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TNO report

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Legionella Safety Assessment for StatiqCooling Dew-Point Coolers

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Summary

At the request of StatiqCooling, TNO-Apeldoorn has carried out a Legionella risk analysis for the use of water in StatiqCooling dew-point coolers. StatiqCooling also delivers this type of dew-point coolers to Skippon and/or Comair Holland b.v. for application in residences in which the same method of humidification is used.

In consultation with TNO, the data of the cooling system – and especially data on the way in which the water is used for cooling – have been supplied by the commissioning party.

The conclusions of the research are:
Considering their nature, StatiqCooling dew-point coolers are subject to the rules set forth in the Dutch Health & Safety Order, Article 4.87, Ministry of Health, Welfare and Sport.
The analysis of the cooler shows no relevant aerosol formation so that the dew-point coolers are Legionella-safe, in accordance with the criteria of the Health & Safety Order. Therefore, a management plan or a logbook is not required.

Contents

1 Introduction

At the request of StatiqCooling, TNO-Apeldoorn has carried out a Legionella risk analysis for the use of water in StatiqCooling dew-point coolers. StatiqCooling also delivers this type of dew-point cooler to Skippon and/or Comair Holland b.v. for application in residences in which the same method of humidification is used.

The risk analysis involved:
- Inventory and description of the way in which water is used in StatiqCooling dew-point coolers;
- Legionella risk analysis for this process;
- Reporting on the results.

In consultation with TNO, the data of the cooling system – and especially data on the way in which water is used for the cooling – have been supplied by the commissioning party.

The risk analysis is based on the risk factors stated by the Ministry of Health, Welfare and Sport in the Health & Safety Order, Article 4.87.

2 Description of statiqcooling dew-point coolers

2.1 Principle of dew-point coolers

In a dew-point cooler (DPC), outside air is cooled down to practically the dew-point of the outside air. This point is reached by cooling down the outside air in an air/air heat exchanger. The cooling is achieved by way of the secondary air flow (process air) which contains about one-third of the primary air flow. This process air is humidified in the entire heat exchanger, causing this flow simultaneously to be cooled adiabatically and to absorb heat from the primary air flow. The result is simultaneous adiabatic cooling and heat absorption from the primary air flow which then cools down. Figure 1 presents this situation.

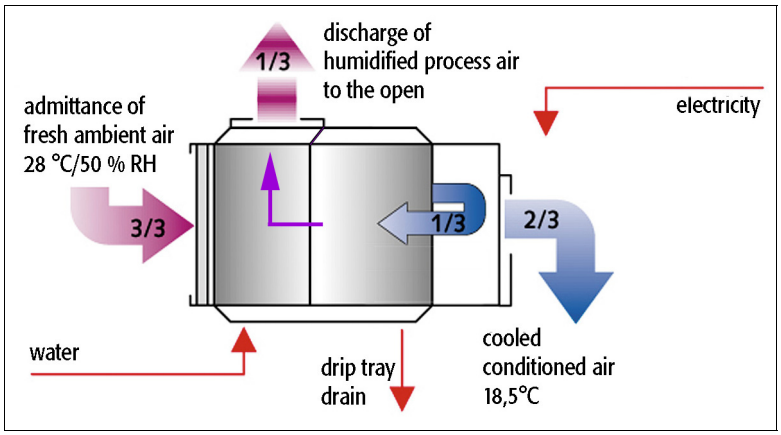

Figure 1 Principle diagram of a dew-point cooler

2.2 Construction of a dew-point cooler

Figure 2 shows the construction of a StatiqCooling dew-point cooler. Water is supplied to the secondary heat exchanger using sprinklers in the spray chamber mounted at the top across the entire width. For humidification, tap water is used that, if necessary, is softened. Superfluous liquid is collected at the bottom and discharged. The leak water is not re-used.
The process air is discharged at the top, with larger DPCs at the bottom as well.

