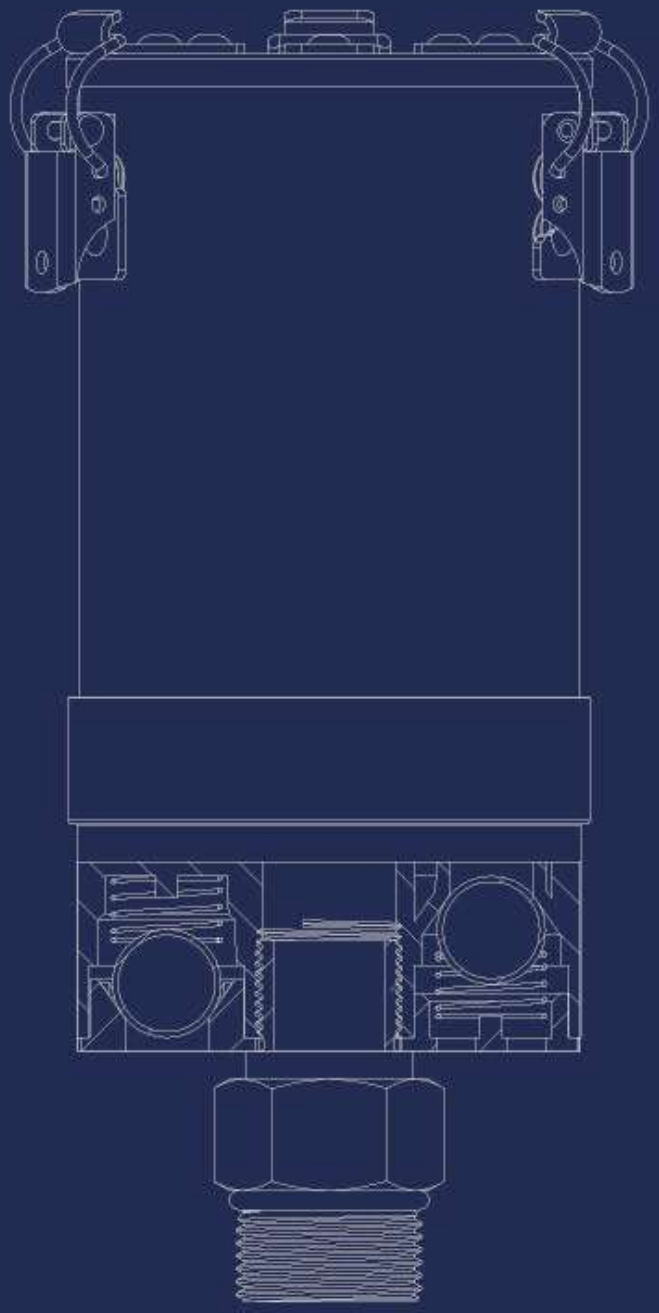

Breathing Drying

Prevention of Condensation Damage in Gears

GIEBEL Adsorber®

Content

Areas of Application

Hydraulic Power Packs

Gears

Storage Tanks

Barrels & IBC

Transformers

Closed Systems

Specialisation

Designed & produced in GERMANY

Team

Heinrich Laas

Projects & Consulting

"I am here for you, for all technical questions regarding the use of an adsorber as well as project inquiries."

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Microsoft Teams

Content

Functionality

Transmission of forces, torque and energy!
→ **Pressure equalization with ambient air**

Air intake from the environment

due to temperature fluctuations

Humidity

Absolute Humidity

Content of water vapor

Relative Humidity

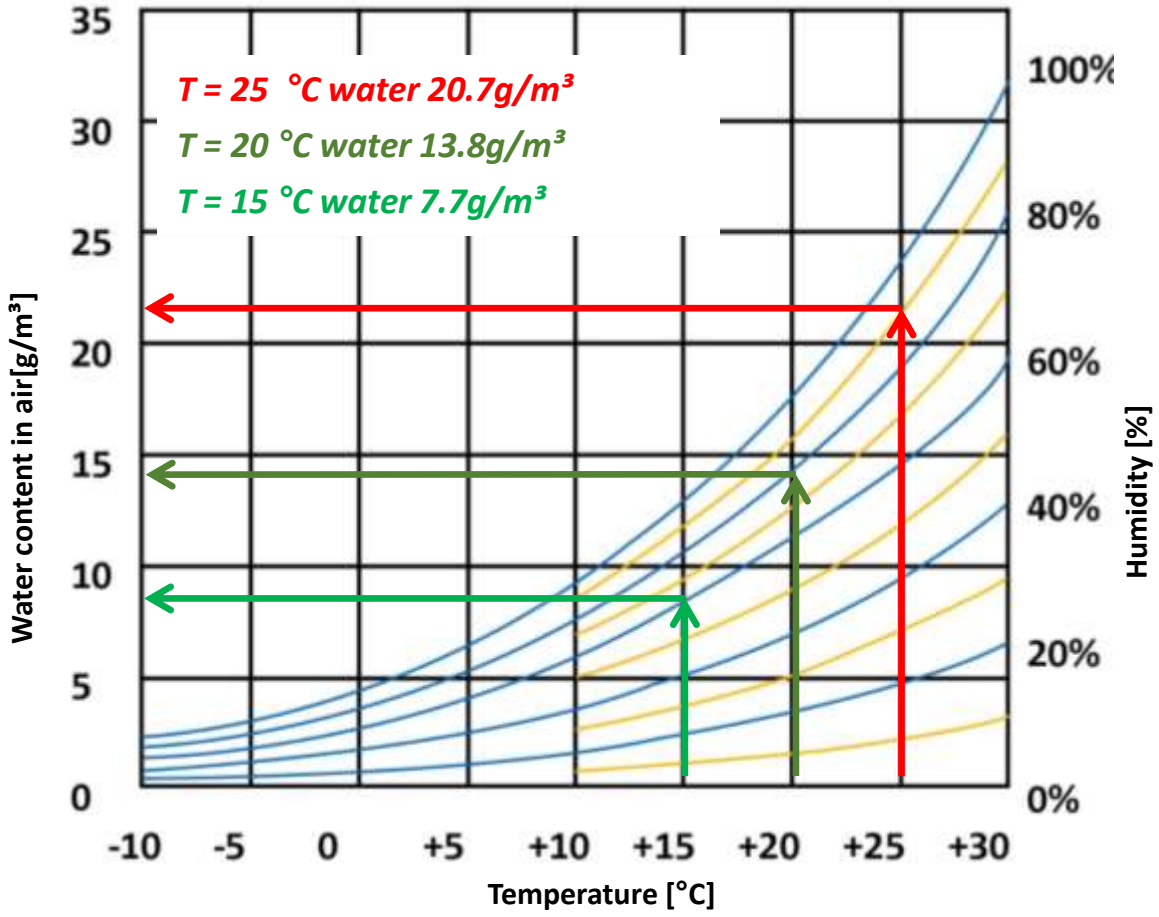
Percentage to maximum humidity

Content of water:

