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THE EUROPEAN EVAPORATIVE COOLING INDUSTRY IN A NUTSHELL

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1. INTRODUCTION

The demand for energy efficient buildings and more stringent environmental sustainability requirements in the process industry have increased in recent years. As a consequence, the comfort and industrial cooling industry needed to be considerably dynamic in replying to the changing market demand. Evaporative cooling combines high thermal efficiency and cost effectiveness by achieving low cooling temperatures with minimum energy and water usage. Low cooling temperatures are essential for many processes to achieve high system efficiency. These processes consume less energy, and, in this way, evaporative cooling contributes to preserving natural resources and the environment.

1.1 GENERAL OBJECTIVE

Evaporative cooling products are used to remove waste heat from processes and reject it to the atmosphere. Unlike with other heat rejection equipment, the thermal performance of evaporative cooling products largely depends on the evaporation of water caused by effective mixing of water and air. The latent heat transfer, caused by evaporation, is not governed by aerodynamic principles only. In fact, aerodynamic efficiency plays only a minor role in the total heat transfer.

With evaporative technologies it is possible to decrease the process temperature up to about the wet bulb temperature (lower than dry temperature). Compared to cooling with dry air (sensible heat transfer), evaporative cooling is more efficient; with 1 kilogram of water the heat removed is about 2,200 kilojoule (heat of evaporation) per degree °C, while with 1 kilogram of air the heat removed is about 1 kilojoule per degree °C.

1.2 DIFFERENT TYPES OF THE EQUIPMENT

1.2.1 OPEN CIRCUIT COOLING TOWER

Water from the heat source enters an inlet connection and is distributed over the fill pack through a spray distribution arrangement. Simultaneously, ambient air is induced or forced through the tower, causing a small portion of the water to evaporate. This evaporation removes heat from the remaining water. The cooled water falls into the tower sump from where it is returned to the heat source. It is ‘open circuit’ as the water to be cooled is in contact with the atmosphere.
1.3.2 CLOSED CIRCUIT COOLING TOWER/CONDENSER

The fluid to be cooled is circulated inside the tubes of the heat exchange coil. A secondary system distributes water over the tubes of the coil. Simultaneously, air is forced or drawn through the coil causing a portion of the secondary water to evaporate. This evaporation removes heat from the fluid or refrigerant inside the coil. The secondary water falls to the sump from where it is again pumped over the coil. This is called ‘closed circuit’ as the fluid to be cooled is in a sealed loop and does not come into contact with the atmosphere.

Fig. 3: Closed circuit cooling towers / condenser

1.3 THE MAJOR APPLICATION AREAS

Evaporative cooling equipment finds its field of application in all those processes which have better efficiency due to water evaporation (benefit of lower cooling temperature). These are the so-called “temperature sensitive” processes.

Examples of these processes include:
- HVAC applications
- Industrial applications
- Industrial refrigeration applications

1.4 THERMAL PERFORMANCE CERTIFICATION: ECC & CTI

The most fundamental aspect of quality for any machine is the ability to fulfill its design function. For evaporative cooling equipment this mission is proper heat rejection. Accurately quantifying the temperature level at which heat is rejected is a challenge that requires expertise and know-how. National and International Standards for thermal performance testing of cooling towers have been prepared in cooperation with engineering societies, associations and institutes. These Standards focus on performance testing as a part of the commissioning process of a specific installation. However, manufacturers have a need for thermal performance testing programmes that certify the performance for an entire product line and guarantee to third parties the correct performance in accordance with published data. Depending on the manufacturing locations, a manufacturer also might wish to guarantee consistent and identical reproduction of the base design with a consequential transferrable performance guarantee to the alternate production locations.

The thermal performance certification has remained a recurring item on the agenda of the European evaporative cooling industry. In this respect, a joint Eurovent Certita Certification (ECC) and CTI (Cooling Technology Institute) certification programme is in place. This programme assesses and certifies the Thermal Performance and Efficiency of a cooling tower.

1.5 THERMAL PERFORMANCE AND EFFICIENCY

The cooling tower shall be capable of cooling a certain amount of water from a defined temperature to another defined temperature at the design wet-bulb air entering temperature.

The thermal performances are ECP certified in accordance with the most recent ECC and CTI certification standards.
2. MANUFACTURERS AND PRODUCTS

2.1 ESTIMATED NUMBER OF MANUFACTURERS IN EUROPE
The European evaporative cooling industry is almost entirely made up of SMEs (Small and Medium Enterprises). By considering manufacturers coming from EU28, Russia, and Turkey, it is possible to estimate a final number of about 45 manufacturers active in Europe1.

2.2 PRODUCTION SITES ALL OVER EUROPE
According to the above estimated number of manufacturers active in Europe, it is possible to estimate that in EU28, Russia, and Turkey there about 50 production sites for evaporative cooling equipment1.

