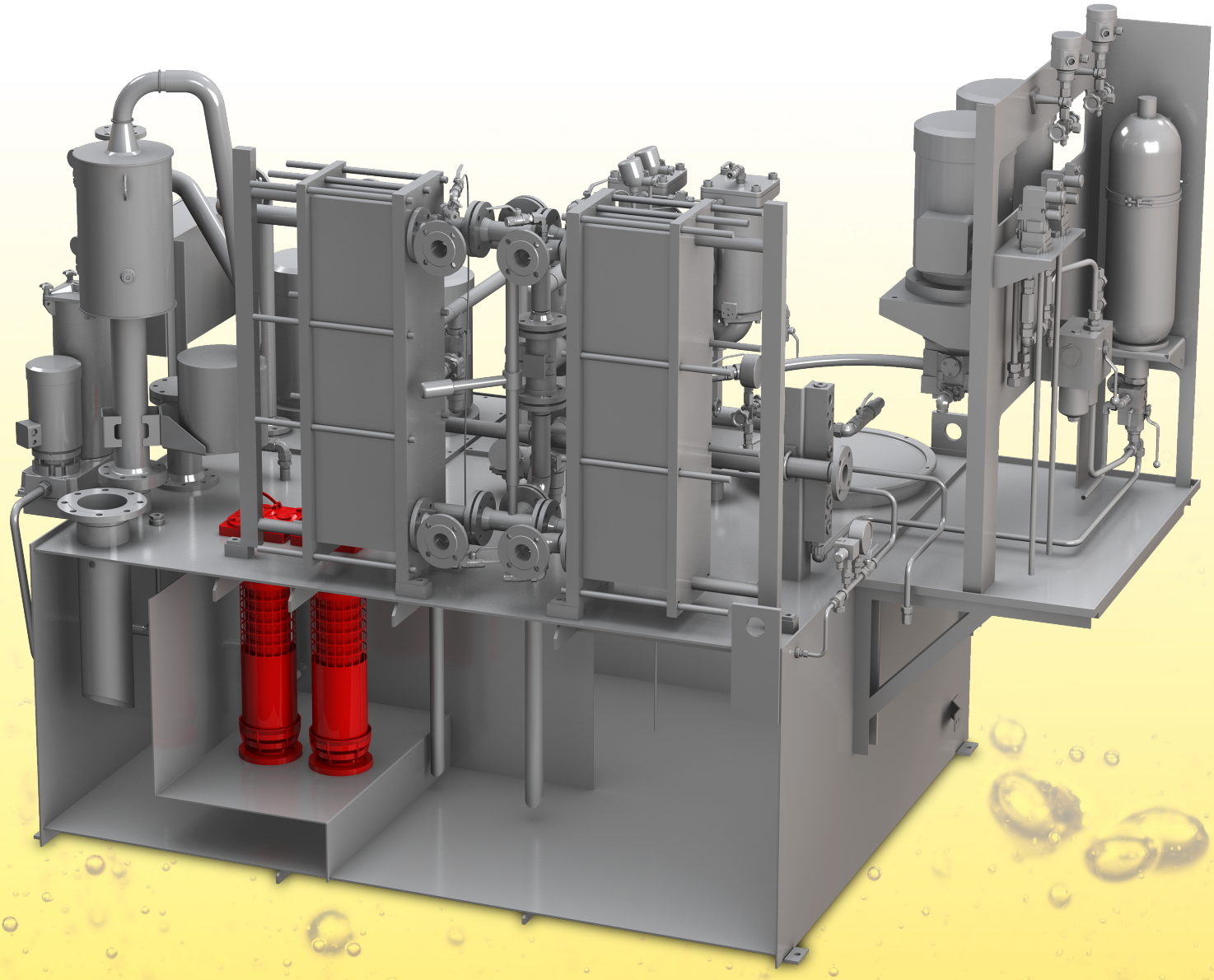
HYDAC INTERNATIONAL

# Tank Concept with Air-X Technology

for low-pressure systems with oils < 50 cSt



EN 7.230.1/08.25

# Tank Concept with Air-X Technology

## Challenge

A breakdown of the lubrication film in machine elements may result in major damage to the machine itself and furthermore to production downtimes. Lubrication systems are therefore used to ensure that bearings, gearboxes, mechanical seals etc. such as those in turbines, process compressors and process pumps are well lubricated.

Lubricating oil systems also channel away abrasion debris and friction heat.
Even air that may have entered the system via the mechanical seals, for example, needs to be removed with almost zero residue. The entry of air into the system is also deliberately increased by oil mist separators. The negative pressure generated in the tank continues up to the mechanical seals and ensures that air is taken in there rather than oil being released to the outside.

## Current state of technology

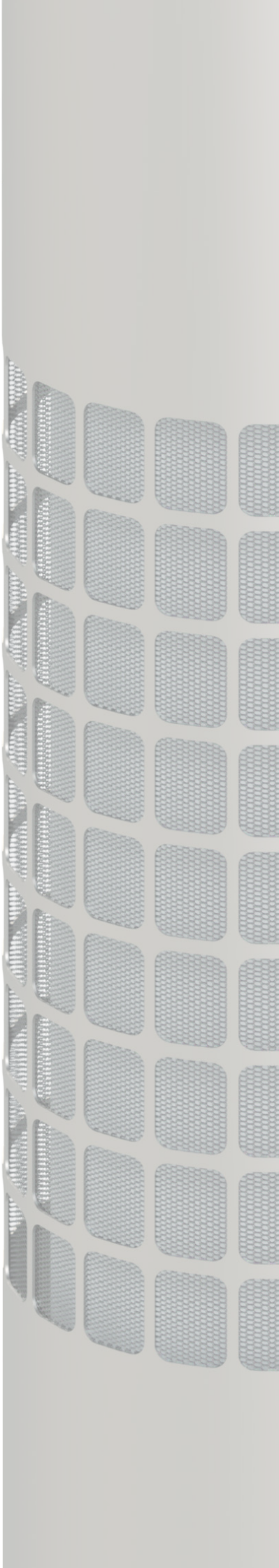
Air bubbles, which may be finely distributed in the oil, rise to the surface in the flowing oil, where they are then “separated”. This process takes time, so conventional lubricating oil tanks are designed for the journey from return line → oil inlet and oil outlet → suction line to take six to eight minutes. Special tank installations channel the oil through the tank.

