

# Cooling Solutions

for the lighting industry

# ebm apst

The engineer's choice



## About ebm-papst North America



### Headquarters - Farmington, CT

- » 250,000 square feet
- » 20 Regional offices
- » Acoustic testing chamber
- » Complete air testing lab on site
- » ISO 9001 and ISO 14001 Certifications
- » Distribution centers in Farmington (CT) and Toronto, Canada

With offices in major cities throughout North America, our highly-skilled and experienced team of professionals are ready to tackle your air moving challenges with solutions that meet your requirements. ebm-papst serves all markets including IT & Telecommunications, Ventilation, Air-Conditioning, Refrigeration, Gas & Heating, Household Appliances, LED/Lighting, Industrial, Drive Systems, Transportation, Agriculture, Medical, and more. Our customers can always count on prompt, courteous service. Customer satisfaction is our number one priority.

### Expert support when and where you need it

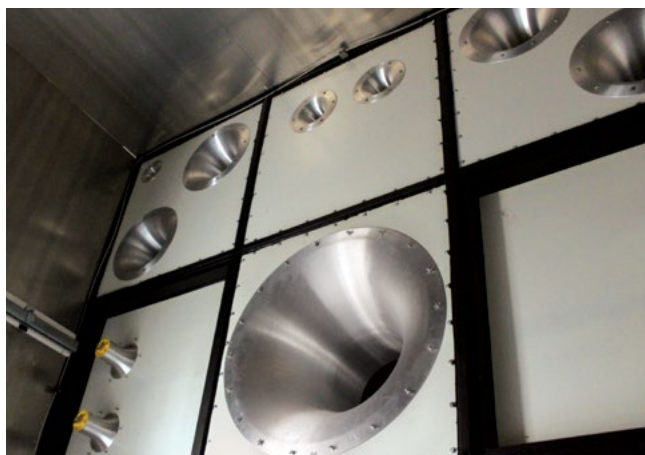
Knowledgeable field sales professionals are close by for face-to-face meetings. Dedicated inside sales associates fulfill all your ordering requirements. To assist you with order management, our customer service department provides automated services such as shipment notifications, reorder notifications, and invoicing.

### Expert design and manufacturing

Beginning with the initial product concept, our application engineers work in tandem with customers to select the best air moving solution to suit specific goals and requirements. Once the prototype has been established, it can then be tested in our state-of-the-art airflow testing chambers, allowing for the optimization of all air moving solutions. Each chamber has been designed to meet AMCA 210 and ISO 5801 requirements. In addition to our airflow testing capabilities, ebm-papst can conduct comparative sound, temperature, and velocity tests. The electrical engineering team can design simple fan controllers for monitoring fan speed, or complex controllers and power supplies, filtering, and specific communication protocols.

### Logistics and inventory management programs

We have over 90,000 square feet of climate-controlled warehousing at our facilities offering real-time inventory transactions and bar-coded inventory. Inventory management programs such as Kanban, demand/pull, safety stock, consignment, and local warehousing can be customized to your needs.



## About ebm-papst Worldwide

### Passionate about air technology and drive engineering

The ebm-papst product portfolio now numbers over 14,500 products. Thus we offer the right solution for almost every air technology and drive engineering task. In addition, we work with you to develop very customized solutions that extend beyond our current product line. This is made possible by our extensive team of over 500 dedicated engineers and technicians out of our three central locations in Germany.

### World Headquarters: Mulfingen, Germany

- » Elektrobau Mulfingen GmbH & Co. KG (ebm) established in 1963
- » Manufacturing Plants: Germany, Hungary, USA, Slovenia, India, China, Czech Republic and Italy
- » Worldwide Revenue / Sales: Over 1.5 Billion
- » 57 Sales and Distribution Groups Worldwide
- » 11,000+ Employees Worldwide
- » Ship Over 46 Million Products Annually
- » Certifications: ISO 9001, ISO 14001 & RoHS Compliant
- » Over 1,000 Patents Held in Fan/ Motor Design

### Core competencies: motor technology, aerodynamics and electronics

Our innovative technologies keep turning into new industrial standards. Our advantage: We consider aerodynamic relationships as a whole. Thus we combine benchmark-setting motor technology with the intelligence of state-of-the art electronics and aerodynamically optimized shapes. The

system solution that result from these three core competencies have a synergy that is unique in all the world and make up the majority of our product line.

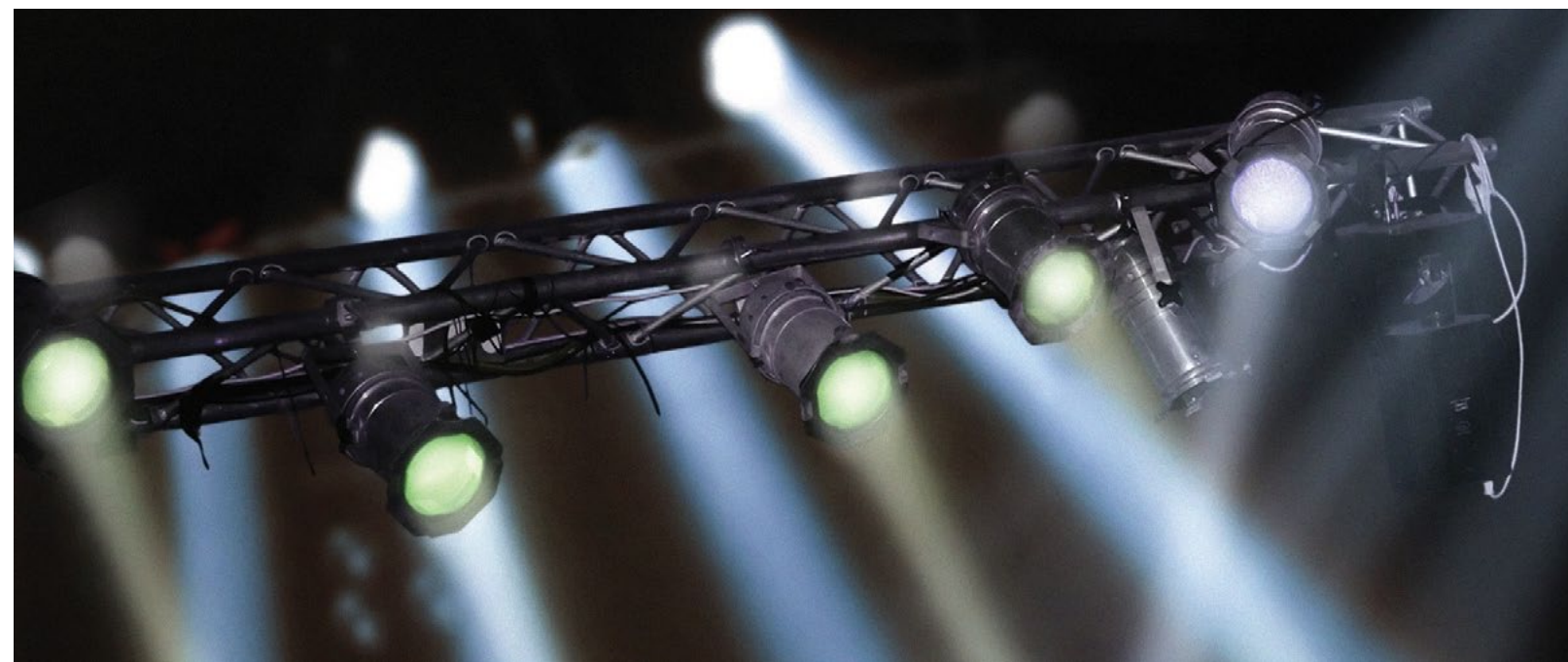
### GreenTech EC technology: Our motor for the future

Virtually our entire product range is now available with GreenTech, the leading edge EC technology. The wear-free and maintenance-free performance, the longer service life, the noise reduction, the intelligent electronic control, the higher efficiency, along with unparalleled energy efficiency when compared to conventional AC Technology makes GreenTech EC motors from ebm-papst the future of air moving technology.

