CTM magnetics
Small. Quiet. Efficient. Reliable.

FlexSine® 120

Air & Liquid Cooled Sine Wave Filters
6 - 120 Hz

Selection Brochure

Buy for Today.
Prepare for Tomorrow.

One Filter.
Induction and PM Motors.
No De-rate.

- **Single Filter**: 60 Hz to 180 Hz Motors
- **Stop derating VFD** for PM Motors
- **Stop Derating Filter** for PM Motors
- **Stop Compromising**: Lower Cost Solutions are Here

MADE IN THE USA

ctmmagnetics.com

STOP SAYING, "WE MADE IT WORK". BETTER SOLUTIONS EXIST.

Solving The Distortion Problem:

High frequency PM motor applications lead to higher harmonic distortion for the entire motor drive system. To account for this you can either reduce the harmonics by derating your VFD, increasing the drive cost and size, or derate your PM motor so that it can absorb the elevated harmonics while maintaining the desired HP rating. Either way, the CAPEX of your system will increase substantially, figure 1 below.

Conventional sine wave filters can take 15% THID from the VFD and filter it to 5% THID. The problem with adding a contemporary sine wave filter is that the cost of the filter is often greater than the cost to derate the PM motor.

CTM sine wave filters are different. Due to superior filtering capabilities, **CTM FlexSine® and HighSine™ filters are able to reduce drive harmonics from 35% THID to 5% THID**. The 35% to 5% relationship of the VFD/SWF/Motor will Lower CAPEX (investment), OPEX, and reduce the system's overall size and weight without introducing additional common mode noise (figure 2 below). Optimize your motor drive system today by adding a CTM FlexSine® or HighSine™ filter.