## Optimum air separation through innovation

Experiments have shown that using the new HYDAC degassing components, which are presented below, can reduce the dwell time of 6 – 8 min, which is typical for the application, to 2 min, depending on how much air enters via the return lines.
For original tank sizes from 100 to 20,000 litres, this means enormous financial savings, a greatly reduced environmental impact, a drastic reduction in the amount of floor space needed and major weight reductions in the steel construction.

## Customer Advantages

- **Large cost reductions thanks to reduced material use**
  (steel, oil (both at initial start-up and during every oil change), smaller fluid conditioning units)
- **Enormous reduction in weight**
  meaning that costs can also be saved in the design of the building
- **Reduced logistics expenditure**
  thanks to lighter and smaller tank
- **Increased sustainability**
  thanks to lower oil quantity



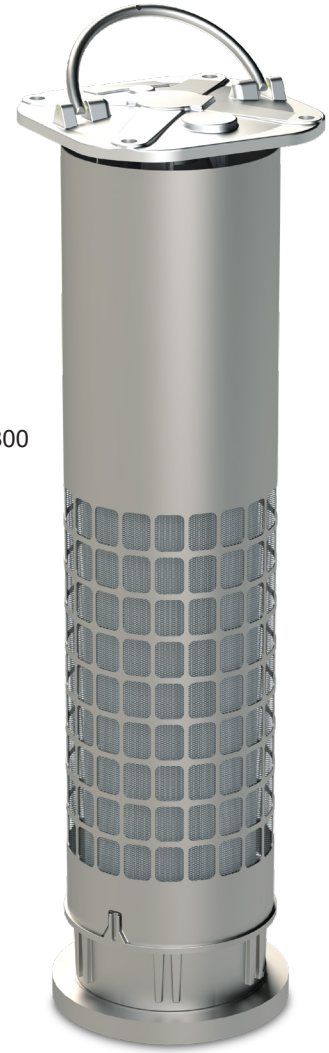
**Note**

The information in this brochure relates to the operating conditions and applications described.
For applications and / or operating conditions not described, please contact the relevant technical department.
Subject to technical modifications.

# HYDAC Product Series Degassing Unit RKB

## Function in detail

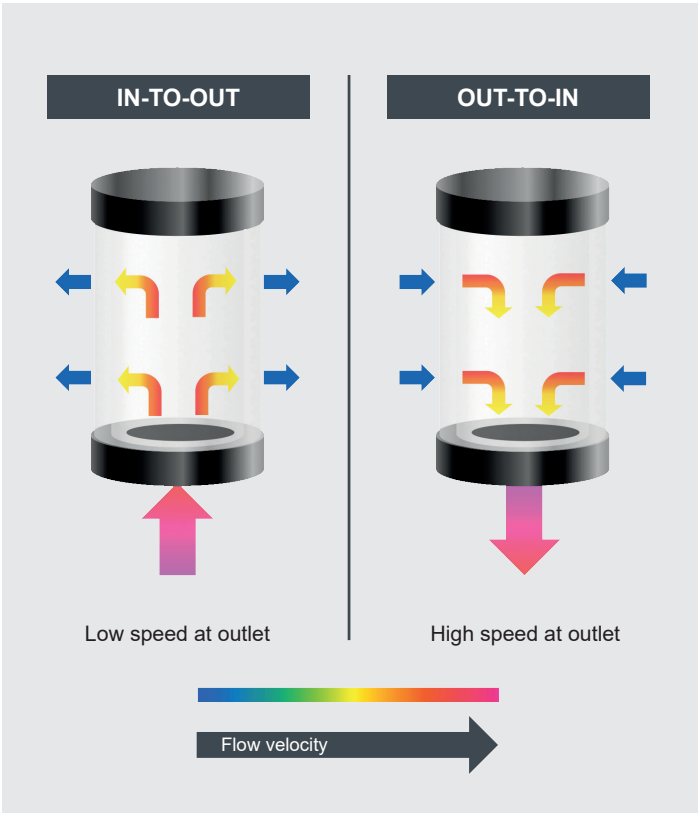
The special degassing concept of the RKB product series enables the quantity of air in the oil to be reduced quickly.
The degassing components are installed close to the return flow. To prevent an undesired backlog from occurring there, the components are designed to be operated with very low pressure losses of roughly 5 mbar at the operating point.



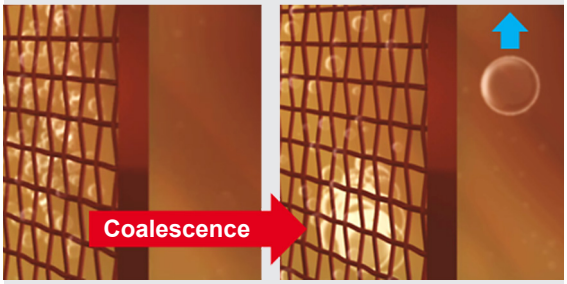
Example: RKB 800

## Flow direction

In all the degassing components in the series, flow passes from the inside to the outside.
One of the important properties of this flow direction is that it calms the flow towards the tank, as well as entrapping coarse dirt on the flow side when the inner Air-X unit is changed.
Because of the larger outlet flow cross section, the oil flows out of the degassing unit much slower. The air bubbles in the oil therefore have more time to rise.
The even and slow exit flow of the oil also results in a calm oil level in the tank. There is no “splashing” in the tank, which could cause air to enter back into the fluid.