### Passion, quality and responsibility: Three reasons for our success

Only real passion for fans and motors makes the highest level of achievement possible. With a clear organizational structure, flat hierarchies and a high degree of personal responsibility, we create the perfect foundation - not only technological innovation, but also for excellent service and active dedication to closely working with our customers.

Of course, our products are also produced with the highest quality - at a total of 17 product sites worldwide. Our quality management is uncompromising, everywhere and in every process stage. This is also confirmed by our certification of compliance with the international standards DIN EN ISO 9001, ISO/TS 16949-2 and the standard DIN EN ISO 14001.





Cooling solutions for the lighting industry

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The symbol of our commitment

GreenTech is a name put to the philosophy ebm-papst has used for decades: “each new product that we develop has to be better than its predecessor in terms of economy and ecology.” Our company philosophy is not just for designing new and more efficient fans and blowers; it is in practice in the offices and factories, locally and internationally. At the U.S. headquarters, two separate arrays of solar panels have been installed to provide the engineering building with electricity, along with additional renovations that make the facilities even more environmentally friendly.

GreenTech symbolizes our continuous commitment, achievements, and passion to provide customers with high quality products through the use of modern development and production methods, responsible business practices and initiatives that benefit not only the user, but the environment as well.

What is EC Technology?

EC technology is an important factor in our GreenTech philosophy. ebm-papst EC fans use permanent magnet external rotor DC motors with fully integrated electronic commutation (EC) and AC to DC power conversion. EC motors give the flexibility of connecting to AC mains with the efficiency and simple speed control of a DC motor. With EC fans, the user benefits from the innovative commutation without wear-and-tear on the motor. The EC motor compares to the direct current shunt-wound motor except that the magnetic field is generated by permanent magnets inside the rotor.

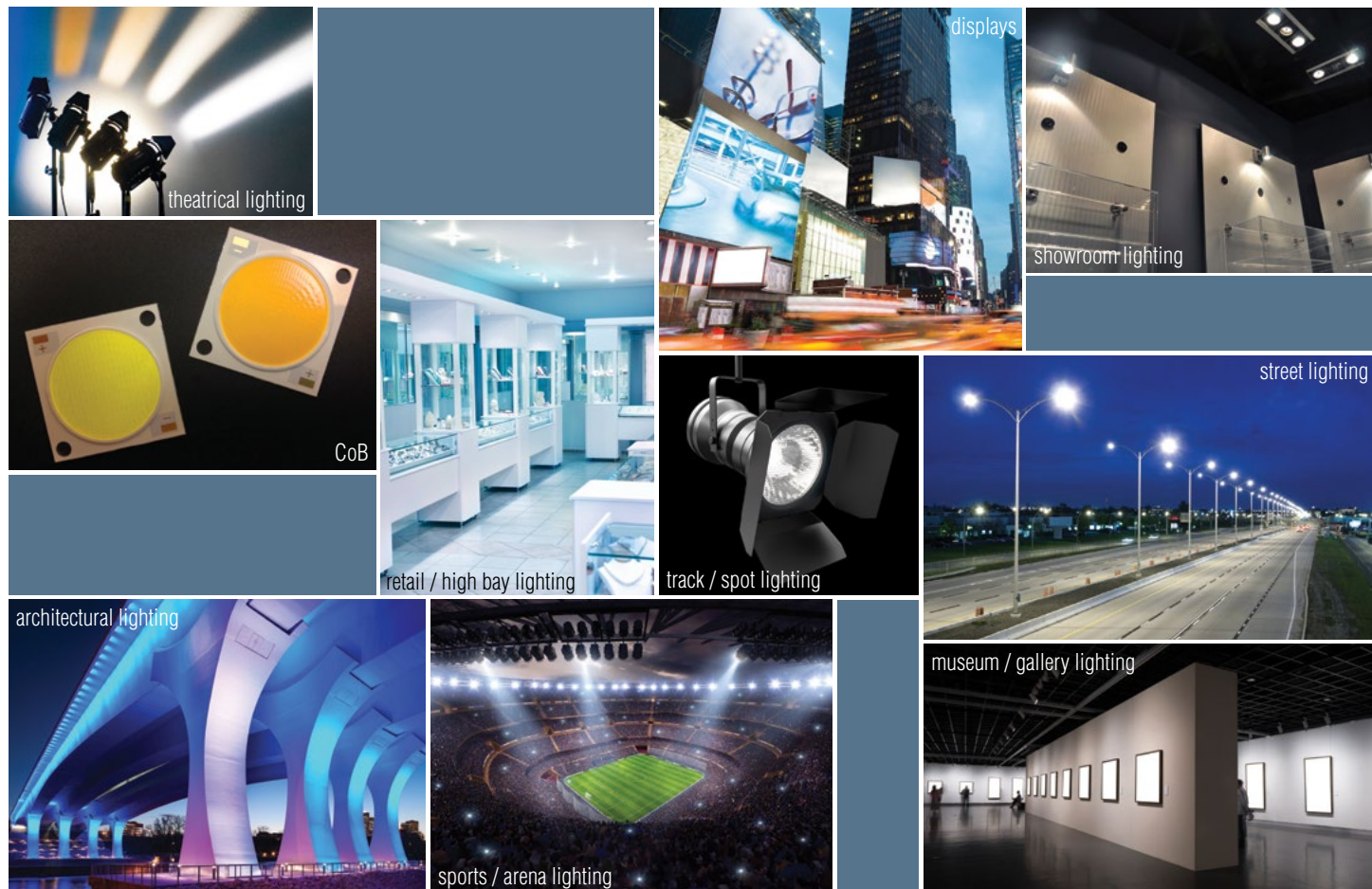
With this technology, EC motors and fans can be easily controlled, are maintenance-free, offer outstanding efficiency and have a considerably long service life. The variable speed range possible in EC technology makes using a multitude of individual models a thing of the past.

