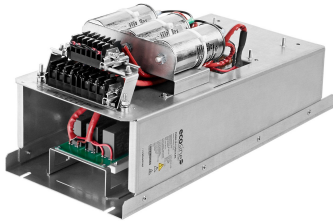


# Ecosine evo, 60 Hz Passive Harmonic Filters



- The industry standard for 6-pulse rectifier and motor drives
- Filters for diode rectifier with DC-link choke
- Best-in-class partial load performance
- Most compact design
- Plug and play, ready to use



## Approvals



(depending on filter configuration)

## Features and benefits

Schaffner ecosine harmonic filters represent an economical solution to the challenge of load-applied harmonics mitigation in three-phase power systems. With a plug-and-play approach and more compact dimensions than comparable products, they can be quickly installed and easily commissioned. They increase the reliability and service life of electric installations, help utilize electric system capacity better, and are the key to meet Power Quality standards such as IEEE 519. Ecosine filters reshape your distorted current back to the desired sinusoidal waveform. Schaffner ecosine filters can be applied to virtually any kind of power electronics with front-end six-pulse rectifiers, 3-phase diode or thyristor bridges, where harmonic current distortion needs to be reduced to defined limits.

## Typical applications

- Equipment with front-end six-pulse rectifier
- Motor drives
- Factory automation equipment
- Water/wastewater treatment facilities
- Fan and pump applications
- HVAC installations
- Mission-critical processes
- DC fast chargers

## 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

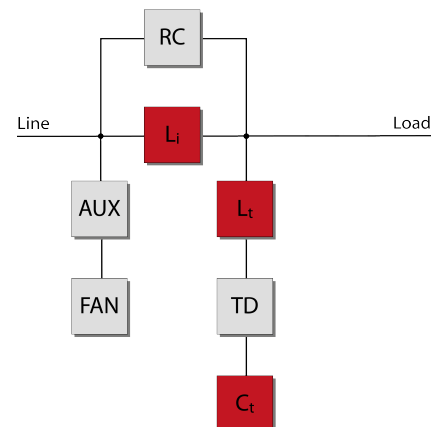
\* System requirements: THVD <2%, line voltage unbalance <1%  
Note: performance specifications in this brochure refer to six-pulse diode rectifiers. SCR rectifier front-ends will produce different results, dependent upon the firing angle of the thyristors. THID ~5% at rated power for filter <6 HP

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

\*\*\* I<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)

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

## Typical electrical schematic



(all configurable optional functionalities shown)

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

Filter	Rated load power @ 380V/60 Hz		Motor drive	Rated filter	Min. required	Min. required	Weight		Typical	Terminal	Frame
	[kW]	[HP]	input current	input current	LDC	LAC	[kg]	[lbs]	losses	[W]****	size
			[Arms]***	[Arms]	[mH]*****	[mH]*****					
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 power terminals

Terminal designation*	Screw thread	Flex wire AWG	Flex wire		Screw torque value		Max width** cable lug [mm]	Frame size
			[mm <sup>2</sup> ]	[Nm]	[lbs-in]			
110	M3	14-22	0.4-2.5	0.5	4.4	7	A	
112	M4	10-22	0.4-6	1.2	10.6	10	B, C	
113	M6	6-18	0.75-16	3	26.6	15	D	
115	M8	1/0-8	10-50	8	70.8	15	E, F	
116	M8	3/0-8	10-95	8	70.8	17	G	
118	M10	3/0-500 kcmil	95-240	10	88.5	35	H	

\* Recommended connector type: wire or cable lug for 110 to 113, only cable lug for 115 to 118

\*\* To fulfill creepage/clearance acc. UL 61800-5-1 without additional protection (insulation). Creepage/clearance can vary depending on applicable standard and must be reviewed by customer. Creepage/clearance may be reduced when additional protection (insulation) is provided.