At 25 °C and 90% rF → 20,7 g/m³

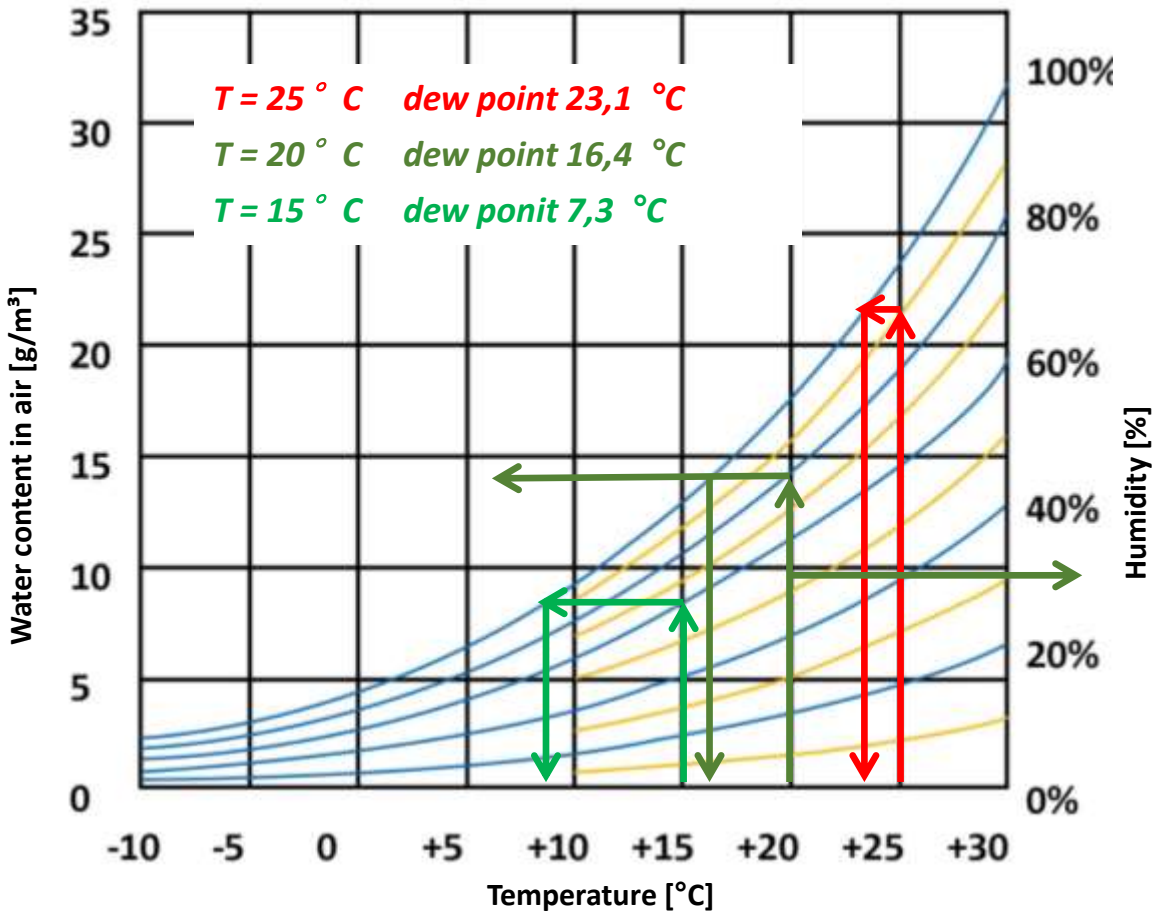
At 20 °C and 80% rF → 13,8 g/m³

At 15 °C and 60% rF → 7,7 g/m³



Dew Point

The temperature at which the humidity will condensate



Dew point in the ambient air

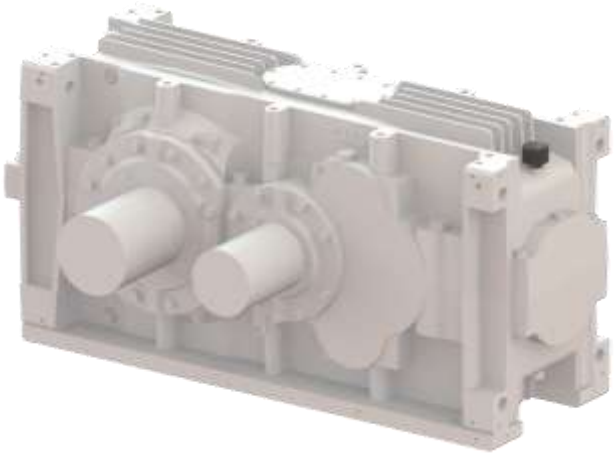
At 15 °C and 90% rF	→ 23,1 °C	dT = 1,9° C
At 20 °C and 80% rF	→ 16,4 °C	dT = 3,6° C
At 15°C and 60% rF	→ 7,3 °C	dT = 7,7° C

Operation Conditions Adsorber

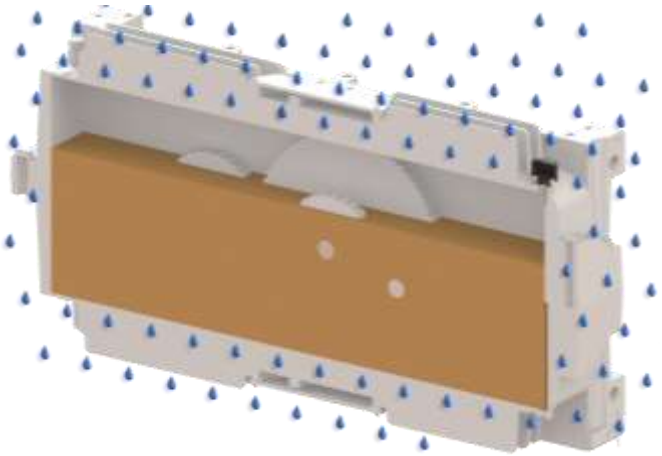
Environment with …
… high humidity > 70% rF
… high temperature > 25°C
… high temperature fluctations ca. 10°C