Our R&D efforts are not only focused on saving energy. In terms of air performance and low noise, our products exceed the toughest specifications. EC technology pays off for every owner or operator, while conserving precious energy resources. When you use intelligent ebm-papst EC technology in your applications, everyone wins - companies, customers, and the environment.





## Market Overview




### The LED market

With high visible light, low radiant energy, and no infrared or ultraviolet light, LEDs are the most efficient light source in the lighting market today. While as much as 80% more energy efficient than traditional incandescent lighting, LED components still create a considerable amount of heat. High temperatures can cut the lifespan of an LED light in half. Temperatures over the maximum rated junction can quickly weaken the lumen output and the color quality of LEDs.

By dissipating the heat emitted by the LED light source, the efficiency and length of life of the light source can increase exponentially. Thermal management is a key factor in lumen output. For high-lumen output applications, passive cooling is not enough. In order to reach the desired lumen values in a small form factor, active cooling is the perfect solution to

effectively disperse the heat produced by LED components. Active cooling solutions are a new contender in LED thermal management systems. Dissipating heat directly from the core of the modules allows for less thermal resistance, making the entire assembly more efficient. Active cooling technology offers thermal capabilities that are superior to passive heat sinks and can raise performance while significantly reducing the size of the lighting fixture. With industry-leading German-engineered compact fans and American-designed assemblies, ebm-papst can provide the perfect cooling solution for your LED application. One of the most significant advantages that ebm-papst fans have on the life of the LED light is due to the reliability of our products. With active cooling solutions far surpassing the 50,000+ hour promise the industry is accustomed to, an ebm-papst fan is now the LED light's most efficient cooling source.

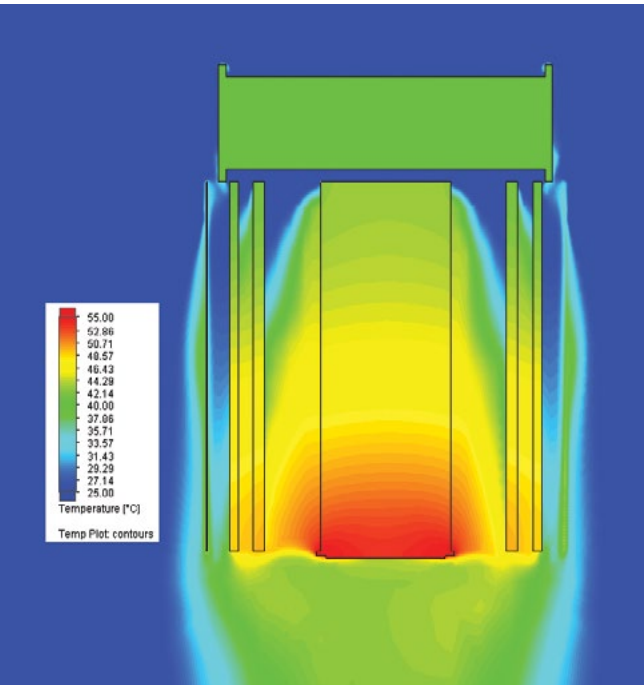
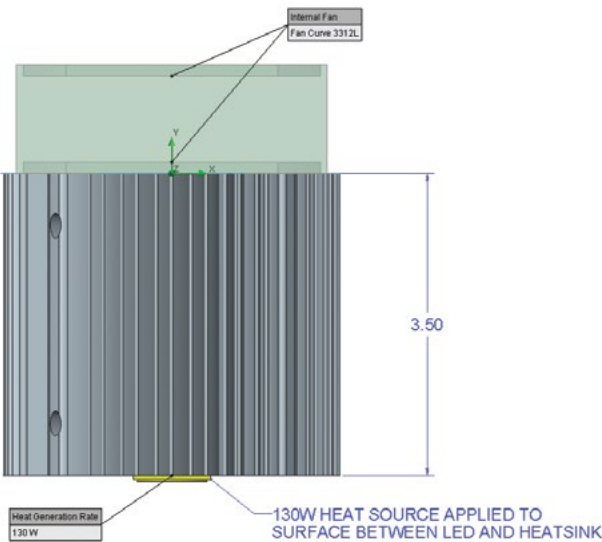
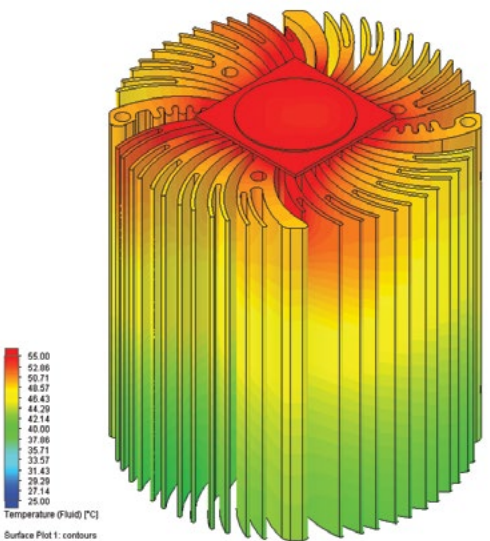
## Service Life

Service Life		Series	Dimensions	Max. T environment	Lifetime	Lifetime
Type			mm	°C	hrs	yrs
Axials		400, 400F	□ 40 x 10 / 20	-20 + 85°C <sup>1</sup>	120,000 / 90,000	13.7 / 10.3
		500F	□ 50 x 15	-20 + 85°C <sup>1</sup>	120,000	13.7
		600F, 620	□ 60 x 15 / 25	-20 + 85°C <sup>1</sup>	120,000 / 305,000	13.7 / 34.8
		8200J, 8400N, 8450	□ 80 x 38 / 25	-20 + 70°C <sup>2</sup>	237,500 / 305,000 / 305,000	27.1 / 34.8 / 34.8
		3200J, 3400N	□ 92 x 38 / 25	-20 + 70°C <sup>2</sup>	265,000 / 305,000	30.3 / 34.8
Radials		4100N, 4300, 4400F, 4400FGLLA	□ 119 x 38 / 32 / 25	-20 + 75°C <sup>3</sup>	305,000 / 322,500 / 285,000	34.8 / 36.8 / 32.5
		RLF35	□ 51 x 15	-20 + 70°C <sup>3</sup>	227,500	26
		RL48	□ 76 x 27	-20 + 70°C <sup>2</sup>	265,000	30.3
		RL65	□ 97 x 93.5 x 33	-20 + 70°C <sup>2</sup>	227,500	26

Note: <sup>1</sup>-4 to 185°F; <sup>2</sup>-4 to 158°F; <sup>3</sup>-4°F to 167°F. Life Expectancy L10 per IPC 9591 at 20°C ambient. Values are dependent on speed and application.