## Filter signal and earth terminals

Terminal type	Screw thread	Screw torque value		Frame size
		[Nm]	[lbs-in]	
Signal	M3*	0.5	4.4	All
Earth (PE)	M5	2.2	19.5	A
Earth (PE)	M6	4	35.4	B
Earth (PE)	M6	4	35.4	C
Earth (PE)	M8	9	79.7	D
Earth (PE)	M8	9	79.7	E
Earth (PE)	M10	17	150.5	F
Earth (PE)	M10	17	150.5	G
Earth (PE)	M10	17	150.5	H

\* Max width cable lug = 7 mm

## 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]	Min. required LDC [mH]*****	Min. required LAC [mH]*****	Weight		Typical losses [W]****	Terminal	Frame size
	[kW]	[HP]					[kg]	[lbs]			
FN 3443-1-110-E2_*****	0.9	1.2	1.4	1.37	21.495	11.607	7	15.4	41	110	A
FN 3443-2-110-E2_*****	1.7	2.4	2.9	2.74	18.207	6.145	9	19.8	53	110	A
FN 3443-4-112-E2_*****	2.9	4	4.8	4.52	10.673	3.602	11	24.3	88	112	B
FN 3443-6-112-E2_*****	4.4	6	7.2	6.85	7.035	2.374	14	31	101	112	B
FN 3443-8-112-E2_*****	5.9	8	9.6	9.2	5.246	1.771	17.4	38	123	112	C
FN 3443-12-112-E2_*****	8.7	12	14.4	13.7	3.558	1.201	20	44	183	112	C
FN 3443-16-113-E2_****	11.9	16	19.3	18.3	2.606	0.880	31	68	228	113	D
FN 3443-20-113-E2_****	15.0	20	24.0	23	2.063	0.696	35	77	277	113	D
FN 3443-24-113-E2_****	17.4	24	29.0	27.5	1.776	0.600	40	88	282	113	D
FN 3443-32-115-E2_****	23.8	32	38.5	36.8	1.301	0.434	52	115	370	115	E
FN 3443-40-115-E2_****	29.3	40	48.0	45.8	1.056	0.357	57	126	453	115	E
FN 3443-48-115-E2_****	35.6	48	58.0	55	0.869	0.293	65	143	476	115	E
FN 3443-60-115-E2_****	44.3	60	72.0	69	0.699	0.236	67	147	634	115	F
FN 3443-80-115-E2_****	59.4	80	97.0	92	0.521	0.176	90	198	779	115	F
FN 3443-100-116-E2_****	73.6	100	120.0	114	0.421	0.142	125	276	788	116	G
FN 3443-120-116-E2_****	88.7	120	144.0	138	0.349	0.118	146	322	831	116	G
FN 3443-160-118-E2_****	118.0	160	192.0	183	0.262	0.089	187	412	1199	118	H
FN 3443-200-118-E2_*****	147.3	200	240.0	229	0.210	0.071	204	450	1022	118	H
FN 3443-240-118-E2_*****	177.3	240	290.0	277	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.

## Filter power terminals

Terminal designation*	Screw thread	Flex wire AWG	Flex wire		Screw torque value		Max width** cable lug [mm]	Frame size
			[mm <sup>2</sup> ]	[Nm]	[lbs-in]			
110	M3	14-22	0.4-2.5	0.5	4.4	7	A	
112	M4	10-22	0.4-6	1.2	10.6	10	B, C	
113	M6	6-18	0.75-16	3	26.6	15	D	
115	M8	1/0-8	10-50	8	70.8	15	E, F	
116	M8	3/0-8	10-95	8	70.8	17	G	
118	M10	3/0-500 kcmil	95-240	10	88.5	35	H	

\* Recommended connector type: wire or cable lug for 110 to 113, only cable lug for 115 to 118

\*\* To fulfill creepage/clearance acc. UL 61800-5-1 without additional protection (insulation). Creepage/clearance can vary depending on applicable standard and must be reviewed by customer. Creepage/clearance may be reduced when additional protection (insulation) is provided.