Systems…
… with a hygroscopic lubrication fluid
… of high importance

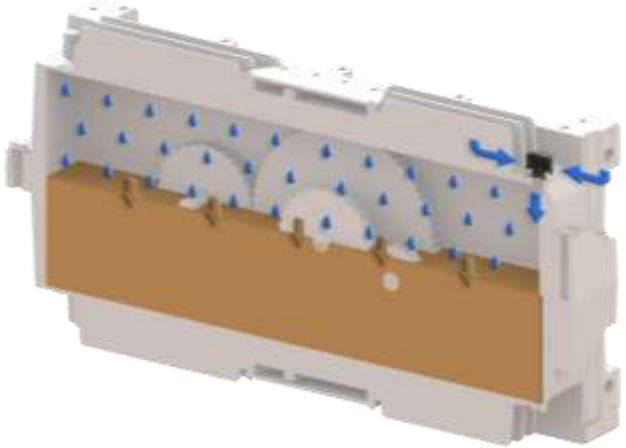
Process Water Entry



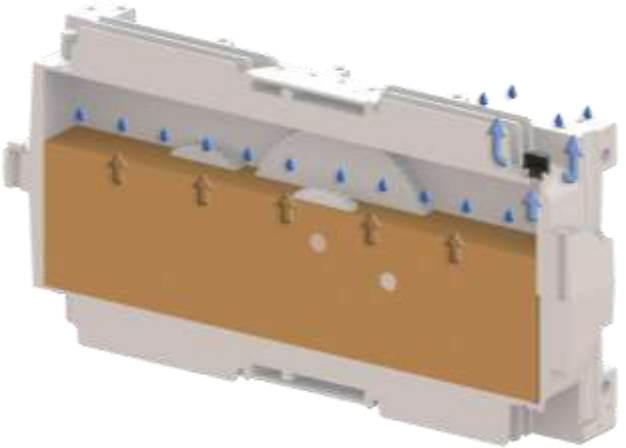
1. Gear WITHOUT Adsorber



2. Environment with humid air

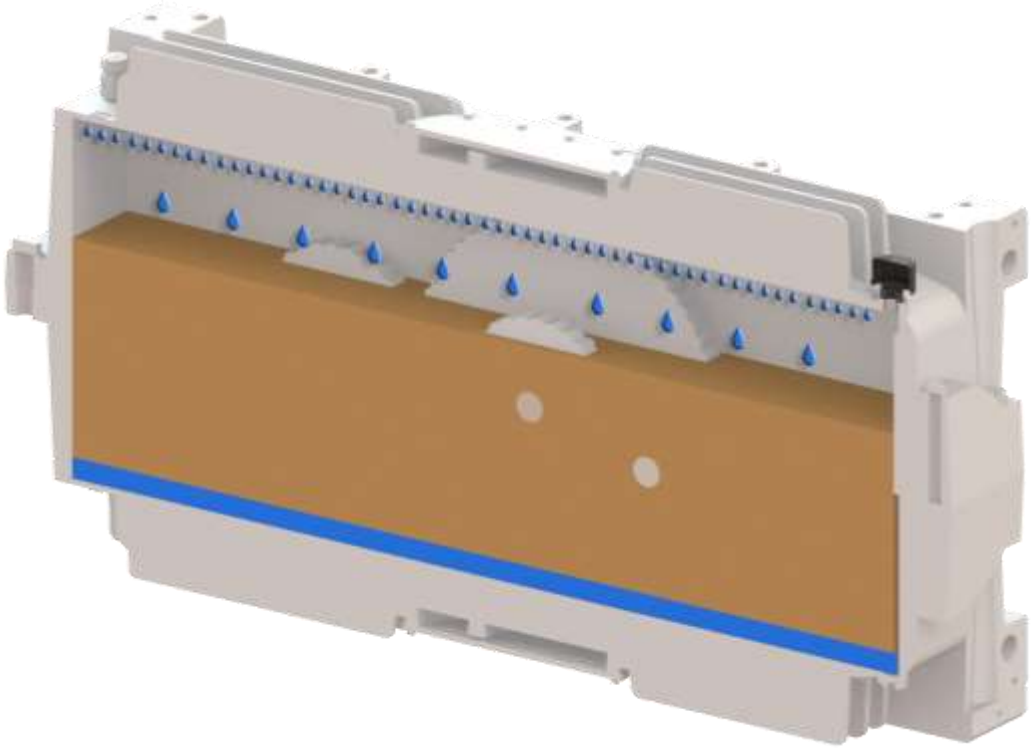


3. Sucking in humid air



4. Pressing out humid air

Formation Condensation Water



5. Condensation from dew point

→ **Formation of condensation water inside**

Water content must be <u>below the saturation point</u> of the oil.

<u>Moisture limit</u>
0,1 Extend-%
1000 mg/kg

Damages as a Result






„Particles and water are the cause of 80% of malfunctions and damage in **hydraulic systems, gearboxes and rolling bearings.“**

<u>Consequences:</u>

- **Hydrolyse:** Rapid aging and degradation of additives
- Promotion of **corrosion**
- Worse **lubrication**

Content

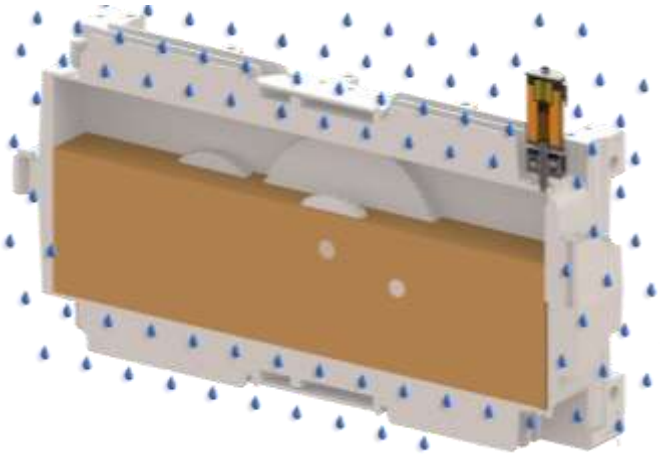
Troubleshooting Adsorber

Adsorption of water, thereby lowering the humidity and the dew point.

