# FREUDENBERG
# FILTRATION TECHNOLOGIES

**Company Presentation 2014**

**Gas Phase Filtration**

Freudenberg

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# FREUDENBERG GROUP

## Freudenberg is a family-owned group of companies

- founded in 1849
- offers its customers technically challenging product solutions & services
- comprises 16 Business Groups operating on various markets in 57 countries around the globe
- Products: seals, vibration control technology components, nonwovens, release agents and lubricants, household cleaning products, medical components, filtration solutions

## Values & Principles

- Since more than 160 years Freudenberg is guided by reliability, trust and enduring personal relationships.
- Combined with innovative strength, prudent entrepreneurship and the ability for constant change, these values are the foundation for our sustained success.

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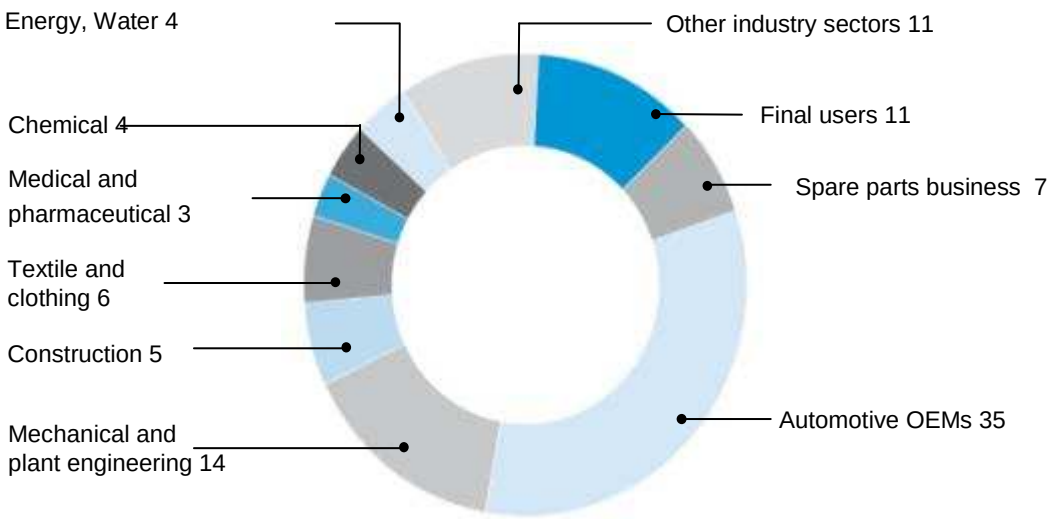
# FREUDENBERG GROUP – KEY FIGURES

| | 2011 | 2012 |
|---|---|---|
| Sales (in mill. EUR) | 5.992 | 6.322 |
| Consolidated profit / loss (in mill. EUR) | 370 | 433 |
| Workforce (per 31.12.) | 36.529 | 37.453 |

Sales by sectors 2012 (in %)





# FREUDENBERG GROUP – ORGANIZATION

**Freudenberg & Co. Kommanditgesellschaft**

**Freudenberg SE**

| Seals and Vibration Control Technology Business Area | Nonwovens and Filtration Business Area | Household Products Business Area | Specialties and Others Business Area |
|---|---|---|---|
| **Business Group** | **Business Group** | **Business Group** | **Business Group** |
| Freudenberg Sealing Technologies | Freudenberg Nonwovens | Freudenberg Household Products | Freudenberg Chemical Specialities |
| NOK-Freudenberg Group China | Freudenberg Filtration Technologies | | Freudenberg NOK Mechatronics |
| Freudenberg Oil & Gas | Freudenberg Politex Nonwovens | | Freudenberg IT |
| Freudenberg Schwab Vibration Control | | | Freudenberg New Technologies |
| EagleBurgmann | | | **Division** |
| Dichtomatik | | | Freudenberg Real Estate Management |
| Helix Medical | | | Freudenberg Service Support |
| TrelleborgVibracoustic | | | Freudenberg Insurance Service |



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# COMPLETE FILTRATION KNOW-HOW: PRODUCTS, SYSTEM SOLUTIONS, SERVICES