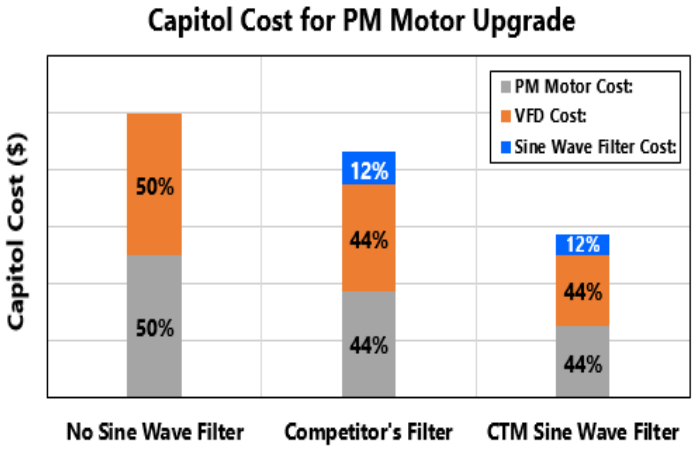


Figure 1. Cost Breakdown for PM Motor Upgrade

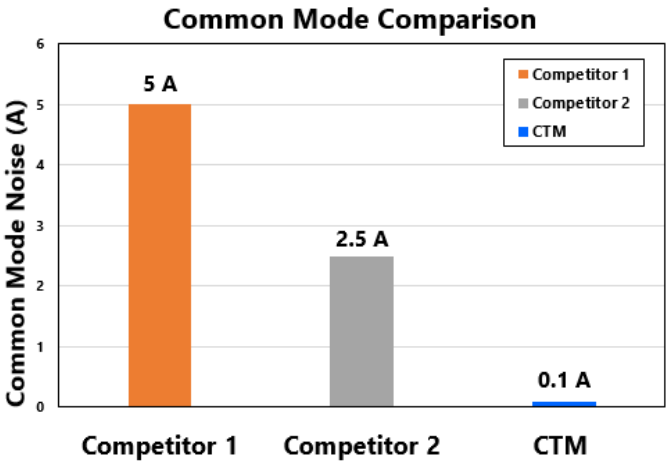
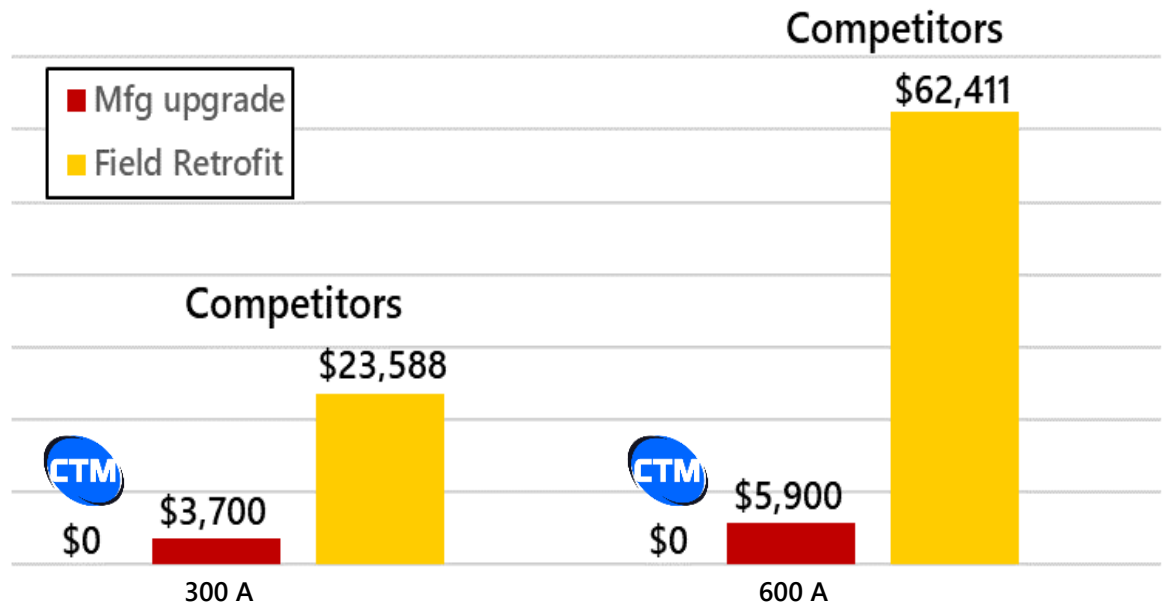


Figure 2. CTM vs. Competitors' Common Mode Noise

Final product specifications subject to change

info@ctmmagnetics.com
480.967.9447

Cost to Upgrade to 120 Hz



■ Manufacturing upgrade is based on 25% filter and 20% VFD de-rate to achieve 120 Hz.
■ Field retrofit estimate requires a new filter and new VFD to meet full power based on de-rate above.

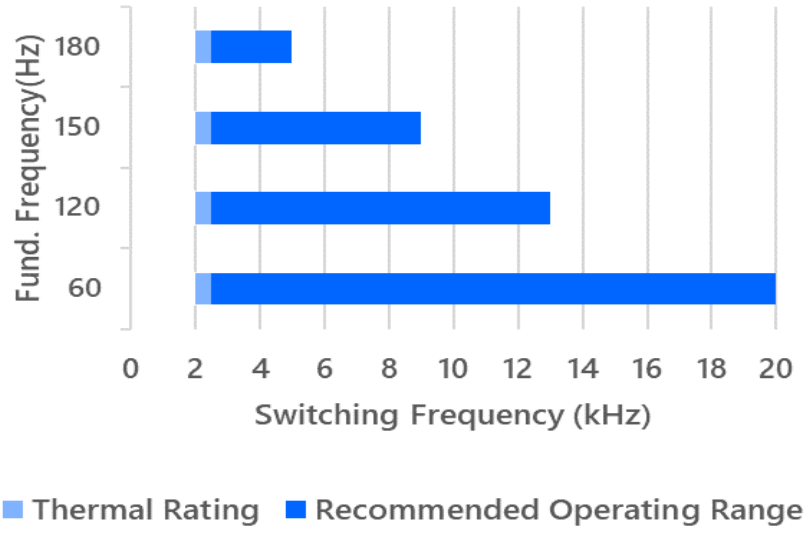
Following our competitor recommendations, upgrading to 120 Hz can be a costly endeavor, with filter de-rates of at least 25% and drive derating of at least 20% (due to the recommended 5 kHz switching frequency). These recommendations become even more costly with field retrofits, as the drive and filter are essentially scrapped.

