

Dilution Systems for Aerosols

Series DIL, DDS, HDS



Dilution System DIL 554 and DIL 540 (automatic readjustment)



Dilution Systems Series DDS (left) and HDS (right)

A great number of measuring tasks related to aerosol technology requires defined dilution of the aerosol to be characterized. So the evaluation of filter and filter media is often only possible using suitable dilution techniques in order to measure particle size distributions at both high and low particle concentrations with the same measuring device.

Dilution systems of the series DIL have been designed for defined total flow rates and fixed dilution factor and have especially been developed for on-site filter testing.

The dilution systems DDS and HDS can be used for different total volume flows, with the dilution factor being adjusted by the user.

Dilution is performed by all of these devices without any auxiliary pressurized air. The keeping of the dilution factor is continuously monitored by an internal measuring unit and is automatically readjusted at DIL 540 and HDS 561.

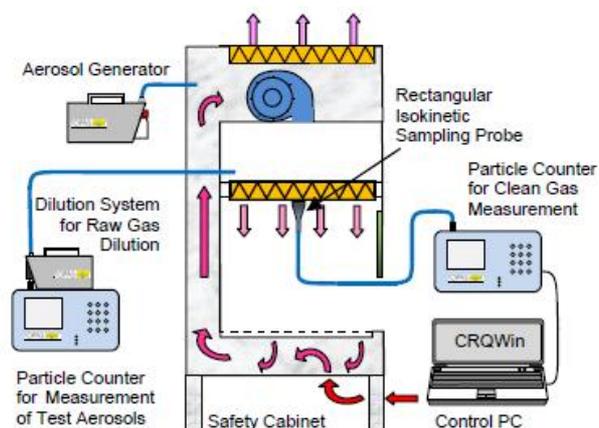
All types of dilution devices are designed for mobile use. A battery supplies the power for the DIL 554.

Special Advantages

- Constant and reproducible aerosol dilution even under changing operation conditions
- Internal monitoring of the dilution ratio including corresponding display.
- Designed for mobile use (no auxiliary pressurized air needed)
- Long term lifetime and reliability, minimum maintenance required
- Precise operation in both over and under pressure mode
- Modifications to user defined requirements (flow rates, dilution factor) available

Applications

- Validation of laminar air flow boxes/benches and clean room facilities
- Evaluation of filtration efficiency
- Measurement of highly concentrated aerosols
- Basic aerosol research



Example of use of Topas Aerosol Dilution Systems: Laminar Air Flow Box Validation Test



Dilution at Fixed Dilution Factor

Dilution at a Fixed Dilution Factor: Series DIL

Dilution systems of the series DIL have been designed for a fixed total flow rate at which defined and certified dilution of the aerosol is performed.

Both the defined total flow rate and the dilution factor determine the flow rates and their ratio between bypass and capillary path.

By measuring the pressure drop over the capillary the capillary flow rate can continuously be monitored. If a deviation of this flow rate from the set value is detected an LED with arrow at the instrument's front panel lights up in order to indicate in which direction the bypass valve should be turned for readjustment of the flow rate balance and thus the dilution factor. In this way a defined and precise dilution factor is always ensured.

The HEPA filter used features high filtration efficiency and long term lifetime even if exposed to high number concentrations. Replacing the filter capsule can easily be performed at any time.

The DIL 554 has a stainless steel casing with integrated battery operation (AC adapter optional). It was especially developed for validation and monitoring of clean room facilities.

The device version DIL 554/H is designed for particle counters with a flow rate from 50 to 56.6 l/min with a dilution factor of 1:100.

The dilution system DIL 540 has the distinctive feature that the fixed dilution factor (10 or 100) is automatically readjusted (volume flow rate 28.3 l/min).