Filter mats


Pocket filters


Cassette filters


EPA/HEPA/ULPA filters


Gas phase filters

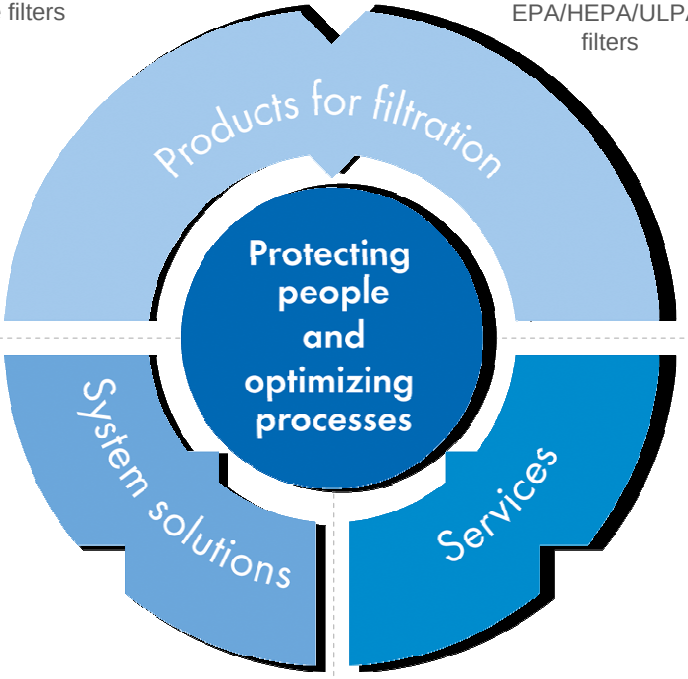

Filters for laser printers


Diesel exhaust filters


High-temperature filters

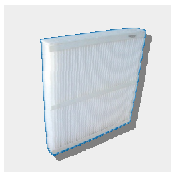

Filter bags


Filter cartridges

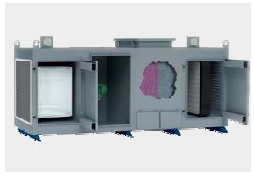




Cabin air filters




Engine intake air filters


Gas phase filtration systems

FEL Air quality control


Services for gas phase filtration systems


Air filtration systems


Water filtration systems


Viledon® filterCair


Filtration testing center



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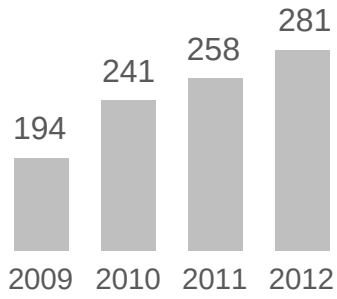
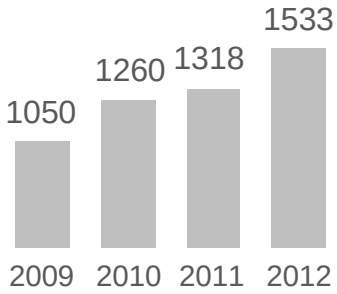
# FREUDENBERG FILTRATION TECHNOLOGIES – FACTS AND FIGURES