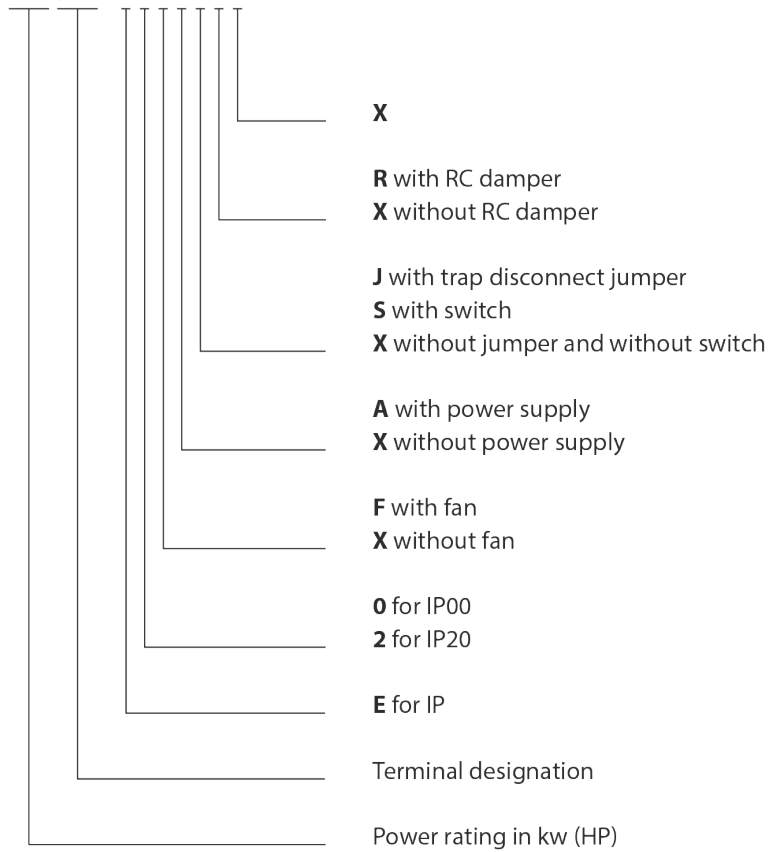
## Filter signal and earth terminals

Terminal type	Screw thread	Screw torque value		Frame size
		[Nm]	[lbs-in]	
Signal	M3*	0.5	4.4	All
Earth (PE)	M5	2.2	19.5	A
Earth (PE)	M6	4	35.4	B
Earth (PE)	M6	4	35.4	C
Earth (PE)	M8	9	79.7	D
Earth (PE)	M8	9	79.7	E
Earth (PE)	M10	17	150.5	F
Earth (PE)	M10	17	150.5	G
Earth (PE)	M10	17	150.5	H

\* Max width cable lug = 7 mm

Product selector

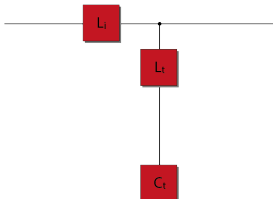
FN 34nn-xxx-yyy-



Filter configurations

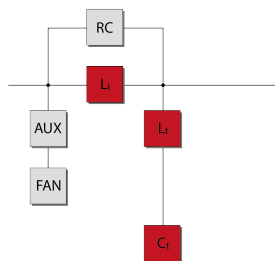
E0XXXXX

- For rectifiers with DC-link choke



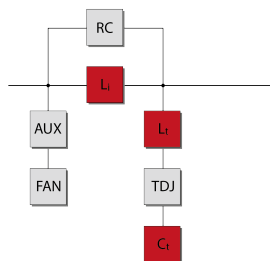
E0FAXRX

- For rectifiers with DC-link choke and with EMI filter  
- Filters contain fan, aux. power supply and RC damper module

