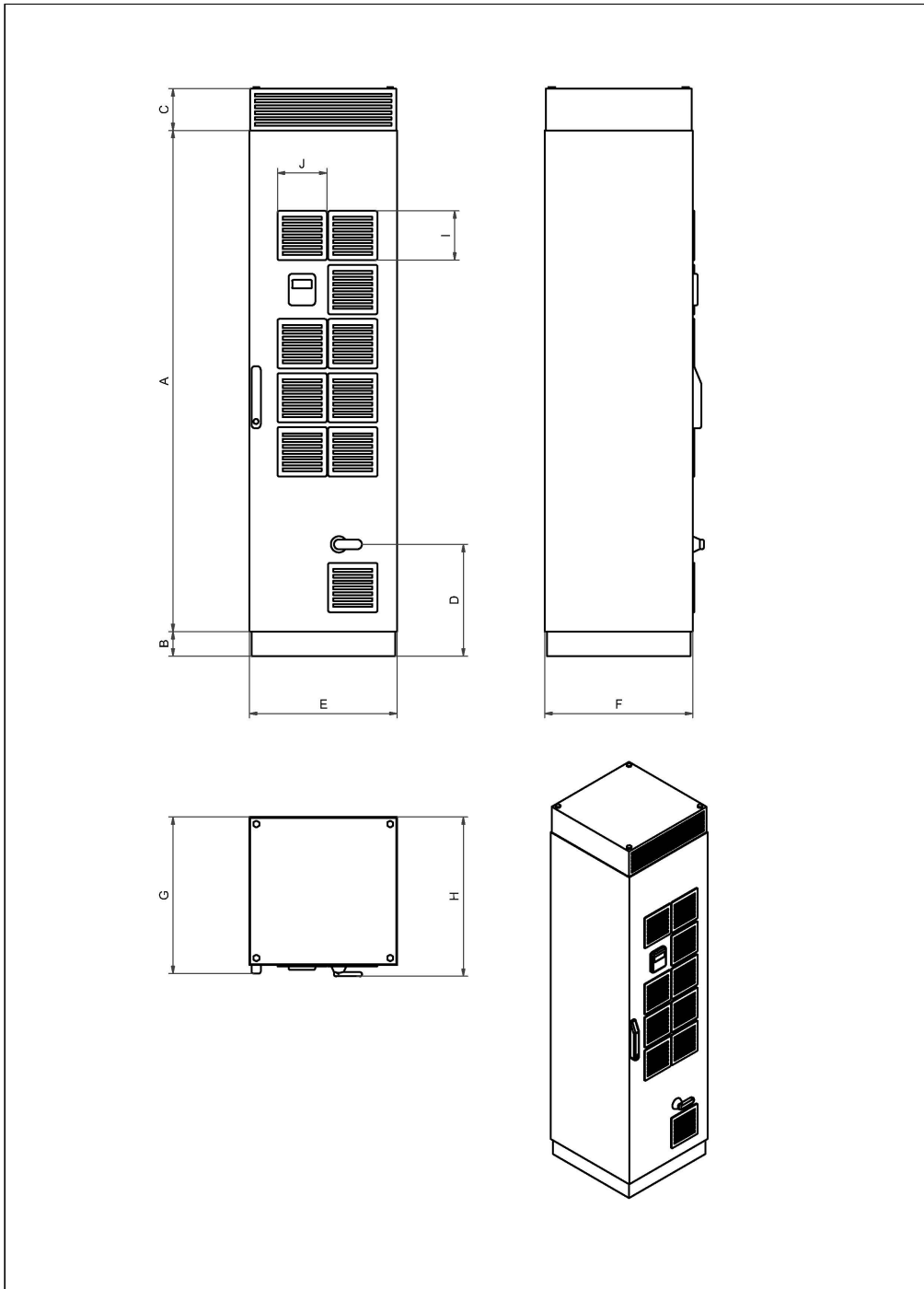


## Dimensions

	Size [mm]	[in]
<b>A</b>	440	17.32
<b>B</b>	420	16.54
<b>C</b>	219.5*	8.64
<b>D</b>	463.5	18.25
<b>E</b>	56	2.20
<b>F</b>	112	4.41
<b>G</b>	23.5	0.93
<b>H</b>	60	2.36
<b>J</b>	3	0.12
<b>K</b>	80	3.15
<b>L</b>	20	0.79
<b>M</b>	95	3.74

\* Module height: 5 rack units

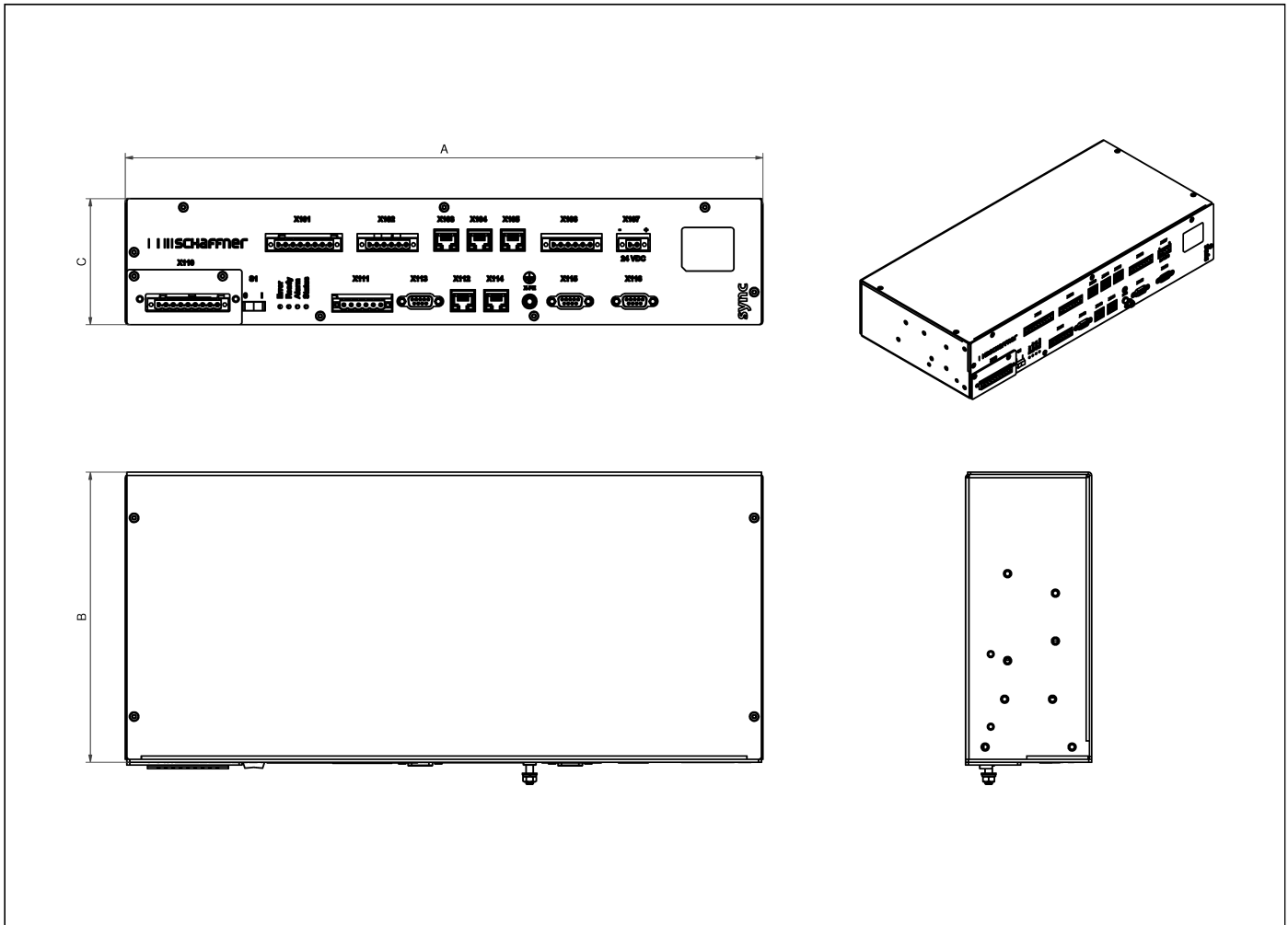
## Mechanical data of cabinet



## Dimensions

	Size [mm]	[in]
A	2057	81
B	100	3.94
C	171.2	6.74
D	458.3	18.04
E	606.7	23.9
F	608	23.9
G	642.5	25.3
H	653.7	25.7
I	204	8.03
J	205	8.07

## Mechanical data of sync module



## Dimensions

	Size	
	[mm]	[in]
<b>A</b>	440	17.32
<b>B</b>	200	7.88
<b>C</b>	87	3.43

## 3-phase Line Reactor to reduce mains disturbances



### Approvals



### Technical specifications

<b>Nominal operating voltage</b>	3x 380 to 480 VAC
<b>Rated operating voltage</b>	3x 340 to 530 VAC
<b>Impedance</b>	4% @ 400 V, 50 Hz and rated rms current
<b>Insulation class</b>	UL electrical insulation system SCH-200(N)
<b>Protection category</b>	IP 00
<b>Cooling</b>	Natural cooling AN
<b>Overload capability</b>	1.6x rated current for 1 minute, once per hour
<b>Ambient temperature range</b>	-40°C to +45°C fully operational +45°C to +100°C derated operation* Note: derating according NEC 310-15(C)
<b>Transportation and storage temperature</b>	-40°C to +100°C transport and storage
<b>Flammability corresponding to</b>	UL 94V-0
<b>Design corresponding to</b>	UL 61800-5-1, EN 61558-2-20, EN 60076-6
<b>Lifetime (calculated)</b>	20 years
<b>Earthing System</b>	TN, TT, IT
<b>Climatic category</b>	40/100/21 (IEC 60068-1)
<b>Pollution degree</b>	PD3
<b>Overvoltage category</b>	OV III (IEC 60664-1 / UL 61800-5-1)

\* $I_{\text{derated}} = I_{\text{nominal}} \cdot \sqrt{\frac{(T_{\text{max}} - T_{\text{amb}})}{(T_{\text{max}} - T_{\text{nominal}})}} = I_{\text{nom}} \cdot \sqrt{\frac{(100^{\circ}\text{C} - T_{\text{amb}})}{55^{\circ}\text{C}}}$



## Reactor selection table

Reactor	Rated current @ 45°C [A]	Rated Power * @ 400V [kW]	Rated Power** @ 480V [kW]	Inductance value [mH]	Typical power losses [W]	Terminal	Weight [kg]
RWK 3044-2-88-E0XXX	1.76	1.1	1.1/1.5	16.7	23	88	0.49
RWK 3044-3.5-88-E0XXX	3.53	2.2	2.2/3	8.3	32	88	0.89
RWK 3044-6.5-88-E0XXX	6.42	4	4/5.5	4.6	47	88	1.2
RWK 3044-9-88-E0XXX	8.82	5.5	5.5/7.5	3.3	61	88	1.7
RWK 3044-12-88-E0XXX	12.0	7.5	7.5/11	2.44	69	88	2.4
RWK 3044-18-89-E0XXX	17.6	11	11/15	1.67	103	89	3.4
RWK 3044-24-89-E0XXX	24.1	15	19	1.22	106	89	4.9
RWK 3044-30-92-E0XXX	29.7	18.5	22	0.99	124	92	5.1
RWK 3044-35-92-E0XXX	35.3	22	30	0.83	151	92	5.4
RWK 3044-48-92-E0XXX	48.1	30	37	0.61	172	92	8.8
RWK 3044-59-92-E0XXX	59.3	37	45	0.50	206	92	10.2
RWK 3044-72-99-E0XXX	72.2	45	55	0.41	294	99	10.3
RWK 3044-88-99-E0XXX	88.2	55	55/75	0.33	257	99	11.4
RWK 3044-120-99-E0XXX	120	75	90	0.24	324	99	13.8
RWK 3044-140-99-E0XXX	144	90	110	0.20	399	99	15.7
RWK 3044-180-99-E0XXX	176	110	132	0.17	456	99	20.0
RWK 3044-210-99-E0XXX	212	132	160	0.14	553	99	24.5
RWK 3044-260-99-E0XXX	257	160	200	0.11	593	99	27.5
RWK 3044-320-99-E0XXX	321	200	250	0.092	747	99	34.5
RWK 3044-400-99-E0XXX	401	250	315	0.073	1055	99	45.5
RWK 3044-510-99-E0XXX	505	315	355	0.058	1069	99	49.5
RWK 3044-570-99-E0XXX	569	355	400	0.052	1181	99	67.5
RWK 3044-640-99-E0XXX	642	400	450	0.046	1116	99	68.5
RWK 3044-800-99-E0XXX	802	500	550/630	0.037	1280	99	103
RWK 3044-1000-99-E0XXX	1010	630	750	0.029	1167	99	110

\* Calculated at rated current, 400VAC and cos phi=0.90

\*\* Calculated at rated current, 480VAC and cos phi=0.89

## 3-phase Line Reactor to reduce mains disturbances



### Approvals



(UL recognized up to 280 A)

### Technical specifications

<b>Nominal operating voltage</b>	3x 500 to 690 VAC
<b>Rated operating voltage</b>	3x 450 to 760 VAC
<b>Impedance</b>	2% @ 690 V, 50 Hz and rated rms current
<b>Insulation class</b>	UL electrical insulation system SCH-200(N)
<b>Protection category</b>	IP 00
<b>Cooling</b>	Natural cooling AN
<b>Overload capability</b>	1.6x rated current for 1 minute, once per hour
<b>Ambient temperature range</b>	-40°C to +45°C fully operational +45°C to +100°C derated operation* Note: derating according NEC 310-15(C)
<b>Transportation and storage temperature</b>	-40°C to +100°C transport and storage
<b>Flammability corresponding to</b>	UL 94V-0
<b>Design corresponding to</b>	UL 61800-5-1, EN 61558-2-20, EN 60076-6
<b>Lifetime (calculated)</b>	20 years
<b>Earthing System</b>	TN, TT, IT
<b>Climatic category</b>	40/100/21 (IEC 60068-1)
<b>Pollution degree</b>	PD3
<b>Overvoltage category</b>	OV III (IEC 60664-1 / UL 61800-5-1)

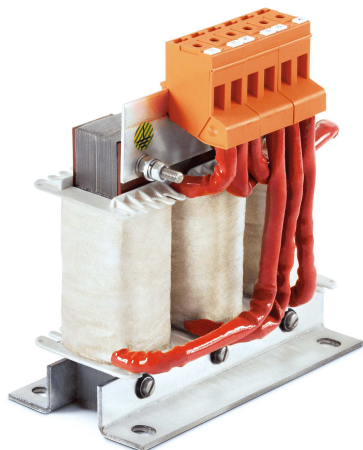
\*I<sub>derated</sub> = I<sub>nominal</sub> \* √((T<sub>max</sub>-T<sub>amb</sub>)/(T<sub>max</sub>-T<sub>nominal</sub>)) = I<sub>nom</sub> \* √((100°C-T<sub>amb</sub>)/55°C)

## Reactor selection table

Reactor	Rated current @ 45°C [A]	Rated power* @ 690 V [kW]	Rated Power** @ 600 V [HP]	Inductance value [mH]	Typical power losses [W]	Terminal		Weight [kg]	Weight [lbs]
RWK 3062-1.5-88-E0XXX	1.52	1.6	1.9	16.7	23	88	0.49	1	
RWK 3062-3-88-E0XXX	3.04	3.1	3.6	8.3	32	88	0.89	1.9	
RWK 3062-5.5-88-E0XXX	5.53	5.7	6.6	4.6	47	88	1.2	2.6	
RWK 3062-7.5-88-E0XXX	7.61	7.9	9.2	3.3	61	88	1.7	3.7	
RWK 3062-10-88-E0XXX	10.4	11	12.8	2.44	69	88	2.4	5.3	
RWK 3062-15-89-E0XXX	15.2	16	18.7	1.67	103	89	3.4	7.5	
RWK 3062-21-89-E0XXX	20.7	21	24.5	1.22	106	89	4.9	10.8	
RWK 3062-26-92-E0XXX	25.6	26	30.3	0.99	124	92	5.1	11.2	
RWK 3062-30-92-E0XXX	30.4	31	36	0.83	151	92	5.4	11.9	
RWK 3062-41-92-E0XXX	41.5	43	50	0.61	172	92	8.8	19.4	
RWK 3062-51-92-E0XXX	51.2	53	62	0.50	206	92	10.2	22.5	
RWK 3062-62-99-E0XXX	62.2	64	75	0.41	294	99	10.3	22.7	
RWK 3062-76-99-E0XXX	76.1	79	92	0.33	257	99	11.4	25.1	
RWK 3062-100-99-E0XXX	104	108	126	0.24	324	99	13.8	30.4	
RWK 3062-120-99-E0XXX	124	128	149	0.20	399	99	15.7	34.6	
RWK 3062-150-99-E0XXX	152	157	183	0.17	456	99	20.0	44.1	
RWK 3062-180-99-E0XXX	183	189	220	0.14	553	99	24.5	54	
RWK 3062-220-99-E0XXX	221	228	266	0.11	593	99	27.5	60.6	
RWK 3062-280-99-E0XXX	277	286	334	0.092	747	99	34.5	76.1	
RWK 3062-350-99-E0XXX	346	358	417	0.073	1055	99	45.5	100.3	
RWK 3062-440-99-E0XXX	436	451	526	0.058	1069	99	49.5	109.1	
RWK 3062-490-99-E0XXX	491	508	592	0.052	1181	99	67.5	148.8	
RWK 3062-550-99-E0XXX	553	572	667	0.046	1116	99	68.5	151	
RWK 3062-690-99-E0XXX	692	715	834	0.037	1280	99	103	227.1	
RWK 3062-870-99-E0XXX	871	900	1049	0.029	1167	99	110	242.5	

\* Calculated at rated current, 690 V and  $\cos \phi = 0.865$ .\*\* Calculated at rated current, 600 V and  $\cos \phi = 0.865$ .