## Strong sales performance

in mill. €




## Growing number of employees




## Comprehensive filtration portfolio

- Industrial Filtration
- Automotive Filters
- Human Protection

## Long-standing filtration know-how


## Convincing brand quality

viledon | micronAir

microfresh | Pyramit

Aquabio | FEL

## Worldwide customer value

37 locations, thereof
17 production sites

Headquarters in Weinheim/Germany



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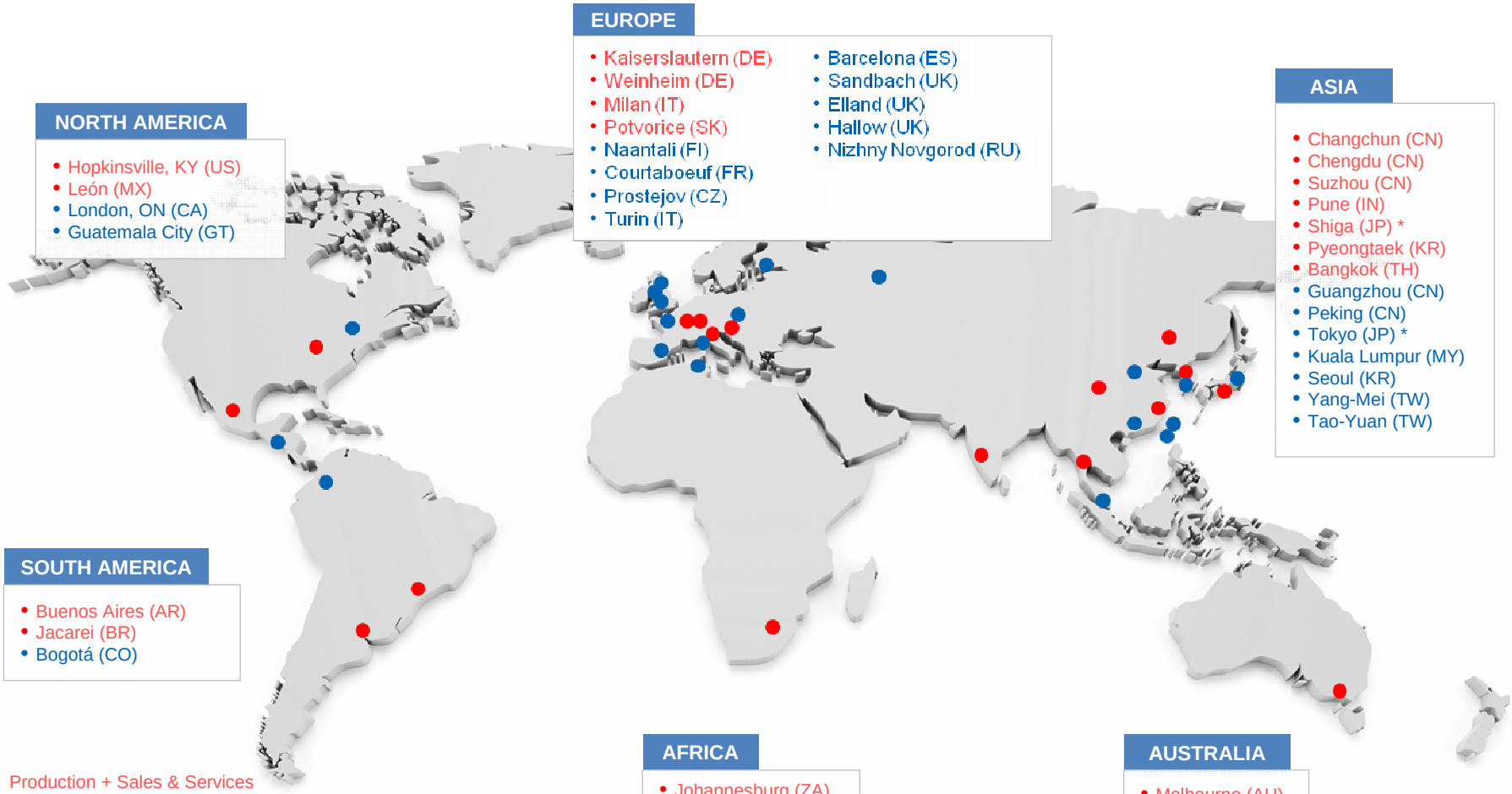
# GLOBAL PRESENCE. LOCAL SOLUTIONS. UNIQUE CUSTOMER VALUE.



**EUROPE**

- Kaiserslautern (DE)
- Weinheim (DE)
- Milan (IT)
- Potvorice (SK)
- Naantali (FI)
- Courtaboeuf (FR)
- Prostejov (CZ)
- Turin (IT)
- Barcelona (ES)
- Sandbach (UK)
- Elland (UK)
- Hallow (UK)
- Nizhny Novgorod (RU)

**NORTH AMERICA**

- Hopkinsville, KY (US)
- León (MX)
- London, ON (CA)
- Guatemala City (GT)

**ASIA**

- Changchun (CN)
- Chengdu (CN)
- Suzhou (CN)
- Pune (IN)
- Shiga (JP) *
- Pyeongtaek (KR)
- Bangkok (TH)
- Guangzhou (CN)
- Peking (CN)
- Tokyo (JP) *
- Kuala Lumpur (MY)
- Seoul (KR)
- Yang-Mei (TW)
- Tao-Yuan (TW)