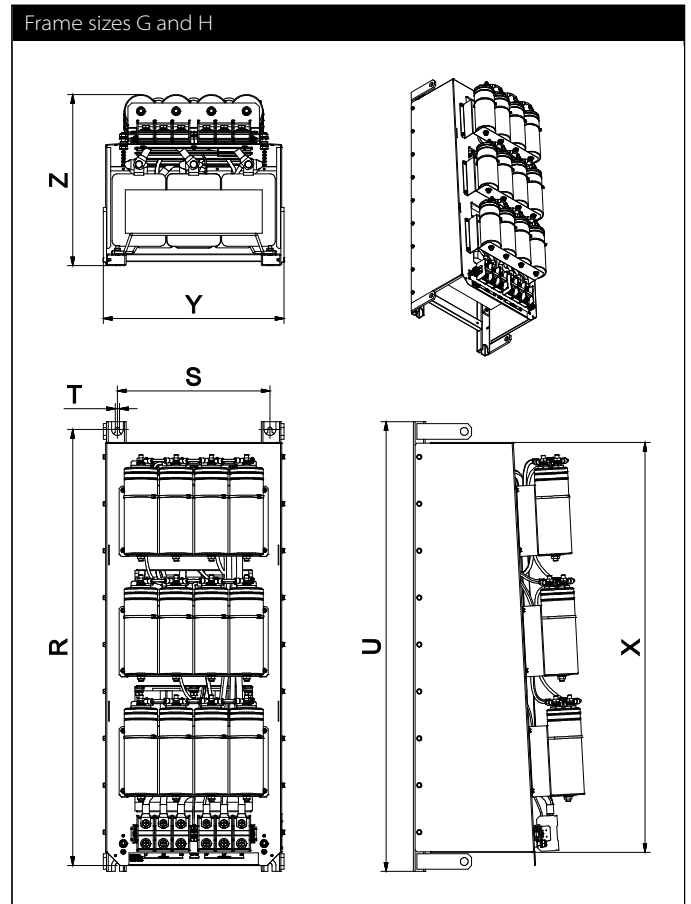
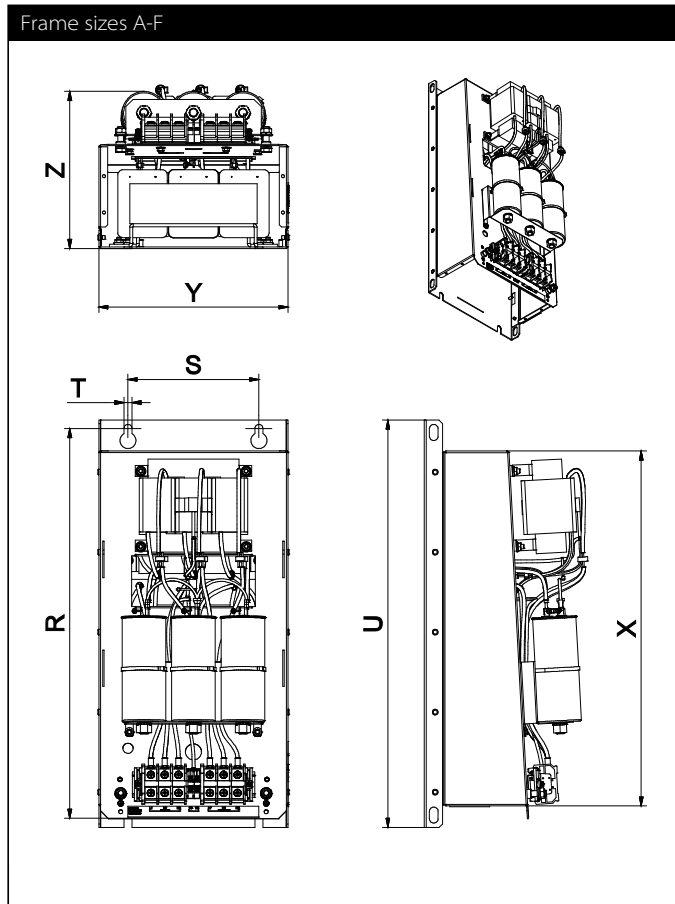