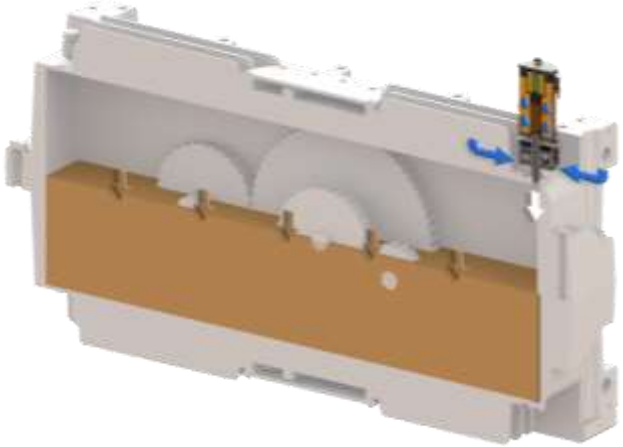
→ **Prevention of condensation!**

Avoid Water Ingress

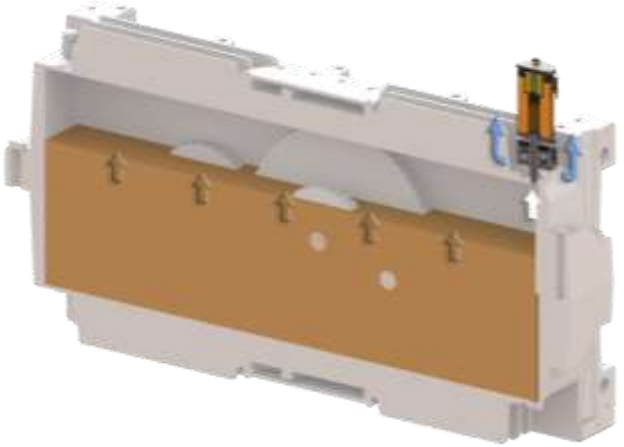
1. Gear WITH Adsorber



2. Environment with humid air

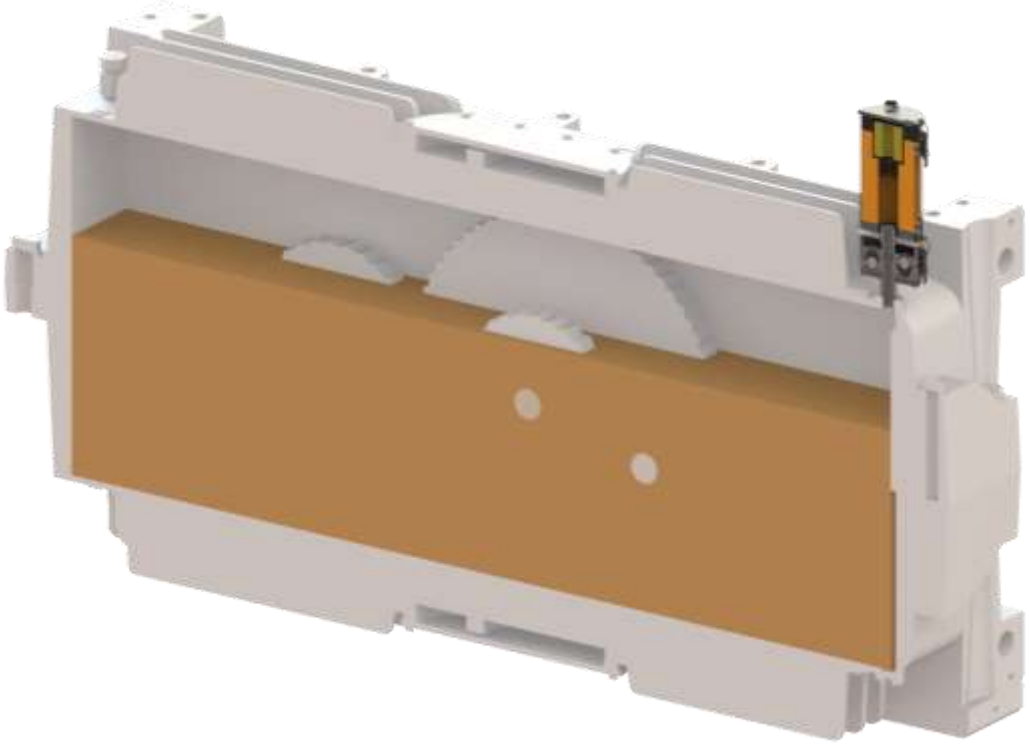


3. Drying the sucked humid air



4. Regeneration with dry air

Dry Oil



ANALYSENERGEBNISSE			Aktuelle Probe		Frühe
LABORNUMMER			3812201	3950498	3812199
GESAMTBEWERTUNG			i	i	!
Untersuchungsdatum			27.01.2020	29.11.2019	28.06.2019
Datum Probenentnahme			23.01.2020	26.11.2019	24.06.2019
Datum letzter Ölwechsel			26.11.2019	16.07.2019	18.12.2013
Nachfüllmenge seit Wechsel			-	-	20
Laufzeit seit Wechsel			-	-	-
Laufzeit gesamt			-	-	-
Öl gewechselt			Ja	-	Ja
VERSCHLEIß					
Eisen	Fe	mg/kg	4	16	38
Chrom	Cr	mg/kg	2	9	27
Zinn	Sn	mg/kg	0	0	0
Aluminium	Al	mg/kg	0	1	1
Nickel	Ni	mg/kg	0	0	0
Kupfer	Cu	mg/kg	1	2	7
Blei	Pb	mg/kg	0	0	0
Molybdän	Mo	mg/kg	0	0	1
Antimon	Sb	mg/kg	1	-	-
Mangan	Mn	mg/kg	0	0	1
PQ-Index	-		< 25	< 25	< 25
VERUNREINIGUNG					
Silizium	Si	mg/kg	1	3	11
Kalium	K	mg/kg	1	4	15
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Wasser K. F.	ppm		33	67	118

