# VKL 100

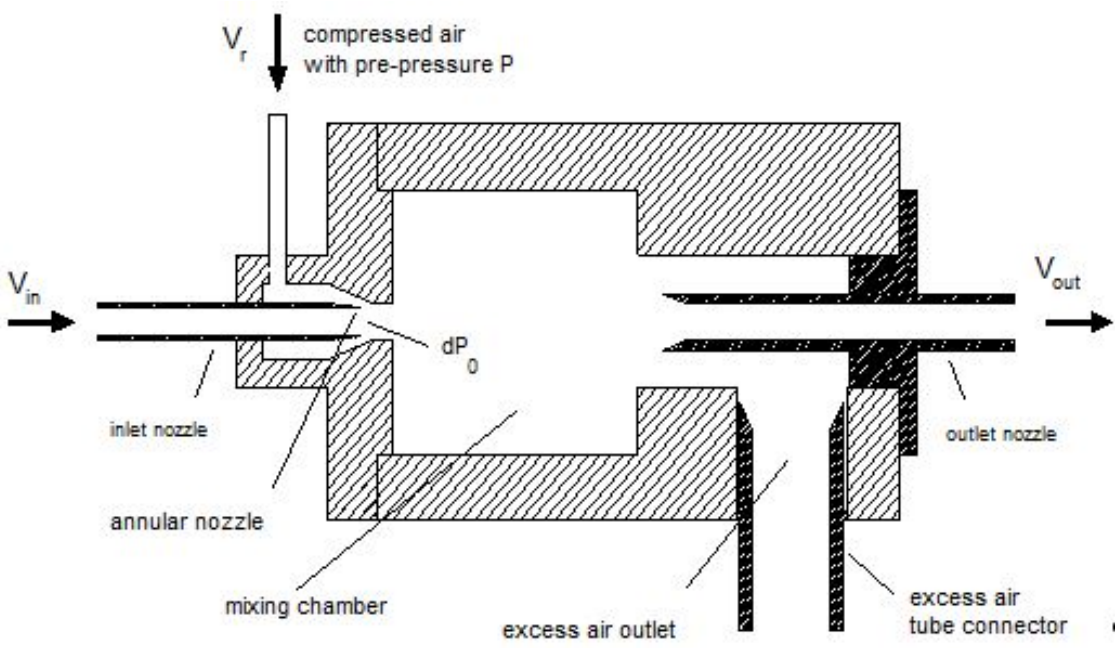



The VKL 100 series of dilution systems can reduce the concentration of aerosols by the dilution factor 1:100, also of very highly concentrated aerosols, in a defined and reliable way.

The Palas VKL, 100 dilution systems, are used in vertical operation for the particle size range up to 2 $\mu$m for applications in the clean room. Dilution factors of up to 1:100,000 are achieved by cascading several VKL systems.

## Operation principle

## Dilution system with dilution factor 1:100



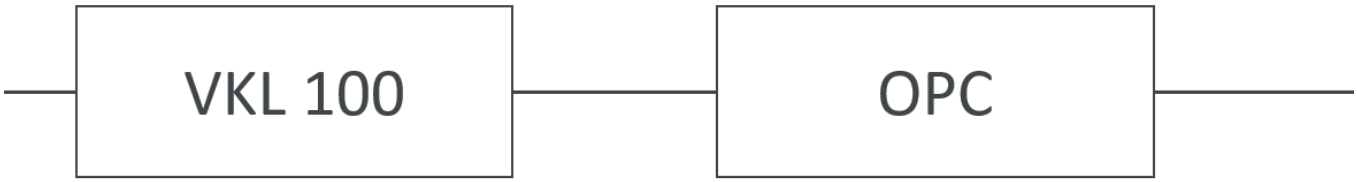
Particle-free air with the volume flow $V_R$ circulates through an annular passage around the suction nozzle. Thus, according to Bernoulli, a volume flow $V_{An}$ is generated at the suction nozzle. The dilution factor $V_F$ is calculated according to the following formula.

$$V_F = \frac{(\dot{V}_R + \dot{V}_{An})}{\dot{V}_{An}}$$

Simple, functional test on-site

With this simple test set-up, the Palascascaded dilution systems can be checked by anyone: First, a particle measurement is performed with one dilution step. Here it is essential that the aerosol concentration, e.g., lab air, to be measured does not exceed the coincidence limit (maximum detectable aerosol concentration). In the second step, the dilution step to be tested is connected in series (cascaded). To check the dilution factor of the test step (position 2), the total particle count from the measurement in position 1 is divided by the total particle count from position 2.

