



# Humidification and Adiabatic Cooling with Danfoss Nessie®

## Well being and performance

Indoor air quality in a building is dependant on numerous factors. Human beings feel most comfortable at humidity between 40 and 60% rH and a temperature between 20 and 22°C (68 and 72°F).

Optimally controlled humidity is a condition for healthy and high-performing people. It minimizes the risk of infections, bacteria growth, mould and the distribution of other micro-organisms.

Under the aspect of energy consumption, hygiene and operation costs, high-pressure atomization has found its place in the market. Danfoss Nessie® has developed a new system, custom tailored for the HVAC industry that one more time clearly puts customer benefit into focus.

## Facts

- Approved technology used for more than 20 years in installations for direct humidification
- The principle works adiabatically which means that the absorption heat is provided by pre-heaters or secondary heaters (similar to traditional air-washers)
- The principle does not represent any hygiene risk, and there is no need for adding any chemicals
- It is suitable for operation with ordinary potable water such as softened and demineralized water (RO-water, DI-water)

## Why Nessie®?

- The total costs of ownership for such a system are considerably lower than for any other humidification system found in the industry
- The energy consumption is extremely low (approximately 4 W per litre of water)
- Certification according to HACCP\* is possible
- All system components only require an absolute minimum of maintenance. Consequently, maintenance costs are very low compared to any other principle.

*\*(Hazard Analysis & Critical Control Point) is an internationally recognized systematic process for generating safe hygiene control systems. The process is applied worldwide, a.o. in the food processing areas, in hospitals and other related areas with rigorous demands on hygiene safety in order to document that the products in question do not present any health hazard.*



### The high-pressure principle

A high-pressure pump unit boosts the pressure to up to 100 bar (1450 psi). With special nozzles and due to the high pressure, the water is atomized into extremely fine aerosols. The water mist evaporates instantaneously and complete without adding any further energy. The change of air-condition is adiabatic and is very well suitable for cooling the return air in connection with cross heat exchangers and heat recovery wheels.

To achieve a complete absorption of the water, the system requires a minimum absorption distance of 1.5 m (5 ft).



### New installations

Total costs of ownership for new systems are the absolutely lowest in the market. A humidifier duct section with nozzles can be integrated in any kind of air-handling-unit without much effort.

The humidifier is typically installed downstream the pre-heater to ensure the best possible conditioning of the air before entering the humidifier and thus fast absorption of the aerosols.

The temperature drop caused by the adiabatic cooling effect can be compensated by the secondary heater, if necessary.



To provide the necessary amount of water, an adequate number of nozzles is installed throughout the entire cross section of the air-handler.

To control the amount in part loads, nozzle groups are switched on and off as required. With 3 Danfoss valves, a 6-step control is possible allowing a sufficiently accurate control of the humidification or adiabatic cooling.



### Retrofitting of existing humidifiers

Traditional air washer duct sections are in most cases retrofittable with the high-pressure technology, because the duct with drain pan and aerosol separator often can be reused. Nevertheless, latest hygiene regulations must be observed. Even existing building management system connections can often be reused.

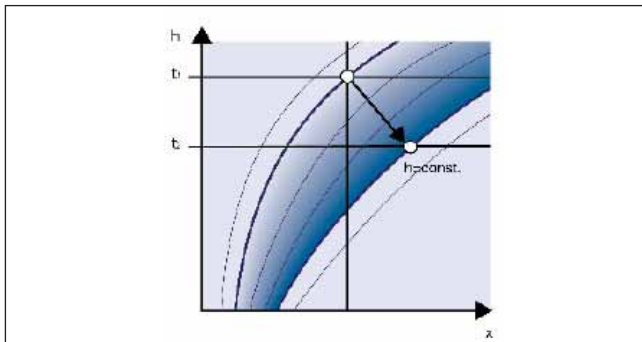
When replacing steam humidifiers, a new duct section is unavoidable, as the absorption distance of such systems is not adequate for high-pressure nozzles. However, experience has shown that even in this case, retrofitting is practicable and economically justifiable.



*The steam system was kept in place for back-up*



Air handling unit with heat recovery wheel, return air in the top, supply air in the bottom



### Adiabatic cooling with high-pressure technology

Analogous to atomizing systems for humidification, the same principle can be used for adiabatic cooling of return air. A temperature drop of up to 10°C (18°F) is achievable with cross heat exchangers or heat recovery wheels transferring the cooling effect to the supply air of the AHU. Adiabatic cooling can assist the chiller or – under favourable climatic conditions - make the operation of the chiller temporarily unnecessary, ie in transition periods in spring or fall.

The achievable temperature drop can be read from the Molier-diagramm (psychrometric charts). Each kilogram of water evaporated per hour represents a cooling effect of 640 W. In other words, a system with a capacity of 100 l/h (220 lbs/h) equals 64 kW cooling effect, while the high-pressure pump only consumes app. 4 W/kg of water. In adiabatic cooling systems it is often not required to treat (demineralize) the water.



### General use

For systems from 5000 m<sup>3</sup>/h / 5000 cfm (capacity from 50 l/h / 110 lbs/h).

The system can be operated with drinking water from the utilities as well as softened water and water from a reverse osmosis or de-ionization plant.

The best possible regulation of the humidifier load is achieved by switching nozzle groups on and off with valves as well as constant pressure control with Danfoss variable speed drive technology.

The number of nozzles is calculated from the necessary humidifier load and the available space.



# What Danfoss Nessie® can offer



## Products

- From a high-pressure pump to a ready-to-go pump unit including valves and humidity controller
- High-pressure nozzles with various capacities for different applications
- Valves to control the humidifier load
- Complete nozzle racks for installation in the plenum of an airhandling-unit

## Consulting, dimensioning and installation

Danfoss supports consultants, contractors and installers with specific application knowledge in specifying, choosing and dimensioning of the high-pressure components as well as other system components of the air-conditioning system.

It is in our special interest to ensure the best possible installation of the nozzle rack to ensure an optimal system performance and lowest operation costs. Furthermore, it is essential to evaluate existing humidification systems to propose the most economic solution in retrofit projects.

We also assist our clients to calculate the amortisation period time in new installations as well as in retrofitting.





*Danfoss Nessie®*  
*Your Source to Knowledge and New Solutions*



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Danfoss A/S is one of the largest industrial companies in Denmark and is a leader in research, development and production for a wide spectrum of different industries. Danfoss products are sold and serviced worldwide by an international network of sales companies and distributors. These companies provide reliable deliveries from local stocks, are committed to customer satisfaction and are managed by local professionals who understand their market's needs.

The Danfoss Group's primary aim is to create quality of life for our stakeholders and to be a leader in refrigeration, heating and motion controls. Our work is based on our Core Values: Trust, Passion for Technology, Reliability, Global Perspective with Local Commitment and Environmental and Social Responsibility

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