Probe und Deckel

5. Dew point not reachable, no water

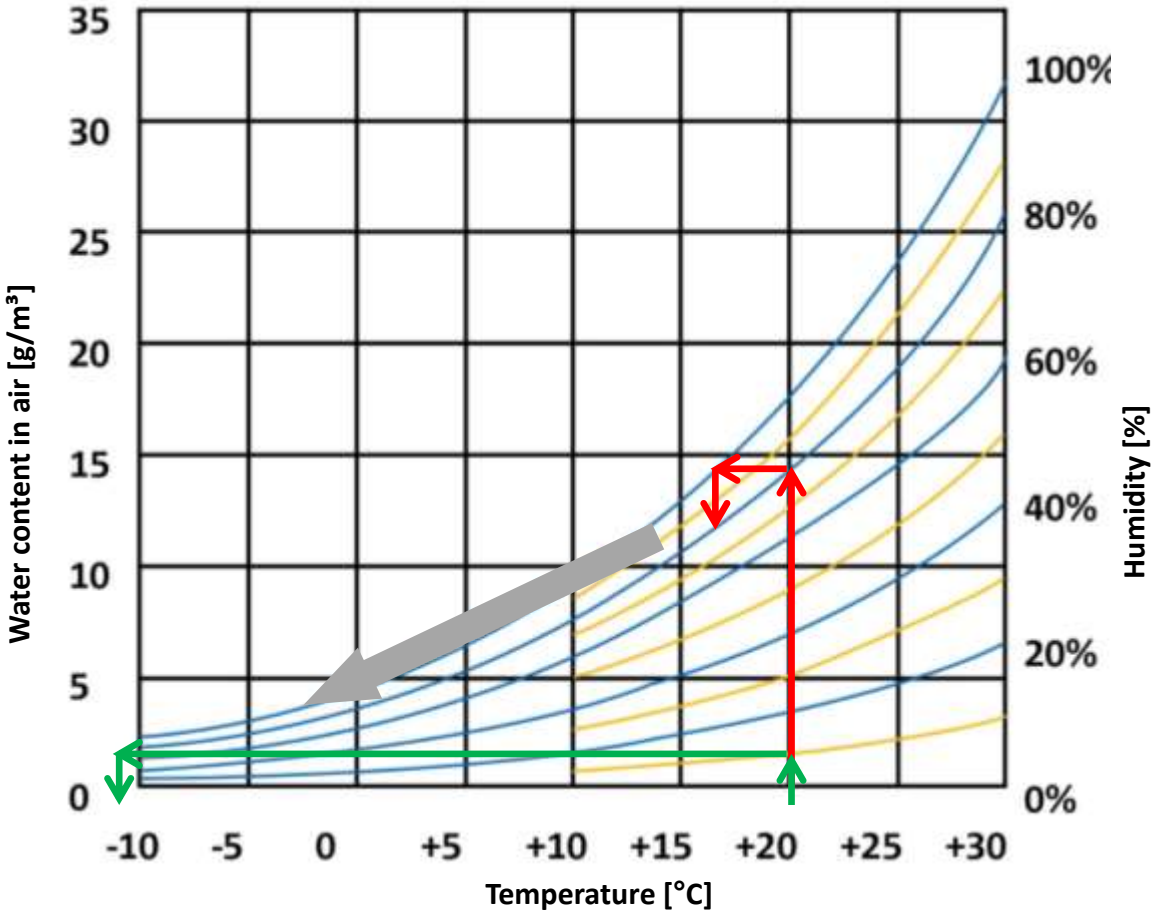
→ **No condensation inside, dry oil**

Mode of Action

Humidity after Adsorber

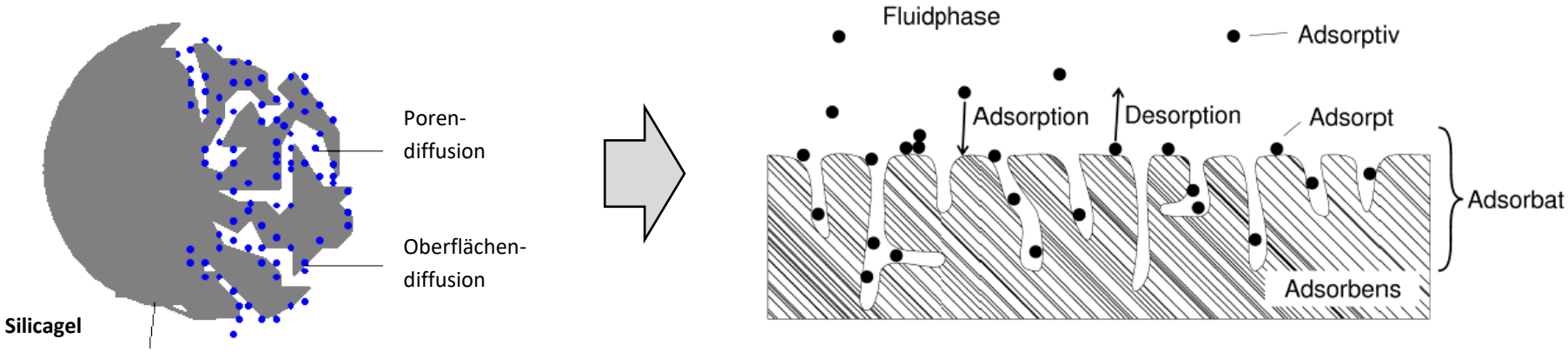
average 10% rH

- Water content: **1,7 g/m³**
- Dew point: **-12,5 °C**



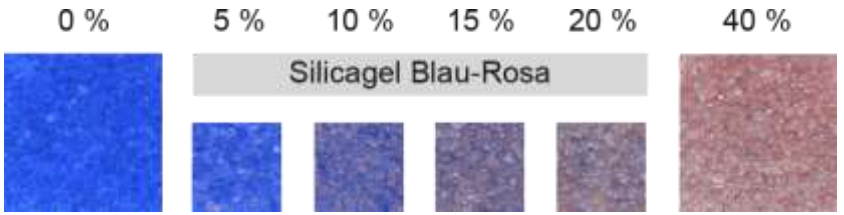
Content

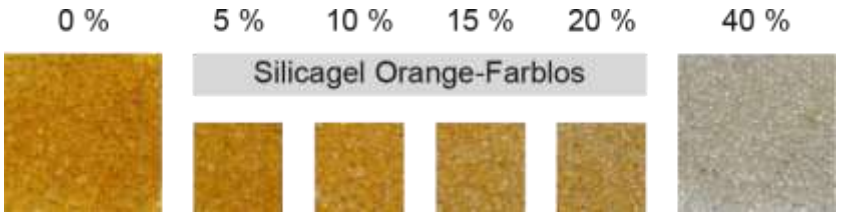
Adsorption

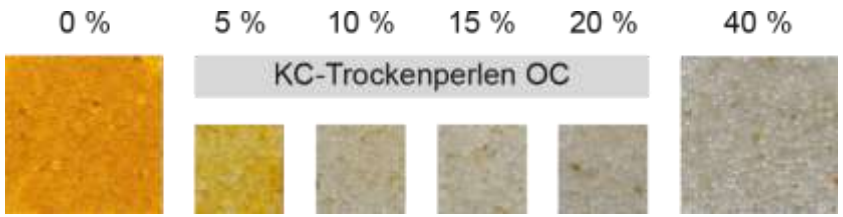


- Wasser molecules are bound **in the pores**
- Adsorption is based on **attractions** (Van der Waals forces)
- Van der Waals forces are **solvable again** → Desorption
- Maximum load, until **equilibrium**!

