Pfannenberg ADVANTAGE SERIES

Water-Cooled Solutions guide



The complete water-cooled solution for industrial control enclosures.

SHARING COMPETENCE

Pfannenberg
ELECTRO-TECHNOLOGY FOR INDUSTRY

Pfannenberg
ELECTRO-TECHNOLOGY FOR INDUSTRY



For over 50 years Pfannenberg has been a leader in thermal management solutions. From simple Fan Cooling and Packaged Air Conditioners to more complex water cooled applications, our expertise helps ensure industrial electronics operate at peak efficiency and extended service life.

Heat is a single common by-product of today's manufacturing machines that include the advanced automation technology required for both high speed operation and high precision. Components such as spindle motors, variable frequency drives, laser and x-ray sources all require cooling to operate properly and reliably - most often in very adverse manufacturing environments. Pfannenberg provides cooling solutions for a wide variety of equipment including machining centers, printing presses, wood working machines, welding systems, packaging machines and food processing machines, this experience allows us to apply proven cooling technology to new applications as well.

Our application engineering team works to match our standard products with as many applications as possible and also works closely with our product engineers to offer custom solutions when required. This continuous interaction allows continuous product development that is always in keeping with the ever changing needs of the market.

Understanding Thermal Management Products

Filterfans are appropriate when ambient air conditions are relatively cool and clean.

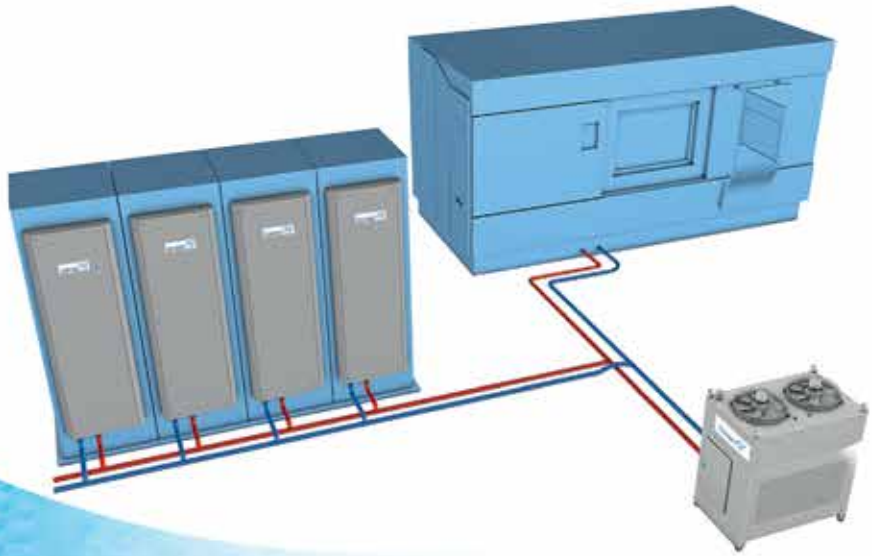




Air Conditioners provide a convenient packaged cooling solution for high ambient temperatures.

Water Cooling Products like our Air/Water Heat Exchangers, Water Cooled Air Conditioners and Packaged Water Chillers provide efficient cooling solutions when ambient conditions are at their worst.