**SOUTH AMERICA**

- Buenos Aires (AR)
- Jacarei (BR)
- Bogotá (CO)

**AFRICA**

- Johannesburg (ZA)
- Tunis (TN)

**AUSTRALIA**

- Melbourne (AU)

● Production + Sales & Services
● Sales & Services
★ Joint-Venture Partner JVC



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# VILEDON® INDUSTRIAL AIR FILTRATION – MARKET SEGMENTS

Contamination Control

Turbomachinery

Surface Treatment

Emission Control

Gas Phase Filtration



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# FOUR LEVELS OF CORROSION SEVERITY ACC. TO ANSI/ISA-S71.04 - 2013

| Class | Severity Level | Copper / Silver Reactivity | Comments |
|---|---|---|---|
| G1 | Mild | <300 Å<br><200 Å | An environment sufficiently well-controlled such that corrosion is not a factor in determining equipment reliability |
| G2 | Moderate | <1000 Å | An environment in which the effects of corrosion are measurable and corrosion may be a factor in determining equipment reliability |
| G3 | Harsh | <2000 Å | An environment in which there is a high probability that corrosive attack will occur. These harsh levels should prompt further evaluation resulting in environmental controls or specially design and package equipment. |
| GX | Severe | >2000 Å | An environment in which only specially designed and packaged equipment would be expected to survive. Specifications for equipment in this class are a matter of negotiation between user and supplier |

**Copper and Silver Reactivity Levels Measured on ChemDetect Coupons**

**ANSI / ISA-S71.04-2013 „Environmental Conditions for Process Measurement and Control Systems: Airborne Contaminants“**

1 Å = 0.1 nanometer = 0.0001 micrometer



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# GAS CONCENTRATIONS RELATED TO ISA CLASSES ACC. TO ISA-S71.04

| | ISA Class G1 | ISA Class G2 | ISA Class G3 | ISA Class GX |
|---|---|---|---|---|
| $H_2S$ | ≤ 3 | ≤ 10 | ≤ 50 | > 50 |
| $SO_2$, $SO_3$ | ≤ 10 | ≤ 100 | ≤ 300 | > 300 |
| $Cl_2$ | ≤ 1 | ≤ 2 | ≤ 10 | > 10 |
| $NO_x$ | ≤ 50 | ≤ 125 | ≤ 1250 | > 1250 |
| HF | ≤ 1 | ≤ 2 | ≤ 10 | > 10 |
| $NH_3$ | ≤ 500 | ≤ 10000 | ≤ 25000 | > 25000 |
| $O_3$ | ≤ 2 | ≤ 25 | ≤ 100 | > 100 |

**Gas concentrations in parts per billion, by volume**

**ANSI / ISA-S71.04-2013 „Environmental Conditions for Process Measurement and Control Systems: Airborne Contaminants“**
**ISA = Instrument Society of America**



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# CORROSION CONTROL

| Prevention | Monitoring |
| --- | --- |
| Room air handling | Temp. / rel. humidity |
| Temperature | Coupon testing |
| Relative Humidity | On-line monitoring |
| Chemical Filtration | Media life analysis |



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# CORROSION CONTROL

**FFT offerings**

| Prevention | Monitoring |
| --- | --- |
| Room air handling | Temp. / rel. humidity (combined with on-line monitoring) |
| Temperature | Coupon testing |
| Relative Humidity | On-line monitoring |
| Chemical Filtration | Remaining life analysis |



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# VILEDON CHEMCONTROL MODULES FOR 75MM PELLET BEDS

# VILEDON CHEMCONTROL MODULES FOR 25MM PELLET BEDS

# AVAILABLE GEOMETRIES OF CHEMCONTROL MODULES

CCM 1810

CCM 1210

CCM 1805

CCM 1205

| Available geometries | | CCM 1810 | CCM 1805 | CCM 1210* | CCM 1205 |
|---|---|---|---|---|---|
| Dimensions (LxWxH) | mm | 598x438x144 | 299x438x144 | 598x295x299 | 299x295x299 |
| Pellet bed depth | mm | 25.4 | 25.4 | 76 | 76 |