Silica gels

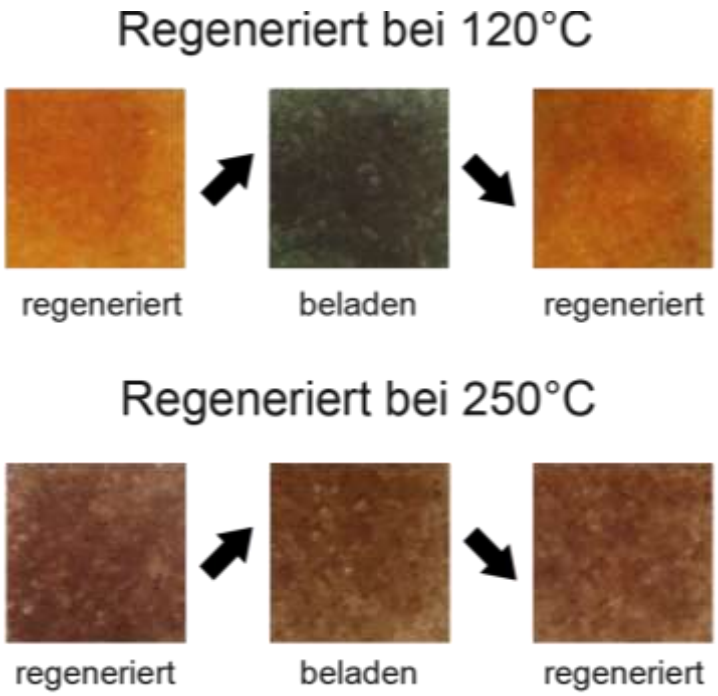


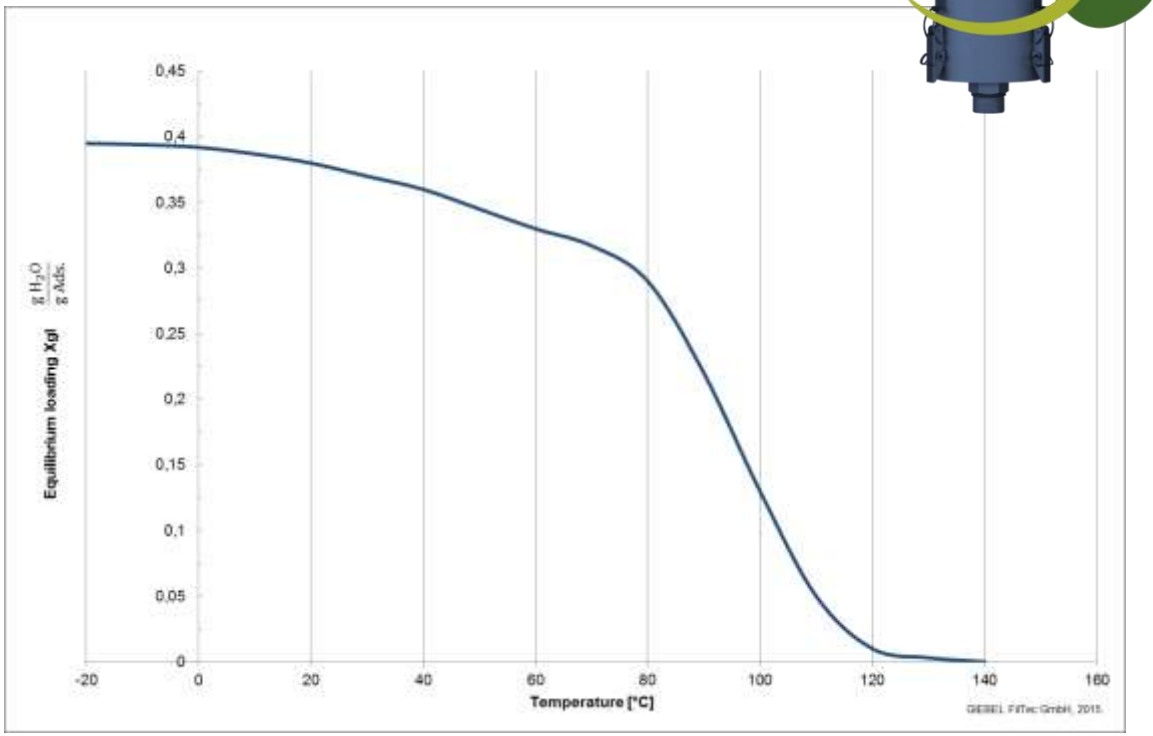




Messdaten GIEBEL FilTec GmbH

Regeneration Silica gel



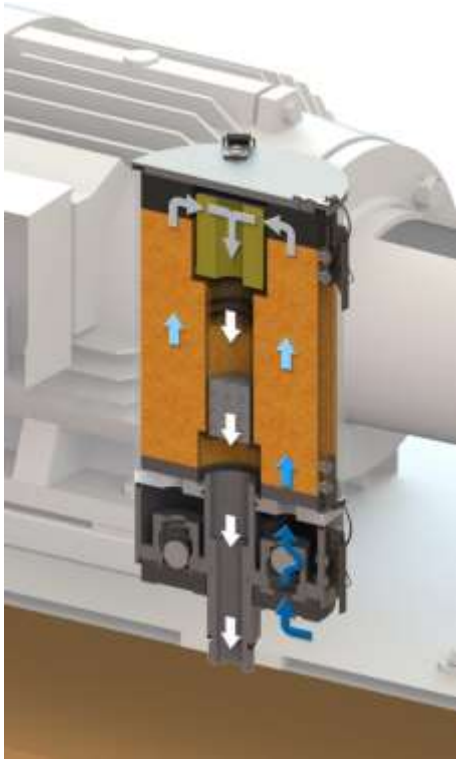


Test data GIEBEL FilTec GmbH

Funktion on Hydraulik Tank

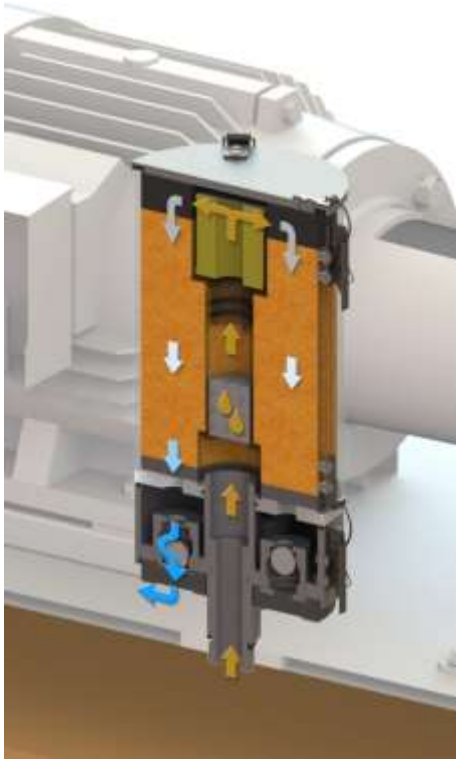
Oil level drops:

- Humid supply air from the environment
  → **Dehumidification**



Oil level rises:

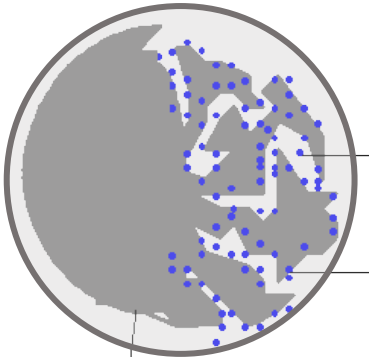
- Oil-containing exhaust air from the system
  → **Self-regeneration**



Protection from Oil

Oil-containing exhaust air:

