



PROJECT INFORMATION
Biffar Edenkoben - Less Is More



Biffar Edenkoben - More ventilation area on a smaller roof opening area

Before the refurbishment, 5x1 m light domes were installed in order to achieve a fairly sufficient air exchange for the size of the hall. The light dome systems opened with a stroke of 300 mm only, hence, ventilation was not very efficient. When the whole roof was refurbished, and a new roofing was to be installed, it was decided to replace the existing plinths as well as the smoke and heat extractors and ventilation systems at the same time. With roda, a business partner was found, who was able to produce tailor-made units for the existing roof openings. Due to the fact that roda double flap systems are able to use their complete aerodynamical effective opening surface for ventilation purposes, it was possible to achieve a significantly higher ventilation capacity with systems of only half the size. While the 5m² light domes just reached a ventilation area of 1.12 m², the 2.39 m² small PHOENIX systems boast an aerodynamically effective opening area of 1.55 m² for ventilation purposes. The other half of the 5x1 m roof opening size was cost-effectively closed off with rigid systems. Apart from the 46 PHOENIX smoke and heat extractors and ventilation systems with a geometrical opening surface of 2.39 m² (23 of them being rigid systems), further 12 PHOENIX with $A_g = 3.24 \text{ m}^2$ and 2 PHOENIX with $A_g = 2.5 \text{ m}^2$ were installed. The total aerodynamically effective opening surface of the installed systems amounts up to 64.26 m²



Michael Erb | Procurement Biffar GmbH & Co. KG

"We are convinced of the quality of roda systems. roda's expertise and the constructive cooperation with this company, in the course of which we were able to find an effective and cost-saving alternative to the existing system, was very convincing, too."

Josef Willerich | Maintainer Biffar GmbH & Co. KG

"Being the maintainer of Biffar it was important to me that we don't just buy quality and above all service just on paper. I am grateful to have found a partner in Mr. Kettler from roda, who already starts thinking along during the planning processes for the sake of the customer and who does not let possible problems arise during the implementation."



Biffar Edenkoben - More opening area on smaller space

The following model calculation demonstrates how ventilation capacity is gained:

Ventilation capacity of a 5x1m light dome:

$$a = 1 \text{ m}$$

$$b = 1 \text{ m}$$

$$c = 300 \text{ mm stroke} = 0,3 \text{ m}$$

$$\begin{aligned} \text{opening angle } \vartheta &= \arccos \left(\frac{b^2 + c^2 - a^2}{2bc} \right) \\ &= \arccos \left(\frac{1\text{m}^2 + 0,3\text{m}^2 - 1\text{m}^2}{0,6} \right) \\ &= 17,25^\circ \end{aligned}$$



Flow coefficient C_{vw} of a D+H single unit without deflector plates

Opening as tilt window	W/H Clear frame dimensions	Opening angle°															
		15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
C_{vw} -Values	$W/H < 0,65$	0,21	0,24	0,28	0,31	0,34	0,36	0,38	0,39	0,40	0,41	0,42	0,42	0,43	0,43	0,43	0,43
	$0,65 \leq W/H < 1,10$	0,18	0,21	0,24	0,26	0,29	0,31	0,33	0,35	0,36	0,37	0,37	0,38	0,38	0,38	0,38	0,38
	$W/H \geq 1,10$	0,22	0,27	0,31	0,36	0,39	0,43	0,46	0,48	0,50	0,51	0,52	0,52	0,52	0,52	0,53	0,53

Attention – this table is for illustrative purposes only.

Source: http://www.raico.de/assets/web/PDFs/Download/Deutsch/Techn.%20Infos/Richtlinien_NRWG.pdf

$$A_v = \text{geometrical opening area} = 5 \times 1 \text{ m} = 5 \text{ m}^2$$

$$C_v = \text{efficiency} \approx 0,225$$

(to be taken from the table - $B/H = 0,2 \leq 0,65$ / Opening angle = $17,25^\circ$)

$$A_A = \text{aerodynamically effective opening area} = A_v \times C_v = 5 \text{ m}^2 \times 0,225 = \underline{1,125 \text{ m}^2}$$

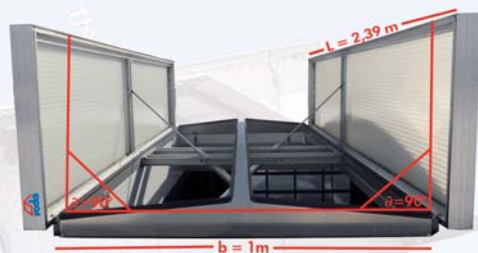
Ventilation capacity of the installed 2.39 x 1 m double flap PHOENIX systems:

$$A_v = \text{geometrical opening area} = 2,39 \times 1 \text{ m} = 2,39 \text{ m}^2$$

$$C_v = \text{efficiency} = 0,65$$

(proved by aerodynamical certificate)

$$A_A = \text{aerodynamically effective opening area} = A_v \times C_v = 2,39 \text{ m}^2 \times 0,65 = \underline{1,554 \text{ m}^2}$$





Many of the old light domes were useless for ventilation as they couldn't be opened any more.



The 5x1 m light domes were operated by three actuators.



One rigid system and one serving as smoke and heat ventilation unit each were installed on the plinths.



Smaller light domes were replaced by custom-made PHOENIX systems as well.