The Seifert Product Guide – how to always find the right product

1. **When can filter fans be used?**
   Filter fans are used if the desired cabinet temperature can be constantly above the ambient air temperature.
   In combination with thermostats from Seifert you can save on energy (fan is only on when needed), on material (less consumption of filter mats) and on time (less cleaning). This will ensure a longer life time of the filter fans and will enhance your process reliability.

2. **The correct use of cooling units**
   Cooling units become necessary when the heat dissipation cannot be constantly guaranteed through the ambient air, when the temperature required inside the cabinet should be equal to or lower than the ambient temperature or when the ambient air is strongly contaminated or humid.

   Product efficiency: Cabinet cooling units in general work on the heat pump principle and consume electrical power which is a financial expense. The efficiency of cooling devices is described using the so-called COP (Coefficient of Performance). The higher the COP, the more efficient the unit is and the lower the electricity consumption.

   The new generation of Energy Efficient cooling units from Seifert has a COP of up to 2.5. This means that a cooling unit of this series with a rated cooling power of 2,000 W (L35L35) will only consume 800 W (2,000 / 2.5) power.

   Each cooling unit from Seifert is produced and tested according to standard DIN 14511 and ISO 9001:2015.

3. **The correct use of heat exchangers**
   Air/air heat exchangers are used when cool ambient air is available but should not enter the control cabinet because of contamination. Air/air heat exchangers are mainly used in outdoor applications.

   Air/water heat exchangers are mainly used when water cooling circuit is available or if high power losses need to be handled in small areas.

4. **The correct use of thermo-electric cooling units (Peltier Units)**

The thermo-electric effect (sometimes called the Peltier effect after its inventor Jean Charles Athanase Peltier) is the direct conversion of temperature differences to electric voltage and vice-versa. Since the direction of heating and cooling is determined by the polarity of the applied voltage, thermo-electric devices can also be used as temperature controllers.

Peltier cooling units are mainly used for smaller power losses (30-800 W). Unlike conventional cooling units, Peltier devices can be mounted in any position (please keep your condensate management in mind) and can be designed in very compact shapes.

5. **The correct use of cabinet heaters**

Cabinet heaters are an important segment of the Seifert cabinet accessories program and form part of our thermal management solutions. Temperature differences in cabinets, mostly in outdoor applications, often result in humidity and condensation which may cause function failures and corrosion.
The use of the appropriate heating unit for your cabinet will eliminate these problems. Fan heaters distribute the internal warm air equally throughout the control cabinet. Further advantage of fan heaters compared to PTC heaters is the much lower starting current.