# Tank Concept with Air-X Technology



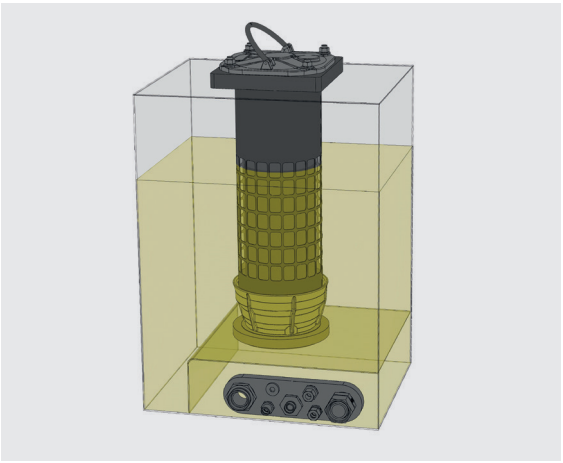

**Coalescence effect at the metal grate**

## Coalescence

From a physics perspective, the time an air bubble takes to rise in the oil is partly dependent on the bubble's diameter. The relationship is quadratic. A bubble with a diameter that is smaller by a factor of 10 will have a rising time that is longer by a factor of 100.

Smaller bubbles therefore have a higher risk of being carried away by the flow. If the oil flows through the filter medium, the fine filter material makes the air bubbles smaller.

The innovative products with the patented "window outflow" with metal mesh cause smaller bubbles to merge to form larger ones. This merging is referred to as coalescence. The resulting large bubbles rise much faster and the separation of air is significantly improved.

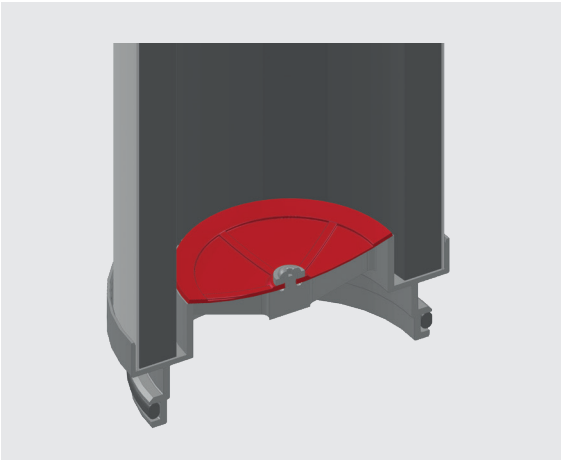


**RKB degassing unit as tank installation**

## Incident flow

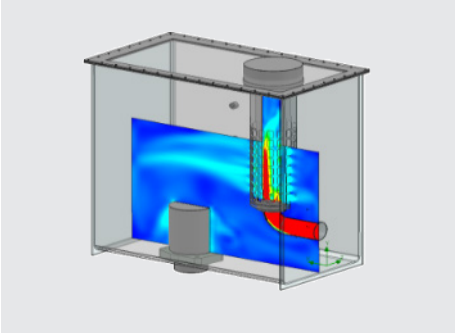
In the tank systems under discussion here, fluid flows to the degassing components from below, so part of the oil flow rate can flow out near the surface, through the windows in the housing. This reduces the distance that air bubbles have to cover to rise to the surface to a minimum and further increases the system's air separation.
The RKB degassing components are perfect for large flow rates. They are mounted in the intermediate chamber that is formed in the bottom part of the tank. The oil therefore flows into the degassing unit from below and then into the tank via the riser tube.
Because of the intermediate chamber, any design is possible for the return port connections and several components can be used without splitting up the return lines. The optimal flow conditions in the chamber guarantee optimum air separation.

If the assembly is to be used as a degassing unit to retain coarse dirt, the patented anti-drain valve can be used optionally.
This prevents oil from returning from the contaminated side to the clean side during element change and the dirt remains trapped in the element.