E0FAJRX and E2FAJRX

- For rectifiers with DC-link choke and with EMI filter  
- Filters contain fan, aux. power supply, RC damper module and trap disconnect jumper



### Mechanical data of IP 00 enclosure



### Dimensions

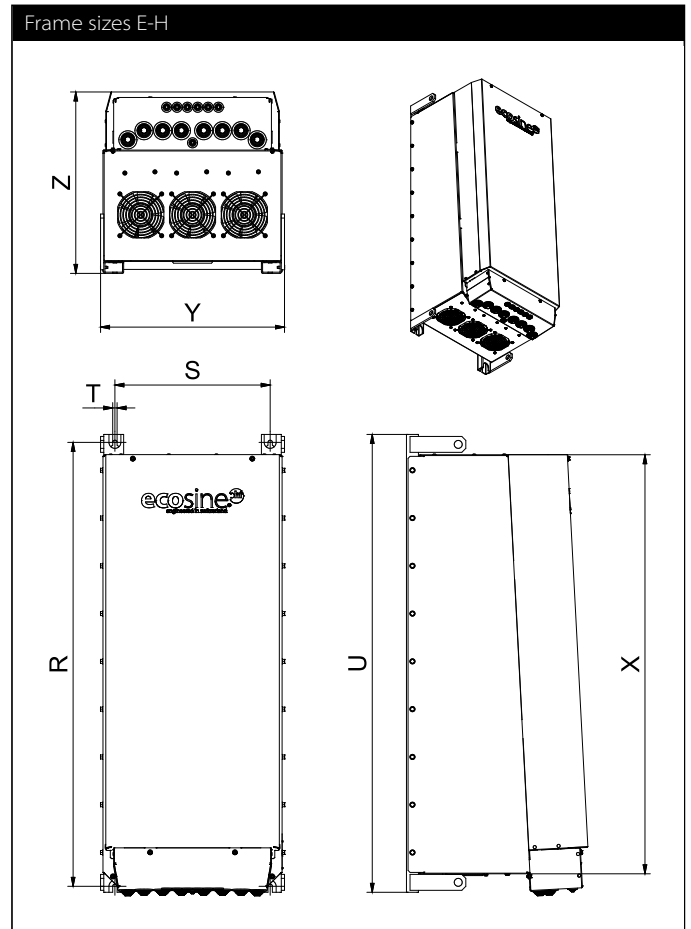
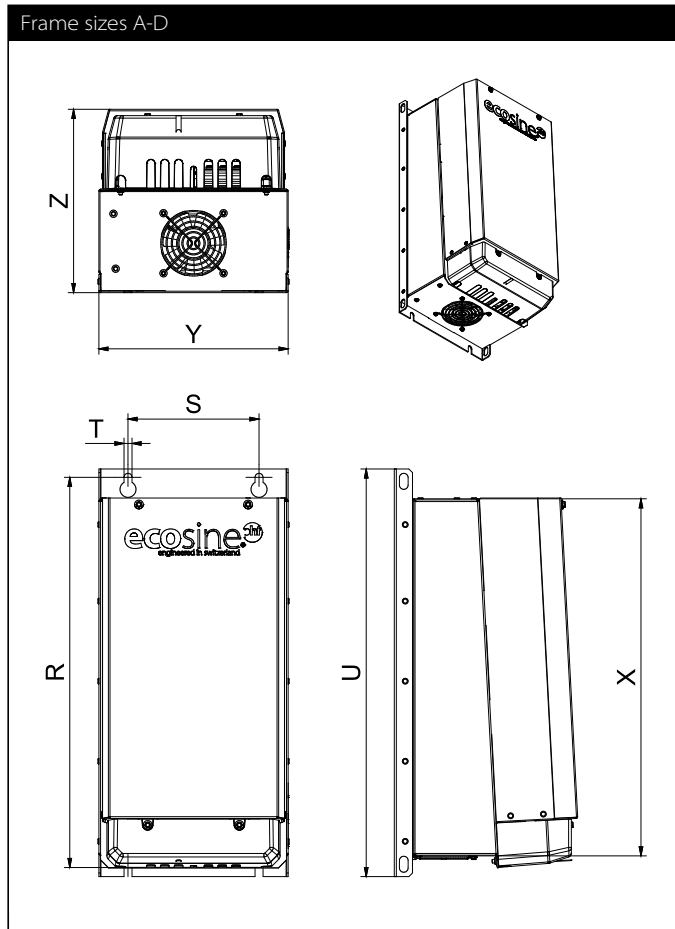
Frame	Dimensions in [mm]								Dimensions in [in]							
	Drill pattern			Base	Volume				Drill pattern			Base	Volume			
	R	S	T	U	X	Y	Z	R	S	T	U	X	Y	Z		
A	340	120	7	360	302	160	185	13.4	4.7	0.3	14.2	11.9	6.3	7.3		
B	405	120	7	425	370	180	206	15.9	4.7	0.3	16.7	14.6	7.1	8.1		
C	460	150	7	483	430	210	221	18.1	5.9	0.3	19.0	16.9	8.3	8.7		
D	540	180	11	560	491	260	252	21.3	7.1	0.4	22.0	19.3	10.2	9.9		
E	680	220	11	705	635	290	319	26.8	8.7	0.4	27.8	25.0	11.4	12.6		
F	730	250	11	752	684	340	343	28.7	9.8	0.4	29.6	26.9	13.4	13.5		
G	920	280	11	960	863	353	386	36.2	11.0	0.4	37.8	34.0	13.9	15.2		
H	1115	390	11	1150	1053	462	456	43.9	15.4	0.4	45.3	41.5	18.2	18.0		