Computational Fluid Dynamics (CFD)

- Flow simulations using Mentor Graphics FloEFD software
- Ability to optimize active cooling solutions in conjunction with lamp design
- Predictive analysis of thermal performance and LED junction temperature
- Validation of results using ebm-papst thermal resources



A new technology for the LED Market

“Today’s high-performance LEDs, particularly the type known as “Chip-on-Board” (CoB), are the fastest-growing package style for lighting. CoBs are arrays of small die placed together under a single phosphor pour. There are many LED cooling technologies; yet, few have truly addressed the unique requirements of LED systems. ebm-papst, one of the most innovative manufacturers of precision fans and blowers, has introduced their Active Cooling solutions - small, specialized fan/heat sinks engineered expressly for high-power LED applications.

ebm-papst’s fan mechanism offers a particularly reliable service life in the hundreds of thousands of hours (> 300K with certain models). Designed to be nearly silent, each fan is enclosed in an acoustic isolation ring, bringing the net acoustic noise to less than 7dB. A very impressive noise reduction when compared to background noise in a quiet office usually about 40 dB. When used with a CoB device, the cooling fan effectively lowers the heat temperature to 90° F/36° C. Typically, CoB devices should be kept at less than 120°C. Using the ebm-papst cooling devices provides far lower temperatures than required parameters. In addition to significant noise and heat reduction, ebm-papst offers an impressive 5-year warranty on fans - far exceeding the life-span of most CoBs. Regardless of manufacturer, we think the ebm-papst active cooling solution is an excellent approach – almost a “platform” - for all CoB lighting systems.”

Benefits of using ebm-papst cooling solutions

- German-engineered compact fan
- American-designed assembly
- Approved reference design through Xicato
- Life expectancy: in excess of 87,500 hours at ambient temperatures up to 40°C
- Industry leading high reliability: 5 year warranty on the 612FL-698 fan cooling modules (see table below)
- 100% end of line testing
- Low noise: Custom acoustic isolation ring
  - Solutions operate as low as 7 dB(A)
  - A quiet office has a background noise of about 40 dB(A)
- High efficiency motor design
- Thermal protection: Thermal isolation ring
- Mounting feature for PG1W-12-60-M3BN is the same Xicato reference design heatsinks (XSA-38)

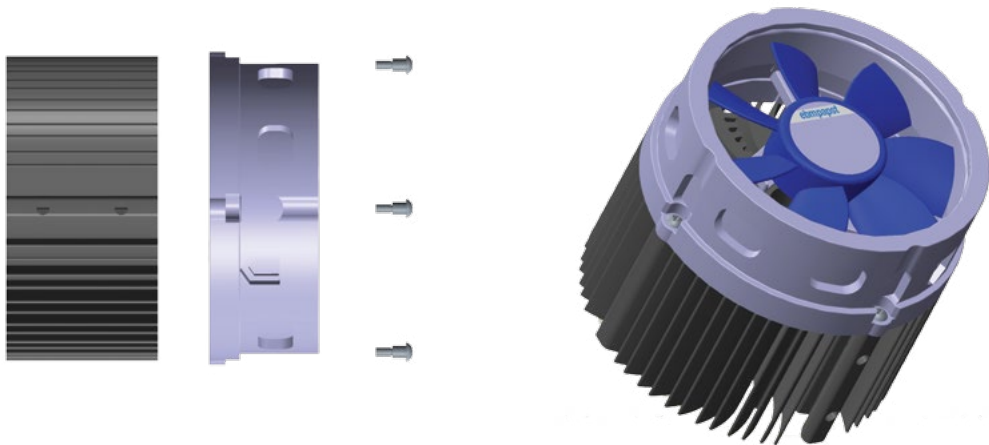


Nominal Data		Nominal voltage	Acoustic noise	Thermal power dissipation capability	Fan speed	Heat sink mass	Power input	Lifetime (at 20°C)	Lifetime (at 40°C)		
CoB / LED OEM	Type	VDC	dB(A)	W	rpm	g	W	hrs	yrs	hrs	yrs
Bridgelux Vero 29	PG1W-012-092-05	12	23	130	1850	1500	0.8	137,500	15.7	80,000	9
Bridgelux Vero 10/13/18	PG1W-012-060-13	12	7	60	1700	200	0.18	197,500	22.5	87,500	10
Cree CXA	PG1W-012-060-07	12	7	50	1700	229	0.18	197,500	22.5	87,500	10
Cree LMH2	PG1W-012-060-11	12	7	73	1700	210	0.18	197,500	22.5	87,500	10
Phillips SLM	PG1W-012-060-06	12	7	50	1700	212	18.0	197,500	22.5	87,500	10
Xicato XSM	PG1W-12-60-M3BN	12	7	38	1700	212	0.18	197,500	22.5	87,500	10
Xicato XLM	PG1W-12-60-L3BN	12	7	53	1700	276	0.18	197,500	22.5	87,500	10
Note: Voltages are based on the 612F base fan model. Other voltages available upon request. Life Expectancy L <sub>50</sub> per IPC 9591.											