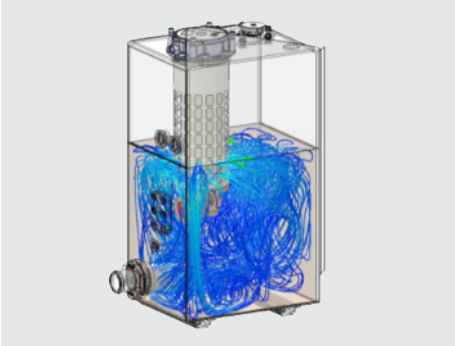


**Anti-drain valve**

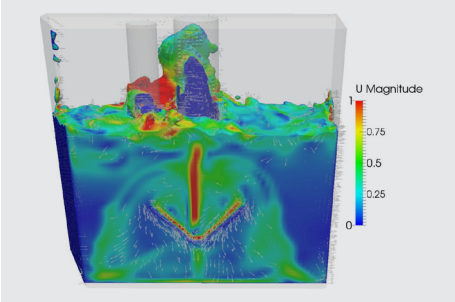
# The Development of the Tank Concept



Flow



Degassing

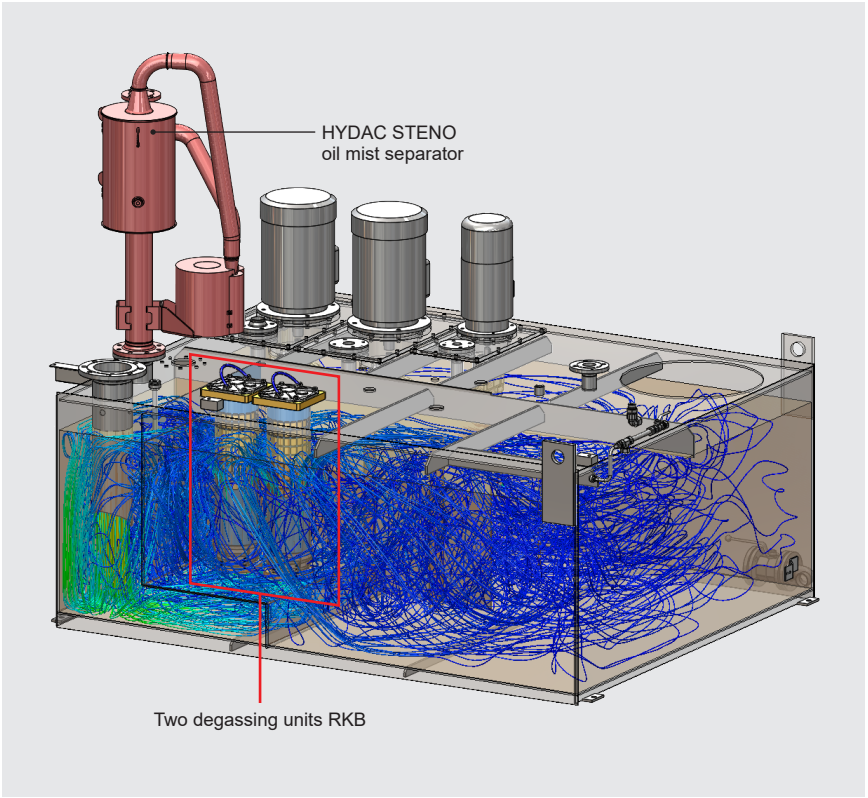


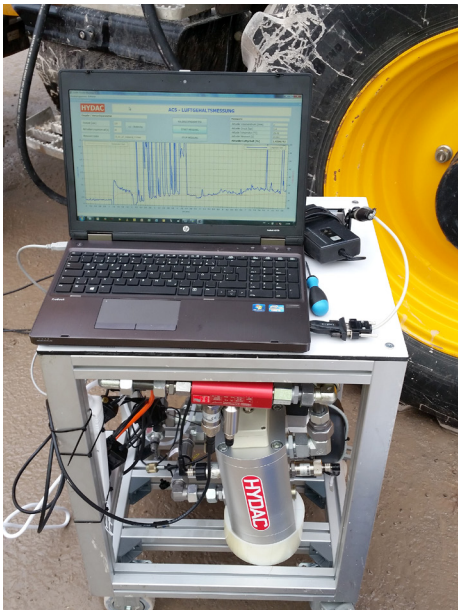

Multi-phase flow

## Simulation

HYDAC has the capacity and the necessary experience to describe hydraulic and lubricating oil tanks in detail. In addition to calculating flows, two-phase flows and complex multi-phase flows can be implemented to observe the surface effects of fluids (surge movements).

Here is an example of two-phase simulation of the tank concept presented below:



ACS air content sensor

## Measurement

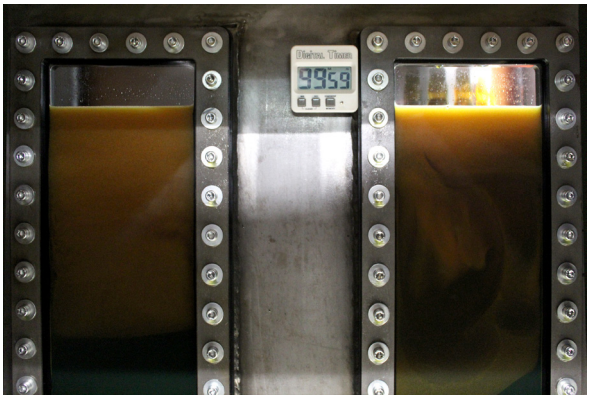
To perform robust measurements, HYDAC has developed a sensor for measuring the air content. This sensor makes it possible to measure vertical and longitudinal profiles in a tank and to determine the air distribution with great accuracy.

There are a series of test facilities at several HYDAC sites where the findings of the simulation can be verified. The measurement sensor is mobile and can also be used in field tests. This can be useful first to determine the initial situation before the degassing units are used and second to test the system after successful modification with the HYDAC products.

