Visit our website or contact us to learn more about our signaling products.
**New Products**

**DTS 34X1 Cooling Units**

12,000 - 17,000 Btu/h range **pages 37, 63 & 83**

- Available in Type 12, NEMA Type 3R/4, and NEMA Type 4/4X
- Cutout sizes same as existing DTS 33X1
- Dual condenser fans to provide partial redundancy
- Designed to meet 2014 ERP European Standards

**PWS 3000 Advantage Series Air/Water Heat Exchangers**

650 - 10,000 W range **pages 119-134**

- UL 484 Listed, category ACVS, UL file #SA10300, CE approved for European use
- Maintains a UL Tested NEMA Type 12/3R/4 seal against enclosure (NEMA Type 4X with stainless option)
- Maintenance-free design can be installed internally or externally
- Easy to mount seal, no elaborate reworking of the mounting cut-out
- Integrated thermostat and solenoid valve for temperature control
- Integrated temperature monitoring with alarm contact
- Casing available with powder coat (RAL 7035) or stainless steel (with #3 polish)

**CC Chillers**

1100 - 7200 W range **pages 111-112**

- Packaged outdoor-rated chiller
- For cooling water, water/glycol mixtures
- Rugged construction - galvanized steel with polyester powder coat finish.
- Service friendly design allows access via hinged front panel
- Many optional features

**Filterfans 4.0™**

- Reduced energy consumption
- NEMA Type protection
- Patented tool-less 4 corner fastening system
- Highest system airflow in industry
- 300% longer service time

**Air/Air Heat Exchangers**

20 - 100 W/K

- Passive cooling with complete separation of ambient & internal air
- Partially recessed design for profile mounting
- Independently adjustable alarm temperature for...
- Compatible with cutout for recessed air conditioners
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What is The Pfannenberg ADVANTAGE™

The Pfannenberg Advantage™ follows a results-driven, four-step process that begins and ends with the user.

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.

Step One: Plant Assessment
Pfannenberg’s field engineering team visits the facility to meet with plant personnel and survey the application in order to fully understand specific thermal management challenges.

Step Two: Solution Development / Product Selection
Factory and field personnel work together to develop an application-specific solution using the best products and practices available to meet process requirements.

Step Three: ROI Analysis
Savings associated with energy usage, maintenance, “up-time”, etc. are quantified and compared to total project costs to verify solution feasibility.

Step Four: Fulfillment
The complete solution is implemented through the coordinated efforts of an experienced team of factory engineers and local partners, from installation, commissioning & training to preventative maintenance & lifecycle service.
Pfannenberg is your reliable and competent partner when it comes to industrial thermal management and process cooling. Few companies in the world can supply you from one source like Pfannenberg - because we develop and produce products ourselves. Many of our products have set milestones in thermal management technology such as our Filterfans®. For better understanding of our customer needs in various industry groups as well as all regional requirements we have development centers in all major regions of the world. For you, this means the security of always being able to benefit from innovative devices of the latest generation.

As you look through this catalog, you may notice the Sharing Competence motto and wonder what this means to you as a member of Pfannenberg's value chain.

The skills and experiences of each of us results in a wealth of knowledge: product and process knowledge alike. Every day we acquire further skills and have new experiences. Whether you are a member of our supply chain, a value-added partner or our customer, sharing this knowledge helps to understand and fulfill everyone's needs to result in successful partnerships.

But furthermore to be a product supplier Pfannenberg looks to be your thermal management engineering team. We provide solutions to your complex problems by using tools like our free PSS software, complete engineering validation of your system using our CF Design program and providing a Test Chamber for theoretical or physical proof of your design.

Pfannenberg passion is innovation - more than 50% of products sold last year were less than 5 years old in design. Just this year we have launched a new series of Chiller, lines of Air Water and Air to Air heat exchanger and completed our line of Industrial Cooling Units. We are constantly leading our customers to the best solutions, while being competitive within the global market.

All new developments are designed to safe energy. Each of our new products has to be energy efficient. Preserving our environment plays a large part in the latest generation of our devices. We are committed to remaining true to our company motto: ‘Safety for man, machine and the environment!’

With best regards,

Andreas Pfannenberg
CEO

Safety for man, machine and the environment!
Why reliable thermal management is so important for your electrical enclosure...

Pfannenberg thermal management products for your electrical enclosures are much more than just an accessory. In fact, they are basically the backbone of your entire production process. Trouble-free production is only guaranteed if the sensitive climate inside your electrical enclosures is maintained. Even the slightest overheating of the electronic component units can result in serious consequences such as production downtime, and premature aging of parts. We not only take into account the demands placed on your equipment.