## Three-phase dv/dt Reactor for Efficient Motor Protection



### Approvals





UL 508C up to 182 A. For use with AC or DC drives (power conversion equipment) only

### Technical specifications

<b>Maximum continuous operating voltage</b>	3 x 500/288 VAC
<b>Motor frequency</b>	60 Hz
<b>Switching frequency</b>	2 to 16 kHz
<b>Rated currents</b>	4 to 1100 A @ 40°C
<b>Motor cable length</b>	30 m max. @ 16 kHz (derating curve next page)
<b>Impedance (uk)</b>	0.8% @ 400 VAC, 50 Hz & rated current
<b>Typical dv/dt reduction</b>	≥factor 5
<b>High potential test voltage</b>	P → E 3000 VAC for 3 sec P → P 3000 VAC for 3 sec
<b>Protection category</b>	IP 00 (KL types according to VBG 4)
<b>Overload capability</b>	2 x rated current at switch on for 30 seconds 1.5 x rated current for 1 minute, once per hour
<b>Temperature range (operation and storage)</b>	-25°C to +100°C (25/100/21)
<b>Insulation class</b>	T40/N (200°C) for ≤182 A types T40/F (155°C) for ≥230 A types
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	EN 61558-2-20 (VDE 0570-2-20), UL 508C, CSA C22.2 NO. 14
<b>MTBF @ 40°C/400 V (Mil-HB-217F)</b>	>500,000 hours

## Reactor selection table

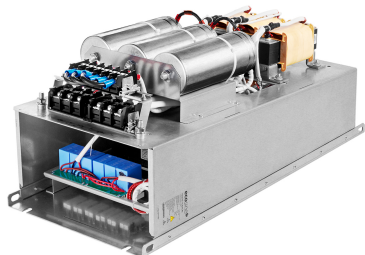
Reactor	Rated current	Typical motor	Nominal	Typical	Input/Output connections			Weight
	@ 40°C	power rating*	inductance	power loss**				Total
	[A]	[kW]	[mH]	[W]				[kg]
RWK 305-4-KL	4	1.5	1.47	22	KL			1.2
RWK 305-7.8-KL	7.8	3	0.754	25	KL			1.2
RWK 305-10-KL	10	4	0.588	30	KL			1.8
RWK 305-14-KL	14	5.5	0.42	34	KL			2.2
RWK 305-17-KL	17	7.5	0.346	38	KL			2.5
RWK 305-24-KL	24	11	0.245	45	KL			2.5
RWK 305-32-KL	32	15	0.184	55	KL			3.9
RWK 305-45-KL	45	22	0.131	60	KL			6.1
RWK 305-60-KL	60	30	0.098	65	KL			6.1
RWK 305-72-KL	72	37	0.082	70	KL			6.1
RWK 305-90-KL	90	45	0.065	75	KL			7.4
RWK 305-110-KL	110	55	0.053	90	KL			8.2
RWK 305-124-KS	124	55	0.047	110		KS		8.2
RWK 305-143-KS	143	75	0.041	115		KS		10.7
RWK 305-156-KS	156	75	0.038	120		KS		10.7
RWK 305-170-KS	170	90	0.035	130		KS		10.7
RWK 305-182-KS	182	90	0.032	140		KS		16
RWK 305-230-KS	230	132	0.026	180		KS		22
RWK 305-280-KS	280	160	0.021	220		KS		29
RWK 305-330-KS	330	160	0.018	240		KS		32
RWK 305-400-S	400	200	0.015	330			S	34
RWK 305-500-S	500	250	0.012	340			S	35
RWK 305-600-S	600	355	0.01	380			S	37
RWK 305-680-S	680	400	0.009	410			S	38
RWK 305-790-S	790	450	0.007	590			S	43
RWK 305-910-S	910	500	0.006	740			S	49
RWK 305-1100-S	1100	630	0.005	760			S	66

\* General purpose four-pole (1500 r/min) AC induction motor rated 400 V/50 Hz.

\*\* Exact value depends upon the motor cable type and length, switching frequency, motor frequency and further stray parameters within the system.

# Ecosine evo, 50 Hz Passive Harmonic Filters

## Approvals



(depending on filter configuration)

## Technical specifications

<b>Nominal operating voltage</b>	3 x 380 VAC to 415 VAC ±10%
<b>Operating frequency</b>	50 Hz ±1 Hz
<b>Nominal motor drive input power rating</b>	1.1 to 250 kW
<b>Total harmonic current distortion THID*</b>	≤5% at rated power
<b>Efficiency</b>	>98% for rated voltage and power
<b>High potential test voltage</b>	P → E 2160 VAC (1 s)
<b>Protection category</b>	IP 00, IP 20
<b>Cooling</b>	Internal fan cooling or external cooling**
<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 +45°C to +70°C derated operation*** -25°C to +85°C transport and storage
<b>Flammability corresponding to</b>	UL 94 V-2
<b>Design corresponding to</b>	Filter: UL 61800-5-1, EN 61800-5-1 Chokes: EN 61558-2-20 or EN 60076-6
<b>MTBF @ 45°C/415 V (Mil-HB-217F)</b>	>200,000 hours
<b>SCCR****</b>	100 kA
<b>Earthing System</b>	TN, TT, IT
<b>Overvoltage category</b>	OV III (IEC 60664-1 / UL 61800-5-1)

\* System requirements: THVD <2%, line voltage unbalance <1%  
 Note: performance specifications in this brochure refer to six-pulse diode rectifiers.  
 SCR rectifier front-ends will produce different results, dependent upon the firing angle of the thyristors.  
 THID ~5% at rated power for filter <6 kW

\*\* Please check the inlet air flow required for cooling table on page 6 of this document.

\*\*\*  $I_{derated} = I_{nominal} \cdot \sqrt{\frac{(T_{max} - T_{amb})}{(T_{max} - T_{nominal})}} = I_{nom} \cdot \sqrt{\frac{(70^\circ\text{C} - T_{amb})}{25^\circ\text{C}}}$

\*\*\*\* External UL-rated fuses required. Please consult the user manual.

## Filter selection table – IP 00 enclosure

Filter	Rated load power @ 400 V/50 Hz [kW]	Motor drive input current [Arms]**	Rated filter input current [Arms]	Weight [kg]	Typical losses [W]****	Terminal	Frame size
FN 3440-1-110-E0_____*	1.1	3	1.63	6.6	61	110	A
FN 3440-2-110-E0_____*	2.2	5.5	3.26	9.6	87	110	A
FN 3440-4-112-E0_____*	4	10	5.93	13.2	135	112	B
FN 3440-6-112-E0_____*	5.5	13	8.17	16.9	183	112	C
FN 3440-8-112-E0_____*	7.5	16	11.1	20.9	256	112	C
FN 3440-11-113-E0_____	11	24	16.3	28.2	287	113	D
FN 3440-15-113-E0_____	15	32	22.2	32.0	359	113	D
FN 3440-19-113-E0_____	19	38	28.2	33.3	343	113	D
FN 3440-22-115-E0_____	22	45	32.5	47.5	460	115	E
FN 3440-30-115-E0_____	30	60	44.4	49.3	570	115	E
FN 3440-37-115-E0_____	37	75	54.8	59.8	581	115	E
FN 3440-45-115-E0_____	45	90	66.7	66.8	783	115	E
FN 3440-55-115-E0_____	55	110	81.6	69.3	858	115	E
FN 3440-75-116-E0_____	75	150	111	117.6	1036	116	G
FN 3440-90-116-E0_____	90	180	134	138.6	1166	116	G
FN 3440-110-118-E0_____	110	210	164	157.9	1365	118	H
FN 3440-132-118-E0_____**	132	260	197	176.3	1392	118	H
FN 3440-160-118-E0_____**	160	320	240	201.8	1462	118	H
FN 3440-200-118-E0_____**	200	400	300	249.7	1644	118	H
<b>New</b>							
FN 3440-250-199-E0XXSXX	250	530	376	324	1746	119	J

\* Filter rating which does not require forced cooling or fan module

\*\* Filter rating which does not require RC damping module for rectifiers with EMI filter

\*\*\* Motor drive input current without harmonic filter

\*\*\*\* Typical losses @ 45°C, 400 V, 50 Hz and rated load power

## Filter selection table - IP 20 enclosure

Filter	Rated load power @ 400 V/50 Hz [kW]	Motor drive input current [Arms]**	Rated filter input current [Arms]	Weight [kg]	Typical losses [W]****	Terminal	Frame size
FN 3440-1-110-E2_____*	1.1	3	1.63	8	61	110	A
FN 3440-2-110-E2_____*	2.2	5.5	3.26	11	87	110	A
FN 3440-4-112-E2_____*	4	10	5.93	15	135	112	B
FN 3440-6-112-E2_____*	5.5	13	8.17	19	183	112	C
FN 3440-8-112-E2_____*	7.5	16	11.1	23	256	112	C
FN 3440-11-113-E2_____	11	24	16.3	32	287	113	D
FN 3440-15-113-E2_____	15	32	22.2	36	359	113	D
FN 3440-19-113-E2_____	19	38	28.2	37	343	113	D
FN 3440-22-115-E2_____	22	45	32.5	53	460	115	E
FN 3440-30-115-E2_____	30	60	44.4	55	570	115	E
FN 3440-37-115-E2_____	37	75	54.8	66	581	115	E
FN 3440-45-115-E2_____	45	90	66.7	73	783	115	E
FN 3440-55-115-E2_____	55	110	81.6	75	858	115	E
FN 3440-75-116-E2_____	75	150	111	126	1036	116	G
FN 3440-90-116-E2_____	90	180	134	147	1166	116	G
FN 3440-110-118-E2_____	110	210	164	175	1365	118	H
FN 3440-132-118-E2_____**	132	260	197	194	1392	118	H
FN 3440-160-118-E2_____**	160	320	240	219	1462	118	H
FN 3440-200-118-E2_____**	200	400	300	267	1644	118	H
<b>New</b>							
FN 3440-250-119-E2FASXX	250	530	376	350	1746	119	J

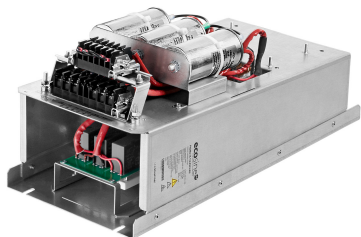
\* Filter rating which does not require forced cooling or fan module

\*\* Filter rating which does not require RC damping module for rectifiers with EMI filter

\*\*\* Motor drive input current without harmonic filter

\*\*\*\* Typical losses @ 45°C, 400 V, 50 Hz and rated load power

# Ecosine evo, 50 Hz Passive Harmonic Filters



## Approvals



(depending on filter configuration)

## Technical specifications

<b>Nominal operating voltage</b>	3 x 380 VAC to 415 VAC ±10%
<b>Operating frequency</b>	50 Hz ±1 Hz
<b>Nominal motor drive input power rating</b>	1.1 to 250 kW
<b>Total harmonic current distortion THID*</b>	≤5% at rated power
<b>Efficiency</b>	>98% for rated voltage and power
<b>High potential test voltage</b>	P → E 2160 VAC (1 s)
<b>Protection category</b>	IP 00, IP 20
<b>Cooling</b>	Internal fan cooling or external cooling**
<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 +85°C transport and storage +45°C to +70°C derated operation***
<b>Flammability corresponding to</b>	UL 94 V-2
<b>Design corresponding to</b>	Filter: UL 61800-5-1, EN 61800-5-1 Chokes: EN 61558-2-20 or EN 60076-6
<b>MTBF @ 45°C/415 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 brochure refer to six-pulse diode rectifiers with 8% DC-link choke.  
 THID ~5% at rated power for filter <6 kW  
 \*\* Please check the inlet air flow required for cooling table on page 6 of this document.  
 \*\*\*  $I_{derated} = I_{nominal} \cdot \sqrt{\frac{(T_{max} - T_{amb})}{(T_{max} - T_{nominal})}} = I_{nominal} \cdot \sqrt{\frac{(70^\circ C - T_{amb})}{25^\circ C}}$   
 \*\*\*\* External UL-rated fuses required. Please consult the user manual.