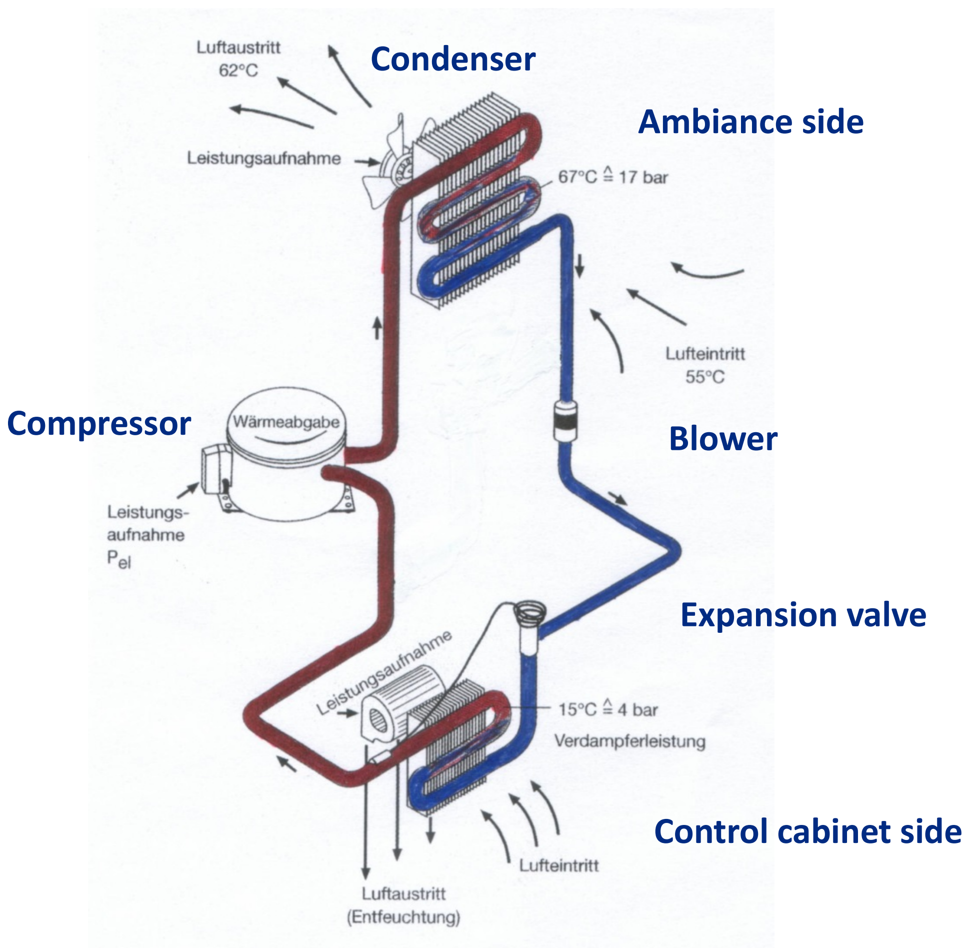
6. **Accessories**

Seifert also offers practical accessories to complement the high-performance thermal management systems. From thermostats and hygrostats to control systems, door switches and energy efficient cabinet lighting we have everything you may need for your cabinet.

We are happy to support you choosing the right units for your applications!

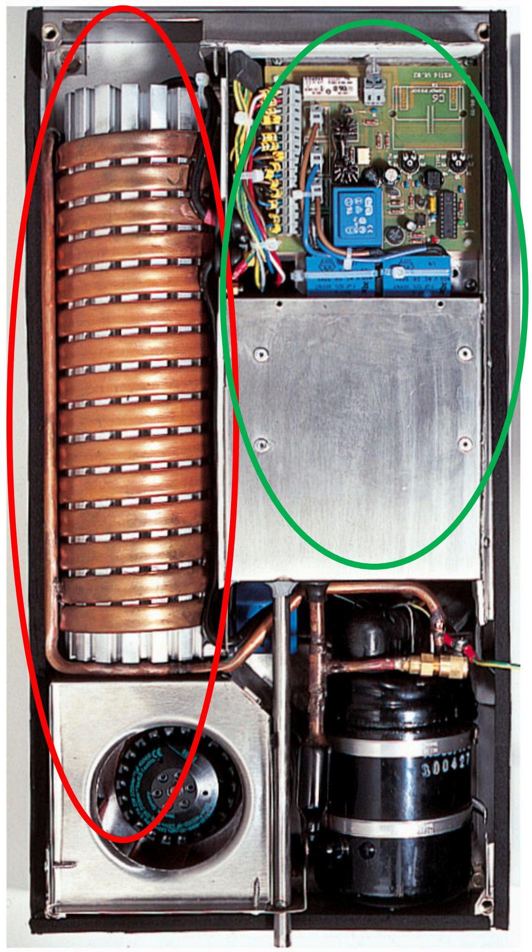
Construction of a control cabinet cooling unit