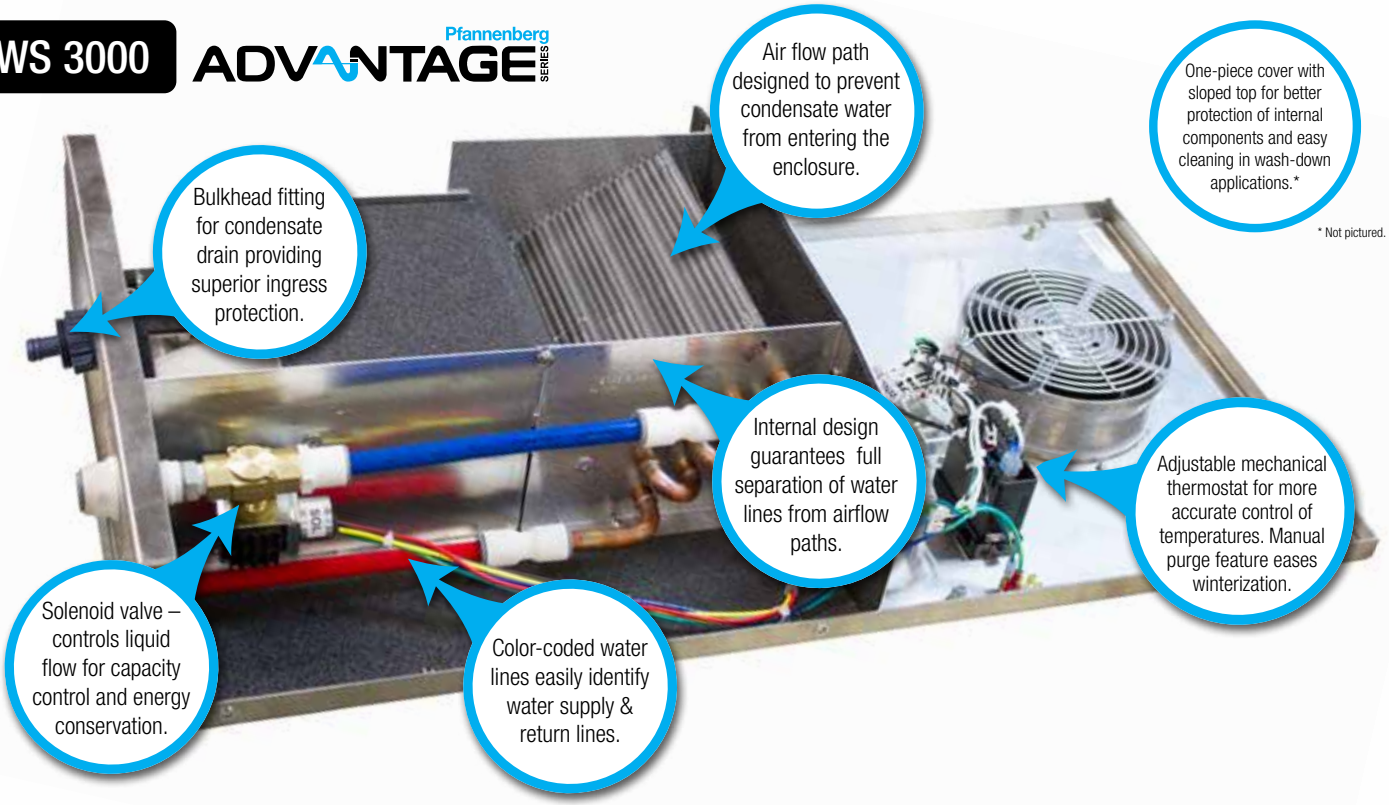




Cooling Electronics with Water

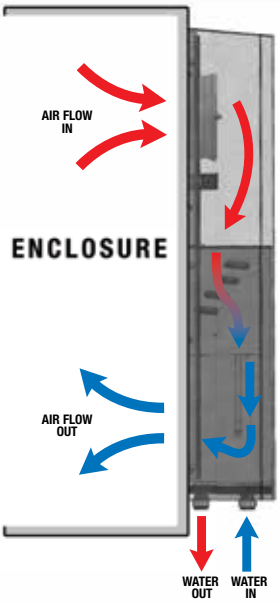
We understand that many users are hesitant to introduce a water-based cooling solution for electronic enclosure cooling. Over the years Pfannenberg's water cooled products have successfully cooled thousands of electronic applications worldwide. **So how do we do this?**

PWS 3000 Pfannenberg ADVANTAGE SERIES



Understanding Air Flow

Heated air is drawn from the top of the enclosure, cooled in the heat exchanger's water coil and delivered at the bottom in keeping with natural air circulation. The wide separation between the air inlet and air outlet prevents short circuiting.