## Filter selection table – IP 00 enclosure

Filter	Rated load power @ 400 V/50 Hz [kW]	Motor drive input current [Arms]**	Rated filter input current [Arms]	Min. required LDC [mH]*****	Min. required LAC [mH]*****	Weight [kg]	Typical losses [W]****	Terminal	Frame size
FN 3441-1-110-E0_*****	1.1	1.7	1.62	37.41	9.8	6	53	110	A
FN 3441-2-110-E0_*****	2.2	3.4	3.23	18.71	6.01	9	73	110	A
FN 3441-4-112-E0_*****	4	6.2	5.9	10.29	3.48	12	104	112	B
FN 3441-6-112-E0_*****	5.5	8.5	8.1	7.483	2.548	15	143	112	C
FN 3441-8-112-E0_*****	7.5	12	11	5.487	1.818	16	193	112	C
FN 3441-11-113-E0_****	11	17	16	3.741	1.264	23	233	113	D
FN 3441-15-113-E0_****	15	23	22	2.744	0.909	26	285	113	D
FN 3441-19-113-E0_****	19	29.3	28	2.166	0.724	30	271	113	D
FN 3441-22-115-E0_****	22	34	32	1.871	0.637	38	355	115	E
FN 3441-30-115-E0_****	30	46	44	1.372	0.454	43	452	115	E
FN 3441-37-115-E0_****	37	57	54	1.112	0.361	48	468	115	E
FN 3441-45-115-E0_****	45	70	66	0.915	0.297	54	596	115	E
FN 3441-55-115-E0_****	55	85	81	0.748	0.245	63	665	115	E
FN 3441-75-116-E0_****	75	116	110	0.549	0.178	98	757	116	G
FN 3441-90-116-E0_****	90	140	133	0.457	0.147	106	854	116	G
FN 3441-110-118-E0_****	110	171	162	0.374	0.12	127	1032	118	H
FN 3441-132-118-E0_******	132	205	195	0.312	0.099	149	1062	118	H
FN 3441-160-118-E0_******	160	249	238	0.257	0.085	167	1073	118	H
FN 3441-200-118-E0_******	200	312	297	0.206	0.064	209	1228	118	H
<b>New</b>									
FN 3441-250-199-E0XXSXX	250	392	376	0.165	0.051	246	1398	119	J

\* Filter rating which does not require forced cooling or fan module

\*\* Filter rating which does not require RC damping module for rectifiers with EMI filter

\*\*\* Motor drive input current without harmonic filter

\*\*\*\* Typical losses @ 45°C, 400V, 50Hz and rated load power

\*\*\*\*\* **In order to apply FN 3441 filters, motor drives have to be equipped with either DC-link choke or AC line choke. The minimum required inductance values are given in mH in the filter selection table. If neither DC-link choke nor AC line choke is present, or if the minimum mH rating is not fulfilled, FN 3441 filter must not be used. In this case, FN 3440 need to be chosen.**

## Filter selection table - IP 20 enclosure

Filter	Rated load power @ 400 V/50 Hz [kW]	Motor drive input current [Arms]**	Rated filter input current [Arms]	Min. required LDC [mH]*****	Min. required LAC [mH]*****	Weight [kg]	Typical losses [W]****	Terminal	Frame size
FN 3441-1-110-E2_ _ _ _ *	1.1	1.7	1.62	37.41	9.8	7	53	110	A
FN 3441-2-110-E2_ _ _ _ *	2.2	3.4	3.23	18.71	6.01	9	73	110	A
FN 3441-4-112-E2_ _ _ _ *	4	6.2	5.9	10.29	3.48	13	104	112	B
FN 3441-6-112-E2_ _ _ _ *	5.5	8.5	8.1	7.483	2.548	16	143	112	C
FN 3441-8-112-E2_ _ _ _ *	7.5	12	11	5.487	1.818	18	193	112	C
FN 3441-11-113-E2_ _ _ _	11	17	16	3.741	1.264	27	233	113	D
FN 3441-15-113-E2_ _ _ _	15	23	22	2.744	0.909	30	285	113	D
FN 3441-19-113-E2_ _ _ _	19	29.3	28	2.166	0.724	34	271	113	D
FN 3441-22-115-E2_ _ _ _	22	34	32	1.871	0.637	44	355	115	E
FN 3441-30-115-E2_ _ _ _	30	46	44	1.372	0.454	48	452	115	E
FN 3441-37-115-E2_ _ _ _	37	57	54	1.112	0.361	54	468	115	E
FN 3441-45-115-E2_ _ _ _	45	70	66	0.915	0.297	59	596	115	E
FN 3441-55-115-E2_ _ _ _	55	85	81	0.748	0.245	68	665	115	E
FN 3441-75-116-E2_ _ _ _	75	116	110	0.549	0.178	107	757	116	G
FN 3441-90-116-E2_ _ _ _	90	140	133	0.457	0.147	115	854	116	G
FN 3441-110-118-E2_ _ _ _	110	171	162	0.374	0.12	144	1032	118	H
FN 3441-132-118-E2_ _ _ _ **	132	205	195	0.312	0.099	166	1062	118	H
FN 3441-160-118-E2_ _ _ _ **	160	249	238	0.257	0.085	185	1073	118	H
FN 3441-200-118-E2_ _ _ _ **	200	312	297	0.206	0.064	226	1228	118	H
<b>New</b>									
FN 3441-250-119-E2FASXX	250	392	376	0.165	0.051	274	1398	119	J

\* Filter rating which does not require forced cooling or fan module

\*\* Filter rating which does not require RC damping module for rectifiers with EMI filter

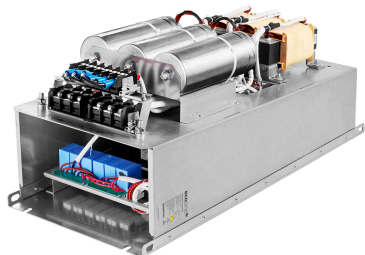
\*\*\* Motor drive input current without harmonic filter

\*\*\*\* Typical losses @ 45°C, 400V, 50Hz and rated load power

\*\*\*\*\* **In order to apply FN 3441 filters, motor drives have to be equipped with either DC-link choke or AC line choke. The minimum required inductance values are given in mH in the filter selection table. If neither DC-link choke nor AC line choke is present, or if the minimum mH rating is not fulfilled, FN 3441 filter must not be used. In this case, FN 3440 need to be chosen.**

# Ecosine evo, 50 Hz Passive Harmonic Filters

## Approvals



(depending on filter configuration)

## Technical specifications

<b>Nominal operating voltage</b>	3 x 440 VAC to 500 VAC ±10%
<b>Operating frequency</b>	50 Hz ±1 Hz
<b>Nominal motor drive input power rating</b>	1.1 to 315 kW
<b>Total harmonic current distortion THID*</b>	<5% at rated power
<b>Efficiency</b>	>98% for rated voltage and power
<b>High potential test voltage</b>	P → E 2160 VAC (1 s)
<b>Protection category</b>	IP 00, IP 20
<b>Cooling</b>	Internal fan cooling or external cooling**
<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 +45°C to +70°C derated operation*** -25°C to +85°C transport and storage
<b>Flammability corresponding to</b>	UL 94 V-2
<b>Design corresponding to</b>	Filter: UL 61800-5-1, EN 61800-5-1 Chokes: EN 61558-2-20 or EN 60076-6
<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
<b>Overvoltage category</b>	OV III (IEC 60664-1 / UL 61800-5-1)

\* System requirements: THVD <2%, line voltage unbalance <1%  
 Note: performance specifications in this brochure refer to six-pulse diode rectifiers.  
 SCR rectifier front-ends will produce different results, dependent upon the firing angle of the thyristors.  
 THID ~5% at rated power for filter <6 kW

\*\* Please check the inlet air flow required for cooling table on page 6 of this document.

\*\*\*  $I_{derated} = I_{nominal} \cdot \sqrt{\frac{(T_{max} - T_{amb})}{(T_{max} - T_{nominal})}} = I_{nominal} \cdot \sqrt{\frac{(70^\circ\text{C} - T_{amb})}{25^\circ\text{C}}}$

\*\*\*\* External UL-rated fuses required. Please consult the user manual.

## Filter selection table – IP 00 enclosure

Filter	Rated load power @ 480 VAC/50 Hz [kW]	Motor drive input current [Arms]**	Rated filter input current [Arms]	Weight [kg]	Typical losses [W]***	Terminal	Frame size
FN 3450-1-110-E0_*****	1.1	1.5	1.35	5.8	49	110	A
FN 3450-2-110-E0_*****	2.2	3	2.75	8.4	76	110	A
FN 3450-4-112-E0_*****	4.4	5.5	4.99	11.3	132	112	B
FN 3450-6-112-E0_*****	5.5	10	6.77	14.0	135	112	B
FN 3450-8-112-E0_*****	7.5	13	9.24	16.9	183	112	C
FN 3450-11-112-E0_*****	11	16	13.6	20.9	256	112	C
FN 3450-15-113-E0_****	15	24	18.5	28.2	287	113	D
FN 3450-19-113-E0_****	19	32	23.3	32.0	376	113	D
FN 3450-22-113-E0_****	22	38	27.0	36.0	374	113	D
FN 3450-30-115-E0_****	30	45	36.9	47.5	460	115	E
FN 3450-37-115-E0_****	37	60	45.4	53.9	546	115	E
FN 3450-45-115-E0_****	45	75	55.2	63.1	598	115	E
FN 3450-55-115-E0_****	55	90	67.5	66.8	784	115	F
FN 3450-75-115-E0_****	75	110	92.5	88.1	1036	115	F
FN 3450-90-116-E0_****	90	150	111	120.1	1016	116	G
FN 3450-110-116-E0_****	110	180	135	140.6	1083	116	G
FN 3450-132-118-E0_****	132	210	163	160.9	1440	118	H
FN 3450-160-118-E0_******	160	260	198	181.1	1412	118	H
FN 3450-200-118-E0_******	200	320	248	216.8	1597	118	H
FN 3450-250-118-E0_******	250	400	310	256.7	1745	118	H
<b>New</b>							
FN 3450-315-99-119-E0XXSXX	315	425	392	331	2025	119	J

\* Filter rating which does not require forced cooling or fan module

\*\* Filter rating which does not require RC damping module for rectifiers with EMI filter

\*\*\* Motor drive input current without harmonic filter

\*\*\*\* Typical losses @ 45°C, 480V, 50Hz and rated load power

## Filter selection table – IP 20 enclosure

Filter	Rated load power @ 480 VAC/50 Hz [kW]	Motor drive input current [Arms]**	Rated filter input current [Arms]	Weight [kg]	Typical losses [W]****	Terminal	Frame size
FN 3450-1-110-E2_ ___ *	1.1	1.5	1.35	7	49	110	A
FN 3450-2-110-E2_ ___ *	2.2	3	2.75	9	76	110	A
FN 3450-4-112-E2_ ___ *	4	5.5	4.99	13	132	112	B
FN 3450-6-112-E2_ ___ *	5.5	10	6.77	15	135	112	B
FN 3450-8-112-E2_ ___ *	7.5	13	9.24	19	183	112	C
FN 3450-11-112-E2_ ___ *	11	16	13.6	23	256	112	C
FN 3450-15-113-E2_ ___	15	24	18.5	32	287	113	D
FN 3450-19-113-E2_ ___	19	32	23.3	36	376	113	D
FN 3450-22-113-E2_ ___	22	38	27.0	40	374	113	D
FN 3450-30-115-E2_ ___	30	45	36.9	53	460	115	E
FN 3450-37-115-E2_ ___	37	60	45.4	60	546	115	E
FN 3450-45-115-E2_ ___	45	75	55.2	69	598	115	E
FN 3450-55-115-E2_ ___	55	90	67.5	74	784	115	F
FN 3450-75-115-E2_ ___	75	110	92.5	95	1036	115	F
FN 3450-90-116-E2_ ___	90	150	111	129	1016	116	G
FN 3450-110-116-E2_ ___	110	180	135	149	1083	116	G
FN 3450-132-118-E2_ ___	132	210	163	178	1440	118	H
FN 3450-160-118-E2_ ___ **	160	260	198	198	1412	118	H
FN 3450-200-118-E2_ ___ **	200	320	248	234	1597	118	H
FN 3450-250-118-E2_ ___ **	250	400	310	274	1745	118	H
<b>New</b>							
FN 3450-250-119-E2FASXX	315	425	392	357	2025	119	J

\* Filter rating which does not require forced cooling or fan module

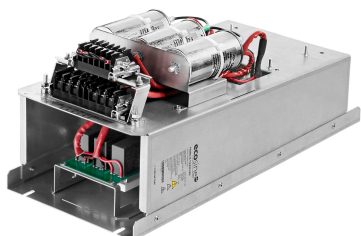
\*\* Filter rating which does not require RC damping module for rectifiers with EMI filter

\*\*\* Motor drive input current without harmonic filter

\*\*\*\* Typical losses @ 45°C, 480V, 50Hz and rated load power

# Ecosine evo, 50 Hz Passive Harmonic Filters

## Approvals



(depending on filter configuration)



## Technical specifications

<b>Nominal operating voltage</b>	3 x 440 VAC to 500 VAC ±10%
<b>Operating frequency</b>	50 Hz ±1 Hz
<b>Nominal motor drive input power rating</b>	1.1 to 315 kW
<b>Total harmonic current distortion THID*</b>	≤5% at rated power
<b>Efficiency</b>	>98% for rated voltage and power
<b>High potential test voltage</b>	P → E 2160 VAC (1 s)
<b>Protection category</b>	IP 00, IP 20
<b>Cooling</b>	Internal fan cooling or external cooling**
<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 +85°C transport and storage +45°C to +70°C derated operation***
<b>Flammability corresponding to</b>	UL 94 V-2
<b>Design corresponding to</b>	Filter: UL 61800-5-1, EN 61800-5-1 Chokes: EN 61558-2-20 or EN 60076-6
<b>MTBF @ 45°C/415 V (Mil-HB-217F)</b>	>200,000 hours
<b>SCCR****</b>	100 kA
<b>Earthing System</b>	TN, TT, IT
<b>Overvoltage category</b>	OV III (IEC 60664-1 / UL 61800-5-1)

\* System requirements: THVD <2%, line voltage unbalance <1%  
 Note: performance specifications in this brochure refer to six-pulse diode rectifiers with 8% DC-link choke.  
 THID ~5% at rated power for filter <6 kW  
 \*\* Please check the inlet air flow required for cooling table on page 6 of this document.  
 \*\*\*  $I_{derated} = I_{nominal} \cdot \sqrt{\frac{(T_{max} - T_{amb})}{(T_{max} - T_{nominal})}} = I_{nom} \cdot \sqrt{\frac{(70^\circ\text{C} - T_{amb})}{25^\circ\text{C}}}$   
 \*\*\*\* External UL-rated fuses required. Please consult the user manual.

## Filter selection table – IP 00 enclosure

Filter	Rated load power @ 480 VAC/50 Hz [kW]	Motor drive input current [Arms]**	Rated filter input current [Arms]	Min. required LDC [mH]*****	Min. required LAC [mH]*****	Weight [kg]	Typical losses [W]****	Terminal	Frame size
FN 3451-1-110-E0_____*	1.1	1.4	1.3	53.87	16.70	5	40	110	A
FN 3451-2-110-E0_____*	2.2	2.8	2.7	26.94	7.85	7	61	110	A
FN 3451-4-112-E0_____*	4	5.1	4.9	14.82	4.47	10	104	112	B
FN 3451-6-112-E0_____*	5.5	7.1	6.7	10.78	3.48	12	104	112	B
FN 3451-8-112-E0_____*	7.5	9.6	9.2	7.90	2.55	15	143	112	C
FN 3451-11-112-E0_____*	11	14.1	13.4	5.39	1.82	17	193	112	C
FN 3451-15-113-E0_____	15	19.3	18.3	3.95	1.26	24	233	113	D
FN 3451-19-113-E0_____	19	24.4	23	3.12	1.02	27	292	113	D
FN 3451-22-113-E0_____	22	28	27	2.69	0.88	31	274	113	D
FN 3451-30-115-E0_____	30	38.5	36.6	1.98	0.64	38	355	115	E
FN 3451-37-115-E0_____	37	47.5	45	1.60	0.527	43	426	115	E
FN 3451-45-115-E0_____	45	58	55	1.32	0.451	49	458	115	E
FN 3451-55-115-E0_____	55	71	67	1.08	0.357	54	611	115	F
FN 3451-75-115-E0_____	75	97	92	0.79	0.265	70	781	115	F
FN 3451-90-116-E0_____	90	116	110	0.66	0.218	100	740	116	G
FN 3451-110-116-E0_____	110	142	135	0.54	0.176	108	799	116	G
FN 3451-132-118-E0_____	132	170	162	0.45	0.149	130	1063	118	H
FN 3451-160-118-E0_____**	160	207	197	0.37	0.118	149	1039	118	H
FN 3451-200-118-E0_____**	200	259	246	0.30	0.094	183	1232	118	H
FN 3451-250-118-E0_____**	250	324	308	0.24	0.073	221	1262	118	H
<b>New</b>									
FN 3451-315-119-E0XSXX	315	410	392	0.188	0.059	252	1553	119	J

\* Filter rating which does not require forced cooling or fan module

\*\* Filter rating which does not require RC damping module for rectifiers with EMI filter

