



OBJECT INFORMATION

NUSSBAUM FRANKENBERG

PERMANENT AIR AND
HEAT EXCHANGE
IN ALUMINIUM PROCESSING



Nussbaum Frankenberg GmbH, founded in 1993, is a family-owned company with three production sites and meanwhile has more than 400 employees. The group is active nationally and internationally in the production of high-quality and sustainable aluminium cans. Particularly in terms of sustainability, Nussbaum is a leader with its Nucan-PCR recyclable cans. These aluminium monobloc cans made of 100% used beverage cans, achieve a CO₂ reduction of 96%. The aluminium cans are developed and manufactured in-house, lacquered individually and distributed. The main application of the products is in the food and pharmaceutical industries. The challenge of the production facility: Aluminium processing is basically very energy-intensive, which leads to a high heat load in the production hall.

BRIEF DESCRIPTION

Location: Nussbaum Frankenberg GmbH
Project: Renovation resp. creation of a permanent ventilation possibility
Time period: 2019-2020
Products: 23 Double flap ventilators type MEGAPHÖNIX including insect screens, nine double flap ventilators type PHÖNIX



**Andreas Klepin, Plant Manager,
Frankenberg Nussbaum GmbH**

“We had our production certified for the manufacture of - primary packaging material for pharmaceuticals - which required new hygiene standards. Another challenge was to effectively extract the heat energy, especially on warm days. The concept of the company roda greatly convinced us here and during the implementation, a smooth conversion of the ventilation systems could even be ensured during ongoing operation.”

RENOVATION WITH REUSE OF THE ROOF OPENINGS

Thanks to careful planning, the renovation measures could take place during ongoing operations. The renovation work on the roof was also kept to a minimum by using the on-site bases. This meant that no further roofing work was necessary, and the roof sealing remained intact.

By using an adapter flange, on-site tolerances were compensated during assembly and the individually manufactured double flap fans, accurate to the millimetre, were mounted on the existing bases.

REQUIREMENTS ON THE SYSTEMS

In order to produce primary packaging for pharmaceutical products, certain hygiene standards must be met due to the direct contact. The requirements for quality management are specified in the GMP 15378 standard (principles of good manufacturing practice), which includes, among other things, insect-fly protection. With the certification for the production of primary packaging for medicinal products, the higher hygiene standards had to be met. An insect-proof design of the natural ventilation systems made the renovation necessary.

The necessary renovation also offered the opportunity to get the heat problem under control. For aluminium to be processed, a processing temperature of at least 400 °C has to be reached, the melting temperature of aluminium is 660.3 °C. In addition, the painting work leads to aerosols, small particles, in the air and has a strong impact on man and machine. The previously installed continuous rooflights, rooflights and ventilation flaps could by no means ensure the necessary air and heat exchange. The old rooflights with their stroke of 300 mm were only suitable to a limited extent. This meant that in summer the rooflights partially had to be unlocked manually on the roof to achieve a sufficient air and heat exchange. This was very time-consuming and expensive.



Before: Continuous rooflights, rooflights and ventilation flaps



roda solution: Double flap ventilator type MEGAPHÖNIX and PHÖNIX



Fall-through grilles for more safety on the roof during cleaning and maintenance work and insect screens for hygiene protection

THE RODA SYSTEMS

To ensure a permanent and sufficient exchange of air and heat, it was decided to use 23 double flap ventilators of type MEGAPHÖNIX with the dimensions 1900 x 1900 mm. The MEGAPHÖNIX is a multi-purpose ventilator that can be used with the full aerodynamic exhaust area in good weather, with the blades set at 90 degrees. Wind and rain sensors open and close the systems automatically. In addition, side flaps ensure sufficient air exchange, even in bad weather, allowing for a permanent exchange of air and heat. This way it is possible to permanently renew the heavily saturated air and thus protect man and machine. These systems were supplemented by

nine additional double-flap fans of the type PHÖNIX, which exclusively serve as a compensation area. In order to meet the hygienic requirements, all systems were equipped with insect screens. These were designed as a drawer for easy access for cleaning work. The roda systems are real endurance runners and are designed in a way that the flaps can be opened and closed several times a day for years, depending on the weather and production demands.



MEGAPHÖNIX in ventilation position 90° for maximum natural air exchange

THERMAL BUOYANCY CALCULATION

Hall area 2880 m²

Hall height 10 m

Heating from working level to under roof 10 K:

Summer fair weather (assumption outside temperature 25 °C):

Calculation for natural thermics:

$$V = \text{Root} (g \times h \times \text{delta } T/TA)$$

$$V = \text{Root} (9,81 \text{ m/s} \times 10 \text{ m} \times 10 \text{ K}/298 \text{ K})$$

$$V = 1,81 \text{ m/s}$$

This results in approx. 83 m² opening area in the roof with 23 units a` 3.61 m²:

$$83 \text{ m}^2 \times 1,81 \text{ m/s} = 150 \text{ m}^3/\text{s}$$

150 m³/s x 60 x 60 = 540.000 m³/h this means an 18-fold air exchange rate.

Summer rain (assumption outside temperature 25 °C cooling down to 15° due to rain):

Calculation for natural thermics:

$$V = \text{Root} (g \times h \times \text{delta } T/TA)$$

$$V = \text{Root} (9,81 \text{ m/s} \times 10 \text{ m} \times 10 \text{ K}/288 \text{ K})$$

$$V = 1,85 \text{ m/s}$$

This results in approx. 26 m² rainproof opening area in the roof with 23 units a` 1.14 m² inner flap area:

$$26 \text{ m}^2 \times 1,85 \text{ m/s} = 48 \text{ m}^3/\text{s}$$

48 m³/s x 60 x 60 = 172.800 m³/h this means an approx. 6-fold air exchange rate even during storms/rain.



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PHOENIX AND MEGAPHOENIX



FIREFIGHTER



VENTURISMOKE VS1/VS2



SMOKEJET AND MULTIJET



SMOKE CURTAINS



LOUVER WINDOWS



DAYLIGHT TECHNOLOGY



NATURAL AND MECHANICAL
VENTILATION



MAINTENANCE



RENOVATION



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METAL CONSTRUCTIONS



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Thermal transmission coefficients for our composite glazing were calculated using the finite element method with reference values in accordance with DIN EN 673 for insulated glass. Based on empirical values and specific characteristics of the plastics, a temperature vector of 15 K was defined as the vector between the outer surfaces of the material. Functional values refer to test specimens and the dimensions used in testing only. We cannot provide any further guarantees of technical values. This particularly applies to changes in installation locations, or if dimensions are re-measured on site.



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