### Inlet air flow required for cooling

Frame size	Min air volume*	
	[m³/h]	CFM [ft³/min]
A, B, C	0	0
D	128	75
E	204	120
F, G	408	240
H	612	360

\* External air flow required for filter configurations without embedded ventilation

### Mechanical data of IP 20 enclosure



### Dimensions

Frame	Dimensions in [mm]							Dimensions in [in]						
	Drill pattern			Base	Volume			Drill pattern			Base	Volume		
	R	S	T	U	X	Y	Z	R	S	T	U	X	Y	Z
A	340	120	7	360	302	160	185	13.4	4.7	0.3	14.2	11.9	6.3	7.3
B	405	120	7	425	370	180	206	15.9	4.7	0.3	16.7	14.6	7.1	8.1
C	460	150	7	483	430	210	221	18.1	5.9	0.3	19.0	16.9	8.3	8.7
D	540	180	11	560	491	260	252	21.3	7.1	0.4	22.0	19.3	10.2	9.9
E	680	220	11	705	635	290	319	26.8	8.7	0.4	27.8	25.0	11.4	12.6
F	730	250	11	752	684	340	343	28.7	9.8	0.4	29.6	26.9	13.4	13.5
G	920	280	11	960	863	353	386	36.2	11.0	0.4	37.8	34.0	13.9	15.2
H	1115	390	11	1150	1053	462	456	43.9	15.4	0.4	45.3	41.5	18.2	18.0

### Inlet air flow required for cooling

Frame size	Min air volume*	
	[m <sup>3</sup> /h]	CFM [ft <sup>3</sup> /min]
A, B, C	0	0
D	128	75
E	204	120
F, G	408	240
H	612	360

\* External air flow required for filter configurations without embedded ventilation



## Headquarters, global innovation and development

### Switzerland

#### Schaffner Group

Nordstrasse 11  
4542 Luterbach  
T +41 32 681 66 26  
[info@schaffner.com](mailto:info@schaffner.com)