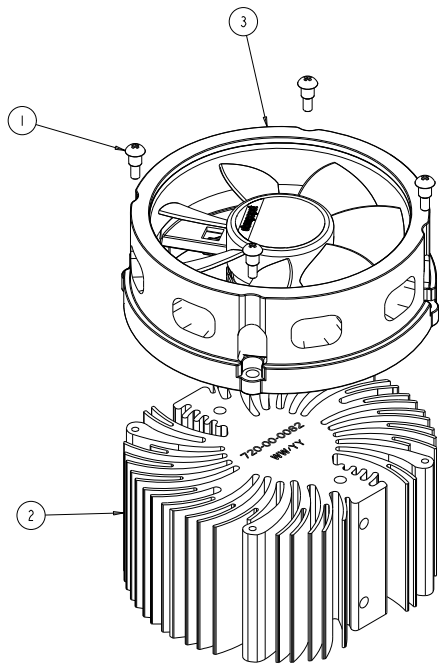


# Bridgelux Vero 10/13/18 Technical Data

PG1W-012-060-13



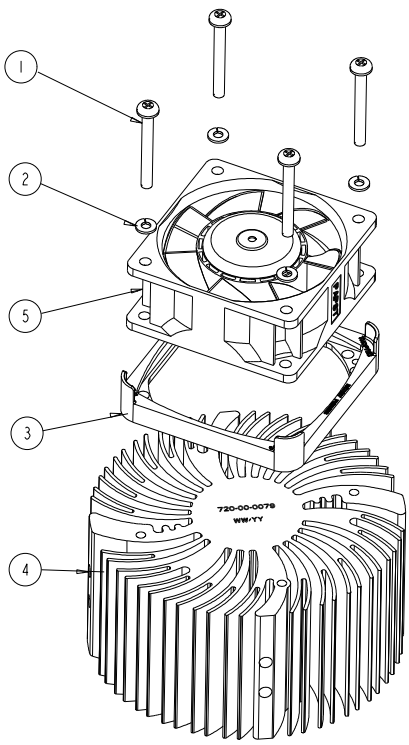
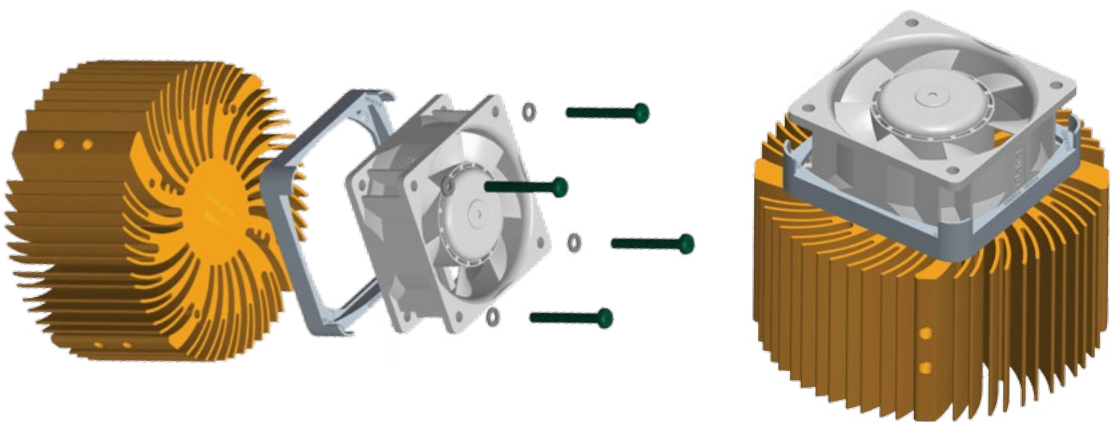
ebm-papst MFG. NOTES			
1	ASSEMBLE ID LABEL APPROX. 2" FROM FAN, FLAG STYLE, ON WIRE LEADS.		
2	USE 600-15-0880 PACKAGING KIT.		



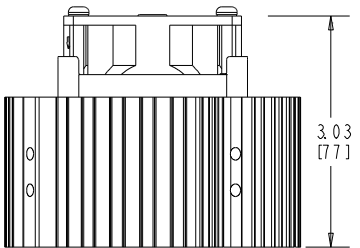
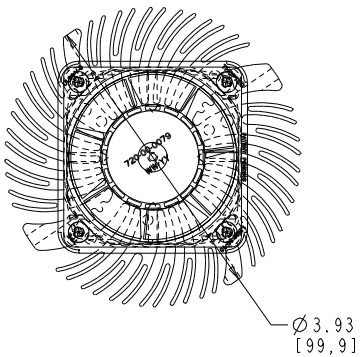
ITEM	QTY	PART NUMBER	DESCRIPTION
3	1	612FL-698	12DC/11.2CFM/0.4W/SB/2650
2	1	720-00-0082	35-00044 HEATSINK
1	4	300-50-0012	CUSTOM M2 SHOULDER SCREW
PGIW-012-060-13			

# Bridgelux Vero 29 Technical Data

PG1W-012-060-09



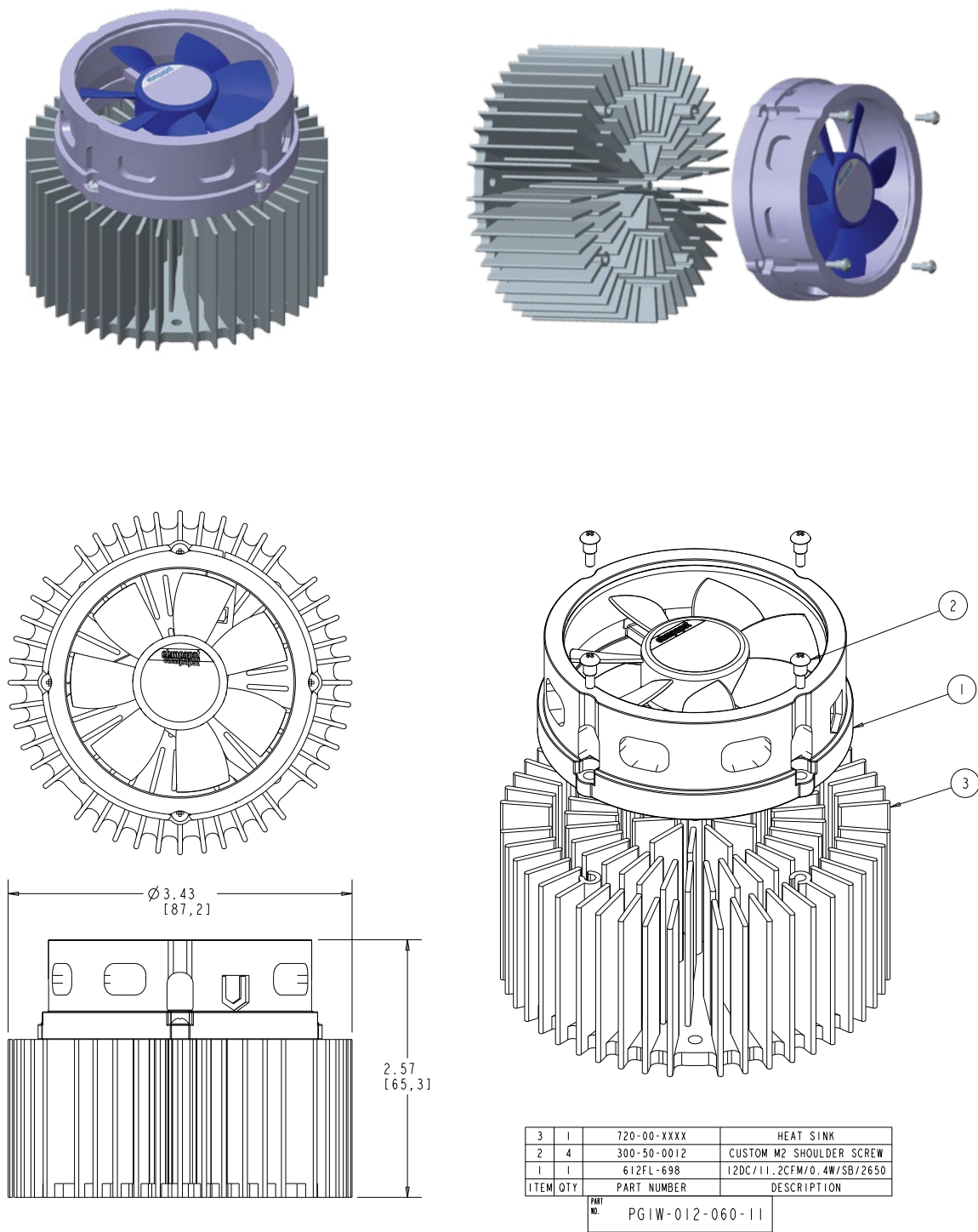
ebm-papst MFG. NOTES			
1	ASSEMBLE ID LABEL APPROX. 2" FROM FAN, ON WIRE LEADS.		
2	TRIM ISOLATOR NUBS FLUSH, 4 PLACES.		
3	AFTER ASSEMBLY, ROUTE WIRES THROUGH CLOSEST HEATSINK CHANNEL, PRIOR TO PACK.		