\*\*\* Motor drive input current without harmonic filter

\*\*\*\* Typical losses @ 45°C, 480V, 50Hz and rated load power

\*\*\*\*\* **In order to apply FN 3451 filters, motor drives have to be equipped with either DC-link choke or AC line choke. The minimum required inductance values are given in mH in the filter selection table. If neither DC-link choke nor AC line choke is present, or if the minimum mH rating is not fulfilled, FN 3451 filter must not be used. In this case, FN 3450 need to be chosen.**

## Filter selection table – IP 20 enclosure

Filter	Rated load power @ 400 V/50 Hz [kW]	Motor drive input current [Arms]**	Rated filter input current [Arms]	Min. required LDC [mH]****	Min. required LAC [mH]****	Weight [kg]	Typical losses [W]****	Terminal	Frame size
FN 3451-1-110-E2_*****	1.1	1.4	1.3	53.87	16.70	6	40	110	A
FN 3451-2-110-E2_*****	2.2	2.8	2.7	26.94	7.85	8	61	110	A
FN 3451-4-112-E2_*****	4	5.1	4.9	14.82	4.47	11	104	112	B
FN 3451-6-112-E2_*****	5.5	7.1	6.7	10.78	3.48	13	104	112	B
FN 3451-8-112-E2_*****	7.5	9.6	9.2	7.90	2.55	16	143	112	C
FN 3451-11-113-E2_****	11	14.1	13.4	5.39	1.82	19	193	112	C
FN 3451-15-113-E2_****	15	19.3	18.3	3.95	1.26	28	233	113	D
FN 3451-19-113-E2_****	19	24.4	23	3.12	1.02	30	292	113	D
FN 3451-22-115-E2_****	22	28	27	2.69	0.88	34	274	113	D
FN 3451-30-115-E2_****	30	38.5	36.6	1.98	0.64	44	355	115	E
FN 3451-37-115-E2_****	37	47.5	45	1.60	0.527	49	426	115	E
FN 3451-45-115-E2_****	45	58	55	1.32	0.451	55	458	115	E
FN 3451-55-115-E2_****	55	71	67	1.08	0.357	62	611	115	F
FN 3451-75-116-E2_****	75	97	92	0.79	0.265	77	781	115	F
FN 3451-90-116-E2_****	90	116	110	0.66	0.218	109	740	116	G
FN 3451-110-118-E2_****	110	142	135	0.54	0.176	117	799	116	G
FN 3451-132-118-E2_****	132	170	162	0.45	0.149	147	1063	118	H
FN 3451-160-118-E2_******	160	207	197	0.37	0.118	166	1039	118	H
FN 3451-200-118-E2_******	200	259	246	0.30	0.094	200	1232	118	H
FN 3451-200-118-E2E2_******	250	324	308	0.24	0.073	238	1262	118	H
<b>New</b>									
FN 3451-315-119-E2FASXX	315	410	392	0.188	0.059	278	1553	119	J

\* Filter rating which does not require forced cooling or fan module

\*\* Filter rating which does not require RC damping module for rectifiers with EMI filter

\*\*\* Motor drive input current without harmonic filter

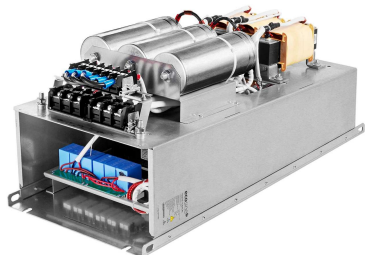
\*\*\*\* Typical losses @ 45°C, 400V, 50Hz and rated load power

\*\*\*\*\* **In order to apply FN 3451 filters, motor drives have to be equipped with either DC-link choke or AC line choke. The minimum required inductance values are given in mH in the filter selection table. If neither DC-link choke nor AC line choke is present, or if the minimum mH rating is not fulfilled, FN 3451 filter must not be used. In this case, FN 3450 need to be chosen.**



# Ecosine evo, 60 Hz Passive Harmonic Filters

## Approvals



(depending on filter configuration)

## Technical specifications

<b>Nominal operating voltage</b>	3x380 VAC to 415 VAC +10%
<b>Operating frequency</b>	60 Hz ±1 Hz
<b>Nominal motor drive input power rating</b>	1 to 240 HP
<b>Total harmonic current distortion THID*</b>	<5% at rated power
<b>Efficiency</b>	>98% for rated voltage and power
<b>High potential test voltage</b>	P → E 2160 VAC (1 s)
<b>Protection category</b>	IP 00, IP 20****
<b>Cooling</b>	Internal fan cooling or external cooling**
<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 +45°C to +70°C derated operation*** -25°C to +85°C transport and storage
<b>Flammability corresponding to</b>	UL 94 V-2
<b>Design corresponding to</b>	Filter: UL 61800-5-1, EN 61800-5-1 Chokes: EN 61558-2-20 or EN 60076-6
<b>MTBF @ 45°C/480 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 brochure refer to six-pulse diode rectifiers.  
 SCR rectifier front-ends will produce different results, dependent upon the firing angle of the thyristors.  
 THID ~5% at rated power for filter <6 HP

\*\* Please check the inlet air flow required for cooling table on page 6 of this document.

\*\*\*  $I_{derated} = I_{nominal} \cdot \sqrt{\frac{(T_{max} - T_{amb})}{(T_{max} - T_{nominal})}} = I_{nom} \cdot \sqrt{\frac{(70^{\circ}C - T_{amb})}{25^{\circ}C}}$

\*\*\*\* External UL-rated fuses required. Please consult the user manual.

### Filter selection table @ 380 V / 60 Hz – IP 00 enclosure

Filter	Rated load power @ 380 V/60 Hz		Motor drive input current [Arms]**	Rated filter input current [Arms]	Weight		Typical losses [W]****	Terminal	Frame size
	[kW]	[HP]			[kg]	[lbs]			
FN 3442-1-110-E0_____*	0.9	1.2	2	1.37	5.7	12.6	50	110	A
FN 3442-2-110-E0_____*	1.7	2.4	4	2.74	7.9	17.4	67	110	A
FN 3442-4-112-E0_____*	2.9	4	7	4.57	10.1	22.3	116	112	B
FN 3442-6-112-E0_____*	4.4	6	11	6.91	12.7	28.0	132	112	B
FN 3442-8-112-E0_____*	5.9	8	14	9.29	15.7	34.6	160	112	C
FN 3442-12-112-E0_____*	8.7	12	21	13.80	18.0	39.7	237	112	C
FN 3442-16-113-E0_____	11.9	16	27	18.50	26.8	59.1	294	113	D
FN 3442-20-113-E0_____	15.0	20	34	23.10	30.8	67.9	351	113	D
FN 3442-24-113-E0_____	17.4	24	44	27.8	35.6	78.5	354	113	D
FN 3442-32-115-E0_____	23.8	32	52	37.2	46.0	101.4	459	115	E
FN 3442-40-115-E0_____	29.3	40	66	46.2	51.1	112.6	571	115	E
FN 3442-48-115-E0_____	35.6	48	83	55.6	59.2	130.5	589	115	E
FN 3442-60-115-E0_____	44.3	60	103	69.3	59.9	132.0	821	115	F
FN 3442-80-115-E0_____	59.4	80	128	92.5	82.4	181.6	1028	115	F
FN 3442-100-116-E0_____	73.6	100	165	115.0	116.2	256.1	1067	116	G
FN 3442-120-116-E0_____	88.7	120	208	139.0	137.1	302.2	1143	116	G
FN 3442-160-118-E0_____	118.0	160	240	184.0	169.7	374.0	1538	118	H
FN 3442-200-118-E0_____**	147.3	200	320	231.0	186.9	411.9	1411	118	H
FN 3442-240-118-E0_____**	177.3	240	403	279.0	251.9	555.2	1775	118	H

\* Filter rating which does not require forced cooling or fan module

\*\* Filter rating which does not require RC damping module for rectifiers with EMI filter

\*\*\* Motor drive input current without harmonic filter

\*\*\*\*Typical losses @ 45°C, 380V, 60Hz and rated load power

### Filter selection table @ 380 V / 60 Hz – IP 20 enclosure

Filter	Rated load power @ 380 V/60 Hz		Motor drive input current [Arms]**	Rated filter input current [Arms]	Weight		Typical losses [W]****	Terminal	Frame size
	[kW]	[HP]			[kg]	[lbs]			
FN 3442-1-110-E2_____*	0.9	1.2	2	1.37	7	15.4	50	110	A
FN 3442-2-110-E2_____*	1.7	2.4	4	2.69	9	19.8	67	110	A
FN 3442-4-112-E2_____*	2.9	4	7	4.57	11	24.3	116	112	B
FN 3442-6-112-E2_____*	4.4	6	11	6.91	14	31	132	112	B
FN 3442-8-112-E2_____*	5.9	8	14	9.29	17.4	38	160	112	C
FN 3442-12-112-E2_____*	8.7	12	21	13.80	20	44	237	112	C
FN 3442-16-113-E2_____	11.9	16	27	18.50	31	68	294	113	D
FN 3442-20-113-E2_____	15.0	20	34	23.10	35	77	351	113	D
FN 3442-24-113-E2_____	17.4	24	44	27.8	40	88	354	113	D
FN 3442-32-115-E2_____	23.8	32	52	37.2	52	115	459	115	E
FN 3442-40-115-E2_____	29.3	40	66	46.2	57	126	571	115	E
FN 3442-48-115-E2_____	35.6	48	83	55.6	65	143	589	115	E
FN 3442-60-115-E2_____	44.3	60	103	69.3	67	147	821	115	F
FN 3442-80-115-E2_____	59.4	80	128	92.5	90	198	1028	115	F
FN 3442-100-116-E2_____	73.6	100	165	115.0	125	276	1067	116	G
FN 3442-120-116-E2_____	88.7	120	208	139.0	146	322	1143	116	G
FN 3442-160-118-E2_____	118.0	160	240	184.0	187	412	1538	118	H
FN 3442-200-118-E2_____**	147.3	200	320	231.0	204	450	1411	118	H
FN 3442-240-118-E2_____**	177.3	240	403	279.0	269	593	1775	118	H

\* Filter rating which does not require forced cooling or fan module

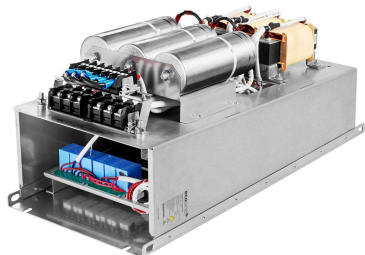
\*\* Filter rating which does not require RC damping module for rectifiers with EMI filter

\*\*\* Motor drive input current without harmonic filter

\*\*\*\* Typical losses @ 45°C, 380V, 60Hz and rated load power

# Ecosine evo, 60 Hz Passive Harmonic Filters

## Approvals



(depending on filter configuration)

## Technical specifications

<b>Nominal operating voltage</b>	3x380 VAC to 415 VAC ± 10%
<b>Operating frequency</b>	60 Hz ±1 Hz
<b>Nominal motor drive input power rating</b>	1 to 240 HP
<b>Total harmonic current distortion THID*</b>	<5% at rated power
<b>Efficiency</b>	>98% for rated voltage and power
<b>Protection category</b>	IP 00, IP 20****
<b>Cooling</b>	Internal fan cooling or external cooling**
<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 +45°C to +70°C derated operation*** -25°C to +85°C transport and storage
<b>Flammability corresponding to</b>	UL 94 V-2
<b>Design corresponding to</b>	Filter: UL 61800-5-1, EN 61800-5-1 Chokes: EN 61558-2-20 or EN 60076-6
<b>MTBF @ 45°C/480 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 brochure refer to six-pulse diode rectifiers.  
 SCR rectifier front-ends will produce different results, dependent upon the firing angle of the thyristors.  
 THID ~5% at rated power for filter <6 HP

\*\* Please check the inlet air flow required for cooling table on page 6 of this document.

\*\*\*  $I_{derated} = I_{nominal} \cdot \sqrt{\frac{(T_{max} - T_{amb})}{(T_{max} - T_{nominal})}} = I_{nom} \cdot \sqrt{\frac{(70^{\circ}C - T_{amb})}{25^{\circ}C}}$

\*\*\*\* External UL-rated fuses required. Please consult the user manual.

## Filter selection table @ 380 V / 60 Hz – IP 00 enclosure

Filter	Rated load power		Motor drive input current [Arms]***	Rated filter input current [Arms]	Min. required LDC [mH]*****	Min. required LAC [mH]*****	Weight		Typical losses [W]****	Terminal	Frame size
	@ 380V/60 Hz						[kg]	[lbs]			
	[kW]	[HP]									
FN 3443-1-110-E0_*****	0.9	1.2	1.4	1.37	21.495	11.607	5	11	41	110	A
FN 3443-2-110-E0_*****	1.7	2.4	2.9	2.74	18.207	6.145	7	15.4	53	110	A
FN 3443-4-112-E0_*****	2.9	4.0	4.8	4.52	10.673	3.602	9	19.8	88	112	B
FN 3443-6-112-E0_*****	4.4	6.0	7.2	6.85	7.035	2.374	12	26.5	101	112	B
FN 3443-8-112-E0_*****	5.9	8.0	9.6	9.2	5.246	1.771	13.6	30	123	112	C
FN 3443-12-112-E0_*****	8.7	12.0	14.4	13.7	3.558	1.201	16	35.3	183	112	C
FN 3443-16-113-E0_****	11.9	16.0	19.3	18.3	2.606	0.880	23	50.7	228	113	D
FN 3443-20-113-E0_****	15.0	20.0	24.0	23	2.063	0.696	26	57.3	277	113	D
FN 3443-24-113-E0_****	17.4	24.0	29.0	27.5	1.779	0.600	30	66.1	282	113	D
FN 3443-32-115-E0_****	23.8	32.0	38.5	36.8	1.301	0.434	37	81.6	370	115	E
FN 3443-40-115-E0_****	29.3	40.0	48.0	45.8	1.056	0.357	42	92.6	453	115	E
FN 3443-48-115-E0_****	35.6	48.0	58.0	55	0.869	0.293	48	105.8	476	115	E
FN 3443-60-115-E0_****	44.3	60.0	72.0	69	0.699	0.236	49	108	634	115	F
FN 3443-80-115-E0_****	59.4	80.0	97.0	92	0.521	0.176	68	150	779	115	F
FN 3443-100-116-E0_****	73.6	100.0	120.0	114	0.421	0.142	97	214	788	116	G
FN 3443-120-116-E0_****	88.7	120.0	144.0	138	0.349	0.118	113	250	831	116	G
FN 3443-160-118-E0_****	118.0	160.0	192.0	183	0.262	0.089	138	304	1199	118	H
FN 3443-200-118-E0_*****	147.3	200.0	240.0	229	0.210	0.071	152	335	1022	118	H
FN 3443-240-118-E0_*****	177.3	240.0	290.0	277	0.175	0.059	205	452	1292	118	H

\* Filter rating which does not require forced cooling or fan module

\*\* Filter rating which does not require RC damping module for rectifiers with EMI filter

\*\*\* Motor drive input current without harmonic filter

\*\*\*\* Typical losses @ 45°C, 380V, 60Hz and rated load power

\*\*\*\*\* In order to apply FN 3443 filters, motor drives have to be equipped with either DC-link choke or AC line choke. The minimum required inductance values are given in mH in the filter selection table. If neither DC-link choke nor AC line choke is present, or if the minimum mH rating is not fulfilled, FN 3443 filter must not be used. In this case, FN 3442 need to be chosen.