Principle setup of a cooling unit



Construction of a control cabinet cooling unit

Actual setup of a cooling unit



Ambiance side

Condenser

Control cabinet side

Evaporator

Compressor

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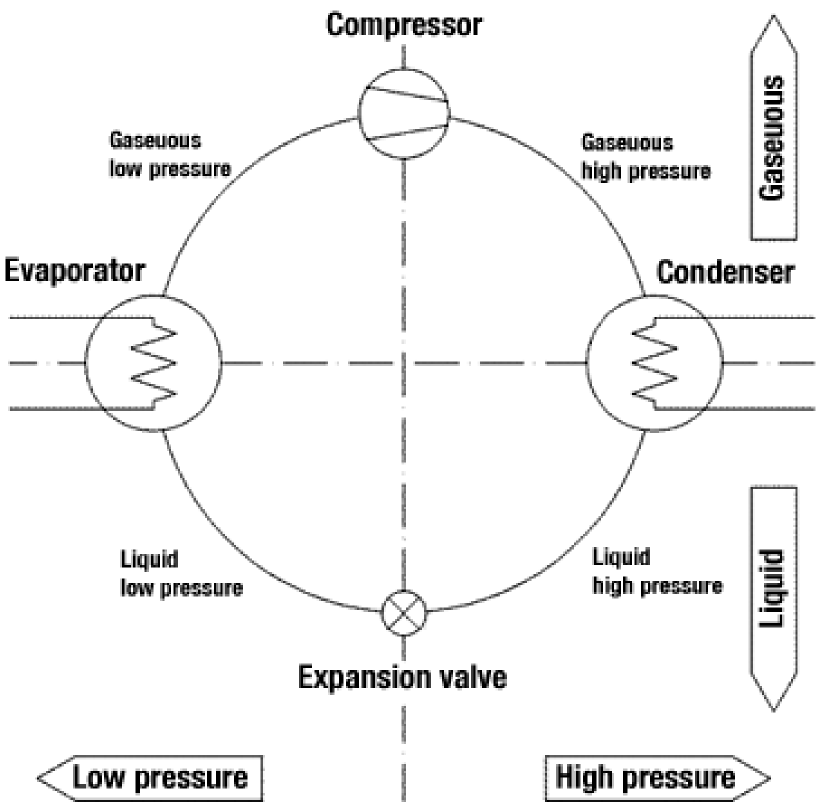
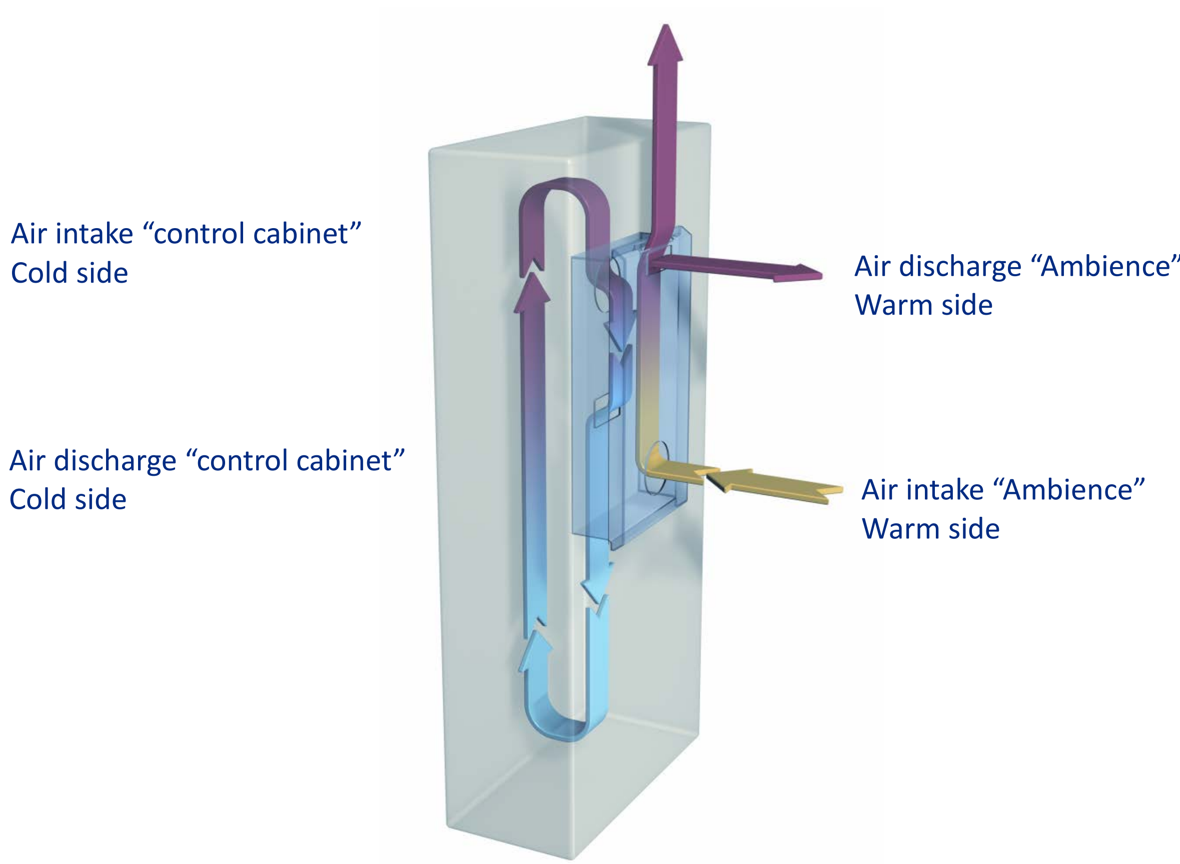
Cooling cycle of a cabinet cooling unit

Operating principle:
The cooling unit for cabinets works on the basis of a refrigeration circuit consisting of four main components: compressor, evaporator, condenser and expansion device.
The circuit is hermetically sealed and R134a refrigerant circulates inside it (R134a is chlorine free and harmless to the ozone layer). The compressor compresses the refrigerant (thus taking it to high pressure and high temperature), and pushes it through the condenser, where it is cooled by ambient air thus changing from gas to liquid state. At the liquid state, it then passes through the expansion device being at a much lower pressure, the refrigerant arrives at the evaporator which absorbs the necessary heat, changing the state from liquid to gas. The gas is then drawn back into the compressor completing the cycle.



