Bus

Manufacturer's Recommendation

Maintenance Plan

KONVEKTA
Thermosysteme

The following recommendations on the maintenance plan are given to emphasize the necessity of an appropriate maintenance of thermal systems to minimize potential risks that may cause a system breakdown.

The explanations are given on the different positions.

Plaese note:

The operator of the system is responsible for its operational and transport safety. This means that all parts of the system need to be mounted safely and the system is being run with the officially required operating and auxiliary materials. Here the operating materials need to be homogenous and comply with the respective specifications of the manufacturer.

We expressly point out that the compliance to the maintenance and and operating recommendations including their careful documentation is necessary for the operational and functional safety as well as for the required separation between warranty and maintenance defects and therefore it is in the interest of the customer to adhere to these recommendations

We do not guarantee for omitted maintencance and/or operational lacks, especially ignorance of the above maintenance recommendations as well as for inaccurate documentation and not solvable breakdowns or failures resulting thereof!

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1 Check the level of refrigerant

Start the system and run it for at least 10 minutes. Afterwards check the consistency of the refrigerant via the inspection glass. There must be no bubbles in the refrigerant. So a potential lack of refrigerant can be diagnosed. Too much refrigerant can only be diagnosed via the pressure levels. Therefore you need the appropriate expertise and experience. Recommended basic conditions are here Ta = 25°C and about 800 l/min.

An accurate fill amount of the system is a basic prerequisite for a faultless operation. So it is ensured that the performance parameters are adhered to and that the components of the cooling circulation are operated according to the manufacturer's specifications. A lack or overfill of refrigerant has an impact on the life cycle of the compressor (cooling / overload) as well as on the performance of the system. Furthermore a lack of refrigerant means that a return of the oil from the circulation to the compressor is no longer ensured. Consequently lubrication is insufficient and the compressor breaks down.

2 Check the oil level of the compressor

Start the system and run it for at least 10 minutes. After that check the oil level at the inspection glass. Here an oil film needs to be visible.

Too much oil is as bad for the life span of the compressor as too little.

The compressor has a continuous oil throw-off into the circulation which may vary according to conditions. The whole system should be constructed in a way that at any operating point a return of the oil to the compressor is guaranteed continuously.
If this is not the case, there is danger that the compressor does not get enough oil (insufficient lubrication) or that suddenly a larger amount of oil gets back to it (oil shock). Both situations cause a breakdown of the compressor.

3 Check function of the high pressure switch

Connect a pressure gauge and watch pressure values at any time.
At high outside temperatures shut down the condenser fan and start the system.
At low outside temperatures close pressure valve at the compressor duct carefully till the cut-out pressure has been reached. This kind of check requires utmost carefulness and experience!
In case the pressure switch shows no reaction up to a pressure of max. 28 bars, the check needs to be cancelled and the switch needs to be changed.

According to DIN EN 378 the high pressure switch is classified as a safety part which has to switch off the pressure generator when reaching the cut-off pressure.
In case the high pressure switch does not work there is the danger that parts of the unit may burst.

So under certain circumstances there is a danger of life!

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4 Check the function of the low pressure switch

Connect a pressure gauge and watch pressure values at any time.

Close magnet valve or manual cut-off valve of the system and start the system.
The low pressure switch needs to be activated within the switching values and switch off the compressor.

With the low pressure switch the pressure on the low-pressure side is monitored. The returning gas is very important for the accurate function of the system and the compressor. With this gas the compressor is being cooled and the amount of conveyed refrigerant can be identified.
Little pressure on the low-pressure side bears the consequence that the compressor is not being cooled and eventually overheats. Furthermore, the system has a significantly lower cooling capacity.

5 Exchange the filter dryer

Exhaust the system or relocate the refrigerant so that the dryer environment is pressure-less.
Renew the dryer with O-rings. Evacuate the system and refill it with refrigerant or re-open the locked circle, respectively, and add refrigerant if necessary.

During the exchange of the dryer it has to be paid attention to the flow direction of the dryer.

The dryer's task is to absorb or filter moisture or impurities out of the refrigerant circuit. Therefore, it is subject to saturation and needs to be renewed in regular intervals.
A saturated or blocked dryer may lead to freezing at the expansion valve or disturb the refrigerant flow oft he system so that a pressure loss takes place and herewith an expansion at the dryer occurs which may endanger the cooling of the compressor. The capacity of the system also decreases significantly.

6 Check condenser battery and evaporator battery regarding soiling and clean if necessary

In order not to damage the fins of the heat exchangers it is recommended to clean them with compressed air. There it has to be paid attention to the condition of the fins and pipes. Do they have a fixed connection with the pipelines? Are they damaged by environmental influences or aggressive detergents by corrosion?