## Filter selection table @ 380 V / 60 Hz – IP 20 enclosure

Filter	Rated load power		Motor drive input current [Arms]***	Rated filter input current [Arms]	Min. required LDC [mH]*****	Min. required LAC [mH]*****	Weight		Typical losses [W]****	Terminal	Frame size
	@ 380 V/60 Hz						[kg]	[lbs]			
	[kW]	[HP]									
FN 3443-1-110-E2_*****	0.9	1.2	2	1.4	21.495	11.607	7	15.4	41	110	A
FN 3443-2-110-E2_*****	1.7	2.4	4	2.7	18.207	6.145	9	19.8	53	110	A
FN 3443-4-112-E2_*****	2.9	4	7	4.6	10.673	3.602	11	24.3	88	112	B
FN 3443-6-112-E2_*****	4.4	6	11	6.9	7.035	2.374	14	31	101	112	B
FN 3443-8-112-E2_*****	5.9	8	14	9.4	5.246	1.771	17.4	38	123	112	C
FN 3443-12-112-E2_*****	8.7	12	21	13.8	3.558	1.201	20	44	183	112	C
FN 3443-16-113-E2_****	11.9	16	29	18.8	2.606	0.880	31	68	228	113	D
FN 3443-20-113-E2_****	15.0	20	36	24.0	2.063	0.696	35	77	277	113	D
FN 3443-24-113-E2_****	17.4	24	43	27.6	1.776	0.600	40	88	282	113	D
FN 3443-32-115-E2_****	23.8	32	57	38.1	1.301	0.434	52	115	370	115	E
FN 3443-40-115-E2_****	29.3	40	71	46.5	1.056	0.357	57	126	453	115	E
FN 3443-48-115-E2_****	35.6	48	84	56.7	0.869	0.293	65	143	476	115	E
FN 3443-60-115-E2_****	44.3	60	104	70.8	0.699	0.236	67	147	634	115	F
FN 3443-80-115-E2_****	59.4	80	133	94.4	0.521	0.176	90	198	779	115	F
FN 3443-100-116-E2_****	73.6	100	163	117	0.421	0.142	125	276	788	116	G
FN 3443-120-116-E2_****	88.7	120	208	142	0.349	0.118	146	322	831	116	G
FN 3443-160-118-E2_****	118.0	160	240	188	0.262	0.089	187	412	1199	118	H
FN 3443-200-118-E2_*****	147.3	200	320	235	0.210	0.071	204	450	1022	118	H
FN 3443-240-118-E2_*****	177.3	240	403	283	0.175	0.059	269	593	1292	118	H

\* Filter rating which does not require forced cooling or fan module

\*\* Filter rating which does not require RC damping module for rectifiers with EMI filter

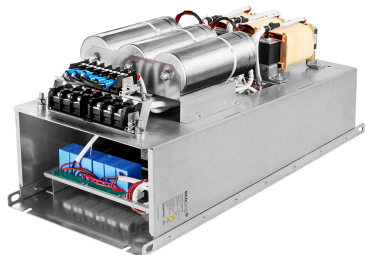
\*\*\* Motor drive input current without harmonic filter

\*\*\*\* Typical losses @ 45°C, 380V, 60Hz and rated load power

\*\*\*\*\* In order to apply FN 3443 filters, motor drives have to be equipped with either DC-link choke or AC line choke. The minimum required inductance values are given in mH in the filter selection table. If neither DC-link choke nor AC line choke is present, or if the minimum mH rating is not fulfilled, FN 3443 filter must not be used. In this case, FN 3442 need to be chosen.

# Ecosine evo, 60 Hz Passive Harmonic Filters

## Approvals



(depending on filter configuration)

## Technical specifications

<b>Nominal operating voltage</b>	3 x 440 VAC to 480 VAC ±10%
<b>Operating frequency</b>	60 Hz ±1 Hz
<b>Nominal motor drive input power rating</b>	1.5 to 300 HP
<b>Total harmonic current distortion THID*</b>	<5% at rated power
<b>Efficiency</b>	>98% for rated voltage and power
<b>High potential test voltage</b>	P → E 2160 VAC (1 s)
<b>Protection category</b>	IP 00, IP 20
<b>Cooling</b>	Internal fan cooling or external cooling**
<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 +45°C to +70°C derated operation*** -25°C to +85°C transport and storage
<b>Flammability corresponding to</b>	UL 94 V-2
<b>Design corresponding to</b>	Filter: UL 61800-5-1, EN 61800-5-1 Chokes: EN 61558-2-20 or EN 60076-6
<b>MTBF @ 45°C/480 V (Mil-HB-217F)</b>	>200,000 hours
<b>SCCR****</b>	100 kA
<b>Earthing System</b>	TN, TT, IT
<b>Overvoltage category</b>	OV III (IEC 60664-1 / UL 61800-5-1)

\* System requirements: THVD <2%, line voltage unbalance <1%  
 Note: performance specifications in this brochure refer to six-pulse diode rectifiers.  
 SCR rectifier front-ends will produce different results, dependent upon the firing angle of the thyristors.  
 THID ~5% at rated power for filter <6 HP

\*\* Please check the inlet air flow required for cooling table on page 6 of this document.

\*\*\* Iderated =  $I_{nominal} \cdot \sqrt{\frac{(T_{max} - T_{amb})}{(T_{max} - T_{nominal})}}$  =  $I_{nom} \cdot \sqrt{\frac{(70^{\circ}C - T_{amb})}{25^{\circ}C}}$

### Filter selection table @ 480 V / 60 Hz – IP 00 enclosure

Filter	Rated load power @ 480 V/60 Hz		Motor drive input current [Arms]**	Rated filter input current [Arms]	Weight		Typical losses [W]****	Terminal	Frame size
	[kW]	[HP]			[kg]	[lbs]			
FN 3452-1-110-E0_____*	1.1	1.5	2	1.37	5.7	12.6	50	110	A
FN 3452-3-110-E0_____*	2.2	3	4	2.76	7.9	17.4	67	110	A
FN 3452-5-112-E0_____*	3.7	5	7	4.57	10.1	22.3	116	112	B
FN 3452-8-112-E0_____*	5.6	7.5	11	6.91	12.7	28.0	132	112	B
FN 3452-10-112-E0_____*	7.5	10	14	9.29	15.7	34.6	160	112	C
FN 3452-15-112-E0_____*	11	15	21	13.8	18.0	39.7	237	112	C
FN 3452-20-113-E0_____	15	20	27	18.5	26.8	59.1	294	113	D
FN 3452-25-113-E0_____	19	25	34	23.1	30.8	67.9	351	113	D
FN 3452-30-113-E0_____	22	30	44	27.8	35.6	78.5	354	113	D
FN 3452-40-115-E0_____	30	40	52	37.2	46.0	101.4	459	115	E
FN 3452-50-115-E0_____	37	50	66	46.2	51.1	112.6	571	115	E
FN 3452-60-115-E0_____	45	60	83	55.6	59.2	130.5	589	115	E
FN 3452-75-115-E0_____	56	75	103	69.3	59.9	132.0	821	115	F
FN 3452-100-115-E0_____	75	100	128	92.5	82.4	181.6	1028	115	F
FN 3452-125-116-E0_____	93	125	165	115	116.2	256.1	1067	116	G
FN 3452-150-116-E0_____	112	150	208	139	137.1	302.2	1143	116	G
FN 3452-200-118-E0_____	149	200	240	184	169.7	374.0	1538	118	H
FN 3452-250-118-E0_____**	186	250	320	231	186.9	411.9	1411	118	H
FN 3452-300-118-E0_____**	224	300	403	279	251.9	555.2	1775	118	H

\* Filter rating which does not require forced cooling or fan module

\*\* Filter rating which does not require RC damping module for rectifiers with EMI filter

\*\*\* Motor drive input current without harmonic filter

\*\*\*\* Typical losses @ 45°C, 480V, 60Hz and rated load power

### Filter selection table @ 480 V / 60 Hz – IP 20 enclosure

Filter	Rated load power @ 480 V/60 Hz		Motor drive input current [Arms]**	Rated filter input current [Arms]	Weight		Typical losses [W]****	Terminal	Frame size
	[kW]	[HP]			[kg]	[lbs]			
FN 3452-1-110-E2_____*	1.1	1.5	2	1.37	7	15.4	50	110	A
FN 3452-3-110-E2_____*	2.2	3	4	2.76	9	19.8	67	110	A
FN 3452-5-112-E2_____*	3.7	5	7	4.57	11	24.3	116	112	B
FN 3452-8-112-E2_____*	5.6	7.5	11	6.91	14	31	132	112	B
FN 3452-10-112-E2_____*	7.5	10	14	9.29	17.4	38	160	112	C
FN 3452-15-112-E2_____*	11	15	21	13.8	20	44	237	112	C
FN 3452-20-113-E2_____	15	20	27	18.5	31	68	294	113	D
FN 3452-25-113-E2_____	19	25	34	23.1	35	77	351	113	D
FN 3452-30-113-E2_____	22	30	44	27.8	40	88	354	113	D
FN 3452-40-115-E2_____	30	40	52	37.2	52	115	459	115	E
FN 3452-50-115-E2_____	37	50	66	46.2	57	126	571	115	E
FN 3452-60-115-E2_____	45	60	83	55.6	65	143	589	115	E
FN 3452-75-115-E2_____	56	75	103	69.3	67	147	821	115	F
FN 3452-100-115-E2_____	75	100	128	92.5	90	198	1028	115	F
FN 3452-125-116-E2_____	93	125	165	115	125	276	1067	116	G
FN 3452-150-116-E2_____	112	150	208	139	146	322	1143	116	G
FN 3452-200-118-E2_____	149	200	240	184	187	412	1538	118	H
FN 3452-250-118-E2_____**	186	250	320	231	204	450	1411	118	H
FN 3452-300-118-E2_____**	224	300	403	279	269	593	1775	118	H

\* Filter rating which does not require forced cooling or fan module

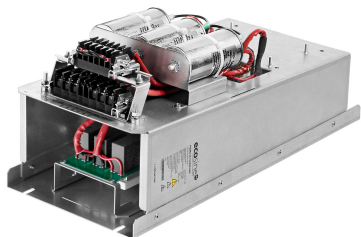
\*\* Filter rating which does not require RC damping module for rectifiers with EMI filter

\*\*\* Motor drive input current without harmonic filter

\*\*\*\* Typical losses @ 45°C, 480V, 60Hz and rated load power

# Ecosine evo, 60 Hz Passive Harmonic Filters

## Approvals



(depending on filter configuration)



## Technical specifications

<b>Nominal operating voltage</b>	3 x 440 VAC to 480 VAC ±10%
<b>Operating frequency</b>	60 Hz ±1 Hz
<b>Nominal motor drive input power rating</b>	1.5 to 300 HP
<b>Total harmonic current distortion THID*</b>	<5% at rated power
<b>Efficiency</b>	>98% for rated voltage and power
<b>High potential test voltage</b>	P → E 2160 VAC (1 s)
<b>Protection category</b>	IP 00, IP 20
<b>Cooling</b>	Internal fan cooling or external cooling**
<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 +85°C transport and storage +45°C to +70°C derated operation***
<b>Flammability corresponding to</b>	UL 94 V-2
<b>Design corresponding to</b>	Filter: UL 61800-5-1, EN 61800-5-1 Chokes: EN 61558-2-20 or EN 60076-6
<b>MTBF @ 45°C/415 V (Mil-HB-217F)</b>	>200,000 hours
<b>SCCR****</b>	100 kA
<b>Earthing System</b>	TN, TT, IT
<b>Overvoltage category</b>	OV III (IEC 60664-1 / UL 61800-5-1)

\* System requirements: THVD <2%, line voltage unbalance <1%  
 Note: performance specifications in this brochure refer to six-pulse diode rectifiers with 8% DC-link choke.  
 THID ~5% at rated power for filter <6 HP

\*\* Please check the inlet air flow required for cooling table on page 6 of this document.

\*\*\*  $I_{derated} = I_{nominal} \cdot \sqrt{\frac{(T_{max} - T_{amb})}{(T_{max} - T_{nominal})}} = I_{nom} \cdot \sqrt{\frac{(70^\circ C - T_{amb})}{25^\circ C}}$

\*\*\*\* External UL-rated fuses required. Please consult the user manual.

## Filter selection table – IP 00 enclosure

Filter	Rated load power		Motor drive input current [Arms]***	Rated filter input current [Arms]	Max. required L <sub>DC</sub> [mH]****	Max. required L <sub>AC</sub> [mH]****	Weight		Typical losses [W]****	Terminal	Frame size
	@ 480 V/60 Hz						[kg]	[lbs]			
	[kW]	[HP]									
FN 3453-1-110-E0_*****	1.1	1.5	1.44	1.37	44.10	14.0	5	11	41	110	A
FN 3453-3-110-E0_*****	2.2	3	2.87	2.74	22.05	6.89	7	15.4	53	110	A
FN 3453-5-112-E0_*****	3.7	5	4.75	4.52	13.35	4.47	9	19.8	88	112	B
FN 3453-8-112-E0_*****	5.6	7.5	7.18	6.85	8.82	2.81	12	26.5	101	112	B
FN 3453-10-112-E0_*****	7.5	10	9.6	9.2	6.59	2.14	13.6	30	123	112	C
FN 3453-15-112-E0_*****	11	15	14.4	13.7	4.41	1.46	16	35.3	183	112	C
FN 3453-20-113-E0_****	15	20	19.3	18.3	3.292	1.082	23	50.7	228	113	D
FN 3453-25-113-E0_****	19	25	24	23	2.641	0.858	26	57.3	277	113	D
FN 3453-30-113-E0_****	22	30	29	27.5	2.195	0.724	30	66.1	282	113	D
FN 3453-40-115-E0_****	30	40	38.5	36.8	1.646	0.531	37	81.6	370	115	E
FN 3453-50-115-E0_****	37	50	48	45.8	1.317	0.433	42	92.6	453	115	E
FN 3453-60-115-E0_****	45	60	58	55	1.097	0.361	48	105.8	476	115	E
FN 3453-75-115-E0_****	56	75	72	69	0.882	0.297	49	108	634	115	F
FN 3453-100-115-E0_****	75	100	97	92	0.658	0.214	68	150	779	115	F
FN 3453-125-116-E0_****	93	125	120	114	0.531	0.178	97	214	788	116	G
FN 3453-150-116-E0_****	112	150	144	138	0.441	0.147	113	250	831	116	G
FN 3453-200-118-E0_****	149	200	192	183	0.331	0.106	138	304	1199	118	H
FN 3453-250-118-E0_*****	186	250	241	229	0.266	0.085	152	335	1022	118	H
FN 3453-300-118-E0_*****	224	300	290	277	0.22	0.073	205	452	1292	118	H

\* Filter rating which does not require forced cooling or fan module

\*\* Filter rating which does not require RC damping module for rectifiers with EMI filter

\*\*\* Motor drive input current without harmonic filter

\*\*\*\* Typical losses @ 45°C, 480V, 60Hz and rated load power

\*\*\*\*\* In order to apply FN 3453 filters, motor drives have to be equipped with either DC-link choke or AC line choke. The minimum required inductance values are given in mH in the filter selection table. If neither DC-link choke nor AC line choke is present, or if the minimum mH rating is not fulfilled, FN 3453 filter must not be used. In this case, FN 3452 need to be chosen.