Air flow inside a control cabinet cooling unit



Duties of a control cabinet cooling unit:

- Keeping constant temperature inside the control cabinet
- Protection against dust and humidity
- Protection against overheating
- Life time extension of electrical components
    a. an increase of the operating temperature by 10°C will reduce the life span of the components already by 50%
    b. permanent temperature variation will make the components to age even faster
- Turning off the cooling when the cabinet door is open (risk of excessive condensation)

Why do we need cooling?

Through the increasing automation of production processes more and more electro- technical components are being used. These components generate a lot of power loss which converts into heat. The increasing temperatures inside the control cabinets have a negative influence on the life cycle of the components inside.

The diagram below shows the effects of the increased heat load on random components' service life. (Fig.1)

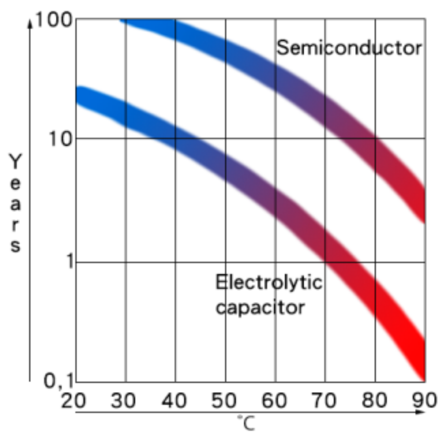


Fig.1

Supporting process reliability and keeping service intervals within economic reasons are the main challenges thermal management of control cabinets is facing today.

Therefore, the choice of the right cooling method has a high significance.

The most common cooling methods used:

1. Natural Convection

If there is only a minimal heat loss in your application, openings in your cabinet with louvers or grills with filters can be effective enough. Usually however this method does not provide enough cooling for today's components.

General rules:

- **Depending on the load inside the cabinet and the temperature outside, the cabinet temperature is likely to be higher than the ambient temperature.**
- **no moving parts - by eliminating external fans, you create a zero maintenance application**
- **no dirt - utilizing exhaust filters prevents dirt from entering into the cabinet. Dirt can damage electronics as much as heat does!**

If the ambient temperature is lower than the temperature inside the electronic cabinet, the dissipated heat escapes into the environment through the surface of the cabinet.

The following simple formula calculates the level of heat dissipated from the cabinet.

$$P_s (W) = k * A * \Delta T$$

P_s [Watt] = Dissipated power (thermal power dissipated from the surface area of the control cabinet)

k [W/m^2K] = Coefficient of heat transmission (Dissipated power per 1 m^2 surface area and 1 K difference in temperature). This constant is determined by the material.[1)]

A [m^2] = Surface area of the cabinet

ΔT [K] = Temperature difference between ambient air and cabinet internal air

[1)] Sheet steel - 5.5 W/m^2K
Aluminum - 12.0 W/m^2K
Stainless steel - 5.5 W/m^2K
Plastic - 3.5 W/m^2K

2. Forced convection

If your installation is in a clean, non-hazardous environment with an ambient temperature less than the desired inside cabinet temperature, a simple forced ventilation system utilizing the ambient air is usually sufficient.
Combined with air filters such devices generally meet the heat dissipation needs of electronic equipment.

General rules:

- **considered rise should be at least + 10 Kelvin above ambient temperature. (can vary depending on the load inside the cabinet and the ambient temperature)**
- **multiple configurations possible – filter fans can be located in a number of locations within complex enclosure configurations**
- **calculate the size of a fan to include static pressure – understanding how static pressure affects the performance of a fan is very important when choosing filter fans.**

The following simple formula calculates the required airflow:

$$V = \frac{3{,}1 * P_v}{\Delta T} \quad [m^3/h]$$

V [m^3/h] = Air flow volume of a filter fan

P_V [Watt] = Power loss (thermal power generated inside a cabinet by the dissipation loss of components)

ΔT [K] = Temperature difference between ambient air and cabinet internal air

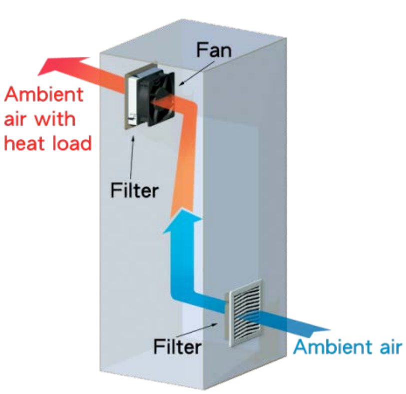
V_1 = Fan with filter and louver rating (free flow)