Through soiling both heat exchangers have only a reduced exchange space and thus can no longer perform the required heat transfer accurately.
Soiling at the condenser means that the system runs with increased pressure values or may even turn off through high-pressure failure. Consequently the applied system load is increased and the capacity decreases.

Soiling at the evaporator means that the system runs in the lower pressure range. This can lead to freezing and activation of the low-pressure switch. Furthermore, the injected refrigerant cannot absorb enough heat and so get liquid into the compressor and destroy the same.

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7 Check the refrigerant collector

Visual inspection of the collector regarding corrosion.

The refrigerant collector is a pressure vessel. It is not subject to a regular inspection due to its relatively small size but nevertheless is under high pressure during operation of the system.
Here corrosion weakens the pressure resistance and to avoid a burst of the vessel, the collector should be exchanged when there is found too much corrosion.

8 Check all air filters regarding soiling and renew if necessary

Take out all air filters and blow them out with compressed air or beat them. Metal filters may be washed cautiously.

Intense soiling of the filters inhibits the air flow and so the heat exchange via the evaporator. So, capacity losses, freezing and thus low-pressure problems up to liquid locks at the compressor may occur.

9 Check function of ventilation flaps

Trigger the ventilation flaps via diagnosis programs or air conditioning regulators.

The ventilation flaps control the operating modes circulating air – fresh air – mixed air. As these are given by the regulator the flaps need to react to the control signals of the regulator in order not to have a negative influence on the temperature control in the vehicle.

10 Check function of the condenser fan

Start the system and check the airflow of the fans. All fans need to perform 100%.

The function of the fans has a significant influence on the condenser heat exchanger's heat transfer to the environment. If the fans do not work the system runs under complicating conditions in high-pressure range up to a high-pressure failure. This means a surplus load for all components which may even lead to a compressor breakdown.

11 Check function of the evaporator blowers

Start the system and check the airflow of the blowers. All blowers need to perform 100%.

The function of the blowers has a significant influence on the evaporator heat exchanger's heat transfer to the interior room.
If the blowers do not work less heat energy can be absorbed by the evaporator and the system runs at lower pressure values in the low-pressure range. The system may freeze, show a low-pressure failure or liquid refrigerant may reach the compressor and damage or destroy the same.

12 Check the condensate outlets

The inlet ports in the evaporator and the outlet ports below the vehicle need to be freely accessible.
The hose needs to be mounted with a light down-grade to allow a draining of the water. The safe draining of the condensate can be checked by pouring water into the evaporator.

During operation the evaporators cool down and so deposit water from the sucked-off air which needs to be led away. This water needs to be continuously led down from the system.
If the water cannot drain accurately, water may enter the interior room or may be sucked via the blowers and may spread all over the system. Short circuits or failures of the electrical system may be the consequence.

13 Check all refrigerant pipes regarding impermeability

The impermeability check should be done with nitrogen. The maximum allowable pressure is 15 bars in the system and should not be exceeded to avoid damage to the control parts. Afterwards all screw connections should be checked carefully with a leakage detection agent.

The refrigerant circulation should be always impermeable to avoid an emission of refrigerant. A too small amount of refrigerant shortens the system capacity and may lead to compressor damage as the same is no longer being cooled accurately.

14 Check all heating pipes regarding impermeability and correct fit

Here a visible control of all heating pipes from the engine to the rooftop systems, convectors, under-seat heaters as well as all connecting points and clamps should take place. If there is a leakage of cooling water, the leak needs to be repaired immediately. Furthermore, the hose pipes should be checked regarding brittleness. Also the cooling water circulation of the vehicle should be checked whether the safety parts are in a faultless condition.

During heating operation, there may be temperatures over 100°C in the ducts and hose pipes. If these pipes are brittle or permeable there is an increased risk for the passengers. These might get in touch with hot cooling water and so suffer from severe burns. For this reason, the heating pipes need to be paid special attention.

15 Check all water valves regarding function and impermeability

Water valves may be activated via the respective vehicle diagnosis systems or the air conditioning regulator to check their function. In parallel, the impermeability of the valves should be checked visually.

The water valves regulate the supply of the warm cooling water to the respective consumers in the vehicle. Their function ensures that the vehicle may be heated accurately even at cold ambient temperatures.

16 Renew the oil fill of the refrigerant compressor

Remove the compressor and let the oil run out via the oil outlet screw. There is also the possibility to suck off the oil from the mounted compressor. However, here cannot be guaranteed that the oil is completely sucked off. When filling in fresh oil, the respective oil amounts of the compressors need to be considered.
Too much oil is as bad as too little and can damage the compressor.