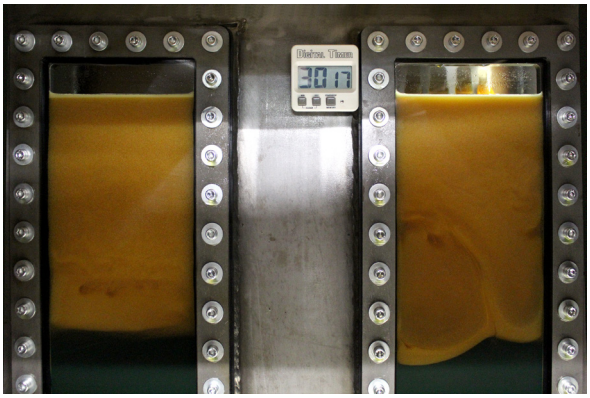
# Tank Concept with Degassing Unit

## Different air contents in the tank

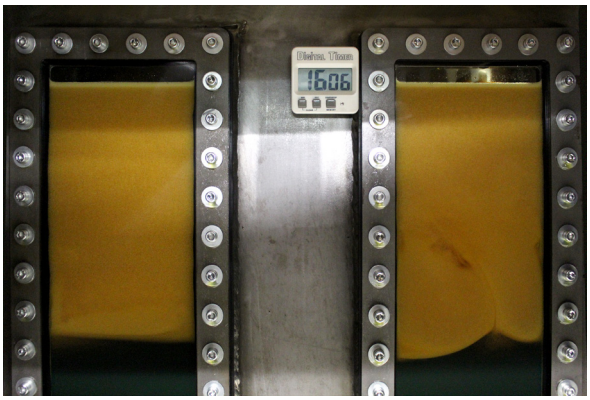
**Air content = 2 vol. %**



**Air content = 5 vol. %**



**Air content = 10 vol. %**

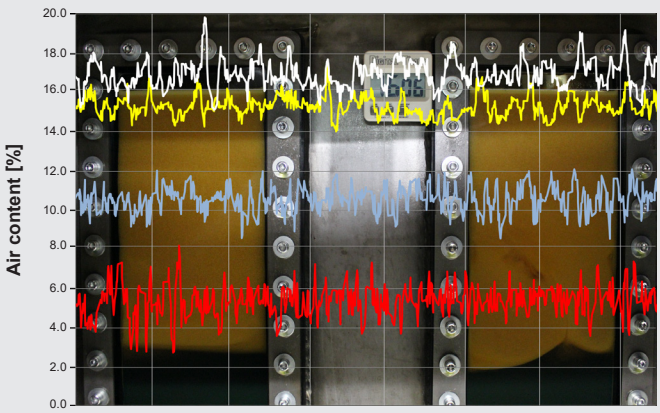


## Measurement results, test setup

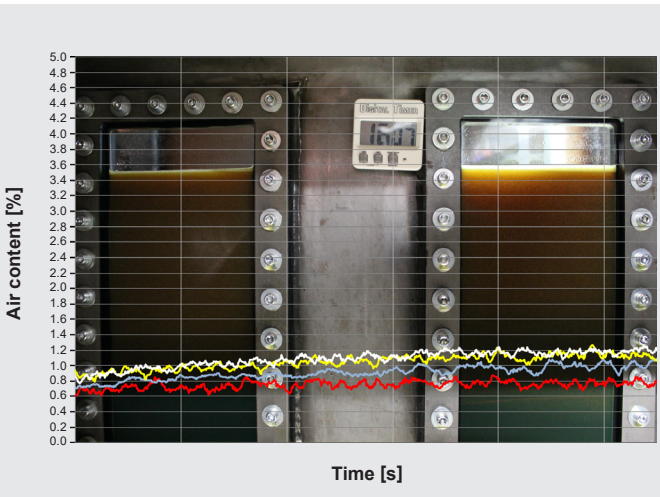
Tests at the HYDAC FluidCareCenter have shown that even high air content in the oil, distributed in fine droplets, can be sufficiently removed in the degassing stages. The following figures show examples of tests with various air concentrations in the oil at 200 l/min and a tank dwell time of two minutes in the return flow and, for comparison, the residual air content **after the degassing stages.**

The colour-coding for before and after is the same in all cases:

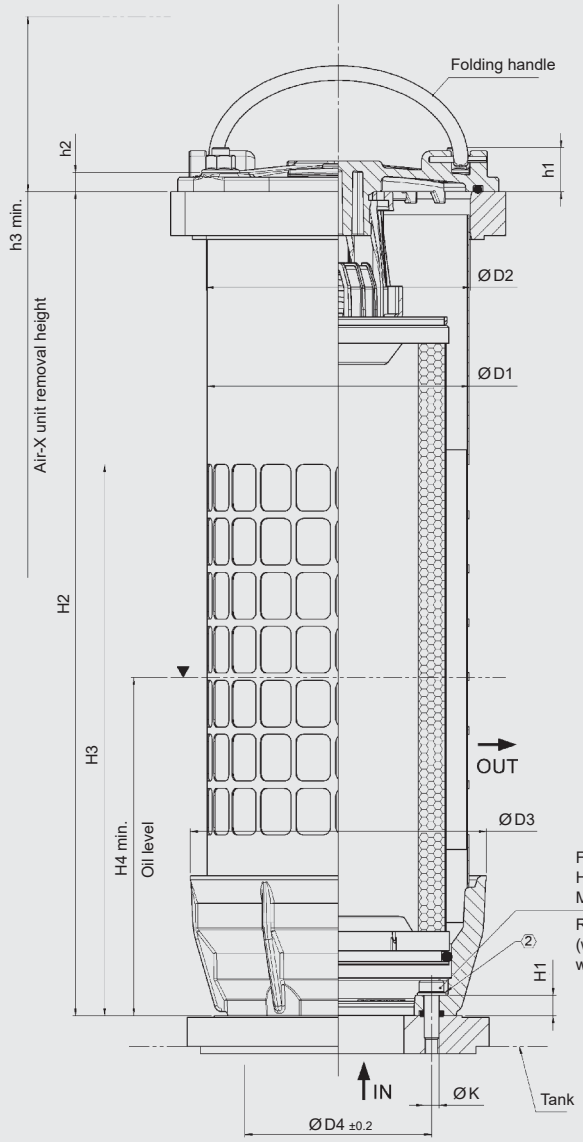
**Before: different air concentrations in the oil**



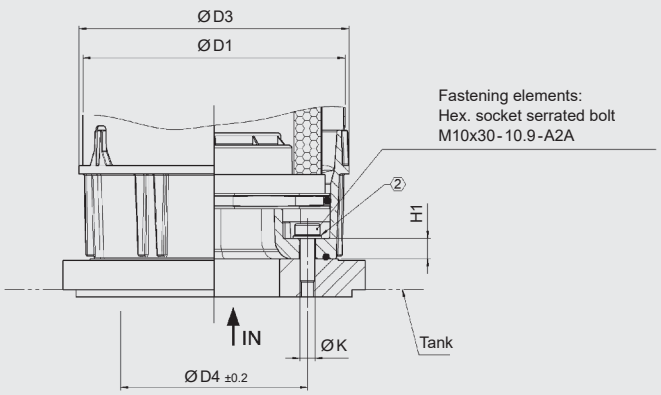

**After: air concentrations after the degassing stages**

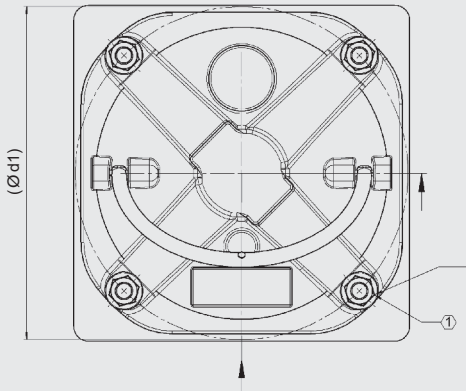


# HYDAC Product Series
# Degassing Unit RKB




Degassing unit with poka yoke
(tank flange version C; I)