How do I know if water works for me?

- ☑ High Ambient
- ☑ Airborne Particulate
- ☑ High Utility Costs
- ☑ Multiple Units Needed
- ☑ Frequent Wash-down

Pfannenberg ELECTRO-TECHNOLOGY FOR INDUSTRY

Where Do We Get The Water From?


Well Water


City Water


Chiller


Cooling Tower Water

UNDERSTANDING THE BENEFITS OF **CLOSED-LOOP LIQUID COOLING OF INDUSTRIAL PROCESS & ELECTRONICS**

WITH MANUFACTURING SPACE AT A PREMIUM, MACHINE PACKAGES HAVE BECOME SMALLER AND LIQUID COOLING HAS EMERGED AS THE MOST EFFICIENT AND ECONOMICAL MEANS OF REMOVING PROCESS HEAT. LIQUID COOLING IS ESPECIALLY WELL ADAPTED TO HOT, DIRTY ENVIRONMENTS WHERE IT PROVIDES A METHOD OF REMOVING THE HEAT NOT ONLY FROM THE MACHINES, BUT ALSO FROM THE FACTORY ITSELF.

APPLICATIONS THAT CAN BENEFIT FROM WATER COOLING SOLUTIONS

AUTOMOTIVE
- SPINDLE MOTORS
- HYDRAULICS
- AUTOMATION DRIVES
- AUTOMATIC WELDERS

ENERGY
- SOLAR INVERTERS
- BOILER CONTROLS
- POWER PLANT ELECTRONICS

FOOD / BEVERAGE & PHARMACEUTICAL
- INGREDIENT MIXERS
- PRODUCT COOLING/DRYING
- PACKAGING AUTOMATION
- INSPECTION SYSTEMS
- OVEN CONTROLS

PAPER & PRINTING
- CHILL ROLLER COOLING
- INK COOLING
- CONVERTING MACHINES
- LAMP COOLING

WATER / WASTEWATER
- PUMP DRIVES

PLASTIC MANUFACTURING
- INJECTION MOLD COOLING
- EXTRUDER COOLING
- BLOW MOLD AIR COOLING
- MACHINE CONTROLS

COMMON DATA CONVERSIONS

1 TON	=	12,000 Btu/hr
1 BHP	=	2.545 Btu/hr
1 l/m	=	0.2642 gpm
1 kW	=	3,415 Btu/hr
1 kcal/h	=	4 Btu/hr
°F	=	1.8 °C + 32

WHAT IS THE WATER SOURCE?

OPEN LOOP
ONCE-THROUGH
100% FRESH WATER
$$$$$$





CITY WATER

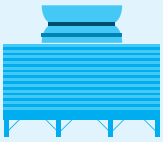


WELL WATER

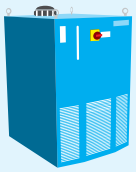
VS.

CLOSED LOOP
RECIRCULATED
WATER
$$



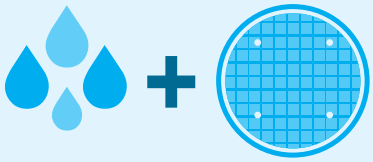


COOLING TOWER WATER



CHILLER

EST. COST OF OPEN LOOP WATER



≃ $10.00 PER THOUSAND GALLONS

{ 1/2 TON OF COOLING REQUIRES 576,000 GALLONS/YEAR }

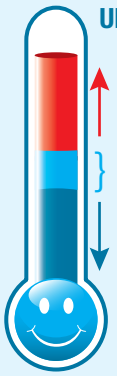
$5,760 PER YEAR

(BASED ON $10.00 PER THOUSAND GALLONS AND 3 SHIFTS PER DAY OPERATION)

HEAT LOAD FLOW OF ANY MATERIAL

BTU/HR = MASS FLOW RATE (LB/HR) X SPECIFIC HEAT (BTU/LB °F) X TEMPERATURE DIFFERENCE (°F)