Dilution Systems DIL 550 and DIL 554

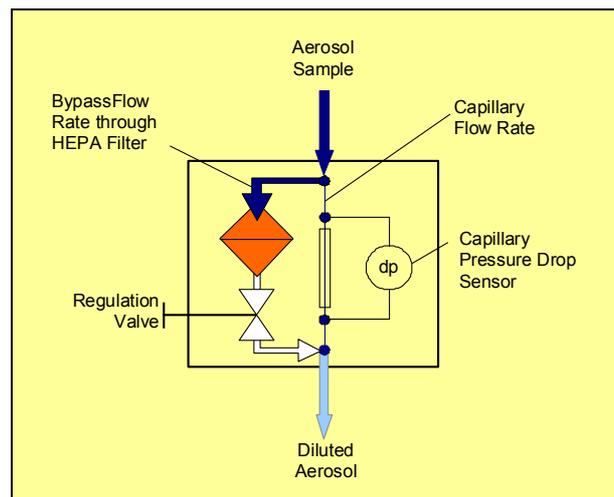
Functional Principle

From the aerosol stream to be diluted a sample is taken through a thin capillary. Particle concentration of the capillary flow rate remains unchanged whereas a HEPA filter removes nearly all particles from the bypassing flow rate. After the capillary and filter both streams are mixed together again. The dilution factor results from the ratio between the two single flow rates.

A major advantage of this dilution technique is that no auxiliary pressurized air is needed for dilution. Therefore no surplus aerosol to be exhausted is generated and the chemical composition of carrier gas remains unaffected.

Dividing up the two parts of flows is caused by the pressure drop of the thin capillary in comparison to the HEPA filter flow resistance. A regulation valve following the HEPA filter in the bypass path is used for (re)adjusting the flow rate balance and finally the dilution factor.

The air-flow-related design of the device ensures isokinetic aerosol sampling at the capillary inlet. Changes of particle size distribution due to dilution have been experimentally found to be very low.



Scheme of the Dilution System of the Series DIL



Dilution at Variable Dilution Factor: Series DDS 560

The dynamic dilution system of the series *DDS 560* combines aerosol dilution as described above with an additional total flow rate measurement section. The currently adjusted dilution factor is calculated by a microprocessor from the output levels of the two pressure transducers. The current values for both the dilution factor and the total flow rate are displayed on an LCD screen on the instrument's front panel.

By adjusting the pressure drop ratio by turning the regulation valve, the dilution factor can easily be changed in a wide range. The setting range depends on the current total flow rate through the device.

Therefore the dynamic dilution system can be used together with particle counters of different total flow rates. The adjustment of the dilution factor enables optimum measuring concentration and precise calculation of the actual particle concentration of the aerosol sample.

Additional total flow rate indication allows checking the proper flow control of the particle counter.



Dynamic Dilution System DDS 560

Active Dilution System HDS 561

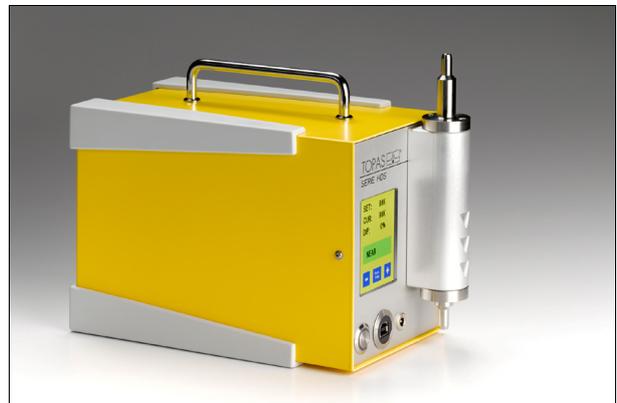
Although the pressure losses of Topas dilution systems are very low due to optimized solutions, there is also a need for a dilution which has virtually no pressure loss. This led to the development of the system *HDS 561*. This device enables extremely high dilution factors and is suitable for particle counters with high volume flow rates.

Advantages

- Dilution with virtually no pressure loss
- Dilution factors adjustable in very wide ranges (100 to 100,000)
- Improved sampling by use of a comparatively large-diameter capillary
- Remote monitoring of the dilution factor possible
- Remote readjustment of the dilution factor possible
- Reliable and reproducible dilution for highest aerosol concentrations

Applications

- Dilution of the aerosol of aerosol generators to generate defined, especially diluted aerosols, such as in case of calibration and comparison of particle counters
- Monitoring of the particle production rate of aerosol generation systems, for instance in case of clean room monitoring systems



High Dilution System HDS 561



Specifications

Devices with Fixed Dilution Factor Series DIL

	Total Volume Flowrate	Dilution Factor
DIL 550, 554	28.3 l/min	100
DIL 551, 554	28.3 l/min	10
DIL 553,554/H	50 / 56.6 l/min	100
DIL 555	2.83 l/min	100
DIL 556	2.83 l/min	10
DIL 540	28.3 l/min	10/100

DIL series device versions with other dilution factors and different total volume flows are optionally available on request, e.g. 1:100 for 1.0 l/min, 1.2 l/min or 5 l/min.