## Sales and application centers

### China

#### Schaffner EMC Ltd. Shanghai

T20-3 C, No 565 Chuangye Road,  
Pudong district  
201201 Shanghai  
T +86 21 3813 9500  
[cschina@schaffner.com](mailto:cschina@schaffner.com)  
[www.schaffner.com.cn](http://www.schaffner.com.cn)

### Finland

#### Schaffner Oy

Sauvonrinne 19 H  
08500 Lohja  
T +358 10 567 2855  
[finlandsales@schaffner.com](mailto:finlandsales@schaffner.com)

### France

#### Schaffner EMC S.A.S.

16-20 Rue Louis Rameau  
95875 Bezons  
T +33 1 34 34 30 60  
F +33 1 39 47 02 28  
[francesales@schaffner.com](mailto:francesales@schaffner.com)

### Germany

#### Schaffner Deutschland GmbH

Schoemperlenstrasse 12B  
76185 Karlsruhe  
T +49 721 56910  
F +49 721 569110  
[germanysales@schaffner.com](mailto:germanysales@schaffner.com)

### India

#### Schaffner India Pvt. Ltd

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

### Italy

#### Schaffner EMC S.r.l.

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

### Japan

#### Schaffner EMC K.K.

Taiju-Seimei Sangenjaya Bldg.  
1-32-12, Kamiuma, Setagaya-ku  
154-0011 Tokyo  
T +81 3 5712 3650  
F +81 3 5712 3651  
[japansales@schaffner.com](mailto:japansales@schaffner.com)  
[www.schaffner.jp](http://www.schaffner.jp)

### Singapore

#### Schaffner EMC Pte Ltd.

#05-09, Kg Ubi Ind. Estate  
408705 Singapore  
T +65 6377 3283  
F +65 6377 3281  
[singaporesales@schaffner.com](mailto:singaporesales@schaffner.com)

### Spain

#### Schaffner EMC España

Calle Caléndula 93, Miniparc III, Edificio E  
El Soto de Moraleja, Alcobendas  
28109 Madrid  
T +34 917 912 900  
F +34 917 912 901  
[spainsales@schaffner.com](mailto:spainsales@schaffner.com)

### Sweden

#### Schaffner EMC AB

Östermalmstorg 1  
114 42 Stockholm  
T +46 8 5050 2425  
[swedensales@schaffner.com](mailto:swedensales@schaffner.com)  
[www.schaffner.com](http://www.schaffner.com)

### Switzerland

#### Schaffner EMV AG

Nordstrasse 11  
4542 Luterbach  
T +41 32 681 66 26  
[switzerlandsales@schaffner.com](mailto:switzerlandsales@schaffner.com)

### Taiwan R.O.C.

#### Schaffner EMV Ltd.

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

### Thailand

#### Schaffner EMC Co. Ltd.

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

### United Kingdom

#### Schaffner Ltd.

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

### USA

#### Schaffner EMC Inc.

52 Mayfield Avenue  
Edison, New Jersey  
T +1 732 225 9533  
F +1 732 225 4789  
[usasales@schaffner.com](mailto:usasales@schaffner.com)  
[www.schaffnerusa.com](http://www.schaffnerusa.com)

### Schaffner North America

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

### Schaffner North America

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

To find your local partner within Schaffner's global network: [www.schaffner.com](http://www.schaffner.com)

© 2018 Schaffner Group

The content of this document has been carefully checked and understood. However, neither Schaffner nor its subsidiaries assume any liability whatsoever for any errors or inaccuracies of this document and the consequences thereof. Published specifications are subject to change without notice. Product suitability for any area of application must ultimately be determined by the customer. In all cases, products must never be operated outside their published specifications. Schaffner does not guarantee the availability of all published products. This disclaimer shall be governed by substantive Swiss law and resulting disputes shall be settled by the courts at the place of business of Schaffner Holding AG. Latest publications and a complete disclaimer can be downloaded from the Schaffner website. All trademarks recognized.