UNDERSTANDING TEMPERATURE

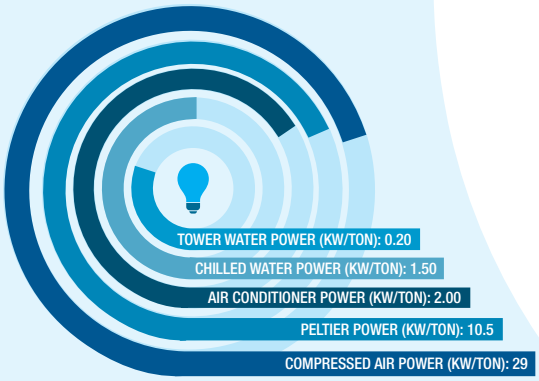


DANGER OF HEAT STRESS FAILURE

ELECTRONICS COOLING "SWEET SPOT"
85°F - 95°F

DANGER OF CONDENSATION

EST. ENERGY COST OF COOLING



$ = TONS X KW/TON X HOURS X $/KWH

(FOR EXAMPLE, EST. ANNUAL COST OF COOLING FOR A 1/2 TON LOAD)

$

COST OF COOLING WITH TOWER WATER:
0.5 X 0.2 KW X 8000 X $0.07/KWH = $56.00

COST OF COOLING WITH CHILLED WATER:
0.5 X 1.5 KW X 8000 X $0.07/KWH = $420.00

COST OF COOLING WITH AN AIR CONDITIONER:
0.5 X 2 KW X 8000 X $0.07/KWH = $560.00

COST OF COOLING WITH PELTIER COOLING UNIT:
0.5 X 10.5 KW X 8000 X $0.07/KWH = $2940.00

COST OF COOLING WITH COMPRESSED AIR:
0.5 X 29 KW X 8000 X $0.07/KWH = $8120.00

(BASED ON $0.07/KWH AND 3 SHIFTS PER DAY OPERATION)

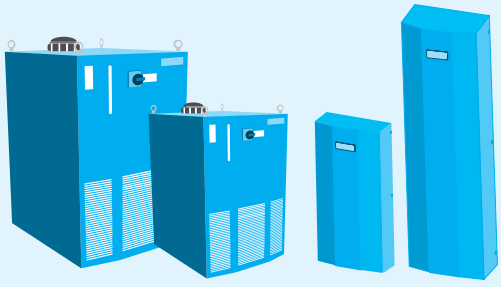
EQUIPMENT SELECTION & RECOMMENDATIONS

IT'S IMPORTANT TO NOTE THAT PROPERLY SELECTED EQUIPMENT IS THE KEY TO COOLING EFFICIENCY.

AIR CONDITIONERS: PROVIDE A CONVENIENT MEANS OF EFFICIENT COOLING FOR MANY INDUSTRIAL CONTROL COOLING APPLICATIONS.

WATER SOLUTIONS: OFTEN ARE THE ONLY METHOD OF PROVIDING SUSTAINABLE EFFICIENCY & RELIABLE PERFORMANCE IN "HOSTILE" ENVIRONMENTS.

< "DIRTY HOSTILE" = HEAT + AIRBORNE PARTICULATE &/OR OILS >
< "CLEAN HOSTILE" = HEAT + REGULAR WASH DOWN W/ CAUSTICS >



IMPROVE
PERFORMANCE

ELIMINATE ELECTRONIC FAILURES AND INCREASE EQUIPMENT UPTIME WITH PFANNENBERG LIQUID COOLED SOLUTIONS.