- Without activated carbon, an impregnation would take place

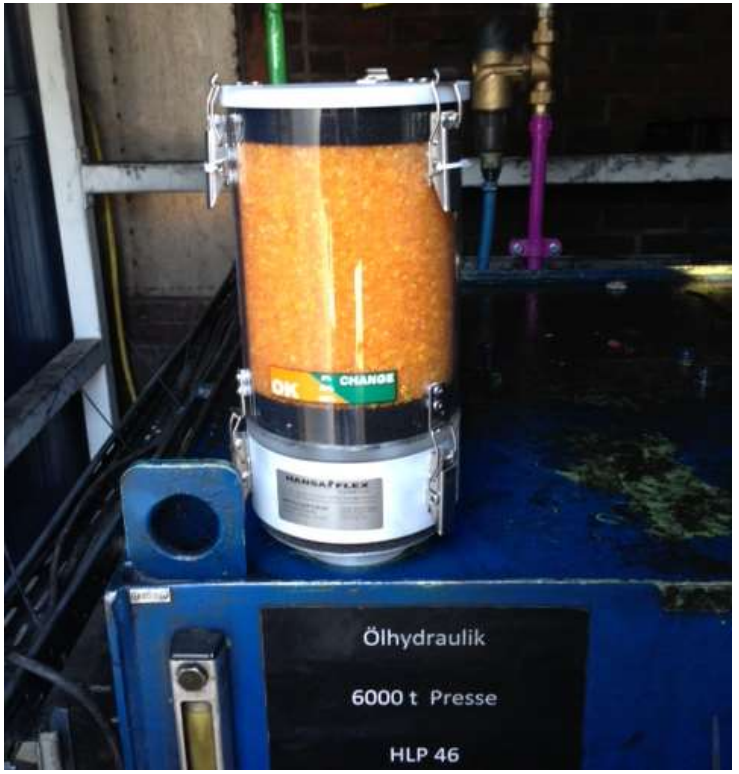


- Block the water-absorbent pores

- Prevent further color change

Visibility Gear Condition

Moisture present in the gear!

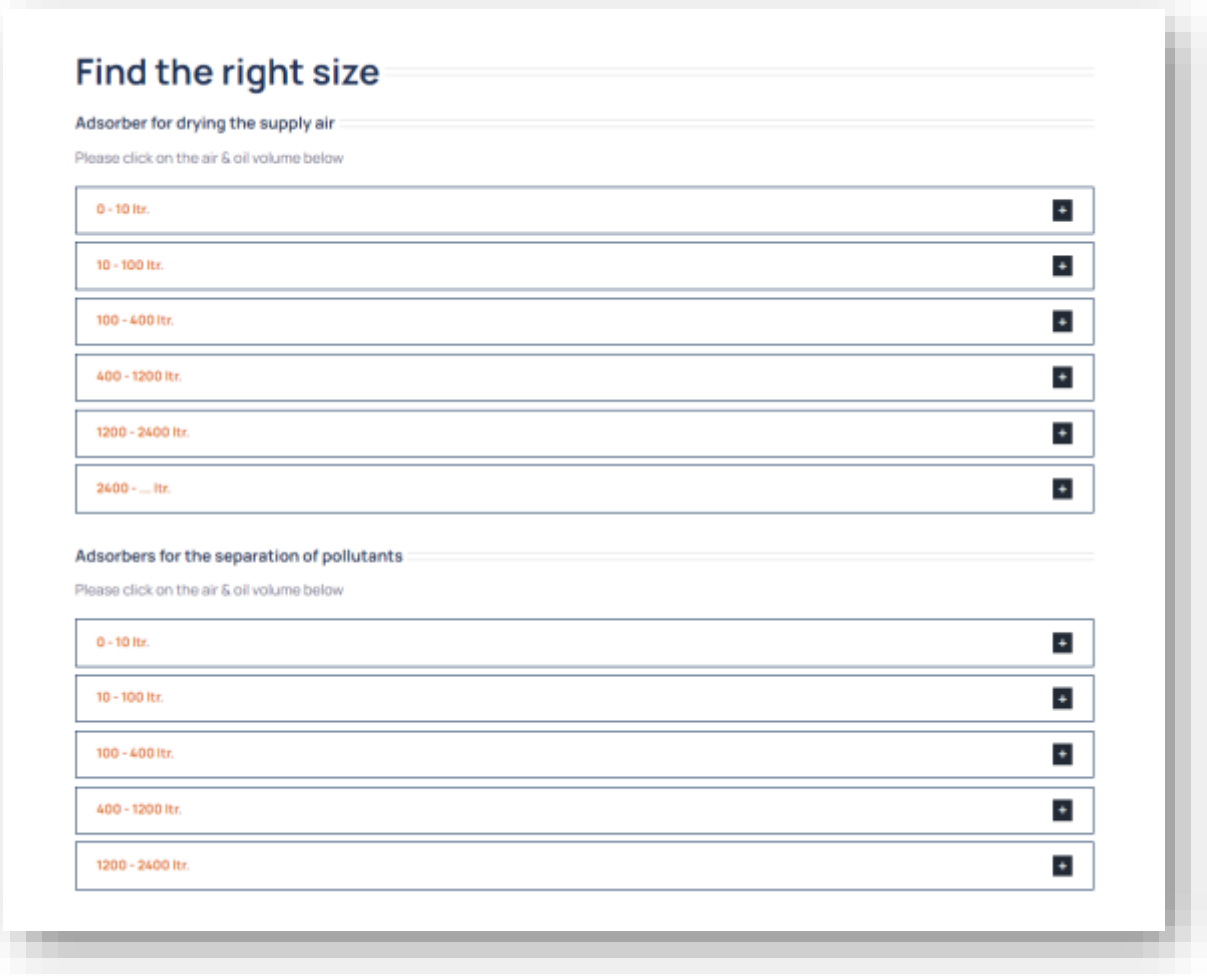


Gear inside dry!