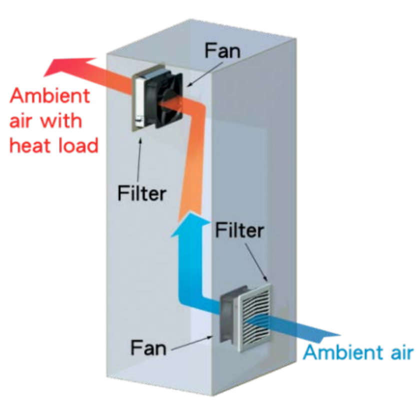
V_2 = System rating with exhaust (includes static pressure drop)

When using filter fans

Preferably use the filter fan to blow the cool ambient air into enclosure (Fig.2.and Fig.3). This ensures that a slight positive pressure builds up inside the cabinet and that only filtered air flows inside it. The air blown into the cabinet displaces the warm air which exits through the exhaust filter. If, however air is drawn out of the cabinet by suction power (Fig.1) only filtered ambient air should enter the cabinet. Ensure that no unfiltered air can enter through poor seals or cable entries.

If you install a combination of filter fan/exhaust filter, the filter fan should always be placed in the lower third of the cabinet and the exhaust filter should be in the upper part of the cabinet to prevent heat pockets inside.





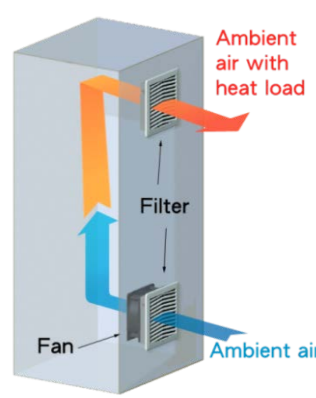


Fig. 1 Exhaust System

Fig. 2 Pressure & Exhaust System

Fig. 3 Pressure System

3. Closed loop cooling units

If your application is installed in an environment with high ambient temperatures, oil and dust exposure and you have high splash proof requirements (NEMA / IP), then it becomes absolutely necessary to prevent the ambient air from entering into the cabinet.

A cooling system with closed loop cooling normally consists of 2 loops; one loop closes the ambient air off and cools and circulates clean air into the cabinet. The second loop uses the ambient air or water to dissipate the heat.

For these applications cooling units and air/water heat exchangers are mainly used.

General rules:

- **the only method to reduce cabinet temperature below ambient temperature**
- **suitable for NEMA /IP requirements**
- **during planning you need to take the ambient temperature and the generated power loss into consideration. For outdoor applications please consider also the solar loading**

Check the performance charts of the product you want to use to ensure that your system temperature is properly maintained

The right selection of a cooling unit is determined by the following criteria:

1. required cooling capacity in Watt
2. max. ambient air temperature and desired cabinet air temperature
3. mounting requirements (side, integrated or top mount)
4. dimensions of cooling unit and cabinet
5. Mounting location (indoor, outdoor, shading, etc.)

The following simple formula calculates the necessary cooling power:

$$P_K = P_V - P_r$$

P_K [Watt] = Cooling capacity of the unit

P_V [Watt] = Power loss (thermal power generated inside a cabinet by the dissipation loss of components)

P_R [Watt] = Radiant heat gain/loss (heat transfer through the outer casing of the cabinet)

The following simple formula calculates the heat gain/loss:

$$P_r = k * A * \Delta T$$

k [W/m²K] = Coefficient of heat transmission (dissipated power per 1 m^2 surface area and 1 K difference in temperature). This constant is determined by the material.

A [m²] = Cabinet surface area

ΔT [K] = Temperature difference between ambient air and cabinet internal air

Important information when utilizing cooling units:

- the enclosure should be sealed to prevent the inflow of ambient air
- the NEMA /IP rating of the cooling unit and of the cabinet should be the same
- use a door contact switch to prevent operation with open doors and consequent excessive accumulation of condensation
- use cooling units with maximum distance between air inflow and air outflow to prevent poor circulation
- make sure that the air inflow and air outflow in the external circuit are not hindered which would prevent proper heat exchanging at the condenser
- when using top-mounted cooling units make sure that components with own fans do not expel the air directly into the cooling unit's cool air outflow.
- make sure the unit stands straight.
- setting the temperature to the lowest is not always the best solution. The value of $+35^0$ C pre-set by Seifert is a good compromise ensuring long life of electrical components, efficient operation and minimum condensation. This might also vary depending on the application.