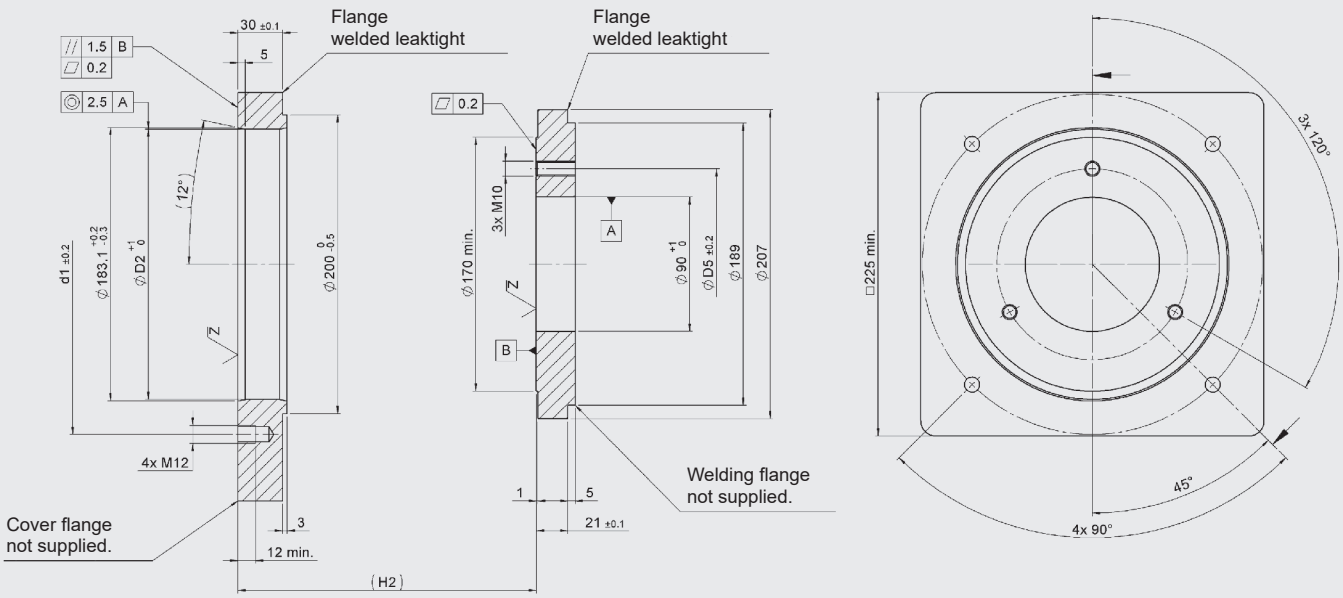


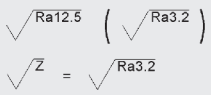




| Type | Tube version | Tank flange | H1 | H2 | H3 | H4 | h1 | h2 | h3 | ØD1 | ØD2 | ØD3 | ØD4 | ØK | Ød1 | Weight [kg] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RKB 0600 | R | B; E | 14 | 565 | 378 | 232 | 30 | 13 | 485 | 179.5 | 181 | 203 | 128 | 10.5 | 228 | 8.8 |
| | | C; I | | | | | | | | | | 185 | | | | 8.7 |
| RKB 0800 | R | B; E | | 758 | 452 | 269 | | | 678 | | | 203 | | | | 11.6 |
| | | C; I | | | | | | | | | | 185 | | | | 11.5 |
| RKB 1200 | R | B; E | | 912 | 600 | 343 | | | 832 | | | 203 | | | | 14.0 |
| | | C; I | | | | | | | | | | 185 | | | | 13.9 |

## Specifications for the tank flange

1. At the degassing unit mounting interface, the tank flange should have a maximum flatness of 0.2 mm and maximum roughness of Ra 3.2 µm.
2. In addition, the mounting interface should be free from damage and scratches.
3. The fixing holes of the cover flange must be blind, or stud bolts with threadlocker must be used to fix the degassing unit.
   As an alternative, the cover flange can be continuously welded from the inside.
4. Both the tank sheet metal and the degassing unit mounting flange must be sufficiently robust so that neither deform when the seal is compressed during tightening.

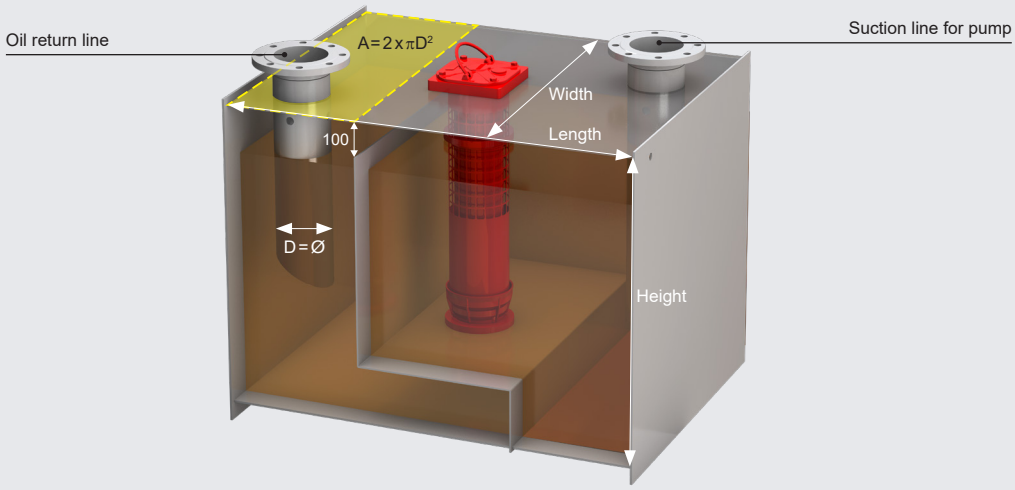



The cover flange must be aligned to the welding flange with a welding gauge.