* Full-size 12" deep-bed modules are designed to hold 1 full box of pellets



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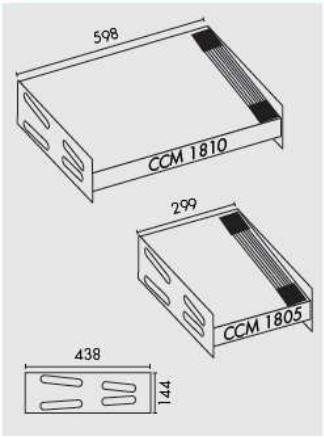
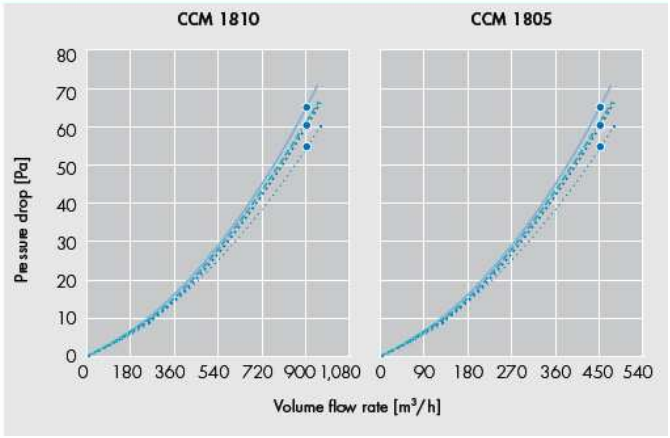
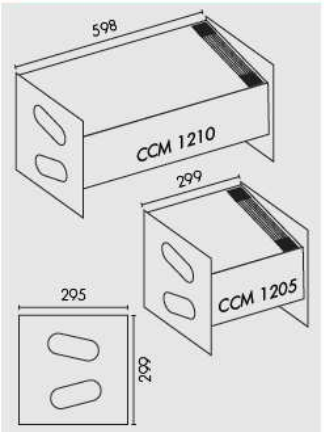
# TECHNICAL DATA OF CHEMCONTROL MODULES

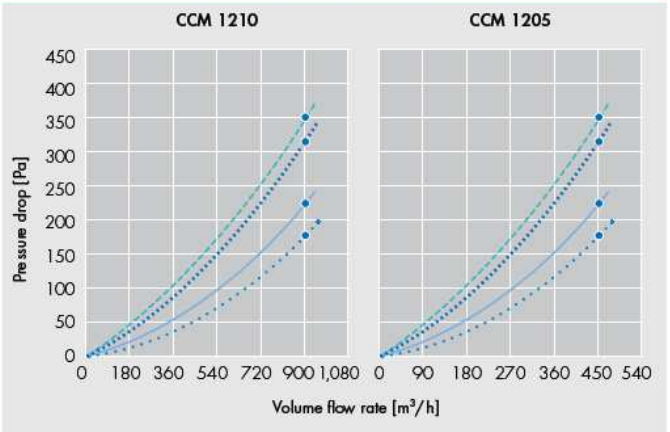
**18xx Series**




**12xx Series**




CCP 104, CCP 108, CCP 210, CCP 310, CCP 510
CCP 610

CCP 810
CCP 903

Nominal air flow rate ●



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# THE COMPLETE VILEDON® GAS PHASE FILTRATION SYSTEM SOLUTION

## How Viledon® ChemControl Recirculation Units work

1. **Intake of contaminated room air**

1b. **Intake of outside air**
Viledon® CRPU model only

2. **Pre-filtration**
Viledon® Compact pocket filter (G 4, acc. to EN 779)

3. **1st gas phase filtration stage**
Viledon® ChemControl module CCM1205 with pellets

4. **Fan** with energy-saving EC motor, meeting the ErP 2015 directive for increased minimum efficiency ratings

5. **2nd gas phase filtration stage**
Viledon® ChemControl module CCM1205 with pellets

6. **Fine filtration**
Viledon® MaxiPleat cassette filter (F 8, acc. to EN 779)

7. **Purified air**
free of fine particles and contaminant gases



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# RECIRCULATION AND RECIRCULATION PRESSURIZATION UNITS: TECHNICAL FEATURES