ITEM	QTY	PART NUMBER	DESCRIPTION
6	1	605-50-5515	ID LABEL
5	1	612NMLE	12V 14.7CFM 0.4W
4	1	720-00-0079	PGIW-012-060-09 HEATSINK
3	1	700-00-1105	QLM-60-30-10 QUALTEK ISOL
2	4	305-51-0005	M3 INTERNAL TOOTH LOCK WASHER
1	4	300-51-0065	M3 X 30 PH PAN SCREW

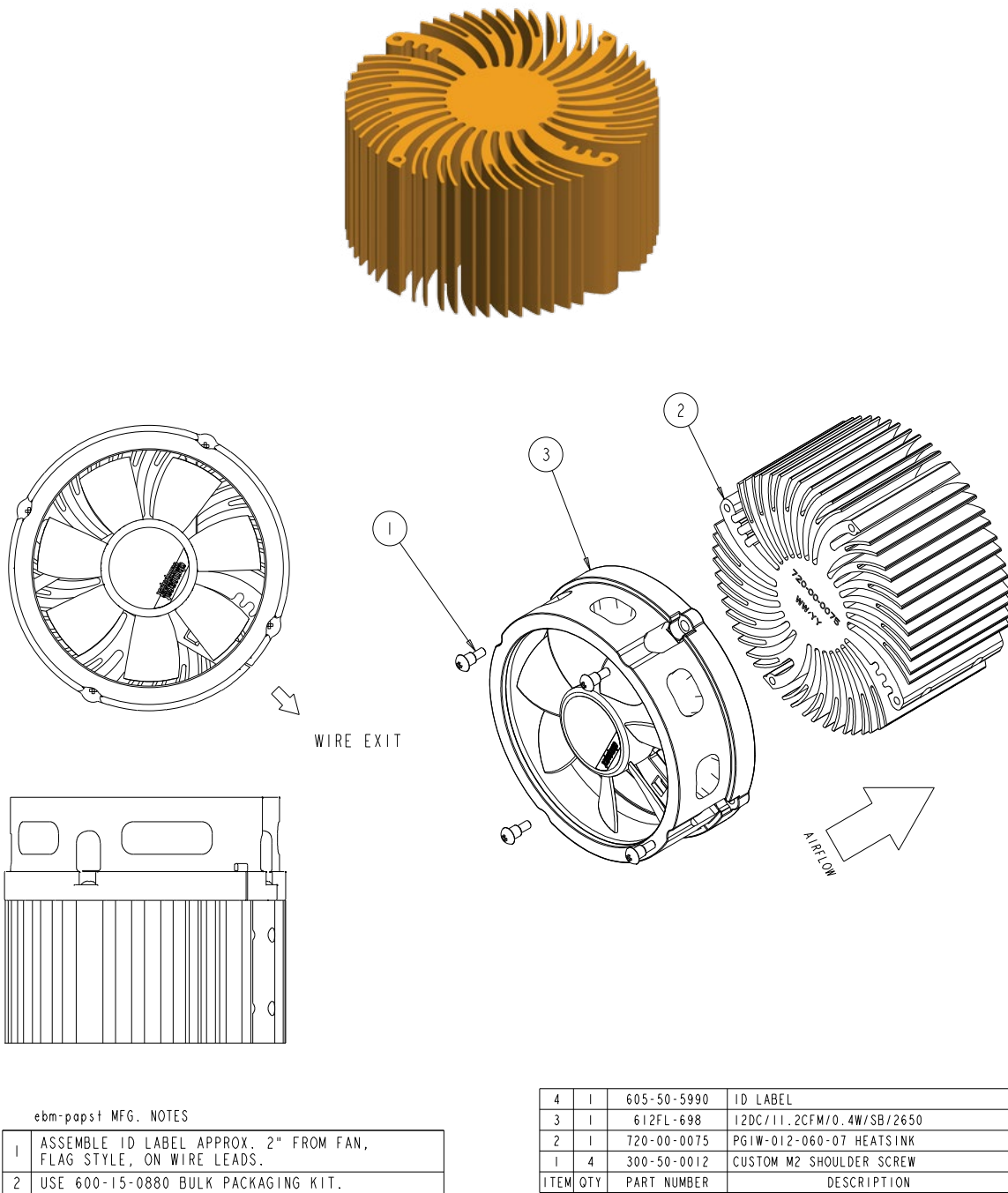
Cree LMH2 Technical Data

PG1W-012-060-11



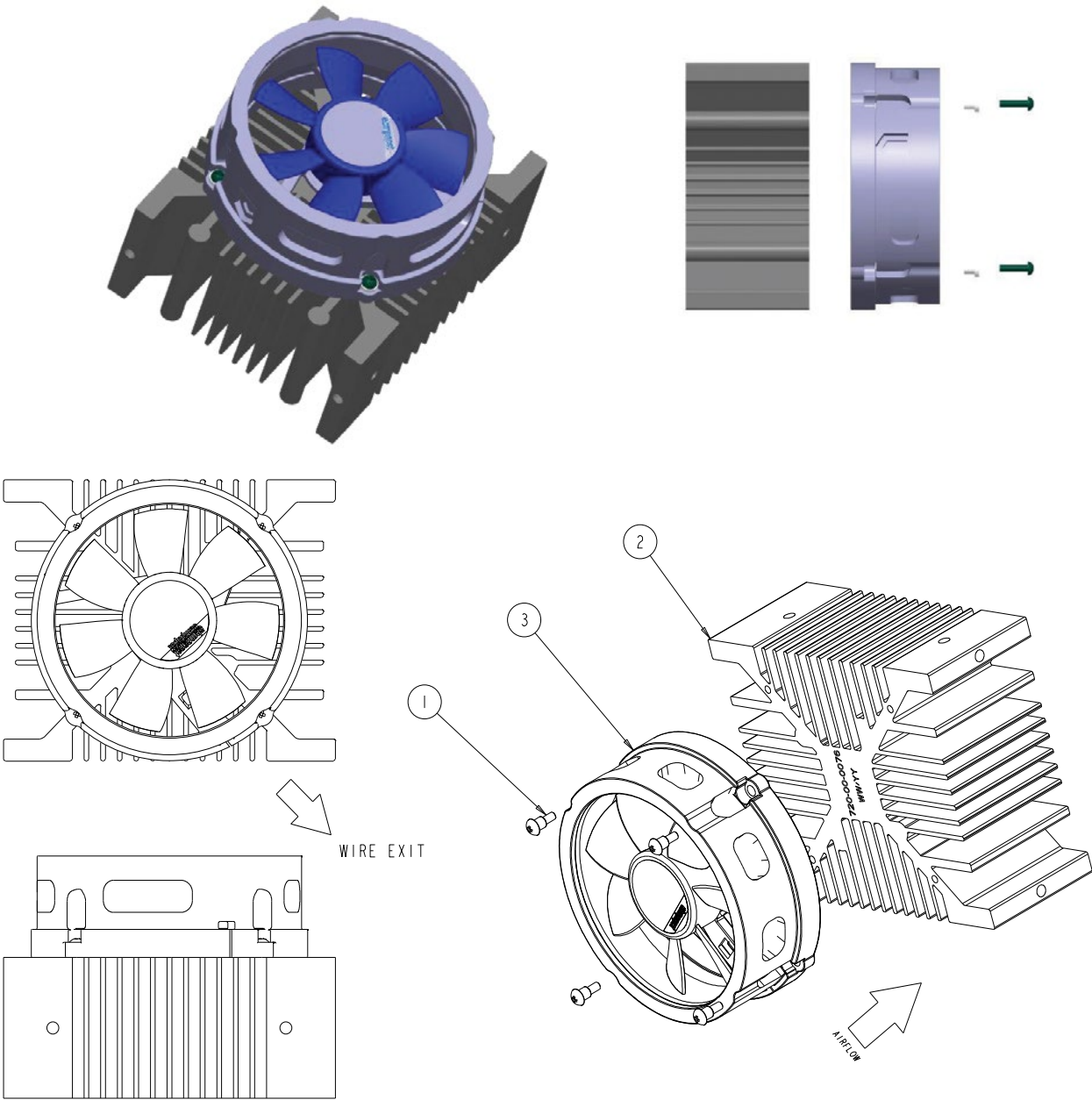
Cree CXA Technical Data

PG1W-012-060-07



Cree CXA Technical Data

PG1W-012-060-08



1	ASSEMBLE ID LABEL APPROX. 2" FROM FAN, FLAG STYLE, ON WIRE LEADS.
2	USE 600-15-0880 BULK PACKAGING KIT.

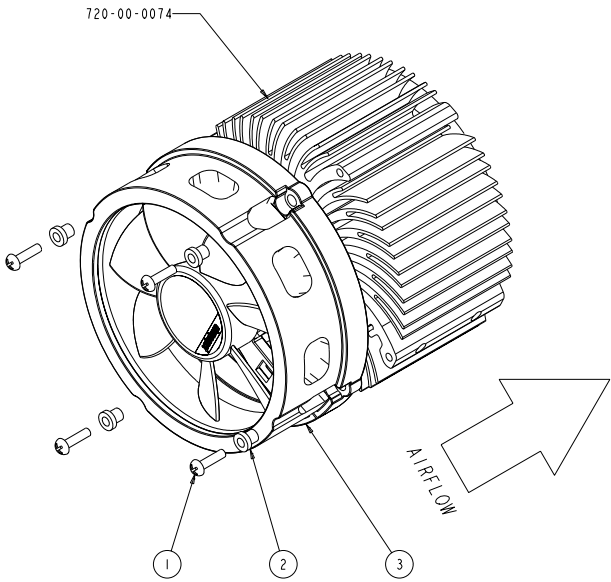
4	1	605-50-5991	ID LABEL