## Filter selection table – IP 20 enclosure

Filter	Rated load power		Motor drive input current [Arms]***	Rated filter input current [Arms]	Max. required L <sub>DC</sub> [mH]****	Max. required L <sub>AC</sub> [mH]****	Weight		Typical losses [W]****	Terminal	Frame size
	@ 480 V/60 Hz						[kg]	[lbs]			
	[kW]	[HP]									
FN 3453-1-110-E2_*****	1.1	1.5	1.44	1.37	44.10	14.0	6	13.2	41	110	A
FN 3453-3-110-E2_*****	2.2	3	2.87	2.74	22.05	6.89	8	17.6	53	110	A
FN 3453-5-112-E2_*****	3.7	5	4.75	4.52	13.35	4.47	10	22	88	112	B
FN 3453-8-112-E2_*****	5.6	7.5	7.18	6.85	8.82	2.81	13	28.7	101	112	B
FN 3453-10-112-E2_*****	7.5	10	9.6	9.2	6.59	2.14	15.7	34.6	123	112	C
FN 3453-15-112-E2_*****	11	15	14.4	13.7	4.41	1.46	17	37.5	183	112	C
FN 3453-20-113-E2_****	15	20	19.3	18.3	3.292	1.082	27	59.5	228	113	D
FN 3453-25-113-E2_****	19	25	24	23	2.641	0.858	29	63.9	277	113	D
FN 3453-30-113-E2_****	22	30	29	27.5	2.195	0.724	34	75	282	113	D
FN 3453-40-115-E2_****	30	40	38.5	36.8	1.646	0.531	43	94.8	370	115	E
FN 3453-50-115-E2_****	37	50	48	45.8	1.317	0.433	48	105.8	453	115	E
FN 3453-60-115-E2_****	45	60	58	55	1.097	0.361	54	119	476	115	E
FN 3453-75-115-E2_****	56	75	72	69	0.882	0.297	57	125.7	634	115	F
FN 3453-100-115-E2_****	75	100	97	92	0.658	0.214	75	165.3	779	115	F
FN 3453-125-116-E2_****	93	125	120	114	0.531	0.178	106	233.7	788	116	G
FN 3453-150-116-E2_****	112	150	144	138	0.441	0.147	122	269	831	116	G
FN 3453-200-118-E2_****	149	200	192	183	0.331	0.106	156	343.9	1199	118	H
FN 3453-250-118-E2_*****	186	250	241	229	0.266	0.085	170	374.8	1022	118	H
FN 3453-300-118-E2_*****	224	300	290	277	0.22	0.073	222	489.4	1292	118	H

\* Filter rating which does not require forced cooling or fan module

\*\* Filter rating which does not require RC damping module for rectifiers with EMI filter

\*\*\* Motor drive input current without harmonic filter

\*\*\*\* Typical losses @ 45°C, 480V, 60Hz and rated load power

\*\*\*\*\* In order to apply FN 3453 filters, motor drives have to be equipped with either DC-link choke or AC line choke. The minimum required inductance values are given in mH in the filter selection table. If neither DC-link choke nor AC line choke is present, or if the minimum mH rating is not fulfilled, FN 3453 filter must not be used. In this case, FN 3452 need to be chosen.



## Ecosine Compact Economy Line of Passive Harmonic Filters



### Approvals



### Technical specifications

<b>Nominal operating voltage</b>	3x 380 to 500 VAC ±10%
<b>Operating frequency</b>	50Hz ±1 Hz (FN 3416)
<b>Total harmonic current distortion THID*</b>	<10% @ rated power (with DC-Link choke) <15% @ rated power (without DC-Link choke)
<b>Total demand distortion TDD</b>	According to IEEE-519
<b>Nominal motor drive input power rating</b>	4 to 160 kW
<b>Efficiency</b>	>98% @ nominal line voltage and power
<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 (LVD2006/95/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 = Inominal \*  $\sqrt{(70^\circ\text{C}-T_{\text{amb}})/25^\circ\text{C}}$

\*\*\* External UL-rated fuses required.

## Filter selection table

Filter*	Rated load power @ 400 VAC/50 Hz	Rated load power @ 500 VAC/50 Hz	Power loss** @ 25°C/50 Hz	Input/output connections		Weight
	[kW]	[kW]	[W]			[kg]
<b>FN 3416-10-44</b>	4	5.5	63	-44		10
<b>FN 3416-13-44</b>	5.5	7.5	82	-44		10
<b>FN 3416-16-44</b>	7.5	11	105	-44		15
<b>FN 3416-24-33</b>	11	15	153	-33		20
<b>FN 3416-32-33</b>	15	18.5	294	-33		22
<b>FN 3416-38-33</b>	18.5	22	256	-33		25
<b>FN 3416-45-33</b>	22	30	306	-33		29
<b>FN 3416-60-34</b>	30	37	408	-34		37
<b>FN 3416-75-34</b>	37	45	410	-34		43
<b>FN 3416-90-35</b>	45	55	493	-35		47
<b>FN 3416-110-35</b>	55	75	546	-35		50
<b>FN 3416-150-40</b>	75	90	784	-40		86
<b>FN 3416-180-40</b>	90	110	817	-40		92
<b>FN 3416-210-40</b>	110	132	887	-40		100
<b>FN 3416-260-99</b>	132	160	947		-99	125
<b>FN 3416-320-99</b>	160	200	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.

# Ecosine Compact Economy Line of Passive Harmonic Filters



## Approvals



## Technical specifications

<b>Nominal operating voltage</b>	3x 380 to 480 VAC ±10%
<b>Operating frequency</b>	60 Hz ±1 Hz
<b>Total harmonic current distortion THID*</b>	<10% @ rated power (with DC-Link choke) <15% @ rated power (without DC-Link choke)
<b>Total demand distortion TDD</b>	According to IEEE-519
<b>Nominal motor drive input power rating</b>	5 to 250 HP
<b>Efficiency</b>	>98% @ nominal line voltage and power
<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 (LVD2006/95/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 = Inominal \*  $\sqrt{(70 \text{ }^\circ\text{C} - T_{amb})/25^\circ\text{C}}$

\*\*\* External UL-rated fuses required.

## Filter selection table

Filter*	Rated load power	Power loss**	Input /output connections		Weight
	@ 460 VAC/60 Hz	@ 25°C/60 Hz			[kg]
	[HP]	[W]			
<b>FN 3418-8-44</b>	5	41	-44		10
<b>FN 3418-11-44</b>	7.5	81	-44		10
<b>FN 3418-15-44</b>	10	72	-44		16
<b>FN 3418-21-33</b>	15	152	-33		20
<b>FN 3418-28-33</b>	20	214	-33		22
<b>FN 3418-35-33</b>	25	277	-33		25
<b>FN 3418-41-33</b>	30	289	-33		28
<b>FN 3418-53-34</b>	40	383	-34		38
<b>FN 3418-65-34</b>	50	393	-34		42
<b>FN 3418-80-35</b>	60	493	-35		45
<b>FN 3418-105-35</b>	75	514	-35		54
<b>FN 3418-130-40</b>	100	741	-40		78
<b>FN 3418-160-40</b>	125	832	-40		87
<b>FN 3418-190-40</b>	150	873	-40		100
<b>FN 3418-240-99</b>	200	876		-99	126
<b>FN 3418-310-99</b>	250	984		-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.

## Ecosine Low-Voltage Economy Line of Passive Harmonic Filters



### Approvals



### Technical specifications

<b>Nominal operating voltage</b>	3x 200 to 240 VAC ±10%
<b>Operating frequency</b>	50Hz ±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 = Inominal \*  $\sqrt{(70^\circ\text{C}-T_{\text{amb}})/25^\circ\text{C}}$

\*\*\* External UL-rated fuses required.

## Filter selection table

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

## Ecosine Low-Voltage Economy Line of Passive Harmonic Filters



### Approvals



### Technical specifications

<b>Nominal operating voltage</b>	3x 200 to 240 VAC ±10%
<b>Operating frequency</b>	60 Hz ±1 Hz
<b>Total harmonic current distortion THID*</b>	<7% @ rated power (with DC-Link choke) <13% @ rated power (without DC-Link choke)
<b>Total demand distortion TDD</b>	According to IEEE-519
<b>Nominal motor drive input power rating</b>	2.5 to 125 HP
<b>Efficiency</b>	>98% @ nominal line voltage and power
<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 2006/96/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 = Inominal \*  $\sqrt{(70^\circ\text{C}-T_{\text{amb}})/25^\circ\text{C}}$

\*\*\* External UL-rated fuses required.

## Filter selection table

Filter*	Rated load power	Power loss**	Input /output connections		Weight
	@ 208 VAC/60 Hz	@ 25°C/60 Hz			[kg]
	[HP]	[W]			
<b>FN 3418 LV-8-44</b>	2.5	41	-44		10
<b>FN 3418 LV-11-44</b>	3.5	81	-44		10
<b>FN 3418 LV-15-44</b>	5	72	-44		16
<b>FN 3418 LV-21-33</b>	7.5	152	-33		20
<b>FN 3418 LV-28-33</b>	10	214	-33		22
<b>FN 3418 LV-35-33</b>	12	277	-33		25
<b>FN 3418 LV-41-33</b>	15	289	-33		28
<b>FN 3418 LV-53-34</b>	20	383	-34		38
<b>FN 3418 LV-65-34</b>	25	393	-34		42
<b>FN 3418 LV-80-35</b>	30	493	-35		45
<b>FN 3418 LV-105-35</b>	40	514	-35		54
<b>FN 3418 LV-130-40</b>	50	741	-40		78
<b>FN 3418 LV-160-40</b>	60	832	-40		87
<b>FN 3418 LV-190-40</b>	75	873	-40		100
<b>FN 3418 LV-240-99</b>	100	876		-99	126
<b>FN 3418 LV-310-99</b>	125	984		-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.



# Ecosine 50 Hz Passive Harmonic Filters



## Approvals



## Technical specifications

<b>Nominal operating voltage</b>	3x 690 VAC
<b>Operating frequency</b>	50 Hz ±1 Hz
<b>Total harmonic current distortion THID*</b>	<5% @ rated power (filters ≤37 kW) ~5% @ rated power with DC-link choke (filters ≥45 kW)
<b>Nominal motor drive input power rating</b>	7.5 to 250 kW
<b>Nominal motor drive input current rating</b>	10 to 320 A @ 50°C
<b>Total demand distortion TDD</b>	According to IEEE-519, table 10-3
<b>Voltage tolerance range</b>	3x 586 to 760 VAC
<b>Efficiency</b>	>98% @ nominal line voltage and power
<b>High potential test voltage</b>	P → E 2500 VAC (1 min)
<b>Protection category</b>	IP 20
<b>Cooling</b>	Internal fan cooling
<b>Overload capability</b>	1.6x rated current for 1 minute, once per hour
<b>Ambient temperature range</b>	-25°C to +50°C fully operational -25°C to +85°C transport and storage +50°C to +70°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 @ 50°C/460 V (Mil-HB-217F)</b>	200,000 hours
<b>SCCR****</b>	100 kA
<b>Earthing System</b>	TN, TT, IT

\* Ecosine filters reduce RMS input and peak current by reducing harmonic currents and improving true power factor.

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

Note: performance specifications in this brochure refer to six-pulse diode rectifiers. SCR rectifier front-ends will produce different results, dependent upon the firing angle of the thyristors.

\*\*\*  $I_{derated} = I_{nominal} * \sqrt{\frac{(T_{max}-T_{amb})}{(T_{max}-T_{nominal})}} = I_{nominal} * \sqrt{\frac{(70^{\circ}C-T_{amb})}{20^{\circ}C}}$

\*\*\*\* External UL-rated fuses required. Please consult the user manual.

## Filter selection table FN 3410 HV 690

Filter*	Rated load power	Power loss**	min. required L <sub>DC</sub> ***	min. required L <sub>AC</sub> ***	Input/Output Connections	Capacitor disconnections	Weight [kg]
	@ 690 VAC/50 Hz [kW]	@ 690 V [W]	[mH]	[mH]			
<b>FN 3410 HV-10-44</b>	7.54	150			-44	-44	20
<b>FN 3410 HV-13-44</b>	11	209			-44	-44	21
<b>FN 3410 HV-16-33</b>	15	270			-33	-44	29
<b>FN 3410 HV-24-33</b>	18.5	333			-33	-44	33
<b>FN 3410 HV-32-53</b>	22	374			-53	-33	44
<b>FN 3410 HV-38-53</b>	30	480			-53	-33	48
<b>FN 3410 HV-45-53</b>	37	555			-53	-33	56
<b>FN 3410 HV-60-35</b>	45	610	2.313	1.565	-35	-34	58
<b>FN 3410 HV-75-35</b>	55	690	1.169	0.835	-35	-34	62
<b>FN 3410 HV-90-35</b>	75	860	1.143	0.776	-35	-34	77
<b>FN 3410 HV-110-35</b>	90	960	0.867	0.595	-35	-34	91
<b>FN 3410 HV-150-40</b>	110	1145	0.696	0.431	-40	-35	131
<b>FN 3410 HV-180-40</b>	132	1275	0.58	0.37	-40	-35	147
<b>FN 3410 HV-210-40</b>	160	1600	0.478	0.325	-40	-35	169
<b>FN 3410 HV-260-99</b>	200	1940	0.39	0.268	-99	-35	230
<b>FN 3410 HV-320-99</b>	250	2500	0.269	0.184	-99	-35	233

\* 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 suitable.

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

\*\*\* L<sub>DC</sub> refers to DC-link choke, L<sub>AC</sub> refers to AC line choke

# Ecosine high power passive harmonic filter modules for system integration



## Approvals



## 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 L <sub>DC</sub> <15% @ de-rated power without L <sub>DC</sub>
<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 00
<b>Cooling</b>	Forced air, to be provided by the installer/integrator
<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 corresponding 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<sub>derated</sub> = I<sub>nominal</sub> \* √((T<sub>max</sub>-T<sub>amb</sub>)/(T<sub>max</sub>-T<sub>nominal</sub>)) = I<sub>nom</sub> \* √((55°C-T<sub>amb</sub>)/15°C)  
 \*\*\* External UL-rated fuses required

## Filter selection table (50 Hz) @ 400 VAC

Filter	Rated load power*	Min. required	Min. required	Typ. power loss @ rated load	Weight	Weight total
	@400 V/50 Hz [kW]	L <sub>DC</sub> [mH]	L <sub>AC</sub> [mH]		choke module [kg]	
FN 3410-380-99-O	200	0.205	0.073	1040	120	140
FN 3410-470-99-O	250	0.164	0.058	1370	135	157
FN 3410-580-99-O	315	0.131	0.049	1540	160	187
FN 3410-650-99-O	355	0.115	0.043	1550	215	247
FN 3410-710-99-O	400	0.102	0.037	1680	250	285

\* Power rating for motor drives with dc-link chokes or ac line chokes, the minimum required L<sub>DC</sub> and L<sub>AC</sub> are specified in the table. If the minimum required L<sub>DC</sub> or L<sub>AC</sub> 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%

**Filter selection table (50 Hz) @ 500 VAC**

<b>Filter</b>	<b>Rated load power* @500 V/50 Hz [kW]</b>	<b>Min. required L<sub>DC</sub> [mH]</b>	<b>Min. required L<sub>AC</sub> [mH]</b>	<b>Typ. power loss @ rated load [W]</b>	<b>Weight choke module [kg]</b>	<b>Weight total [kg]</b>
<b>FN 3410-380-99-O</b>	250	0.257	0.097	1040	120	140
<b>FN 3410-470-99-O</b>	315	0.203	0.078	1370	135	157
<b>FN 3410-580-99-O</b>	355	0.180	0.063	1540	160	187
<b>FN 3410-650-99-O</b>	400	0.160	0.057	1550	215	247
<b>FN 3410-710-99-O</b>	450	0.142	0.052	1680	250	285

\* Power rating for motor drives with dc-link chokes or ac line chokes, the minimum required L<sub>DC</sub> and L<sub>AC</sub> are specified in the table. If the minimum required L<sub>DC</sub> or L<sub>AC</sub> 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%.