However, there is another option. By installing a CTM FlexSine 120 filter now, you not only get the benefits of a low cost 60 Hz sine wave filter, you also unlock the ability to upgrade to a 120 Hz PM motor at no additional cost, whether that is an initial or future plan. Buy for today, be prepared for tomorrow.

FlexSine® 120 Operating Range

The FlexSine 120 product line is electrically designed to provide -17 dB attenuation at a switching frequency of 2.5 kHz. The product line is thermally designed to operate at 120 Hz and minimum 2 kHz switching frequency. The chart to the right displays the maximum switching frequencies at various fundamental frequencies.

With an operating switching frequency of 2.0 kHz the attenuation drops to -12.4 dB and allows for more harmonic distortion at the output of the filter. It is up to the customer to determine if this is an appropriate amount of filtering for the application.



Final product specifications subject to change

info@ctmmagnetics.com
480.967.9447

Stop Trying to Make Silicon Steel "Work"...

Motor advances are driving the market to switch to faster spinning PM motors. These higher speeds lead to high frequency harmonic distortion at the output of the drive. Our competitors' filters overheat under this additional stress, forcing them to derate their filters. Furthermore, competitors often demand higher drive switching frequencies (to decrease THID), which then requires a drive derating. CTM FlexSine 120 filters are designed to handle this additional stress without requiring a derate.

Performance Specifications

Harmonic Voltage Dist.	<5% THVD @ 2.5 kHz	
Voltage Range	480 V ±10%	
Voltage Insertion Loss	<3.3%	
Fundamental Frequency	6 - 120 Hz *(Up to 180 Hz with de-rating)* - *For up to 500 Hz applications, see HighSine Series Sine Wave Filters*	
Switching Frequency	2.5 kHz Nominal 2.0 kHz Minimum *(See FlexSine 120 Operating Range Chart)*	
Current Range	100 - 960 A *(Air cooled)* 100 - 1440 A *(Liquid cooled)*	
Overload Capability	150% rated current for 1 minute *(Air)* 200% rated current for 1 minute *(Liquid)*	
Ambient Temperature Range	Maximum: 50 °C (122 °F)-*Air* 65 °C (149 °F)-*Liquid*	Minimum: -40 °C (-40 °F)-*Air* -40 °C (-40 °F)-*Liquid* [A]
Audible Noise	~40 dB (Air)	~0 dB (Liquid)
Relative Humidity	95% without condensation	
Enclosure Options	Modular Panel Integrated Panel *(Air cooled only)* NEMA 3R Cabinet	
Motor Cable Length	Up to 15,000 feet	
Maximum Altitude	3,300 ft (Air) *Higher with derate*	No Limit (Liquid)
Agency Recognitions	c UL us LISTED	

Liquid Cooled Options:

Maximum Coolant Temp.	50 °C (122 °F) *(Higher with de-rating)*
Approved Coolants	Drinking water Water-glycol mixture *For R134A, contact CTM*
Plumbing Material Options	Aluminum (standard) Copper
Heat Removal	97% to Liquid Coolant 3% to Ambient Air

[A] Preventative measures should be taken to ensure the coolant does not freeze in the system.

FlexSine® 120 Highlights

Single Design for IM and PM Motor Operation

The FlexSine 120 is the only sine wave filter designed specifically for operation with today's 60 Hz induction motor applications as well as tomorrow's high frequency permanent magnet (PM) motors.

Avoid Equipment De-rates At High Frequency

Competitors' solution to high frequency PM motors is to force you to buy a larger filter and switch the VFD at 5 kHz. Not only are you forced to pay more for the larger filter, the 5 kHz switching frequency derates the drive, increasing up-front costs further by requiring a larger drive.

The FlexSine 120 is different. Due to a unique patented design and proprietary materials, the FlexSine 120 allows you operate at 2.5 kHz, avoiding any drive de-rate. The FlexSine 120 also is rated at full current up to 120 Hz (up to 180 Hz with 0-15% de-rate).