3	1	612FL-698	120C/11.2CFM/0.4W/SB/2650
2	1	720-00-0076	PG1W-012-060-08 HEATSINK
1	4	300-50-0012	CUSTOM M2 SHOULDER SCREW
ITEM QTY		PART NUMBER	DESCRIPTION
PART NO. PG1W-012-060-08			

Phillips SLM Technical Data

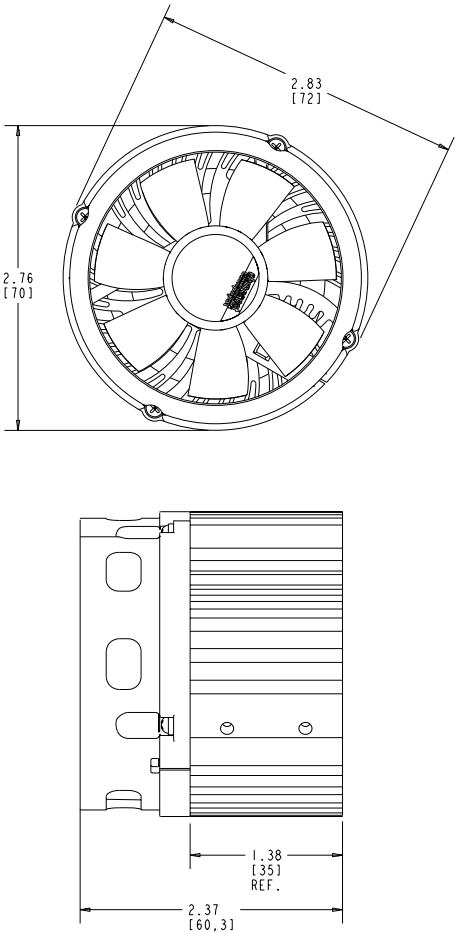
PG1W-012-060-06



1 ASSEMBLE ID LABEL APPROX. 2" FROM FAN ON WIRE LEADS.



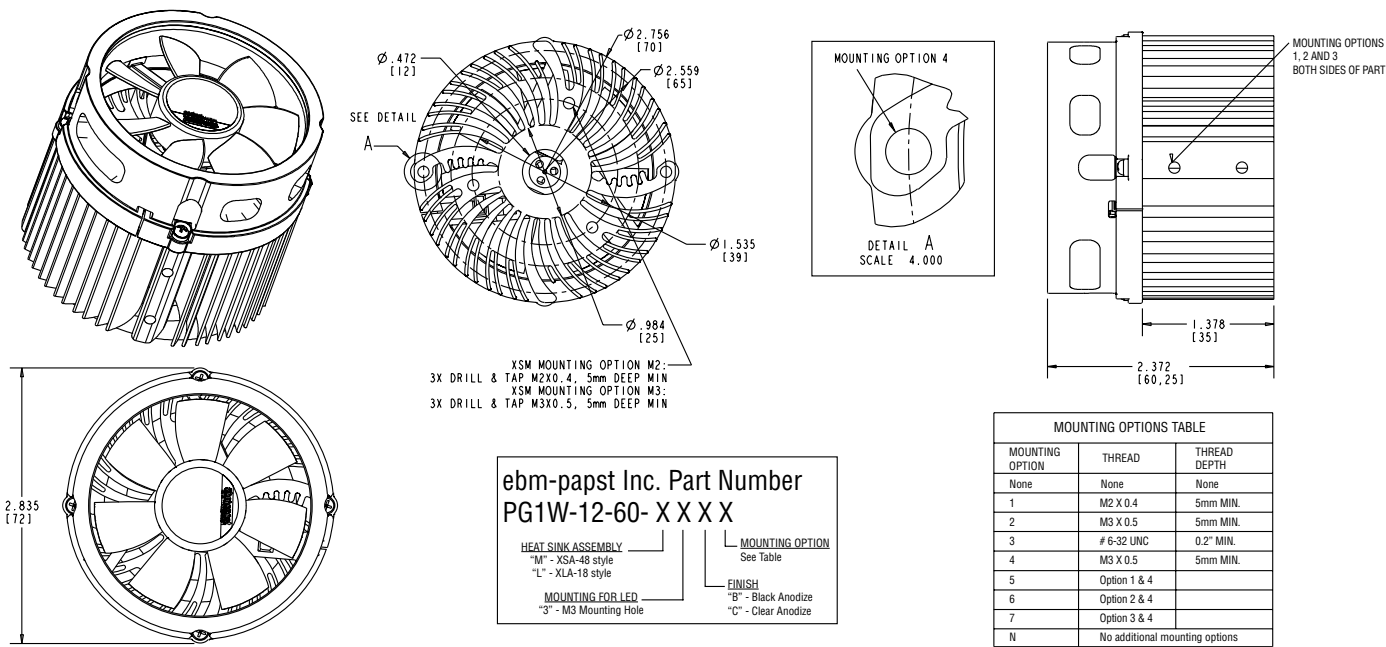
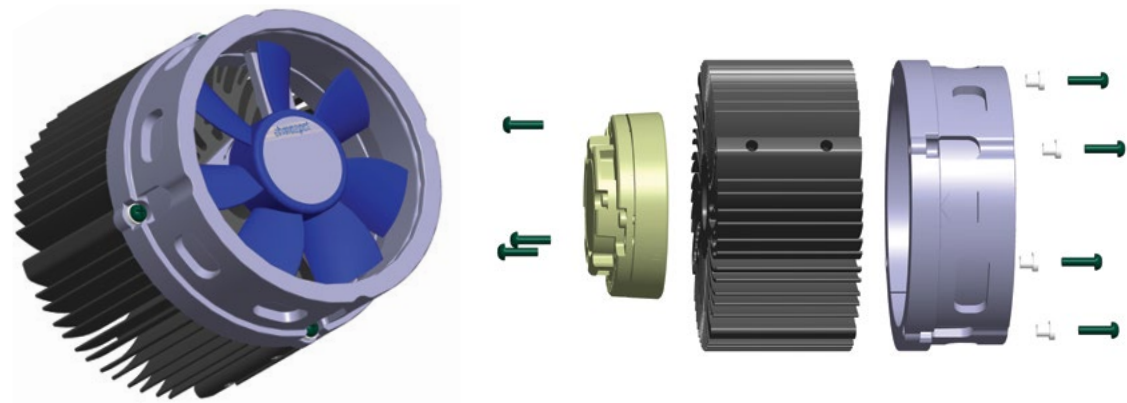
4	1	605-50-5386	I.D. LABEL
3	1	612FL-698	120C/11.2CFM/0.4W/SB/2650
2	4	305-11-0005	MCMASTER SHOULDER WASHER
1	4	300-50-0011	M2 X 8 PH PAN M/S ZINC
ITEM QTY		PART NUMBER	DESCRIPTION
PART NO. PG1W-012-060-06			