2.3 ESTIMATED COMBINED ANNUAL TURNOVER
Based on declared and reassessed data, the EU evaporative cooling industry (not including the field erected equipment) has a direct yearly combined turnover of about 265M EUR1.

2.4 EMPLOYMENT FIGURES
Based on declared and reassessed data, the EU evaporative cooling industry (not including the field erected equipment) has an aggregated direct number of employees of about 1,420 people1.

2.5 PRODUCTS INSTALLED IN EUROPE PER YEAR
Based on declared and reassessed data, the total aggregated number of installed evaporative cooling equipment (not including the field erected equipment) in EU28, Russia, and Turkey in 2017 is about 4,000 sold units1.

1 Source: Eurovent Market Intelligence
3. ENERGY CONSUMPTION AND CO₂ SAVING

3.1 INSTALLED HEAT REJECTION CAPACITY
Based on declared and reassessed data, the installed heat rejection capacity (not including the field erected equipment) in EU28, Russia, and Turkey in 2017 is about 3,600,000 kW1.

3.2 ELECTRICAL POWER ABSORBED BY AUXILIARIES’ COMPONENTS (FANS)
Based on declared and reassessed data, the electrical power absorbed by auxiliaries’ components (fans) in EU28, Russia, and Turkey in 2017 is about 66,000 kW5.

3.3 ACHIEVABLE CO₂ SAVING DUE TO EVAPORATIVE TECHNOLOGIES AND RELATED FIGURES
The average installed base of air-cooled chillers (cooling capacity > 1,000 kW) in EU28 is about 530 units per year2.

Eurovent has conducted an extensive study, which has simulated, on a year-round base, the typical behaviour of a refrigeration system using an air-cooled condenser and a water-cooled condenser using wet cooling towers.

This study has resulted in average CO₂ emission saving of about 15.5% for industrial applications and 16% for HVAC applications.

By converting the above estimated installed base of air-cooled chillers (530 units per year in EU28), it is possible to conclude that by using evaporative cooling equipment CO₂ emission saving of about 56,000 tons of CO₂ per year is fully achievable.

The above estimated possible CO₂ savings can be translated in:
- Greenhouse gas emissions from 10,800* passenger vehicles driven for one year
- CO₂ emissions from electricity use of 8,800* for one year
- CO₂ emissions from 118,000* consumed barrels of oil
- Carbon sequestered by 24,000* hectares of forest

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1 Source: Eurovent Market Intelligence
2 Source: Eurovent Market Intelligence
4. LEGISLATION AND STANDARDISATION

4.1 APPLICABLE EU LEGISLATION

4.2 APPLICABLE NATIONAL LEGISLATION
[12] Italy: Linea Guida del Ministero della Santità: Linea guida per la prevenzione ed il controllo della legionellosi – 2005

4.3 ISO STANDARDS
[2] ISO 3744: Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for an essentially free field over a reflecting plane

4.4 EN STANDARDS
[1] EN 12705 - Method of measurement and evaluation of thermal performances of wet cooling towers
[2] EN 13741 - Thermal performance acceptance testing of mechanical draught series wet cooling towers

4.5 CTI STANDARDS
[1] CTT-ISO: Acceptance Test Code for mechanical draft and natural draft cooling towers

4.6 ASHRAE STANDARDS

4.7 NATIONAL STANDARDS, SPECIFICATIONS AND RECOMMENDATIONS

4.8 EUROVENT RECOMMENDATIONS
[5] Eurovent 9/5 - 2002: Recommended code of practice to keep your cooling system efficient and safe
[7] Eurovent 9/7 - 2011: Recommendation to keep your cooling system efficient and safe

4.9 VDI COOLING TOWER CODE OF PRACTICE
ABOUT EUROVENT

Eurovent is Europe’s Industry Association for Indoor Climate (HVAC), Process Cooling, and Food Cold Chain Technologies. Its members from throughout Europe, the Middle East and Africa represent more than 1,000 organisations, the majority small and medium-sized manufacturers. Based on objective and verifiable data, these account for a combined annual turnover of more than 30bn Euros, employing around 150,000 people within the association’s geographic area. This makes Eurovent one of the largest cross-regional industry committees of its kind. The organisation’s activities are based on highly valued democratic decision-making principles, ensuring a level-playing field for the entire industry independent from organisation sizes or membership fees.

OUR MEMBERS

Our ‘Members’ are national associations from Europe, the Middle East and Africa that are representing manufacturers in the area of Indoor Climate (HVAC), Process Cooling, Food Cold Chain, and Industrial Ventilation technologies.

The more than 1,000 manufacturers within our network (Eurovent ‘Affiliated Manufacturers’ and ‘Corresponding Members’) are represented in Eurovent activities in a democratic and transparent manner.

For in-depth information and a list of all our members, visit www.eurovent.eu
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