As every lubricant also the compressor oil is subject to a certain abrasion and needs to be renewed after the first year and afterwards every 3 years. Furthermore, it is highly hygroscopic and so brings humidity into the system. This humidity can disturb the operation of the system. The compressor develops also certain grit during operation which is being absorbed by the oil, too. Over the years the grit may lead to severe soiling in the circulation. At systems with half-hermetic compressors, acidification of the oil may occur in case of winding defects which may destroy the gaskets and other parts of the air conditioning system completely.

17 Check screwed connections at the refrigerant compressor and brackets regarding tight fit

Visual check whether all screws are fixed safely at the compressor and the compressor bracket as well as its connected parts like generators, clamping element and rubber-bonded metals. In case a visual check cannot be done comprehensively, it is recommended to do the check of the mounting parts with tools and the respective required torque.

The compressor is located on a bracket which is partly mounted at the engine of the chassis. Here these bracket systems and the mounted parts are subject to vibrations which may loosen the screwed connections or even destroy them. To avoid dangers for third persons, it has to be ensured that the compressor itself is closed hermetically and the brackets and mounted parts are fixed safely and tightly at the respective place.

18 Check the v-belt of the refrigerant compressor regarding its condition

Visual check whether the belt drive of the compressor and its mounted parts are in an excellent condition.

The belts are made of natural rubber and other different materials. Especially natural rubber can become severely porous through permanent high temperatures. Poor condition of the belt increases the slip of the belt drive and so causes internal overheating of the belt through frictional heat. Via the v-belt all powers from the engine are transferred to the compressor and its mounted parts. To avoid tearing of the belts, they need to be elastic and not brittle or even show scissures.

19 Check the v-belt of the refrigerant compressor regarding clamping

This check can either be done by pressing with the thumb or with measurement instruments according to the respective manufacturer's specifications. New v-belts need to be retensioned after a short operational period to compensate the elongation.

A v-belt that is too tight generates too strong powers at the driven parts and may cause damage to the seals or bearings (rotary seal of the compressor, bearing of the magnetic clutch) or even cause cracks at the driven shaft. Bearings could be damaged and overheat which could – depending on the course of the failure - even cause a fire. A v-belt that is too loose tends to strong vibrations and to a high slip. Its vibration behaviour has the same impact as a belt that is too tight, or it may completely go off the belt drive and potentially entangle itself in other parts of the engine compartment and cause further damage.

20 Check all temperature sensors regarding function and tight fit

The correct position is checked by visual control. The function of the sensors can be checked by the assistance of the diagnosis systems. Here the sensors need to show realistic values. Furthermore, each sensor has a certain resistance value at a certain temperature. This can be checked by measuring of the environmental temperature and parallel measurement of the resistance with an ohmmeter.

The temperature sensors are an important basis for the function of the control system in the vehicle. With them the air conditioning system is run adequately and according to the respective specifications. The function and the correct position let the air conditioning system work economically and thus provide the desired effect.

21 Check the electrical plug connections and fuses

Visual check and mechanical check of the plug connection, fuses and screwed connections of the electric components.

Different components of the air conditioning system are run electrically and according to the specification and performance of the system there can be currents of more than 100 amperes. These performances need to be designed according to the rules of electrical engineering and to be fused in order to avoid overcharge.
The safety parts may not be manipulated in their size or exchanged as they consequently lose their function and may cause overcharge and high temperatures or even physical injuries to persons. To exclude these overcharges, fuses have to be checked according to size and all plug and screwed connections have to be checked regarding correct mechanical connection. Furthermore, electrical components need to be maintained in clean condition so that potential high temperatures do not cause dirt to work as a fire accelerant and generate a fire in the vehicle. Basically, when electric components are concerned, a preventive exchange of components is recommended as they are subject to a ageing and abrasion which is not visible from the outside.

22 Check heating performance

Activate the mode „maximum heating“ via the diagnosis system or the air conditioning regulator and check the heating function.

Control of the regulating parts and measurement of the temperatures at the inlet and outlet of the heat exchanger and the ambient room temperature. Assessment of the vehicle on the basis of its heating performance (functional check).

23 Check air conditioning performance

Activate the mode „maximum cooling“ via the diagnosis system or the air conditioning regulator and check the cooling system.

Control of the regulating parts and measurement of the temperatures at the inlet and outlet of the heat exchanger and the ambient room temperature. Assessment of the vehicle on the basis of its cooling performance (functional check).

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