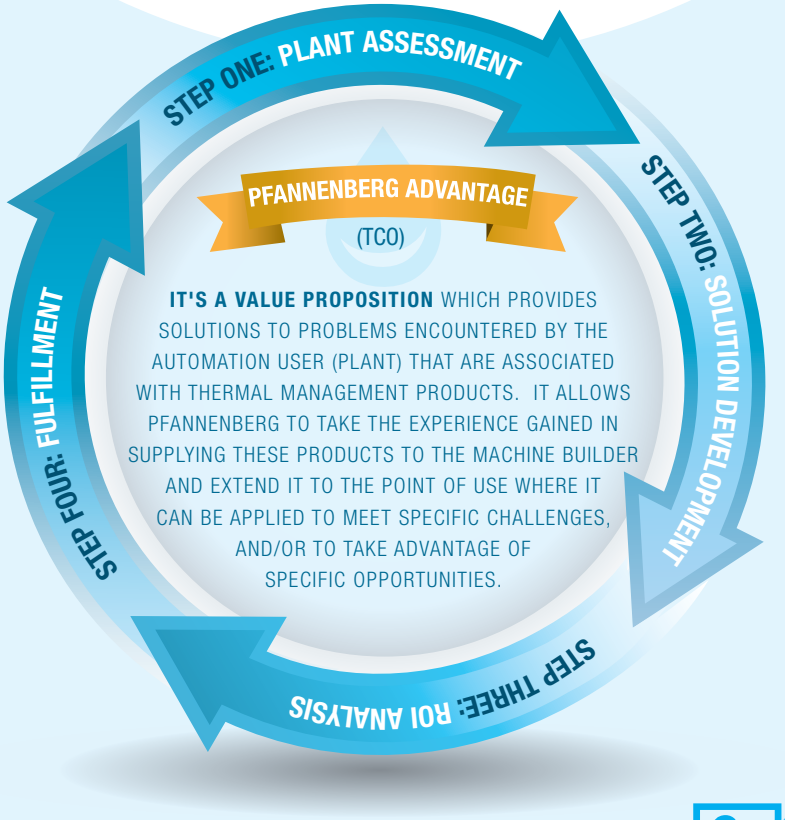
REDUCE
MAINTENANCE

MAXIMIZE YOUR SYSTEM EFFICIENCIES WITH PFANNENBERG LIQUID COOLED SOLUTIONS.

PREVENT
UNPLANNED REPAIRS

REDUCE YOUR MAINTENANCE BUDGETS WITH PFANNENBERG PREVENT SERVICE PLANS.

EFFICIENCIES
TOTAL COST OF OWNERSHIP (TCO)



IT'S A VALUE PROPOSITION WHICH PROVIDES SOLUTIONS TO PROBLEMS ENCOUNTERED BY THE AUTOMATION USER (PLANT) THAT ARE ASSOCIATED WITH THERMAL MANAGEMENT PRODUCTS. IT ALLOWS PFANNENBERG TO TAKE THE EXPERIENCE GAINED IN SUPPLYING THESE PRODUCTS TO THE MACHINE BUILDER AND EXTEND IT TO THE POINT OF USE WHERE IT CAN BE APPLIED TO MEET SPECIFIC CHALLENGES, AND/OR TO TAKE ADVANTAGE OF SPECIFIC OPPORTUNITIES.