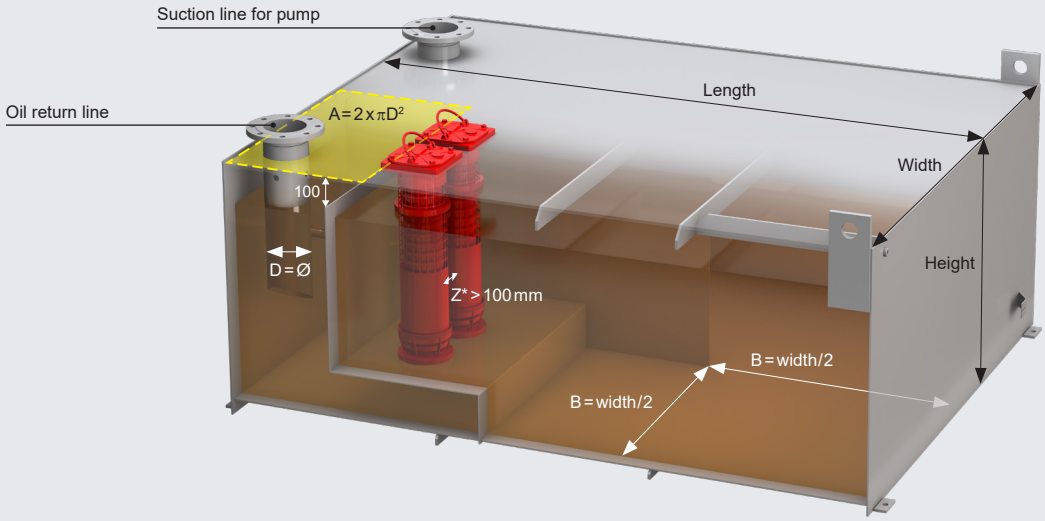
| Degassing unit assembly | | Anti-drain valve | $Q_{max}$ [l/min] | Spare part AIR-X degassing unit | |
|---|---|---|---|---|---|
| Part no. | Model code | | | Part no. | Model code |
| 1901305 | RKB 1200 WPI 200 V X B R X C N VXX 1/SAL | – | 300 | 1901338 | WPI-0200-152-XD31-Q-N-K/SAL |
| 1901327 | RKB 1200 WPI 200 V X B R V C N VXX 1/SAL | x | 300 | 1901339 | WPI-0200-152-XF31-Q-N-K/SAL |
| 1901306 | RKB 0800 WPI 200 V X B R X C N VXX 1/SAL | – | 200 | 1901336 | WPI-0200-152-XD25-Q-N-K/SAL |
| 1901328 | RKB 0800 WPI 200 V X B R V C N VXX 1/SAL | x | 200 | 1901337 | WPI-0200-152-XF25-Q-N-K/SAL |
| 1901307 | RKB 0600 WPI 200 V X B R X C N VXX 1/SAL | – | 150 | 1901334 | WPI-0200-152-XD18-Q-N-K/SAL |
| 1901329 | RKB 0600 WPI 200 V X B R V C N VXX 1/SAL | x | 150 | 1901335 | WPI-0200-152-XF18-Q-N-K/SAL |

## Design recommendations for tank volumes up to 1,600 litres




| Tank | Tank volume [l] | | Tank dimensions [m] | | | | Volume [l] | | Degassing unit | Air intake 0–15 % | | | Air intake <5 % | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size | from | to | Width | Length | Height | Oil level | Tank | Oil | Type | Flow rate [l/min] | Time [min] | Number of units | Flow rate [l/min] | Time [min] | Number of units |
| Small | 100 | 1,600 | 0.5 | 1.0 | 0.8 | 0.6 | 400 | 300 | RKB 600 | 150 | 2 | 1 | 150 | 2 | 1 |
| | | | 0.5 | 1.5 | 0.8 | 0.6 | 600 | 450 | | 225 | 2 | 2 | 225 | 2 | 1 |
| | | | 0.5 | 2.0 | 0.8 | 0.6 | 800 | 600 | | 300 | 2 | 2 | 300 | 2 | 1 |
| | | | 0.8 | 2.0 | 0.8 | 0.6 | 1,280 | 960 | | 480 | 2 | 3 | 480 | 2 | 2 |
| | | | 0.8 | 2.5 | 0.8 | 0.6 | 1,600 | 1,200 | | 600 | 2 | 4 | 600 | 2 | 2 |