As an example, how large are the fluctuations in the ambient temperature? Is the control cabinet placement in an environment where the air is full of dust or oil? Is the equipment to be cooled exposed to the weather, i.e. moisture and sunshine? How large are the designated dimensions of the required cooling units? Once these questions have been clarified completely, Pfannenberg supplies you with highly efficient thermal solutions that guarantee the highest degree of safety and energy efficiency.

Air/Water Heat Exchanger
from the New Pfannenberg PWS 3000 Advantage Series

Cooling unit
from the New Pfannenberg DTS 34X1 Series
Why should you trust in Pfannenberg?

As our Filterfan 4.0™ slogan goes, "trust in the original", Pfannenberg has been helping our customers increase the safety of their machines and people for almost 60 years.

Pfannenberg provides solutions to complex thermal management problems with a broad array of products including cooling units, chillers, air to water, air to air heat exchangers, Filterfans®, heaters and thermostats.

Many of our products are industry leaders in energy efficiency and performance. Our international service centers and partners provide complete support throughout the life of our equipment trust your machine to Pfannenberg!

Partially recessed cooling units
from the Pfannenberg DTI series
Determine the correct thermal management products

When can Filterfans® be used?
If the ambient temperature is always lower than the temperature required in the electrical enclosure, then Filterfans® represent an economical solution for thermal management of electrical enclosures.

Important for the use of Filterfans®:
Use Filterfans® to force the surrounding air into the electrical enclosure, so that a slight overpressure builds up inside the enclosure. The surrounding air enters the electrical cabinet exclusively via the Filterfans®, which ensures that it is filtered. Install the Filterfans® in the lower third of the electrical enclosure and the exhaust filter as close to the top as possible. This assists the natural convection of the air and avoids hot spots within the enclosure.

When are cooling units necessary?
- if cooling cannot be accomplished by the outside air
- if the temperature required inside the electrical cabinet should be equal to or lower than the ambient temperature
- if the ambient air is strongly contaminated with oil or conductive dusts
- when higher ingress protection is required (Type rating)

Important for the use of cooling units:
- ensure a good supply of air intake and outtake from the external circuit of the cooling unit, so that thermal energy can be transferred to the surroundings
- the lowest temperature inside the enclosure may not necessarily be the best. The 35 °C preset by Pfannenberg represents a good compromise between service life and the accumulation of condensation.

When must air/water heat exchangers be used?
- if a chilled water supply is available
- if aggressive ambient air restricts the use of conventional cooling units
- if a very high IP class is required (up to IP 65)
- if a maintenance-free cooling unit is required
- if energy efficiency is considered at a plant level concern

When must air/air heat exchangers be used?
- if the panel temperature is allowed to be higher than the maximum ambient temperature
- if vapors, particulates or other foreign materials in the environment that must not be allowed to penetrate the enclosure.
- important for air/air: Air to air units have performances that are rated on the difference in temperature between the ambient and enclosure. This makes this solution ideal for equipment that can take high temperatures or systems in environments with modern ambients.
Combined use as a system solution

Air/water heat exchangers and Chillers
The combination of air/water heat exchangers and chillers offers an ideal system solution for the cooling of your processes, machines and controllers. All cooling tasks in a system or machine and also on a control cabinet can be taken care of simply and economically via a closed pipeline system.

• through the highly economical supply of water as the cooling medium for the air conditioning of control cabinets with air/water heat exchangers
• and 100% independence from the ambient temperature at the installation location

Filterfans and Thermostats
With a combination of filterfans and thermostats you can additionally achieve energy savings, material and time plus a significantly longer service life. This results in an optimised environmental balance as well as greater reliability of your production process:

• through reduced energy consumption and improvement of the filterfan efficiency
• through the reduction of the time required for cleaning the filter mats
• through a reduction in the consumption of filter mats

Thermostats, Hygrostats and Heaters
Electrical enclosure heaters in combination with thermostats and hygrostats ensure that the correct temperature is always available. In addition to savings on energy and, therefore, a better environmental balance, the combination of heaters with thermostats and hygrostats offers greater reliability of the production process:

• through pinpoint distribution and constant temperatures in the electrical enclosure
• through reduced energy consumption and improvement of the heater efficiency
The Technology of Cooling...