Experimental setup




Position 1: Lab air




Position 2: Lab air

The VKL 100 measures coincidence-free with the OPC; the VKL 10 is tested.

| Particle class in µm | Number Pos.1 |
|---|---|
| 0.2 | 151648 |
| 0.3 | 71604 |
| 0.5 | 4305 |
| 0.7 | 360 |
| 1.0 | 82 |
| 2.0 | 16 |
| 3.0 | 1 |
| 5.0 | 0 |
| Sum | 228016 |

| Particle class in µm | Number Pos.2 |
|---|---|
| 0.2 | 15166 |
| 0.3 | 7290 |
| 0.5 | 524 |
| 0.7 | 65 |
| 1.0 | 21 |
| 2.0 | 3 |
| 3.0 | 0 |
| 5.0 | 2 |
| Sum | 23071 |

Calculation of the dilution factor:

$$V_F = \frac{\dot{N}_{GesPos1}}{\dot{N}_{GesPos2}} = 9{,}88$$

Provided the first measurement is not affected by a coincidence error and the dilution system under test is working (not soiled), a dilution factor of almost 10 is determined. If this should not be the case, there was possibly a coincidence in measurement 1. In this case, the aerosol concentration has to be decreased or a further dilution step used. Another possibility would be that the dilution step to be tested is soiled. In this case, the device has to be cleaned and the test repeated.

| Type | Dilution factor* $V_F$ | Pressure - resistant up to 10 bar | Chemically resistant | Heatable up ... °C | $dp_{max}$ in µm | Compressed air 4 – 8 bar | Cascadable | Voltage |
|---|---|---|---|---|---|---|---|---|
| DC 100 | 10, 100 | | | | < 5 | | | 115 V / 230 V |
| DC 1000 | 10, 100, 1000 | | | | < 5 | | | 115 V / 230 V |
| DC 10000 | 10, 100, 1000, 10000 | | | | < 5 | | | 115V / 230 V |
| KHG 10 | 10 | | x | 150 | < 20 | x | x | 115 V / 230 V |
| KHG 10 D | 10 | x | x | 150 | < 20 | x | x | 115 V / 230 V |
| PMPD 100 | 100 | | x | 200 | < 5 | x | | 115 V / 230 V |
| PMPD 1000 | 1000 | | x | 200 | < 5 | x | | 115 V / 230 V |
| VDD 10 | 1 – 10 | | | | < 10 | x | | 115 V / 230 V |
| VKL 10 | 10 | | | | < 20 | x | x | |
| VKL 10 E | 10 | | x | | < 20 | x | x | |
| VKL 10 ED | 10 | x | x | | < 20 | x | x | |
| VKL 10 V | 10 | | | | < 20 | x | x | |
| VKL 27 | 27 | | | | < 10 | x | x | |
| VKL 100 | 100 | | | | < 2 | x | x | |

*Other dilution factors on request

Table 1: Technical characteristics of Palas dilution systems

VDI report no. 1973 from 2007 proved metrologically that a reproducible aerosol dilution is possible with the Palas dilution systems down to VF 100,000.

## Benefits

- The dilution systems from Palas® are characterized unambiguously. This is documented with a calibration certificate for each device
- The dilution steps deliver a temporally constant, representative dilution with the factors 10 and 100
- The dilution systems can be cascaded with the factors 100, 1,000, 10,000 and 100,000
- Low compressed air consumption, e.g., just 128 l/min with a dilution factor of 10,000 with four VKL 10 systems
- The dilution steps are combinable with all common particle counters
- The users themselves can test these cascaded dilution systems with a simple test set-up
- Simple, functional test on-site

## DATASHEET

| | |
|---|---|
| Volume flow (clean air) | |
| | 17 – 45 l/min |
| Volume flow (suction flow) | 0.15 – 0.5 l/min |
| Isokinetic suction nozzles | 0.028–0.06 l/min, 0.23–0.5 l/min, 0.6–1.6 l/min, 2–5 l/min, 28 l/min => 15–37 l/min |
| Maximum particle size | < 2 µm (for dusts) |
| Compressed air supply | 4 – 8 bar |
| Dilution factor | 1 : 100 |
| Dimensions | 100 • 245 • 100 mm (H • W • D) |
| Weight | Approx. 4 kg |
| Special features | Cascadable |

## Applications

- Aerosol measurement technology: test aerosols from filters and inertial separators
- Separation efficiency determination with counting measuring methods, e.g., HEPA/ULPA filters
- Leak test and acceptance measurements of clean rooms, isolators, and safety work benches
- Inhalation toxicology
- Quality control of respirator masks and filter cartridges

Mehr Informationen:
https://www.palas.de/en/product/vkl100