The DIL series dilution systems can also be used one after another, thereby increasing the achievable dilution factor. If, for instance, two dilution systems with dilution factors of 1:10 and 1:100 respectively are coupled in series then the resulting dilution would be 1:1000.

Option Remote Control:

Optionally the dilution system series DIL (excluding DIL 554) can be equipped with a contact port for remote control. The provided on/off signal indicates that the capillary flow rate is in-between the error boundaries and finally the dilution factor as well.

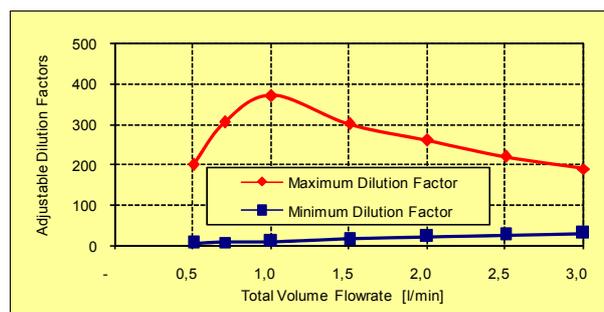
Further Technical Data

Power Supply DIL 554	9 V alkaline-manganese battery (optional: AC/DC adapter)
DIL 55x (without 554); DIL 540, DDS 560	12 V DC via AC adapter
Max. counter pressure	5 kPa (50 mbar) 30 kPa for DIL 554
Tube connectors	Ø 8 mm / 10 mm (optional)
Dimensions	ca. 200 x 300 x 120 mm
Weight	ca. 1.5 ... 3 kg

Devices with Variable Dilution Factor Series DDS

Total Volume Flowrate [l/min]	Dilution Factors
0.5	1 : 5 to 1 : 200
1.0	1 : 10 to 1 : 370
2.0	1 : 20 to 1 : 260
3.0	1 : 30 to 1 : 190

DIL series device versions with other volume flow and dilution ranges are optionally available on request.



Adjustable dilution factors at various total volume flowrates for the Dynamic Dilution System DDS 560
The range of adjustment of the dilution factor depends on the current total volume flow.

HDS 561 (Very High Dilution Factors)

Total Volume Flowrate	Adjustable Dilution Factors
28 ... 100 l/min	100 ... 100.000

Further Technical Data

Tube connector	Ø 13 mm
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QMS certified to DIN EN
ISO 9001



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For more information please visit
our website at
www.topas-gmbh.de

Specifications are subject to
change without notice.

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Product Overview (04/2015)

Serie DIL

Volume Flow l/min	Dilution ratio	Model-number	Comments
28,3	100	DIL 540	self-aligning, fixed parameters
28,3	100	DIL 540/C	Test rig model, self-aligning, without handhold, with Remote Status Enquiry System (with integrated signal output)
28,3	10	DIL 541	self-aligning, fixed parameters
28,3	10	DIL 541/C	Test rig model, self-aligning, without handhold, with Remote Status Enquiry System (with integrated signal output)
28,3	100	DIL 550	Hand wheel, fixed parameters
28,3	10	DIL 551	Hand wheel, fixed parameters
28,3	10...500	DIL 552	Hand wheel, fixed parameter, user defined dilution ratio
28,3	100	DIL 554	Stainless steel housing, preferred use in cleanroom technology, low pressure drop, power supply via battery, $\frac{3}{8}$ "- connector
28,3	10	DIL 554/Z	Stainless steel housing, preferred use in cleanroom technology, low pressure loss, power supply via battery, $\frac{3}{8}$ "- connector ($\frac{1}{4}$ " - connector on request)
28,3	100	DIL 554/T	Stainless steel housing, preferred use in cleanroom technology, low pressure drop, power supply via battery, $\frac{1}{4}$ " connector
50/56,6	100	DIL 554/H	Stainless steel housing, preferred use in cleanroom technology, low pressure loss, power supply via battery, $\frac{3}{8}$ "- connector
2,83 / 3,0 (0,1cfm)	100	DIL 555	Hand wheel, fixed parameters
2,83 / 3,0 (0,1cfm)	10	DIL 556	Hand wheel, fixed parameters
0,3...10	10...200	DIL 557	User defined dilution ratio and/or volume flow

If it's not possible, to assign these parameters, please do not hesitate to contact us.