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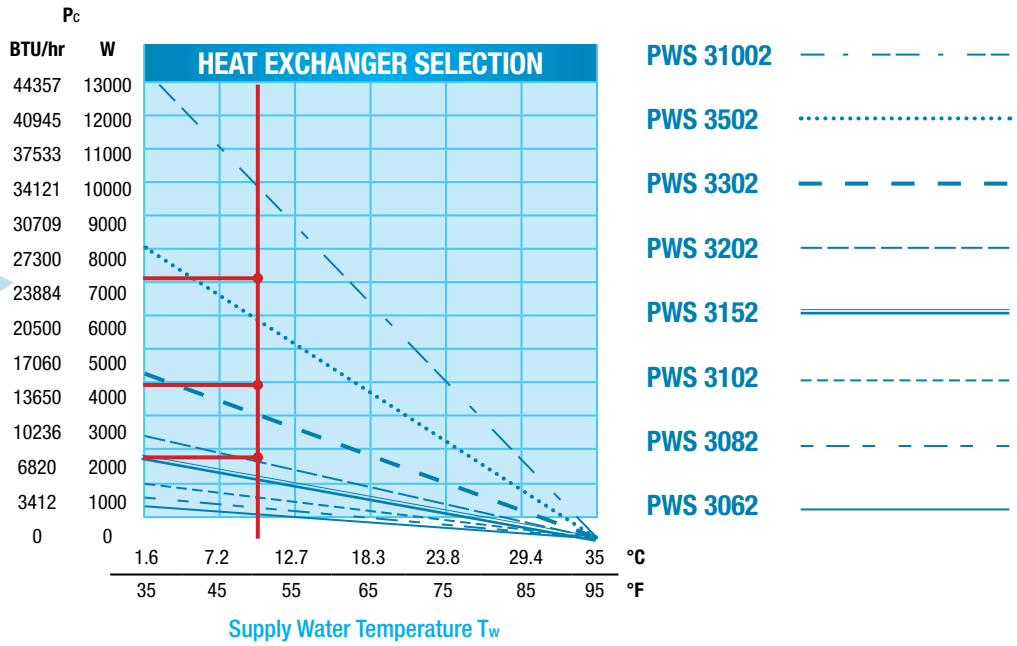
Performance and Examples

STEP 1.
Calculate load

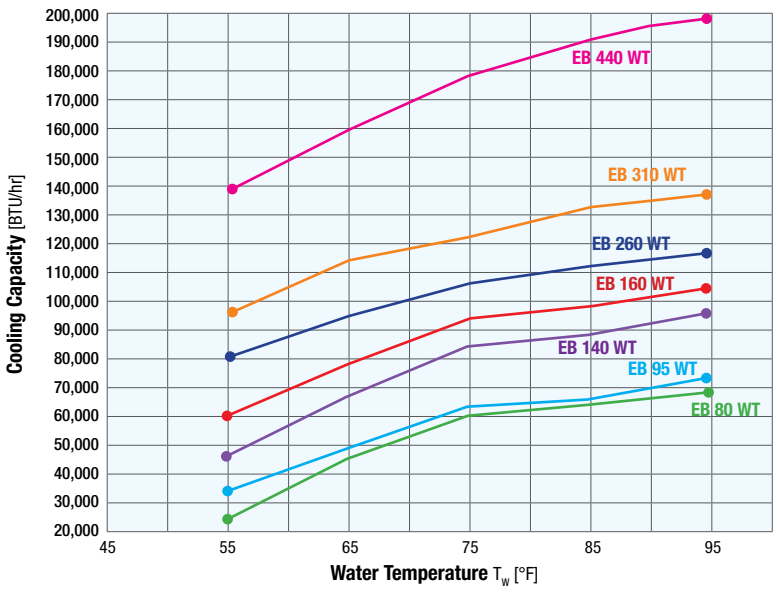
ENCLOSURES AND LOADS		
(est.) Load	**Drive**	**Control Enclosures**
2236 W	150 HP	36 x 72 x 24
4471 W	300 HP	48 x 72 x 24
4471 W	300 HP	48 x 72 x 24
7450 W	500 HP	60 x 72 x 24
7450 W	500 HP	60 x 72 x 24

26078 W **TOTAL LOAD**

STEP 2.
Select Properly Sized Air/Water Heat Exchanger



STEP 3.
Select Properly Sized Chiller (if water is needed)



ADDITIONAL CHILLER SELECTION:
Our CCE and EB Series Chiller products are available for smaller applications. Please consult the Pfannenberg Thermal Management Solutions Catalog for additional information.