Upgrade to PMM with Existing Equipment

The FlexSine 120 allows you to use your current drive to upgrade to PMM frequencies. Simply switch out your existing sine wave filter with an appropriately sized FlexSine filter to start reaping the benefits of PMM.

Liquid Cooled Advantages

Highest Power Density

Superior heat removal technology enables smaller magnetics, yielding the highest power density reactors available. Low surface temperatures eliminate clearance requirements, further increasing "effective" power density.

Thermal Isolation

With up to 97% of heat removed through the coolant, liquid cooled reactors have negligible effects on cabinet air temperature. No climate control required.

Sealed Design for Harsh Environments

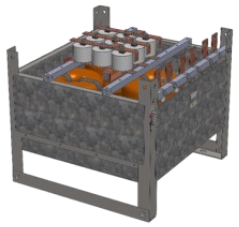
CTM inductors are environmentally sealed in potting, creating an extremely rugged and reliable design ideal for use in the harshest environments.

Extremely Low Audible Noise

Due to superior materials and geometric shapes, magnetostriction-induced noise is significantly lower in CTM filters. When combined with a sealed package, the result is a nearly silent solution.

info@ctmmagnetics.com
480.967.9447

Mechanical Specifications (Air):



Size filter based on the Full Load Amps (FLA) of the drive. The filter current rating must be greater than or equal to the FLA. Order filters by CTM Part Number online at ctmmagnetics.com/contact-us, or call us directly at 480.967.9447.

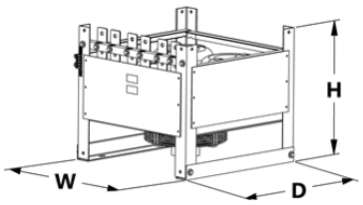
Rated Current (A_{RMS})	Est. Motor HP [1]	Fund. Frequency Derating		Modular Panel				Integrated Panel			NEMA 3R Cabinet		
		150 Hz	180 Hz	Part Number [2]	Size (W x D x H) Reactor (in)	Size (W x D x H) Cap Panel (in)	Approx. Weight (lb)	Part Number [2]	Size (W x D x H) (in)	Approx. Weight (lb)	Part Number [2]	Size (W x D x H) (in)	Approx. Weight (lb)
100	75	100%	95%	S120F100A25MA00	18.3 x 18.3 x 18.0	11.0 x 8.9 x 5.9	82	S120F100A25PA00	18.3 x 18.3 x 19.4	82	S120F100A25RA00	25.3 x 36.4 x 44.5	209
130	100	100%	95%	S120F130A25MA00	18.3 x 18.3 x 18.0	11.0 x 8.9 x 5.9	91	S120F130A25PA00	18.3 x 18.3 x 19.4	91	S120F130A25RA00	25.3 x 36.4 x 44.5	217
160	125	95%	90%	S120F160A25MA00	18.3 x 18.3 x 18.0	11.0 x 8.9 x 5.9	104	S120F160A25PA00	18.3 x 18.3 x 19.4	104	S120F160A25RA00	25.3 x 36.4 x 44.5	230
200	150	100%	95%	S120F200A25MA00	18.3 x 18.3 x 18.0	11.0 x 8.9 x 5.9	108	S120F200A25PA00	18.3 x 18.3 x 19.4	108	S120F200A25RA00	25.3 x 36.4 x 44.5	234
240	200	100%	95%	S120F240A25MA00	18.3 x 18.3 x 18.0	11.0 x 8.9 x 5.9	121	S120F240A25PA00	18.3 x 18.3 x 19.4	121	S120F240A25RA00	25.3 x 36.4 x 44.5	247
300	250	95%	90%	S120F300A25MA00	18.3 x 18.3 x 18.0	11.0 x 8.9 x 12.1	137	S120F300A25PA00	18.3 x 18.3 x 21.3	137	S120F300A25RA00	25.3 x 36.4 x 44.5	264
360	300	100%	100%	S120F360A25MA00	20.8 x 20.8 x 18.3	11.0 x 8.9 x 12.1	173	S120F360A25PA00	20.8 x 20.8 x 21.8	173	S120F360A25RA00	25.3 x 36.4 x 44.5	295
420	350	100%	90%	S120F420A25MA00	20.8 x 20.8 x 18.3	11.0 x 8.9 x 8.6	173	S120F420A25PA00	20.8 x 20.8 x 20.8	173	S120F420A25RA00	25.3 x 36.4 x 44.5	294
480	400	90%	85%	S120F480A25MA00	20.8 x 20.8 x 18.3	11.0 x 8.9 x 8.6	179	S120F480A25PA00	20.8 x 20.8 x 20.8	179	S120F480A25RA00	25.3 x 36.4 x 44.5	300
540	450	95%	90%	S120F540A25MA00	24.8 x 24.8 x 20.5	11.0 x 8.9 x 8.6	237	S120F540A25PA00	24.8 x 24.8 x 22.6	237	S120F540A25RA00	30.5 x 41.9 x 49.5	403
600	500	95%	85%	S120F600A25MA00	24.8 x 24.8 x 20.5	11.0 x 8.9 x 12.1	250	S120F600A25PA00	24.8 x 24.8 x 23.6	250	S120F600A25RA00	30.5 x 41.9 x 49.5	416
720	600	100%	90%	S120F720A25MA00	26.0 x 26.0 x 21.6	11.0 x 8.9 x 12.1	281	S120F720A25PA00	26.0 x 26.0 x 24.4	281	S120F720A25RA00	30.5 x 41.9 x 49.5	442
840	700	100%	95%	S120F840A25MA00	26.0 x 26.0 x 21.6	21.5 x 8.9 x 8.6	322	S120F840A25PA00	26.0 x 26.0 x 24.4	322	S120F840A25RA00	30.5 x 41.9 x 49.5	484
960	800	95%	90%	S120F960A25MA00	26.0 x 26.0 x 21.6	21.5 x 8.9 x 8.6	327	S120F960A25PA00	26.0 x 26.0 x 24.4	327	S120F960A25RA00	30.5 x 41.9 x 49.5	488