# Ecosine high power passive harmonic filter modules for system integration



## Approvals



## 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 L <sub>DC</sub> <15% @ de-rated power without L <sub>DC</sub>
<b>Total demand distortion TDD</b>	According to IEEE-519
<b>Nominal motor drive input power rating</b>	200 to 400 kW
<b>Efficiency</b>	≥99% @ nominal line voltage and power
<b>Voltage tolerance range</b>	3x 342 to 550 VAC
<b>High potential test voltage</b>	P → E 2500 VAC (2 sec)
<b>Protection category</b>	IP 00
<b>Cooling</b>	Forced air, to be provided by the installer/integrator
<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 corresponding 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: SCR rectifier front-end will produce different results, depending upon the firing angle of the thyristors  
 \*\* I<sub>derated</sub> = I<sub>nominal</sub> \* √((T<sub>max</sub>-T<sub>amb</sub>)/(T<sub>max</sub>-T<sub>nominal</sub>)) = I<sub>nom</sub> \* √((55°C-T<sub>amb</sub>)/15°C)  
 \*\*\* External UL-rated fuses required

## Filter selection table (50 Hz) @ 400 VAC

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 3411-380-99-O	200	0.205	0.073	1040	120	140
FN 3411-470-99-O	250	0.164	0.058	1370	135	157
FN 3411-580-99-O	315	0.131	0.049	1540	160	187
FN 3411-650-99-O	355	0.115	0.043	1550	215	247
FN 3411-710-99-O	400	0.102	0.037	1680	250	285

\* Power rating for motor drives with dc-link chokes or ac line chokes, the minimum required L<sub>DC</sub> and L<sub>AC</sub> are specified in the table. If the minimum required L<sub>DC</sub> or L<sub>AC</sub> 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%

**Filter selection table (50 Hz) @ 500 VAC**

<b>Filter</b>	<b>Rated load power* @ 500 VAC/50 Hz [kW]</b>	<b>Min. required L<sub>DC</sub> [mH]</b>	<b>Min. required L<sub>AC</sub> [mH]</b>	<b>Typ. power loss @ rated load [W]</b>	<b>Weight choke module [kg]</b>	<b>Weight total [kg]</b>
<b>FN 3411-380-99-O</b>	250	0.257	0.097	1040	120	140
<b>FN 3411-470-99-O</b>	315	0.203	0.078	1370	135	157
<b>FN 3411-580-99-O</b>	355	0.180	0.063	1540	160	187
<b>FN 3411-650-99-O</b>	400	0.160	0.057	1550	215	247
<b>FN 3411-710-99-O</b>	450	0.142	0.052	1680	250	285

\* Power rating for motor drives with dc-link chokes or ac line chokes, the minimum required L<sub>DC</sub> and L<sub>AC</sub> are specified in the table. If the minimum required L<sub>DC</sub> or L<sub>AC</sub> 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%.

# Ecosine high power passive harmonic filter modules for system integration



## Approvals



## Technical specifications

<b>Nominal operating voltage</b>	3x 380 to 480 VAC
<b>Operating frequency</b>	60 Hz +/-1 Hz
<b>Total harmonic current distortion THID*</b>	~5% @ rated power with L <sub>DC</sub> <15% @ de-rated power without L <sub>DC</sub>
<b>Total demand distortion TDD</b>	According to IEEE-519
<b>Nominal motor drive input power rating</b>	300 to 500 HP
<b>Efficiency</b>	≥ 99% @ nominal line voltage and power
<b>Voltage tolerance range</b>	3x 342 to 528 VAC
<b>High potential test voltage</b>	P → E 2500 VAC (2 sec)
<b>Protection category</b>	IP 00
<b>Cooling</b>	Forced air, to be provided by the installer/integrator
<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 corresponding 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<sub>derated</sub> = I<sub>nominal</sub> \* √((T<sub>max</sub>-T<sub>amb</sub>)/(T<sub>max</sub>-T<sub>nominal</sub>)) = I<sub>nom</sub> \* √((55°C-T<sub>amb</sub>)/15°C)

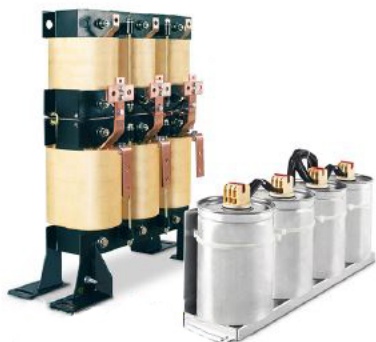
\*\*\* External UL-rated fuses required

## Filter selection table (60 Hz)

Filter	Rated load power*	Min. required	Min. required	Typ. power loss	Weight	Weight total
	@ 460 VAC/60 Hz	L <sub>DC</sub>	L <sub>AC</sub>		@ rated load	
	[HP]	[mH]	[mH]	[W]	[kg]	[kg]
FN 3412-380-99-O	300	0.202	0.074	1090	120	135
FN 3412-440-99-O	350	0.173	0.081	1400	135	155
FN 3412-490-99-O	400	0.151	0.058	1480	150	170
FN 3412-540-99-O	450	0.134	0.052	1500	195	218
FN 3412-590-99-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<sub>DC</sub> and L<sub>AC</sub> are specified in the table. If the minimum required L<sub>DC</sub> or L<sub>AC</sub> 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%

# Ecosine high power passive harmonic filter modules for system integration



## Approvals



## Technical specifications

<b>Nominal operating voltage</b>	3x 380 to 480 VAC
<b>Voltage tolerance range</b>	3x 342 to 528 VAC
<b>Operating frequency</b>	60 Hz +/-1 Hz
<b>Nominal motor drive input power rating</b>	300 to 500 HP
<b>Total harmonic current distortion THID*</b>	~5% @ rated power with L <sub>DC</sub> <15% @ de-rated power without L <sub>DC</sub>
<b>Total demand distortion TDD</b>	According to IEEE-519
<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 00
<b>Cooling</b>	Forced air, to be provided by the installer/integrator
<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 corresponding 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: SCR rectifier front-end will produce different results, depending upon the firing angle of the thyristors

\*\* I<sub>derated</sub> = I<sub>nominal</sub> \* √((T<sub>max</sub>-T<sub>amb</sub>)/(T<sub>max</sub>-T<sub>nominal</sub>)) = I<sub>nom</sub> \* √((55°C-T<sub>amb</sub>)/15°C)

\*\*\* External UL-rated fuses required

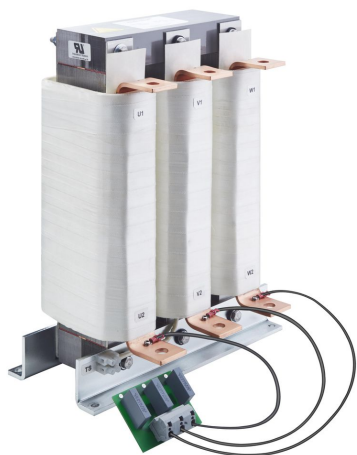
## Filter selection table (60 Hz)

Filter	Rated load power*	Min. required	Min. required	Typ. power loss	Weight	Weight total
	@ 460 VAC/60 Hz	L <sub>DC</sub>	L <sub>AC</sub>		@ rated load	
	[HP]	[mH]	[mH]	[W]	[kg]	[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<sub>DC</sub> and L<sub>AC</sub> are specified in the table. If the minimum required L<sub>DC</sub> or L<sub>AC</sub> 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%



# Output Filter for Motor Drives



## Approvals



UL recognized up to 700 A

## Technical specifications

<b>Nominal operating voltage</b>	3x500 VAC
<b>Rated operating voltage</b>	3x550 VAC
<b>Rated currents</b>	12 to 1100 A @ 40°C
<b>Motor frequency</b>	0..60 Hz (with derating up to 120 Hz)
<b>Switching frequency</b>	2..16 kHz, depending on motor cable length and motor frequency -> refer graph on page 2
<b>Typical dv/dt reduction</b>	Factor 8 to 12
<b>Max. peak voltage</b>	≤1000 V
<b>Voltage drop</b>	<3 V @ 50 Hz
<b>Ambient temperature range</b>	-25°C to +40°C fully operational +40°C to +100°C with derating* -25°C to +100°C transport and storage
<b>Overload capability</b>	1.5 x rated current for 1 minute, ones per hour
<b>Protection category</b>	IP 00
<b>Flammability corresponding to</b>	UL 94V-2
<b>Design corresponding to</b>	UL 61800-5-1, EN 61800-5-1, EN 61558-2-20 or EN 60076-6

## Filter selection table

Filter	Rated current @ 40°C/50 Hz [A]	Typical motor drive power rating @ 400 V* [kW]	Typical motor drive power rating @ 480 V** [kW]	Nominal inductance [mH]	Nominal capacitance [nF]	Typical power loss*** [W]	Voltage drop**** [V]	Input/ Output connections	Weight [kg]
<b>FN 5060-12-84</b>	12	5.5	6.6	0.095	4.7	53	0.4	-84	1
<b>FN 5060-24-84</b>	24	11	13.2	0.098	4.7	55	0.7	-84	1.6
<b>FN 5060-30-99</b>	30	15	18	0.254	33	143	2.4	-99	6.3
<b>FN 5060-45-99</b>	45	22	26.4	0.17	33	182	2.4	-99	6.3
<b>FN 5060-60-99</b>	60	30	36	0.127	33	189	2.4	-99	7.4
<b>FN 5060-70-99</b>	70	37	44.4	0.109	33	214	2.4	-99	8.6
<b>FN 5060-90-99</b>	90	45	52.8	0.085	33	254	2.4	-99	10.4
<b>FN 5060-110-99</b>	110	55	66	0.069	33	316	2.4	-99	11.5
<b>FN 5060-150-99</b>	150	75	90	0.051	68	449	2.4	-99	14.6
<b>FN 5060-180-99</b>	180	90	108	0.042	68	464	2.4	-99	18.0
<b>FN 5060-250-99</b>	250	132	158.4	0.031	68	508	2.4	-99	22.1
<b>FN 5060-320-99</b>	320	160	192	0.024	68	604	2.4	-99	29.6
<b>FN 5060-400-99</b>	400	200	240	0.019	68	637	2.4	-99	32.2
<b>FN 5060-500-99</b>	500	250	300	0.015	68	471	2.4	-99	54.5
<b>FN 5060-600-99</b>	600	315	378	0.013	100	437	2.5	-99	63.5
<b>FN 5060-700-99</b>	700	400	480	0.011	100	486	2.4	-99	74.0
<b>FN 5060-900-99</b>	900	500	600	0.008	100	597	2.3	-99	86.5
<b>FN 5060-1100-99</b>	1100	630	756	0.007	100	695	2.4	-99	114.0

\* General purpose four-pole (1500 r/min) AC induction motor rated 400 V/50 Hz.

\*\* General purpose four-pole (1500 r/min) AC induction motor rated 480 V/50 Hz.

\*\*\* Power loss at 2 kHz switching frequency/80 m motor cable length. Exact value depends upon the motor cable type and length, switching frequency and further stray parameters within the system.

\*\*\*\* Voltage drop at rated current and 50 Hz.

# Output Filter for Motor Drives

## Approvals



UL recognized up to 320 A



## Technical specifications

<b>Max. operating voltage</b>	3 ph 760 VAC
<b>Rated currents</b>	30 to 1200 A @ 40°C
<b>Motor frequency</b>	0..60 Hz (with derating up to 120 Hz)
<b>Switching frequency</b>	up to 16 kHz, depending on motor cable length and motor frequency -> refer graph on page 2
<b>Typical dv/dt reduction</b>	Factor 8 to 12
<b>Max. peak voltage</b>	≤1850 V (according EN 60034-25B)
<b>Voltage drop</b>	<3 V @ 50 Hz
<b>Rated temperature</b>	+40°C without derating up to 100°C
<b>Operation temperature</b>	-25°C to +100°C (25/100/21)
<b>Transportation and storage temperature</b>	-40°C to +100°C (25/100/21)
<b>Overload capability</b>	1.5 x rated current for 1 minute, once per hour
<b>Protection category</b>	IP 00
<b>Flammability corresponding to</b>	UL 94V-2
<b>Design corresponding to</b>	UL 61800-5-1, CSA 22.2 No.14, EN 61558-2-20

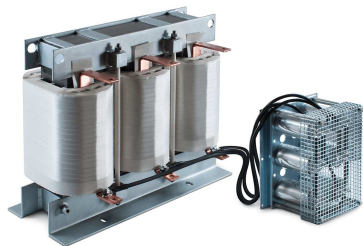
## Filter selection table

Filter	Rated current @ 40°C/50 Hz [A]	Nominal inductance [mH]	**Typical power loss [W]	Input/ Output connections	Weight [kg]
FN 5060 HV-30-99	30	0.17	641	-99	12
FN 5060 HV-45-99	45	0.17	653	-99	12.5
FN 5060 HV-75-99	75	0.1	478	-99	23
FN 5060 HV-115-99	115	0.069	394	-99	27
FN 5060 HV-165-99	165	0.051	301	-99	36
FN 5060 HV-220-99	220	0.035	371	-99	44
FN 5060 HV-320-99	320	0.023	383	-99	59
FN 5060 HV-450-99	450	0.019	376	-99	68
FN 5060 HV-660-99	660	0.012	455	-99	100
FN 5060 HV-900-99	900	0.009	550	-99	111
FN 5060 HV-1200-99	1200	0.007	670	-99	139

\* General purpose four-pole (1500 r/min) AC induction motor rated 690 V/50 Hz.

\*\* Power loss at 2 kHz switching frequency/80 m motor cable length. Exact value depends upon the motor cable type and length, switching frequency and further stray parameters within the system.

## LC Sine Wave Filter for Motor Drives



### Approvals





UL 61800-5-1 up to 750 A for FN 5040, 480 A for FN 5045. For use with AC or DC drives (power conversion equipment) only

### Technical specifications

<b>Nominal operating voltage</b>	3x480 VAC
<b>Rated operating voltage</b>	3x525 VAC
<b>Motor frequency</b>	0...70 Hz (up to 200Hz with derating (see graph))
<b>Switching frequency</b>	See filter selection table
<b>Rated currents</b>	4.5 to 1200 A @ 45°C
<b>Motor cable length</b>	Up to 2,000 m (see graph)
<b>Impedance (uk)</b>	8 to 10% @ 400 V, 50 Hz and rated current
<b>Residual ripple voltage</b>	<5%
<b>High potential test voltage</b>	P → E 3000 VAC, 1 minute P → P 2500 VAC, 1 minute
<b>Protection category</b>	IP 00 (FN 5040) IP 20 (FN 5045)
<b>Overload capability</b>	1.5x rated current for 1 minute, once per hour
<b>Ambient temperature range</b>	-25°C to +45°C fully operation +45°C to 70°C derated operation* -25°C to +85°C transport and storage
<b>Insulation class</b>	EIS 200
<b>Flammability corresponding to</b>	UL 94 V-2
<b>Design corresponding to</b>	Chokes: EN 61558-2-20 or EN 60076-6 Filter: UL 61800-5-1, EN 61800-5-1
<b>MTBF</b>	>100,000 hours
<b>Rated currents</b>	4.5 to 1200 A @50°C (480 V filters)

\* I<sub>derated</sub> = I<sub>nominal</sub> \* √((T<sub>max</sub>-T<sub>amb</sub>)/(T<sub>max</sub>-T<sub>nominal</sub>)) = I<sub>nom</sub> \* √((70°C-T<sub>amb</sub>)/25°C)