Due to the increasing automation of processes, electro-technical components are used more and more. Therefore, the development of warmth inside the cabinet increases. The diagram below shows the effects of the increased heat load on random components’ service life. The process reliability and keeping service intervals within an economic framework are special challenges thermal management of control cabinets is faced with special challenges such as process reliability and keeping service intervals within an economic framework. Therefore, the choice of the cooling method can be pivotal with regards to it’s advantages.

Three basic cooling methods

When selecting a cooling method there are three types to consider:

Natural Convection
If there is only a minimal heat loss in your application, use of louvers or grills with filters can be effective. This method, however, usually provides less cooling effect than is necessary with today’s components.

Forced convection
If the installation will be in a clean, non-hazardous environment with an acceptable ambient (outside the enclosure) temperature range, a simple forced-air cooling system utilizing outside air is usually adequate. Combined with an air filter, such devices generally meet the heat removal needs of typical electronic equipment and many electrical applications. An example of forced convection air cooling is Filterfans ®.

Closed-loop cooling
In harsh environments involving high temperatures, wash-down requirements, heavy particulate matter or the presence of chemicals capable of damaging components (NEMA 4 or 12 environments), ambient air must be kept out of the enclosure. Closed-loop cooling consists of two separate circulation systems. One system seals out the ambient air, cooling and re-circulating clean, cool air throughout the enclosure. The second system uses ambient air or water to remove and discharge the heat. Example of closed-loop cooling equipment employed with electronics and process controls are cooling units and heat exchangers.
Cooling by natural convection

Rules of thumb:

• limited to roughly + 45 Fahrenheit rise above ambient - in general, the temperature rise inside the enclosure would be roughly + 45 Fahrenheit utilizing natural convection
• no moving parts - by eliminating external fans, you create a zero maintenance application
• no dirt - utilizing exhaust filters prevents dirt from entering cabinet, dirt can damage electronics as fast as heat!

If the ambient temperature is lower than the temperature inside the electronic cabinet, the dissipated heat escapes into the atmosphere throughout the surface of the electronic cabinet. The following simple equation is used to calculate the level of heat radiated from the electronic cabinet:

\[ P_R(W) = C \times A \times \Delta T \]

- \( P_R \) [Watt]: Radiation Power: Thermal power radiated from the surface area of the electronic cabinet into the ambience into the electronic cabinet.
- \( C \) [W/m²K]: Coefficient of heat transmission: Radiation power per 1 m² surface area and is difference in temperature. This constant is determined by the material:
  - sheet steel - 5.5 W/m²K
  - stainless steel - 5.5 W/m²K
  - aluminium - 12.0 W/m²K
  - plastic - 3.5 W/m²K

- \( A \) [m²]: Surface area of electronic cabinet: Effective surface area of a electronic cabinet measured according to the specifications of VDE 0660, part 500.
- \( \Delta T \) [K]: Difference between ambient air temperature and inside air temperature

Cooling with Filterfans®

Rules of thumb:

• limited to roughly + 10 Fahrenheit rise above ambient - in general, the temperature rise inside the enclosure would be roughly + 10 Fahrenheit
• multiple configurations possible - Filterfans® can be located in a number of locations within complex enclosure configurations
• size fans to include static pressure - understanding how static pressure effects the performance of a fan is very important when sizing Filterfans®, see chart below!

Follow this simple equation for calculating the required airflow:

\[ V = \frac{3.28 \times (P_D)}{\Delta T \text{[cfm]}} \]

- \( V \) [cfm]: Airflow volume of Filterfans®
- \( P_D \) [Watt]: Dissipation loss: Thermal power generated inside a cabinet by the dissipation loss of components
- \( \Delta T \) (°F): Difference in temperature between the ambient and inside the electronic cabinet

Model No. | CFM1 | CFM2 | CFM3
--- | --- | --- | ---
PF11000 | 36 | 17 | 11
PF22000 | 105 | 38 | 28
PF32000 | 105 | 65 | 38
PF42500 | 121 | 94 | 74
PF43000 | 224 | 155 | 122
PF65000 | 489 | 297 | 224
PF66000 | 1024 | 462 | 295
PF67000 | 1250 | 560 | 368

NOTE: Always calculate cooling capacity of Filterfans® with the CFM3 value.
The Technology of Cooling... (continued)

When utilizing Filterfans®

Always use the Filterfans® to propel the cool ambient air into enclosure. This ensures that slight positive pressure builds up inside the electronic cabinet in comparison to the ambience and that only air filtered by the Filterfans® flows into the enclosure. The air propelled into the cabinet displaces the warm air which exits through the exhaust filter. If, however, the air is drawn out of the electronic cabinet by suction power, unfiltered air can also enter through poor seals and cable entries.