[1] *Motor HP estimated based on typical conditions. Actual HP will vary with application. Size filter based on drive FLA.*

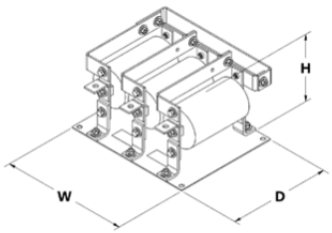
[2] *Use part number table (bottom right) for additional options.*

Modular Panel:

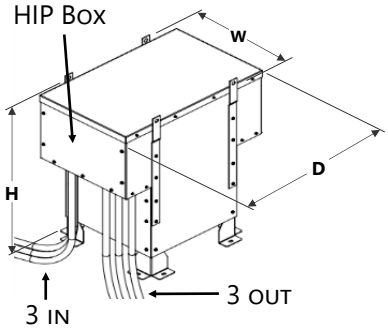
Reactor:



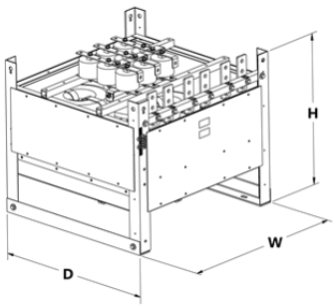
Capacitor Panel:



NEMA 3R Cabinet:



Integrated Panel:



Part Number System

S 120 F 720 A 25 M A 00

- **Sine Wave Filter**
- **Nominal Frequency**
  - 120 = 120 Hz
- **Forced-Air Cooled**
- **Current Rating (Amps)**
- **Drive Voltage**
  - A = 480 VAC
- **Switching Frequency**
  - 25 = 2.5 kHz
- **Enclosure**
  - M = Modular Panel
  - P = Integrated Panel
  - R = NEMA 3R Cabinet
- **Fan Options**
  - A = 115 VAC
  - B = 230 VAC
- **Design Options**

Note: Information is for reference only. Data subject to change without notice.

info@ctmmagnetics.com
480.967.9447

Electrical Specifications (Liquid):

Size filter based on the Full Load Amps (FLA) of the drive. The filter current rating must be greater than or equal to the FLA. Order filters by CTM Part Number online at ctmmagnetics.com/contact-us, or call us directly at 480.967.9447.