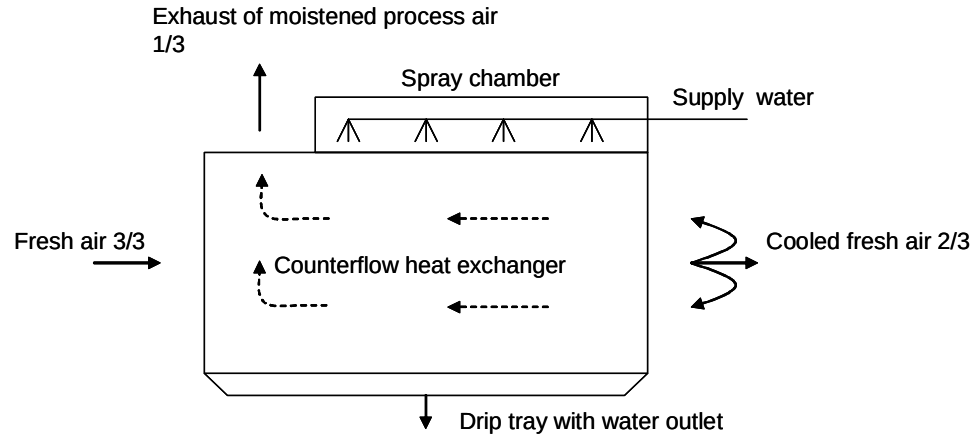

Figure 2 Diagram of DPC with the water flow for humidification

At the top of the heat exchanger the liquid from the spray chamber is absorbed by way of a membrane mounted on the inside of the process air ducts. This membrane absorbs the liquid at the top, transports it down, meanwhile releasing moisture to the process air through evaporation (Figs. 3 and 4).
Free air exchange between spray chamber and process air ducts is not possible since there is so little room between the membranes and the ducts. It is not possible for the moisture to be transferred to the outside air ducts.