If you install a combination of Filterfans®/exhaust filter, fit the Filterfans® in the lower third of the electronic cabinet if possible. The exhaust filter must be installed as near to the top as possible to prevent heat pockets in the upper part of the cabinet.

Install a FLZ 530 thermostat to control your Filterfans®. This will increase the life of the fan and decrease the amount of maintenance required to clean the filters.

Cooling with closed loop cooling units

Rules of thumb:

- only method for reducing cabinet temperature below ambient - if the ambient temperature is greater than the target internal temperature of the enclosure, active cooling is required
- applications from NEMA type 12 to 4x - closed loop systems can maintain the NEMA type rating of the cabinet
- designer must size per ambient temperatures - by utilizing performance charts, be sure to correctly size your system!

Pfannenberg cooling units operate on the principle of the Carnot cycle. This means that the cooling unit functions as a heat pump that "pumps" the thermal energy transferred from the electronic cabinet (heat dissipated from the components) up to a higher level of temperature (the ambient temperature can reach levels as high as +55 °C). The air inside the enclosure is cooled down by the evaporator and at the same time dehumidified.

Steps for sizing a cooling unit - Proper selection of a cooling unit is determined by the following criteria:

- required cooling capacity in Watt
- mounting requirements (side, integrated or top mount)
- dimensions of cooling unit and enclosure

Follow this simple equation for calculating the required cooling capacity:

\[ P_C = P_D - P_R \]

- \( P_C \) [Watt]: Refrigeration capacity of a cooling unit
- \( P_D \) [Watt]: Dissipation loss: Thermal power generated inside a cabinet by the dissipation loss of components
- \( P_R \) [Watt]: Radiant heat gain/loss: Heat transfer through the skin of the enclosure (insulation factor not included)

Cooling units are used if:

- the outside air cannot be used for cooling
- the required temperature inside the enclosure should be equal-to or lower-than the required ambient temperature
- the ambient air is extremely oily or dirty

Follow this simple equation for calculating the required capacity:

\[ P_R = C \times A \times \Delta T \]

- \( C \) [W/m²K]: Coefficient of heat transmission
- \( A \) [m²]: Surface area of electronic transmission
- \( \Delta T \) [K]: Difference in temperature between the ambience and inside the electronic cabinet
Utilizing performance curves to properly size cooling units:

Pfannenberg utilizes the DIN standard 35/35 °C when rating our cooling units. Many other companies use 50/50 °C, which provides a higher, non-usable value. Customers should use their own application temperatures to determine the proper cooling capacity of the system.

Important information when utilizing cooling units:

- the refrigeration capacity should exceed the dissipation loss from the installed components by approximately 10%
- the enclosure should be sealed to prevent the inflow of ambient air
- use the door contact switch to impede operation with open doors and consequent excessive accumulation of condensation
- use cooling units with maximum clearance between air inflow and air outflow to prevent poor circulation
- make sure that the air inflow and air outflow in the external circuit is not hindered, preventing proper heat exchanging at the condenser
- when using top-mounted cooling units, make sure that components with their own fans do not expel the air directly into the cooling unit’s cool air outflow. Make sure unit is level.
- setting the temperature to the lowest setting is not the optimal solution due to the condensation issues. The value we have preset on the cooling unit is a sound compromise between cooling the inside of the enclosure and the accumulation of condensation.

![Performance Curve](image)

Cooling with closed loop Air/Air Heat Exchangers

Air to air heat exchangers are used when the complete separation between the enclosure and the environment is required but the internal temperature can be higher than the ambient. The air to air units have a rating showing how much heat can be removed based on the difference in the ambient and the internal temperatures. This is traditionally rated on W/K which is the watts of heat that the unit can remove per temperature difference in degree K.

- max ambient is 35 °C (95 °F) and the max internal temperature that the system can take is 45 °C (113 °F)
- the temperature difference is 10 °C which is the same as 10K
- if you apply this temperature difference to the rating of the air to air unit you will get the total amount of heat that the item can remove

so a unit rated 100 W/K could remove 1000 Watts (100 x 10) of heat under these conditions

If temperatures are given in Farenheight, air to air ratings can be converted from W/K to W/F by dividing by 1.81.

\[
\frac{20 \text{ W/K}}{1.81} = 11 \text{ W/F}
\]