Rated Current (A_{RMS})	Est. Motor HP [1]	Part Number [2]	Total Filter Power Losses (Watts)			
			At 120 Hz Only [3]		*120 Hz / 2.5 kHz* [4]	
			Liquid	*Air*	*Liquid*	*Air*
100	75	**S120L100A25MA00**	544	17	608	19
130	100	**S120L130A25MA00**	687	21	786	24
160	125	**S120L160A25MA00**	829	26	972	30
200	150	**S120L200A25MA00**	821	25	966	30
240	200	**S120L240A25MA00**	890	28	1,051	32
300	250	**S120L300A25MA00**	1,135	35	1,350	42
360	300	**S120L360A25MA00**	1,228	38	1,440	45
420	350	**S120L420A25MA00**	1,406	43	1,694	52
480	400	**S120L480A25MA00**	1,499	46	1,827	57
540	450	**S120L540A25MA00**	1,708	53	2,078	64
600	500	**S120L600A25MA00**	1,772	55	2,148	66
720	600	**S120L720A25MA00**	1,868	58	2,287	71
840	700	**S120L840A25MA00**	2,177	67	2,700	84
960	800	**S120L960A25MA00**	2,305	71	2,869	89
1080	900	**S120L1K1A25MA00**	2,538	78	3,169	98
1200	1000	**S120L1K2A25MA00**	2,648	82	3,323	103
1320	1100	**S120L1K3A25MA00**	2,776	86	3,489	108
1440	1200	**S120L1K4A25MA00**	2,945	91	3,693	114

[1] *Motor HP estimated based on typical conditions. Actual HP will vary with application. Size filter based on drive FLA.*

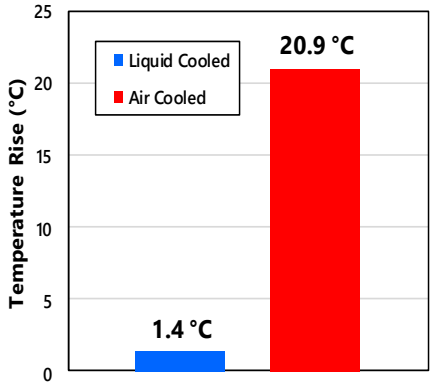
[2] *Use part number table (bottom right) to select options. Unspecified options will be assumed to carry the default "-MA00" option number.*

[3] *Loss calculations performed at rated current, 120 Hz, and 20 °C coolant.*

[4] *Loss calculations performed at rated current, 120 Hz with 2.5 kHz switching frequency, and 20°C coolant. THD-i is 14.7%.*

Liquid Cooled vs. Air Cooled

Cabinet Air Temperature Rise



Part Number System

S 120 L 720 A 25 M A 00

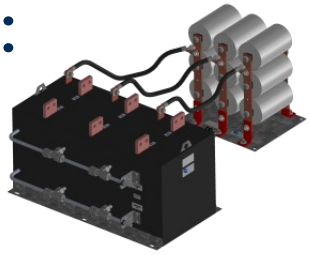
- **Sine Wave Filter**
- **Nominal Frequency**
  - 120 = 120 Hz
- **Liquid Cooled**
- **Current Rating (Amps)**
- **Drive Voltage**
  - A = 480 VAC
- **Switching Frequency**
  - 25 = 2.5 kHz
- **Enclosure**
  - M = Modular Panel
- **Cooling System Options**
  - A = Aluminum
  - C = Copper
- **Design Options**

Reduced Cabinet Air Temperature:

CTM liquid cooled filters will have negligible temperature effects when installed in an existing cabinet. Liquid cooled inductors are thermally isolated from their enclosures, meaning a majority (97%) of the heat is removed directly through the liquid coolant. This results in increased reliability for all electronics within the cabinet.

Note: Information is for reference only. Data subject to change without notice.