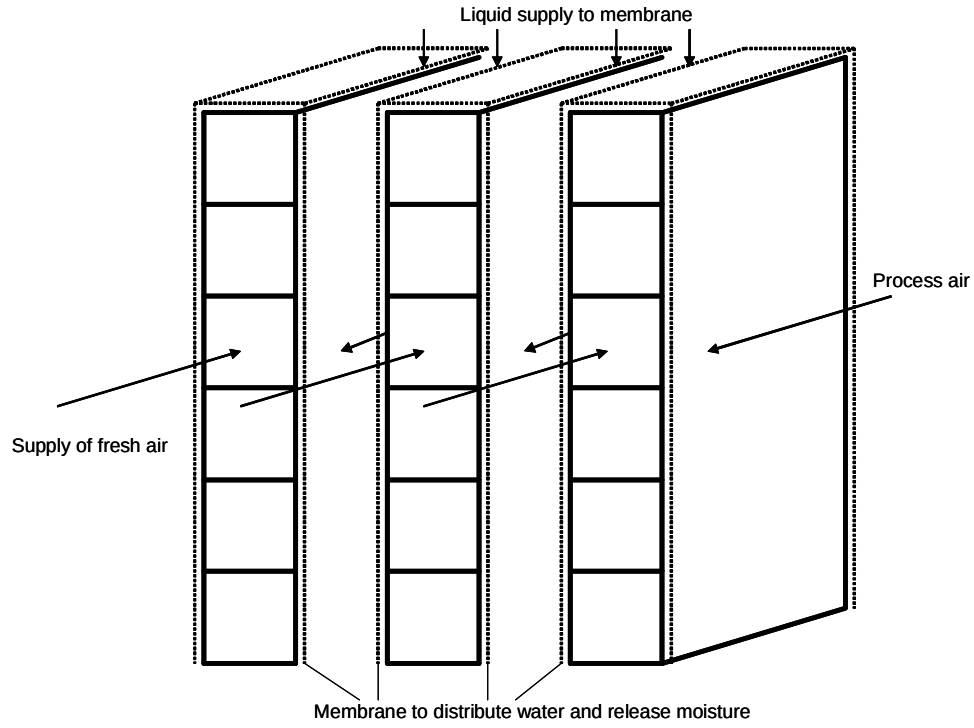

Figure 3 Construction of air ducts with membrane for humidification

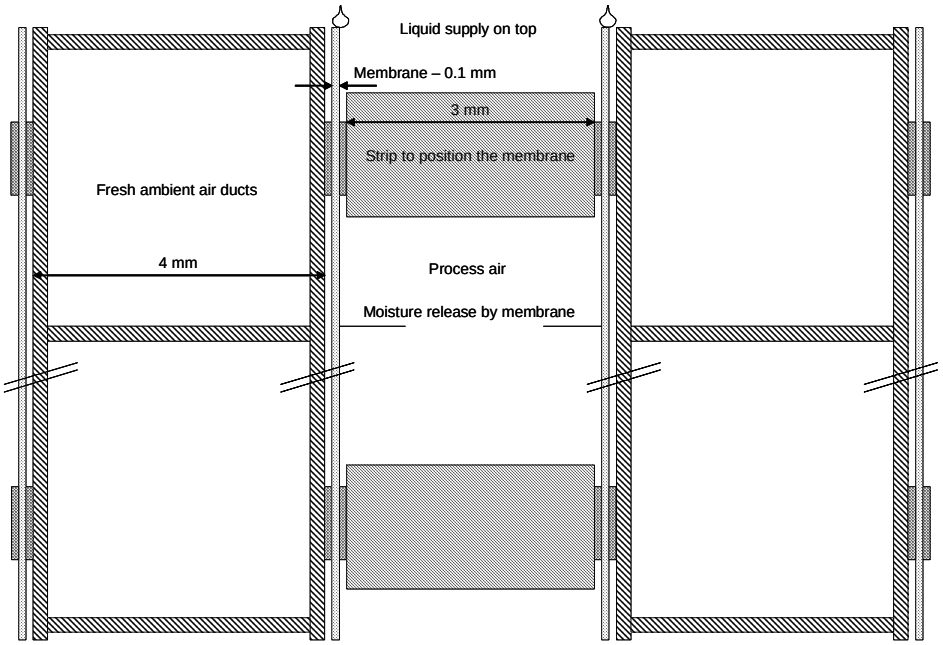

Figure 4 Details and measurements of air ducts with membrane for humidification

In StatiqCooling dew-point coolers, the process air is humidified through evaporation, and subsequently discharged to the outside. In this process, only tap water is used. Leak water is not re-used for humidification.

3 Legionella safety risk analysis

3.1 Rules

The rules and regulations with respect to the Legionella safety of air-conditioning systems have been laid down in the Health & Safety Order, Article 4.87, of the Ministry of Health, Welfare and Sport [1]. They are further worked out in Health & Safety Information folder 32 [2]. The rules pertain to a cooling tower, air humidifier or water plant that can bring water, in the form of aerosol, into the air. For such plants, a risk analysis and a management plan must be drawn up, and a logbook must be kept. Considering their nature, StatiqCooling dew-point coolers must meet the rules and regulations stated in the Health & Safety Order.

3.2 Risk Analysis

In StatiqCooling dew-point coolers, the only place where water in aerosol form is brought into the air is in the spray chamber above the heat exchanger. The air in this room has no open connections with the ambient air. Neither is any free exchange of air possible from the spray chamber with the process air at the top of the heat exchanger. Next, the liquid is absorbed by the membranes that evaporate the liquid in the heat exchanger. In normal operation, aerosol formation is not possible, because there is no atomization or any other form of free drop formation.
Considering the lack of relevant aerosol formation, the dew-point cooler is Legionella-safe.

However, if the water supply does not function properly, the occurrence of a very high water supply is possible. In that case, the water supply to the membranes is limited by the room between the strips and the supply channels (Fig. 4). The admitted water will flow downward through and behind the membrane (that is, between membrane and supply channel wall). No aerosols are formed in this process. If more water is supplied than can possibly be discharged in this way, the spray chamber will overflow, and water will flow along the outside of the DPC to the leak bin. From a functional point of view, it is desirable to equip the cooler with some kind of safety or alarm system for these situations.
Considering the above, the dew-point cooler is Legionella-safe and the risk analysis can thus be concluded. A management plan or a logbook is not required.

In order to prevent other forms of organic contamination from occurring in the DPC, it is desirable that the DPC and the membranes are dry the moment the ventilation is switched off. This can be achieved simply by stopping the water supply before switching off the ventilation, so that the process air can absorb the moisture remaining in the membranes.

When the DPC is connected to the water system, it is important to pay attention to the connecting pipe. It is expected that the DPC will not use any water during the heating season. A long connecting pipe (more than 5 times the diameter of the frequently used pipe to which the former pipe is connected) then forms a risk for the rest of the drinking water plant, and should therefore be avoided. Alternatives include directly connecting the DPC to the frequently used pipe, or tapping the connecting pipe during the heating season, which would also prevent freezing. An automated drain can be used for this tapping.

4 Conclusions

The conclusions are:
Considering their nature, StatiqCooling dew-point coolers must meet the rules and regulations stated in the Health & Safety Order, Article 4.87, of the Ministry of Health, Welfare and Sport.
The analysis of the cooler shows that no relevant aerosols are formed so that, according to the criteria of the Health & Safety Order, the dew-point cooler is Legionella-safe. Therefore, a management plan or a logbook is not required.

5 References

1. Arbowet 1998, artikel 5 / Arbobesluit artikel 4.87
(Occupational Health & Safety Act, 1998, article 5 / Health & Safety Order, Article 4.87)
Ministry of Health, Welfare and Sport, The Hague, January 2004

2. Arbo-Informatieblad 32 Legionella
(Occupational Health & Safety Information folder 32 Legionella)
SDU Publishers, The Hague, 2004

6 Authentication

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