Water Cooling Product Lines

Air to Water Heat Exchangers



Type	Cooling capacity Btu/h / W*	Rated voltage	Dimensions/Weight			
			W	L	D	Wt.
PWS 3062	2218 / 650	115 / 230 V	10.13 in 257 mm	24.14 in 613 mm	5.62 in 142.8 mm	22 lb 10 kg
PWS 3082	2900 / 900	115 / 230 V	10.13 in 257 mm	24.14 in 613 mm	5.62 in 142.8 mm	22 lb 10 kg
PWS 3102	3753 / 1100	115 / 230 V	15.80 in 401 mm	32.05 in 814 mm	6.28 in 159 mm	33 lb 15 kg
PWS 3152	5800 / 1700	115 / 230 V	11.78 in 299 mm	36.65 in 930 mm	8.16 in 207 mm	34 lb 15.5 kg
PWS 3202	7165 / 2100	115 / 230 V	15.76 in 400 mm	51.89 in 1318 mm	9.07 in 230 mm	62 lb 28 kg
PWS 3302	12283 / 3600	115 / 230 V	15.76 in 400 mm	51.89 in 1318 mm	9.07 in 230 mm	66 lb 30 kg
PWS 3502	21496 / 6300	115 / 230 V	15.76 in 400 mm	57.09 in 1450 mm	8.60 in 218 mm	73 lb 33 kg
PWS 31002	34121 / 10000	230 /460 V	19.74 in 501 mm	65.52 in 1664 mm	12.10 in 307 mm	126 lb 57 kg

Highlighted units above are the selections based on sample calculations found in the performance and example curves on the previous page.

Chillers



Model	Capacity			Power Supply	Dimensions/Weight (inches / lbs.)			
	Btu/hr	kW	Tons	V/Ph/Hz	W	D	H	Wt.
CCE 6301	8,200	2.4	.68	230 1~	19.4	23.62	22.5	158
CCE 6401	12,000	3.5	1	400 3~/460 3~	26.61	23.62	36.27	240
CCE 6601	22,000	6.5	1.8	400 3~/460 3~	26.61	23.62	36.27	251
EB 2.0 80 WT	27,000	8	2.25	400 3~/460 3~	23.62	29.94	54.17	330
EB 2.0 95 WT	32,500	9.5	2.7	400 3~/460 3~	23.62	29.94	54.17	352
EB 2.0 140 WT	47,750	14	4	400 3~/460 3~	29.96	33.68	60.40	396
EB 2.0 160 WT	54,500	16	4.5	400 3~/460 3~	29.96	33.68	60.40	418
EB 260 WT	89,053	26.1	7.4	400 3~/460 3~	66.14	31.10	55.51	888
EB 310 WT	106,454	31.2	8.8	400 3~/460 3~	66.14	31.10	55.51	956
EB 440 WT	151,492	44.4	12.6	400 3~/460 3~	65.7	31	55.7	1102

Highlighted units above are the selections based on sample calculations found in the performance and example curves on the previous page.

Global Service - Your Local Advantage



Pfannenberg's innovation has made it one of the largest globally operating manufacturers of thermal management and process cooling equipment today. Our wide product range stretches from individual warning and signaling components to complete system solutions for machine cooling and enclosure air conditioning.

We speak your language - In addition to manufacturing facilities located on three continents, Pfannenberg has developed a worldwide network of local subsidiaries and sales partners eager to meet your service needs.

We're there when you need us - Worldwide

Repair service

If your cooling system is down, you can expect immediate assistance from Pfannenberg. Our repair service affords you the fastest possible response – nationally or internationally. We ensure that your cooling system is returned to optimal condition – even if it's not a Pfannenberg product. Our on-site service gets you back on line faster, eliminating the transit time associated with factory repair programs.

We offer you the following services:
Fault diagnostics • Repair cost estimates • On-site repair • Handling and disposal of returned goods.

Pfannenberg Service Centers

in Germany (headquarters), USA, China, UK, Italy, Brazil, France, Russia, Singapore and India

Service Support Centers

visit www.pfannenberg.com/support/service/ for a complete list.

Service Agents

Serving 42 countries on 5 continents

Pfannenberg
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