Mechanical Specifications (Liquid):



Size filter based on the Full Load Amps (FLA) of the drive. The filter current rating must be greater than or equal to the FLA. Order filters by CTM Part Number online at ctmmagnetics.com/contact-us, or call us directly at 480.967.9447.

Note: Information is for reference only. Data subject to change without notice.

Rated Current (A_{RMS})	Est. Motor HP [1]	Modular Panel				Reference Figure	Flow Rate (GPM) [3]
		Part Number [2]	Size (W x D x H)		Approx. Weight (lb)		
			Reactor (in)	*Cap Panel (in)*			
100	75	**S120L100A25MA00**	9.7 x 9.3 x 9.6	11.0 x 8.9 x 5.9	70	F1	0.6
130	100	**S120L130A25MA00**	9.7 x 9.3 x 9.6	11.0 x 8.9 x 5.9	71	F1	0.6
160	125	**S120L160A25MA00**	12.0 x 9.3 x 9.6	11.0 x 8.9 x 5.9	88	F1	0.8
200	150	**S120L200A25MA00**	12.0 x 9.3 x 9.6	11.0 x 8.9 x 5.9	89	F1	0.8
240	200	**S120L240A25MA00**	12.6 x 10.1 x 10.3	11.0 x 8.9 x 5.9	108	F1	0.8
300	250	**S120L300A25MA00**	12.6 x 10.1 x 10.3	11.0 x 8.9 x 12.1	115	F1	1.1
360	300	**S120L360A25MA00**	15.3 x 10.1 x 10.3	11.0 x 8.9 x 8.6	137	F1	1.1
420	350	**S120L420A25MA00**	15.3 x 10.1 x 10.3	11.0 x 8.9 x 8.6	139	F1	1.3
480	400	**S120L480A25MA00**	15.4 x 12.5 x 11.9	11.0 x 8.9 x 8.6	162	F2	1.8
540	450	**S120L540A25MA00**	17.0 x 11.3 x 11.7	11.0 x 8.9 x 8.6	196	F1	1.6
600	500	**S120L600A25MA00**	17.0 x 11.3 x 11.7	11.0 x 8.9 x 12.1	203	F1	1.7
720	600	**S120L720A25MA00**	20.9 x 12.5 x 11.9	11.0 x 8.9 x 12.1	230	F2	1.8
840	700	**S120L840A25MA00**	20.9 x 12.5 x 11.9	21.5 x 8.9 x 8.6	254	F2	2.1
960	800	**S120L960A25MA00**	22.0 x 14.0 x 13.3	21.5 x 8.9 x 8.6	332	F2	2.4
1080	900	**S120L1K1A25MA00**	22.0 x 14.0 x 13.3	21.5 x 8.9 x 12.1	343	F2	2.4
1200	1000	**S120L1K2A25MA00**	22.0 x 14.0 x 13.3	21.5 x 8.9 x 12.1	346	F2	2.7
1320	1100	**S120L1K3A25MA00**	23.1 x 15.5 x 15.1	21.5 x 8.9 x 12.1	443	F2	2.7
1440	1200	**S120L1K4A25MA00**	23.1 x 15.5 x 15.1	21.5 x 8.9 x 12.1	458	F2	3.0

Mechanical Figures (Modular Panel)

Capacitor Panel:

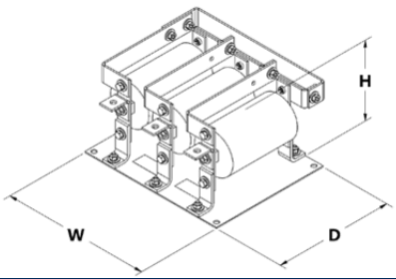


Figure F1 :