High efficiency EC fan technology meets the ErP directive for 2015


Double wall casings for improved noise reduction in operation


Control unit protected according to IP54 standard


Particle filters meet the F1 fire classification according to DIN 53438

Units meet the requirements of the applicable EC directives

All available module-pellets-configurations are UL 900 classified

Units optimized for high energy efficiency performance

Viledon® fine filters are certified by Eurovent

| Viledon® CRPU<br>Standard casing: low noise double wall (DW) casing with aluminum edges and plastisol-coated panels. | Nominal volume flow rate [m³/h] | Dimensions (H x W x D) [mm] | Weight, approx. [kg] | Number of modules per stage | Number of pre-filters | Number of fine filters | Power consumption average [kW] |
|---|---|---|---|---|---|---|---|
| 1800 DW | 1,800 | 2,600x750x750 | 560 | 4 | 1 | 1 | ~ 0.8 |
| 1800 DW stainless steel* | 1,800 | 2,600x750x750 | 590 | 4 | 1 | 1 | ~ 0.8 |
| 3600 DW | 3,600 | 2,600x1,500x750 | 660 | 8 | 2 | 2 | ~ 1.3 |
| 3600 DW stainless steel* | 3,600 | 2,600x1,500x750 | 690 | 8 | 2 | 2 | ~ 1.3 |



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# THE COMPLETE VILEDON® GAS PHASE FILTRATION SYSTEM SOLUTION

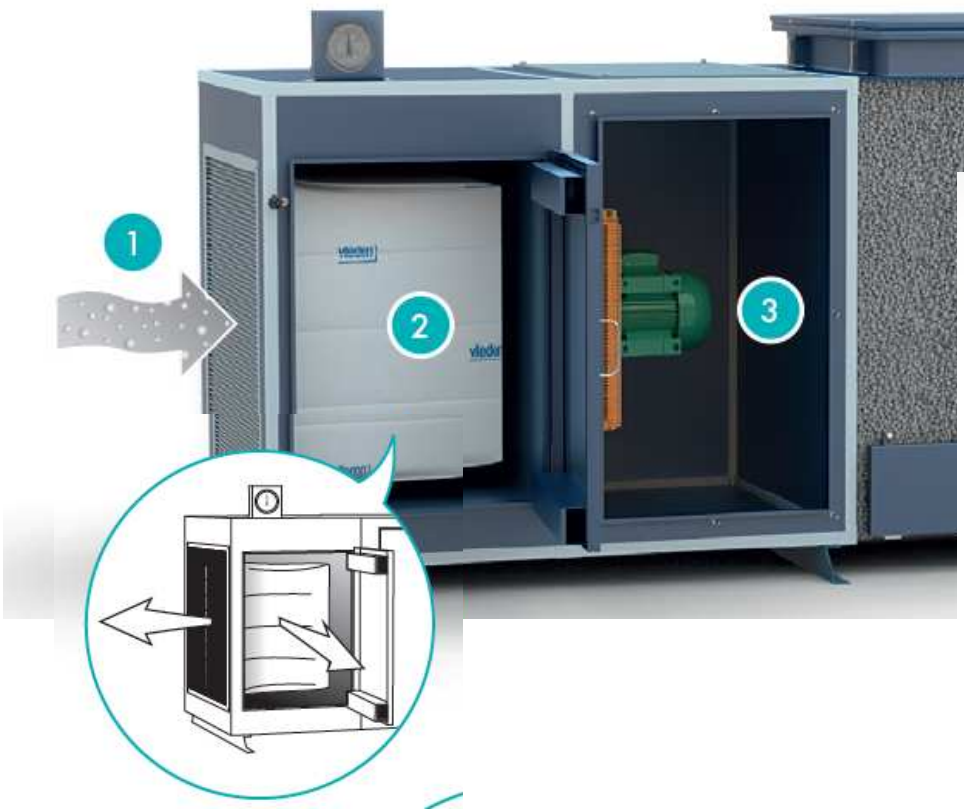


Figure: Example illustration of a complete Viledon® ChemControl Deep-Bed Pressurization Unit (CDBPU)

## How Viledon® ChemControl Deep-Bed Pressurization Units work

1. **Intake of contaminated outside air**
2. **Pre-filtration**
   Viledon® Compact pocket filter (M 6, acc. to EN 779:2012)
3. **Fan** with energy-saving EC motor, meeting the ErP 2015 directive for increased minimum efficiency ratings
4. **Deep-bed filtration**
   Viledon® ChemControl Pellets
5. **Fine filtration**
   Viledon® MaxiPleat cassette filter (F 8, acc. to EN 779:2012)
6. **Purified air**
   free of fine particles and contaminant gases