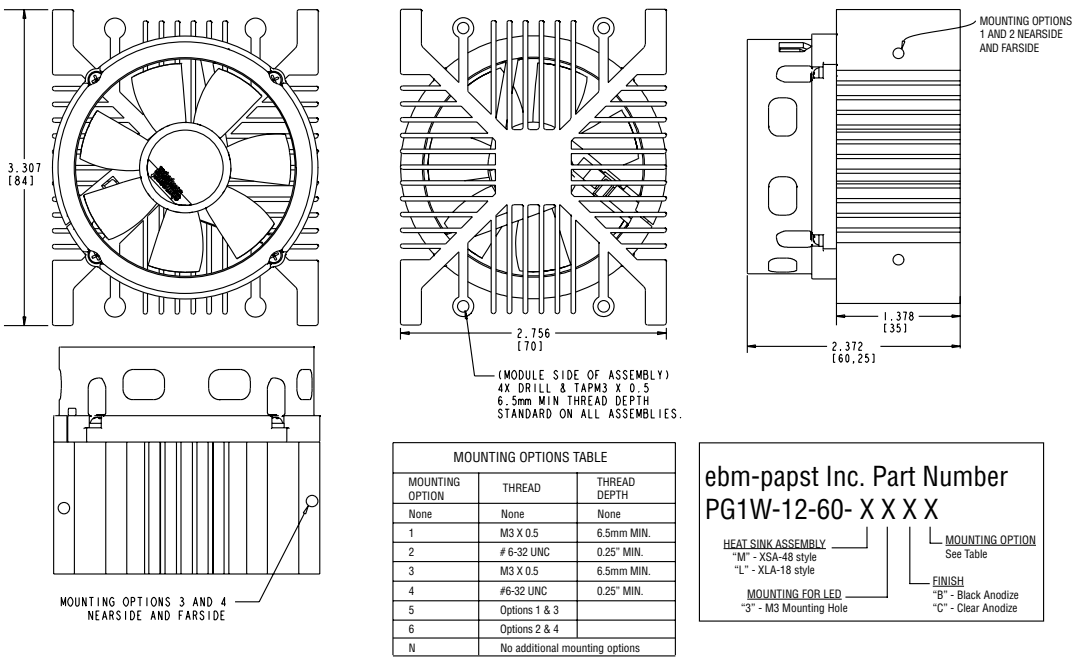
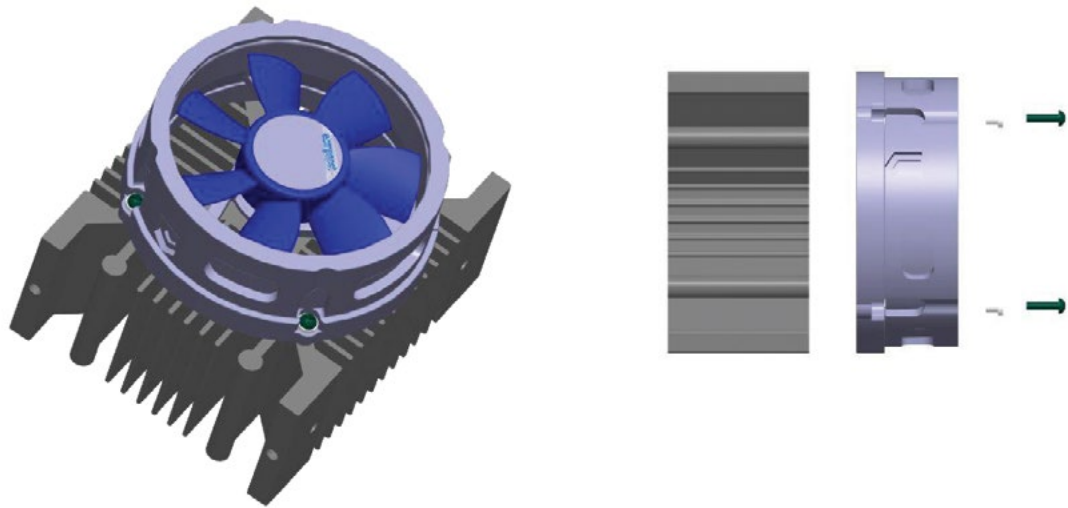
Xicato XSM Technical Data

PG1W-12-60-M3BN



Xicato XLM Technical Data

PG1W-12-60-L3BN





Notes



**ebm-papst Inc.  
North America**

100 Hyde Road  
Farmington, CT 06034  
Phone + 1 860-674-1515  
Fax + 1 860-674-8536  
sales@us.ebmpapst.com  
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The engineer's choice