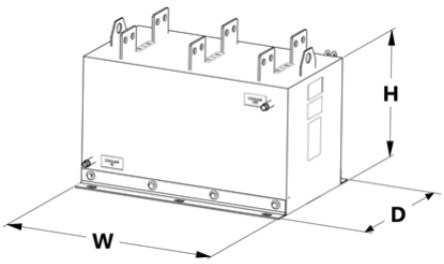
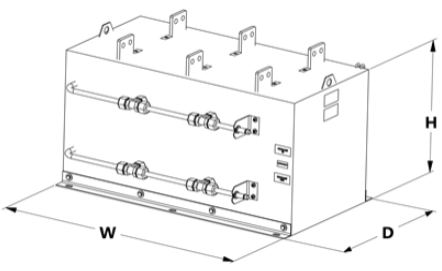


Figure F2:



info@ctmmagnetics.com
480.967.9447

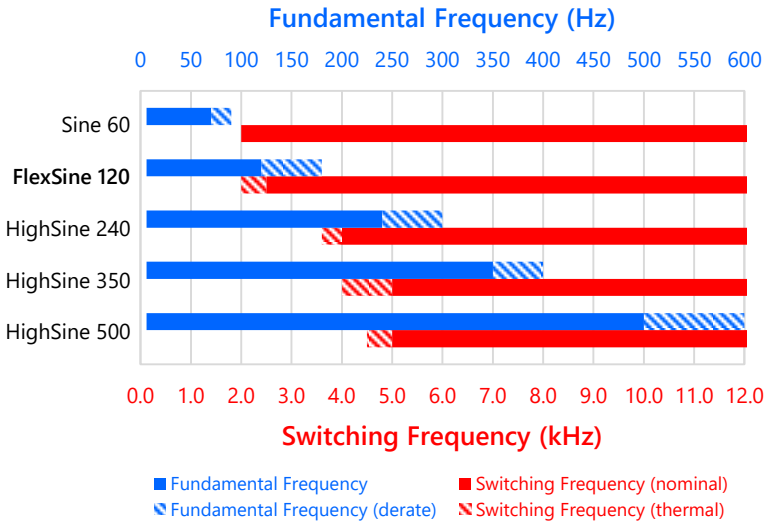
THE IDEAL FILTER FOR EVERY APPLICATION

SINE WAVE FILTERS

CTM Magnetics offers a broad portfolio of sine wave filters to meet all your motor filtering needs.

- **Sine 60** - The optimal choice for 60 Hz motor protection. Designed for up to 70 Hz fundamental and 2+ kHz switching frequency.
- **FlexSine 120** - For both induction and PM motor applications. Designed for up to 120 Hz fundamental (180 Hz with derate) and 2.5+ kHz switching frequency.
- **HighSine 240** - Perfect for high-speed, PM motor applications (240 Hz). Designed for up to 240 Hz fundamental and 4+ kHz switching frequency.
- **HighSine 350** - Perfect for high-speed, PM motor applications (350 Hz). Designed for up to 350 Hz fundamental and 5+ kHz switching frequency.
- **HighSine 500** - Perfect for high-speed, PM motor applications (500 Hz). Designed for up to 500 Hz fundamental and 5+ kHz switching frequency.

Filter Operating Ranges



GRIDHAWK® FILTERS

CTM Magnetics offers cutting edge GridHawk Harmonic filters to meet all your front end needs. CTM also provides a 5 year capacitor warranty on all GridHawk products.

- **GridHawk** - The optimal choice for grid protection. Designed to handle input voltage distortion of ≤5% THVD.
- **GridHawk HD** - For applications where the voltage distortion is ≤15% THVD, GridHawk HD is your choice for grid protection. GridHawk HD beats any other passive harmonic filter, AFE (Active front end), or 18 pulse drive available on the market. Where everyone else fails, we succeed.
- **GridHawk XD** - For applications where the voltage distortion is ≤25% THVD, contact CTM for XD solutions.

GRIDHAWK® HD

BUILT TO SURVIVE.
WE GUARANTEE IT.

CTM magnetics
Small. Quiet. Efficient. Reliable.

Additional information is available online:
ctmmagnetics.com
Contact us online at:
ctmmagnetics.com/contact-us

Order Your FlexSine™ 120 Sine Wave Filter

Scan for CTM:

Final product specifications subject to change

CTM Magnetics, Inc.
710 W Geneva Drive • Tempe, AZ 85282
480.967.9447 • ctmmagnetics.com • Contact Us