## Design recommendations for tank volumes up to 27,000 litres

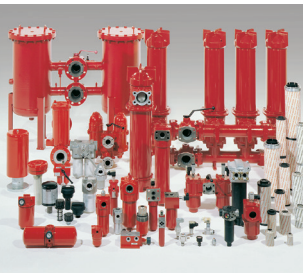



*Minimum distance Z between each housing of a degassing unit 100 mm

| Tank | Tank volume [l] | | Tank dimensions [m] | | | | Volume [l] | | Degassing unit | Air intake 0–15 % | | | Air intake <5 % | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Size | from | to | Width | Length | Height | Oil level | Tank | Oil | Type | Flow rate [l/min] | Time [min] | Number of units | Flow rate [l/min] | Time [min] | Number of units |
| Medium | 1,500 | 9,000 | 1.0 | 1.5 | 1.0 | 0.7 | 1,500 | 1,050 | RKB 800 | 525 | 2 | 3 | 525 | 2 | 0 |
| | | | 1.0 | 2.0 | 1.0 | 0.7 | 2,000 | 1,400 | | 800 | 2 | 4 | 800 | 2 | 2 |
| | | | 1.0 | 2.5 | 1.0 | 0.7 | 2,500 | 1,750 | | 875 | 2 | 4 | 875 | 2 | 2 |
| | | | 1.0 | 3.0 | 1.0 | 0.7 | 3,000 | 2,100 | | 1,050 | 2 | 5 | 1,050 | 2 | 3 |
| | | | 2.0 | 2.0 | 1.0 | 0.7 | 4,000 | 2,800 | | 1,400 | 2 | 7 | 1,400 | 2 | 4 |
| | | | 2.0 | 2.5 | 1.0 | 0.7 | 5,000 | 3,500 | | 1,750 | 2 | 9 | 1,750 | 2 | 4 |
| | | | 2.0 | 3.0 | 1.0 | 0.7 | 6,000 | 4,200 | | 2,100 | 2 | 11 | 2,100 | 2 | 5 |
| | | | 2.0 | 4.0 | 1.0 | 0.7 | 8,000 | 5,600 | | 2,800 | 2 | 14 | 2,800 | 2 | 7 |
| Medium to large | 9,000 | 27,000 | 2.0 | 3.0 | 1.5 | 1.2 | 9,000 | 7,200 | RKB 1200 | 3,600 | 2 | 12 | 3,600 | 2 | 6 |
| | | | 2.0 | 4.0 | 1.5 | 1.2 | 12,000 | 9,600 | | 4,800 | 2 | 16 | 4,800 | 2 | 8 |

Medium to large tanks with more than 16 degassing units and / or a tank volume of more than 27,000 litres are possible with customised dimensioning on request.

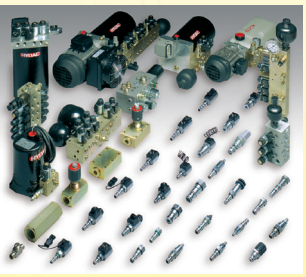
Accumulator Technology 30.000



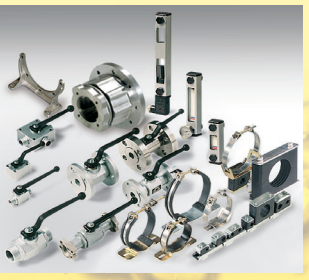
Filter Technology 70.000

Process Technology 77.000

Filter Systems 79.000



Compact Hydraulics 53.000



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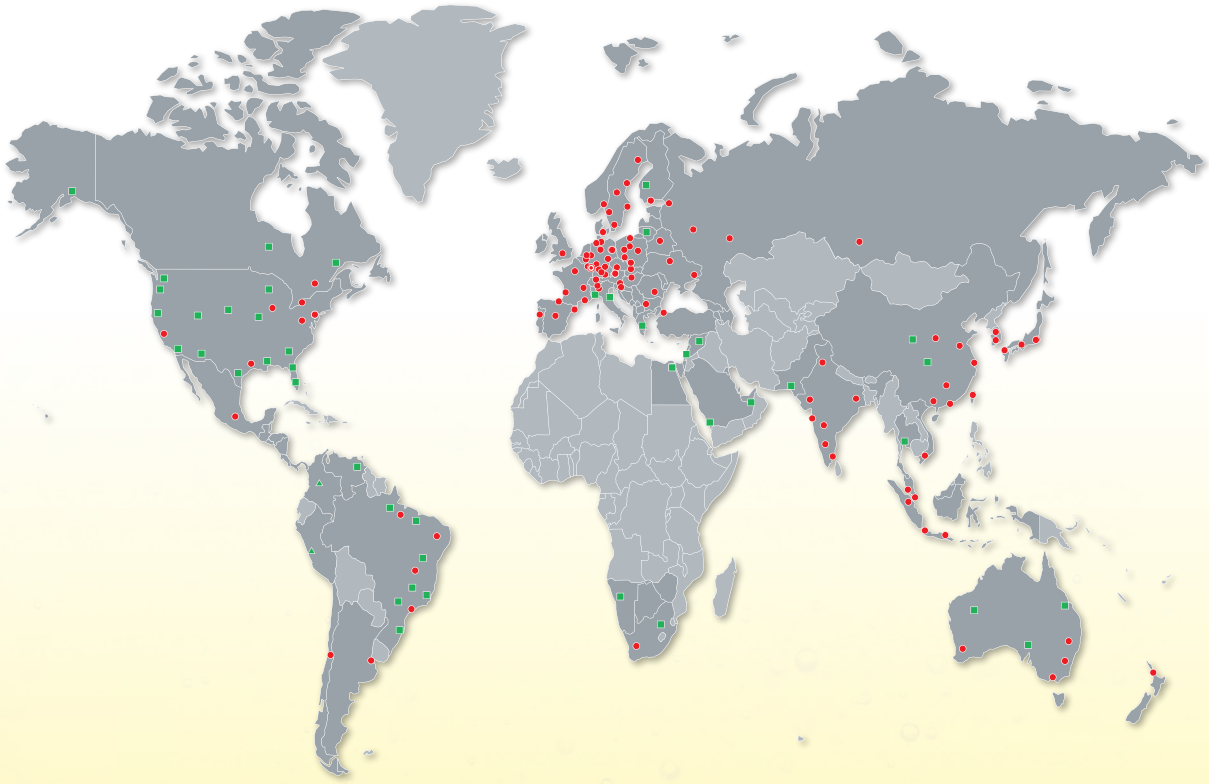

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