## Filter selection table

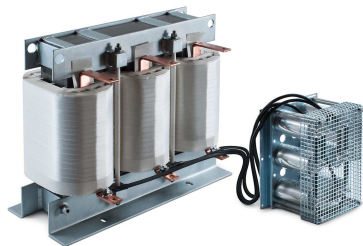
Filter	Rated current @ 45°C/50Hz	Rated current @ 45°C/100Hz	Typical motor drive power rating @ 400 V*	Typical motor drive power rating @ 480 V**	Nominal inductance	Nominal inductance	Capacitance connection	Min. switching frequency	Typical power loss***	Input/Output connections	Weight
	[A]	[A]	[kW]	[kW]	[mH]	[μF]		[kHz]	[W]	 	[kg]
<b>FN 5040-4.5-82</b>	4.5	4.05	1.1/1.5	1.3/1.8	13	2.2	Y	4	65	-82	3.3
<b>FN 5040-8-82</b>	8	7.2	2.2/3	2.64/3.6	6.9	4.7	Y	4	80	-82	4.6
<b>FN 5040-10-83</b>	10	9	4	4.8	5.2	6.8	Y	4	90	-83	6.1
<b>FN 5040-17-83</b>	17	15.3	5.5/7.5	6.6/9.0	3.1	10	Y	4	115	-83	7.8
<b>FN 5040-24-84</b>	24	21.6	11	13.2	2.4	10	Y	4	150	-84	14.4
<b>FN 5040-38-84</b>	38	34.2	15/18.5	18/22.2	1.6	10	Y	4	170	-84	25.0
<b>FN 5040-48-85</b>	48	43.2	22	26.4	1.1	14.7	Y	4	260	-85	33.0
<b>FN 5040-62-86</b>	62	55.8	30	36	0.85	30	Y	3	280	-86	36.0
<b>FN 5040-75-87</b>	75	67.5	37	44.4	0.75	30	Y	3	330	-87	42.0
<b>FN 5040-115-87</b>	115	103.5	45/55	52.8/66	0.5	20	Δ	3	500	-87	68.0
<b>FN 5040-180-99</b>	180	162	75/90	90/108	0.3	33	Δ	3	680	-99	86.0
<b>FN 5040-260-99</b>	260	234	110/132	132/158.4	0.2	47	Δ	3	880	-99	125.0
<b>FN 5040-410-99</b>	410	369	160/200	192/240	0.13	66	Δ	3	1100	-99	184.0
<b>FN 5040-480-99</b>	480	432	250	300	0.11	94	Δ	3	1350	-99	235.0
<b>FN 5040-660-99</b>	660	594	315/355	378/426	0.14	141	Δ	2	2000	-99	310.0
<b>FN 5040-750-99</b>	750	675	400	480	0.12	165	Δ	2	2800	-99	470.0
<b>FN 5040-880-99</b>	880	792	400/500	480/600	0.11	188	Δ	2	3400	-99	640.0
<b>FN 5040-1200-99</b>	1200	1080	560/630	672/756	0.075	282	Δ	2	3800	-99	680.0
<b>FN 5045-4.5-44</b>	4.5	4.05	1.1/1.5	1.3/1.8	13	2.2	Y	4	65	-44	4.1
<b>FN 5045-8-44</b>	8	7.2	2.2/3	2.64/3.6	6.9	4.7	Y	4	80	-44	5.4
<b>FN 5045-10-44</b>	10	9	4	4.8	5.2	6.8	Y	4	90	-44	6.9
<b>FN 5045-17-33</b>	17	15.3	5.5/7.5	6.6/9.0	3.1	10	Y	4	115	-33	9.0
<b>FN 5045-24-33</b>	24	21.6	11	13.2	2.4	10	Y	4	150	-33	15.6
<b>FN 5045-38-33</b>	38	34.2	15/18.5	18/22.2	1.6	10	Y	4	170	-33	18.9
<b>FN 5045-48-34</b>	48	43.2	22	26.4	1.1	14.7	Y	4	260	-34	35.8
<b>FN 5045-62-34</b>	62	55.8	30	36	0.85	30	Y	3	280	-34	37.8
<b>FN 5045-75-35</b>	75	67.5	37	44.4	0.75	30	Y	3	330	-35	60.0
<b>FN 5045-115-35</b>	115	103.5	45/55	52.8/66	0.5	20	Δ	3	500	-35	70.0
<b>FN 5045-180-99</b>	180	162	75/90	90/108	0.3	33	Δ	3	680	-99	92.0
<b>FN 5045-260-99</b>	260	234	110/132	132/158.4	0.2	47	Δ	3	880	-99	131.0
<b>FN 5045-410-99</b>	410	369	160/200	192/240	0.13	66	Δ	3	1100	-99	198.0
<b>FN 5045-480-99</b>	480	432	250	300	0.11	94	Δ	3	1350	-99	243.0
<b>FN 5045-660-99</b>	660	594	315/355	378/426	0.14	141	Δ	2	2000	-99	425.0
<b>FN 5045-750-99</b>	750	675	400	480	0.12	165	Δ	2	2800	-99	482.0
<b>FN 5045-880-99</b>	880	792	400/500	480/600	0.11	188	Δ	2	3400	-99	652.0
<b>FN 5045-1200-99</b>	1200	1080	560/630	672/756	0.075	282	Δ	2	3800	-99	692.0

\* General purpose four-pole (1500 r/min) AC induction motor rated 400 V/50 Hz.

\*\* General purpose four-pole (1500 r/min) AC induction motor rated 480 V/50 Hz.

\*\*\* Exact value depends on the motor cable length and type, switching frequency and further stray parameters of the system.

# LC Sine Wave Filter for 600 VAC and 690 VAC Motor Drives Applications



## Approvals



(UL up to 300 A)

## Technical specifications

<b>Nominal operating voltage</b>	3x690 VAC (UL: 3x600 VAC)
<b>Motor frequency</b>	0...70 Hz (up to 200 Hz with derating according graph)
<b>Rated currents</b>	13 to 1320 A
<b>Temperature range (operation and storage)</b>	-25°C to 70°C (25/070/21) 13 to 45 A: -25 to +30°C 75 to 1320 A: -25 to +45°C
<b>Motor cable length</b>	Up to 2,000 m (see graph)
<b>Impedance (uk)</b>	8 to 10% @ 690 V, 50 Hz and rated current
<b>Residual ripple voltage</b>	<5%
<b>High potential test voltage</b>	P → E 3600 VAC, 1 minute P → P 3600 VAC (without Caps), 1 minute P → P 2600 VDC, 1 minute
<b>Protection category</b>	IP 00
<b>Overload capability</b>	1.5 x rated current for 1 minute, once per hour
<b>Insulation class</b>	EIS 200
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	IEC 61558-2-20
<b>Environmental reliability</b>	IEC 60068-2-1
<b>Capacitor class</b>	UL 810 approved
<b>Creepage and clearance distances</b>	According UL 61800-5-1
<b>Inductors</b>	UL-approved Electrical Insulation System (EIS) class 200 (N)
<b>Rated currents</b>	13 to 1320 A @ 45°C
<b>Switching frequency</b>	See filter selection table

## Filter selection table

Filter****	Rated temp. [°C]	Rated current	Typical motor drive power rating	Typical motor drive power rating	Nominal inductance [mH]	Nominal capacitance *** [µF]	Min. switching frequency ** [kHz]	Typical power loss [W]	Input/Output connections	Weight
		@ rated temp. / 50 Hz [A]	690 V/50 Hz* [kW]	600 V/60 Hz* [HP]						
<b>FN 5040 HV-13-83</b>	30	13	7.5	10	11.7	4.7	2	170	-83	14
<b>FN 5040 HV-28-84</b>	30	28	22	25	5.5	10	2	280	-84	30
<b>FN 5040 HV-45-86</b>	30	45	37	40	3.4	20	2	360	-86	38
<b>FN 5040 HV-75-99</b>	45	75	55	60	2	33	2	500	-99	75
<b>FN 5040 HV-115-99</b>	45	115	90	100	1.3	47	2	850	-99	106
<b>FN 5040 HV-165-99</b>	45	165	132	150	0.9	66	2	1100	-99	145
<b>FN 5040 HV-260-99</b>	45	260	200	250	0.6	94	2	1200	-99	220
<b>FN 5040 HV-300-99</b>	45	300	250	300	0.5	136	2	1600	-99	240
<b>FN 5040 HV-430-99</b>	45	430	355	400	0.35	272	1.5	2000	-99	311
<b>FN 5040 HV-530-99</b>	45	530	450	500	0.28	340	1.5	2400	-99	410
<b>FN 5040 HV-660-99</b>	45	660	630	650	0.23	408	1.5	2900	-99	505
<b>FN 5040 HV-765-99</b>	45	765	710	750	0.2	476	1.5	3800	-99	536
<b>FN 5040 HV-940-99</b>	45	940	900	1000	0.16	612	1.5	3400	-99	668
<b>FN 5040 HV-1320-99</b>	45	1320	1200	1300	0.12	816	1.5	4700	-99	945

\* At rated current, voltage and frequency. The proper power selection depends on the drive specification, the motor and the application requirements.

\*\* With reduced motor cable length, the max. switching frequency is 16 kHz.

\*\*\* The capacitance connection is Y

\*\*\*\* Filters up to 300 A are with UL approval. 430 A ... 1320 A are without UL approval.

# Add-on Sine Wave Module for Common-mode Voltage Improvement




Approvals

## ROHS

### Technical specifications

<b>Maximum continuous operating voltage</b>	3x 500/288 VAC
<b>dc link voltage</b>	1000 VDC max.
<b>Motor frequency</b>	0 to 600 Hz
<b>Switching frequency</b>	6 to 15 kHz
<b>Rated currents</b>	25 to 120 A @ 50°C
<b>Motor cable length</b>	1000 m max. (in combination with FN 5020 only)
<b>High potential test voltage</b>	P → E 2000 VAC for 2 sec P → P 1100 VDC for 2 sec
<b>Protection category</b>	IP 20
<b>Overload capability</b>	1.5x rated current for 1 minute, once per hour
<b>Temperature range (operation and storage)</b>	-25°C to +100°C (25/100/21)
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
<b>MTBF @ 50°C/400 V (Mil-HB-217F)</b>	>100,000 hours
<b>Lifetime (calculated)</b>	>10 years (25, 55 A) ~5 years (75, 120 A)

### Filter selection table

Filter	Rated current @ 50°C [A]	Typical motor power rating* [kW]	Typical power loss** [W]	Output connections 	Weight [kg]
<b>FN 5030-25-33</b>	25	15	n.a.	-33	13
<b>FN 5030-55-34</b>	55	30	n.a.	-34	14
<b>FN 5030-75-35</b>	75	45	n.a.	-35	27
<b>FN 5030-120-35</b>	120	75	n.a.	-35	40

\* General purpose four-pole (1500 r/min) AC induction motor rated 480 V/50 Hz.

\*\* Exact value highly depends upon the motor cable type and length, switching frequency, motor frequency and further stray parameters within the system. Please contact your local Schaffner partner for individual application support.



# Sine wave output filter for high-speed motor drives




## Approvals

### RoHS

### Technical specifications

<b>Maximum continuous operating voltage</b>	3x 500/288 VAC
<b>dc link voltage</b>	1000 VDC max.
<b>Motor frequency</b>	0 to 600 Hz
<b>Switching frequency</b>	6 to 15 kHz
<b>Rated currents</b>	25 to 120 A @ 50°C
<b>Motor cable length</b>	200 m max.
<b>Residual ripple voltage</b>	<5%
<b>High potential test voltage</b>	P → E 2000 VAC for 2 sec P → P 1000 VDC for 2 sec
<b>Protection category</b>	IP 20
<b>Overload capability</b>	1.5x rated current for 1 minute, once per hour
<b>Temperature range (operation and storage)</b>	-25°C to +100°C (25/100/21)
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	UL 1283, CSA 22.2 No. 8 1986
<b>MTBF @ 50°C/400 V (Mil-HB-217F)</b>	>100,000 hours
<b>Lifetime (calculated)</b>	>10 years (25, 55 A) ~5 years (75, 120 A)

### Filter selection table

Filter	Rated current @ 50°C	Typical motor power rating*	Typical power loss**	Output connections	Weight
	[A]	[kW]	[W]		[kg]
FN 5020-25-33	25	15	n.a.	-33	13
FN 5020-55-34	55	30	n.a.	-34	29
FN 5020-75-35	75	45	n.a.	-35	49
FN 5020-120-35	120	75	n.a.	-35	57

\* General purpose four-pole (1500 r/min) AC induction motor rated 480 V/50 Hz.

\*\* Exact value highly depends upon the motor cable type and length, switching frequency, motor frequency and further stray parameters within the system. Please contact your local Schaffner partner for individual application support.

# Output Filter for Motor Drives



## Approvals

## ROHS

## Technical specifications

<b>Nominal operating voltage</b>	3x 500/288 VAC
<b>Motor frequency</b>	0 to 400 Hz (4 to 24 A) 0 to 200 Hz (33 to 66 A)
<b>Switching frequency</b>	2 to 16 kHz
<b>Rated currents</b>	4 to 66 A @ 50°C
<b>Motor cable length</b>	80 m max. @ 16 kHz
<b>Voltage drop</b>	≤10 V @ 50 Hz
<b>Typical dv/dt reduction</b>	Factor 8 to 12
<b>Typical reduction of overvoltages</b>	≤1000 V
<b>High potential test voltage</b>	P → E 2500 VDC for 2 sec P → P 1100 VDC for 2 sec
<b>Protection category</b>	IP 20, if temperature auxiliary contact is connected with IP 20 faston connector
<b>Overload capability</b>	1.4x rated current for 1 minute, every 15 minutes
<b>Temperature range (operation and storage)</b>	-25°C to +70°C (25/070/21)
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
<b>MTBF @ 50°C/400 V (Mil-HB-217F)</b>	>100,000 hours

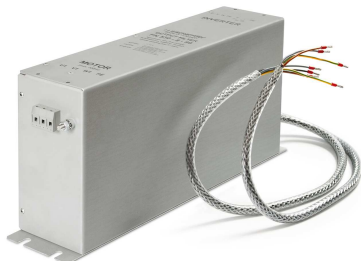
## Filter selection table

Filter	Rated current @ 50°C [A]	Typical motor power rating* [kW]	Typical power loss** [W]	Input/Output connections	Weight [kg]
FN 510-4-29	4	1.5	90	-29	2.1
FN 510-8-29	8	3.7	90	-29	2.1
FN 510-12-29	12	5.5	90	-29	4
FN 510-16-29	16	7.5	90	-29	4.8
FN 510-24-33	24	11	100	-33	7.7
FN 510-33-33	33	15	110	-33	10
FN 510-50-34	50	22	130	-34	21
FN 510-66-34	66	30	130	-34	22

\* General purpose four-pole (1500 r/min) AC induction motor rated 400 V/50 Hz.

\*\*Power loss at 16 kHz switching frequency/80m motor cable length. Exact value depends upon the motor cable type and length, switching frequency and further stray parameters within the system.

# Sine Wave and EMC Output Filter for Motor Drives with a DC Link Access



Approvals

## ROHS

### Technical specifications

<b>Nominal operating voltage</b>	3 x 480 VAC
<b>dc link voltage</b>	850 VDC max.
<b>Motor frequency</b>	0 to 200 Hz
<b>Switching frequency</b>	6 to 20 kHz
<b>Rated currents</b>	4 to 16 A @ 40°C
<b>Motor cable length</b>	≤1000 m max.
<b>Voltage drop</b>	≤10 V @ 50 Hz
<b>Current in +/- control loop</b>	1 to 2 A approx.
<b>Residual ripple voltage</b>	<5%
<b>High potential test voltage</b>	P → E 2500 VDC for 2 sec P → P 1100 VDC for 2 sec
<b>Protection category</b>	IP 20
<b>Overload capability</b>	1.4x rated current for 1 minute, every 15 minutes
<b>Temperature range (operation and storage)</b>	-25°C to +100°C (25/100/21)
<b>Flammability corresponding to</b>	UL 94 V-2 or better
<b>Design corresponding to</b>	UL 1283, CSA 22.2 No. 8 1986, IEC/EN 60939
<b>MTBF @ 40°C/400 V (Mil-HB-217F)</b>	>100,000 hours

### Filter selection table

Filter	Rated current	Typical motor power rating*	Typical power loss**	Motor side	Motor drive side	Weight
	@ 40°C					
	[A]	[kW]	[W]			[kg]
<b>FN 530-4-99</b>	4	1.5	15	-29	-99	11.5
<b>FN 530-8-99</b>	8	3.0	33	-29	-99	15
<b>FN 530-12-99</b>	12	5.5	50	-29	-99	18.5
<b>FN 530-16-99</b>	16	7.5	37	-33	-99	21

\* General purpose four-pole (1500 r/min) AC induction motor rated 400 V/50 Hz.

\*\* Exact value depends upon the motor cable type and length, switching frequency, motor frequency and further stray parameters within the system.

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