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# DEEP BED PRESSURIZATION UNITS: TECHNICAL FEATURES

## Viledon® ChemControl Deep-Bed Pressurization Units (CDBPU) features

- Boxed anodized aluminum pentapost frame and high strength 30 mm double skin plastisol panels as standard offer reduced leakage rates of L3 in accordance with EN1886, compared to single skin products.
- High quality assembly ensures a smooth interior surface, thereby minimizing frictional losses and providing a positive air seal where panels are fitted to the frames.
- Units equipped with two deep bed stages; optionally availabe with third or fourth stage for higher gas concentrations.
- Integrated pressure gauges allow clear monitoring onsite.
- Internal and external weatherproof designs available.

| Unit type | Construction | Connection | | Air volume [m³/h] | Number of pre-filters (M6) | Number of fine filters (F8) | Overall unit height** (excludes refill ports) [mm] | Overall unit width** (excluding control panel) [mm] | Overall unit length (excluding duct connections) [mm] | Overall weight (excluding filters and pellets**) [kg] | Power consumption (based on 900 Pa total system pressure at air volume stated) [kW] | Control panel |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Air intake | Air outlet | | | | | | | | | |
| DBPU 1000 Indoor | Plastisol inner / outer double skin panels, with aluminum extrusion frame* | Duct | Duct | 1,000 | 1 | 1 | 1,076 | 700 | 3,700 | 400 | 1.35 | IP54 |
| DBPU 3000 Indoor | | Duct | Duct | 3,000 | 4 | 4 | 1,576 | 1,280 | 3,700 | 700 | 2.30 | IP54 |
| DBPU 6000 Indoor | | Duct | Duct | 6,000 | 9 | 9 | 2,176 | 1,900 | 3,700 | 900 | 4.70 | IP54 |
| DBPU 1000 Outdoor | | Louvre | Duct | 1,000 | 1 | 1 | 1,076 | 700 | 3,700 | 420 | 1.35 | IP66 |
| DBPU 3000 Outdoor | | Louvre | Duct | 3,000 | 4 | 4 | 1,576 | 1,280 | 3,700 | 740 | 2.30 | IP66 |
| DBPU 6000 Outdoor | | Louvre | Duct | 6,000 | 9 | 9 | 2,176 | 1,900 | 3,700 | 960 | 4.70 | IP66 |



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# VILEDON CHEMDETECT COUPONS

## Viledon® ChemDetect Coupons

Each pair of Viledon® ChemDetect Coupon labels contains a specific project number (see top left). Please do not change any of these project numbers, as this number is important for the global tracking of all coupon testing projects. Fill out the blue label and stick it onto the customer's coupon plate. Then fill out the grey label; the grey label is for documentation and internal use only. After you have installed the coupon at the customer, please register the project in the "Coupon testing" list at Sharepoint as soon as possible: https://sharepoint.freudenberg-filter.com/sites/filtereu/gpf.

**To be used for coupon at customer**

Project Nr. 0001

Viledon® ChemDetect Coupon

viledon

| | |
|---|---|
| Coupon Location: | |
| Date installed: | |
| Date removed: | |
| Viledon® Contact: | |
| Phone: | |

Freudenberg Filtration Technologies KG
viledon@freudenberg-filter.com | www.freudenberg-filter.com

Freudenberg

**For internal documentation only**

Project Nr. 0001

Viledon® ChemDetect Coupon

viledon

| | |
|---|---|
| Customer: | |
| Site Location: | |
| Coupon Location: | |
| Customer Contact: | |

Freudenberg Filtration Technologies KG
viledon@freudenberg-filter.com | www.freudenberg-filter.com

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# CONTINUOUS MONITORING OF CORROSIVITY LEVELS


Silver & Copper Corrosion Sensors

- Measurement of change in electrical resistance caused by corrosion (resistance increases with corrosion)
- Two independent channels for copper and silver sensors
- Offers direct signal to control board system
- Offers data logger for reading out of data with software
- Measurement of temperature and rel. humidity



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