Selection Criteria Gears

- System
  - Gear volume [l]
  - Pendulum volume [l/min]
  - Lubrication fluid
  - Oil movement

- Environment
  - Humidity
  - Temperature



Content

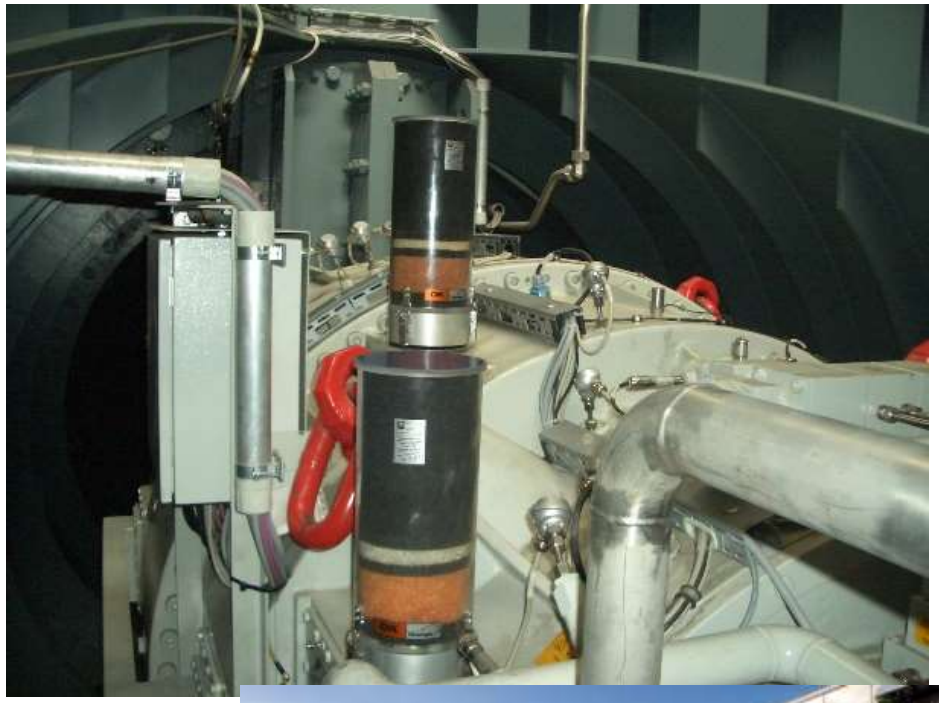
Example Sewage Plant

Task: moving the circular basin

Operation: continuous, outdoor use

→ **Usage of Adsorber ME-RV 3M**

Example Hydropower Plant



Task: Ventilation turbines, protection against oil mist

Operation: continuous operation, evaporating oil particles

→ **Usage of**

Adsorber VG-D 5L

Example Radio Telescope

Task: Rotate the radio telescope

Operation: Rare use, outdoor use

→ **Usage of**

Adsorber VV-RV 3MV

Example Ship

Task: Drive of a ferry

Operation: continuous operation, protection against evaporating oil particles

→ **Usage of**

Adsorber VG-D 5L

Example Sugar Factory

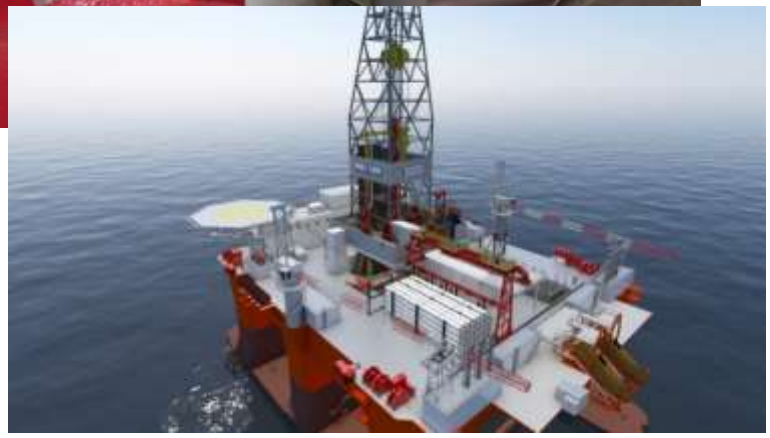
Task: e.g. drive of the pulp press

Operation: Continuous operation during campaign, high humidity and temperature fluctuation

→ **Usage of**

Adsorber MA-RV 3M

Example Drilling Rig



Task: Lifting the drill pipe out of the ground

Operation: Continuous operation offshore

→ **Usage of**

Adsorber ME-RV 3L

Example Minning

Task: Drive of the conveyor system

Operation: Continuous operation, very dusty and humid

→ **Usage of**

Adsorber MA-RV 3M

Example Wind Turbine Gearbox

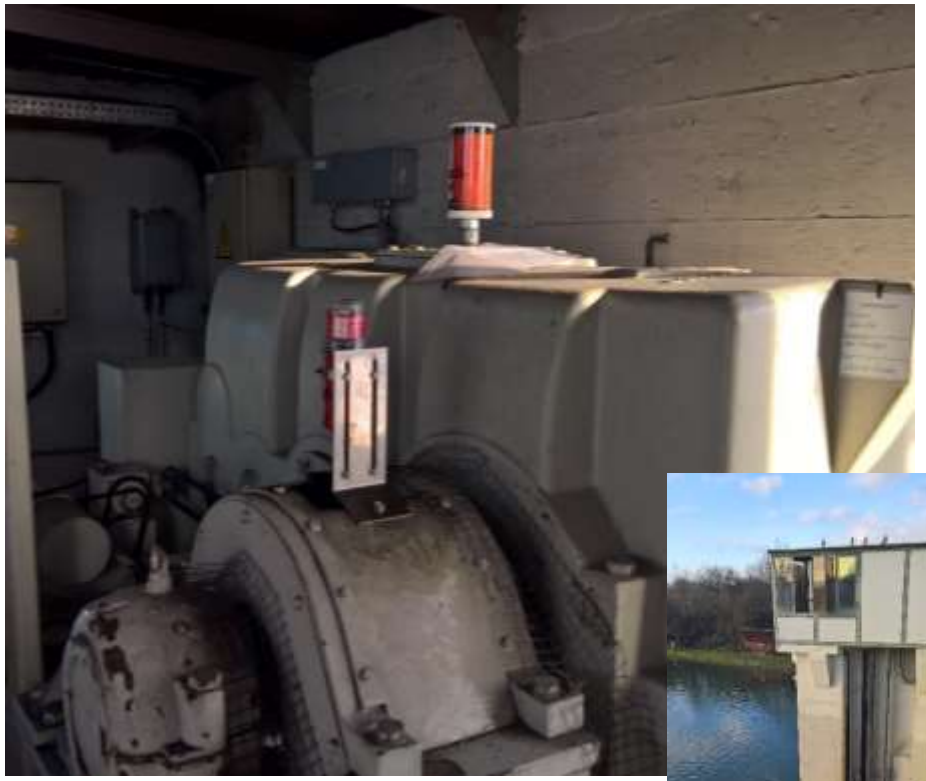
Task: Transfer of the energy of the blades to generator

Operation: continuous use, maintenance interval annually

→ **Usage of**

Adsorber VG-D 5L (for oil fumes) or VV-DV 3L (for humidity)

Example Weir



Task: Lifting and lowering of the weir system.

Operation: Use very rarely, only temperature fluctuations

→ **Usage of**

Adsorber VV-DV 2L

More Examples

IBCs

Barrels

Transformers

Gears

Mobile Machines

Storage tanks

References

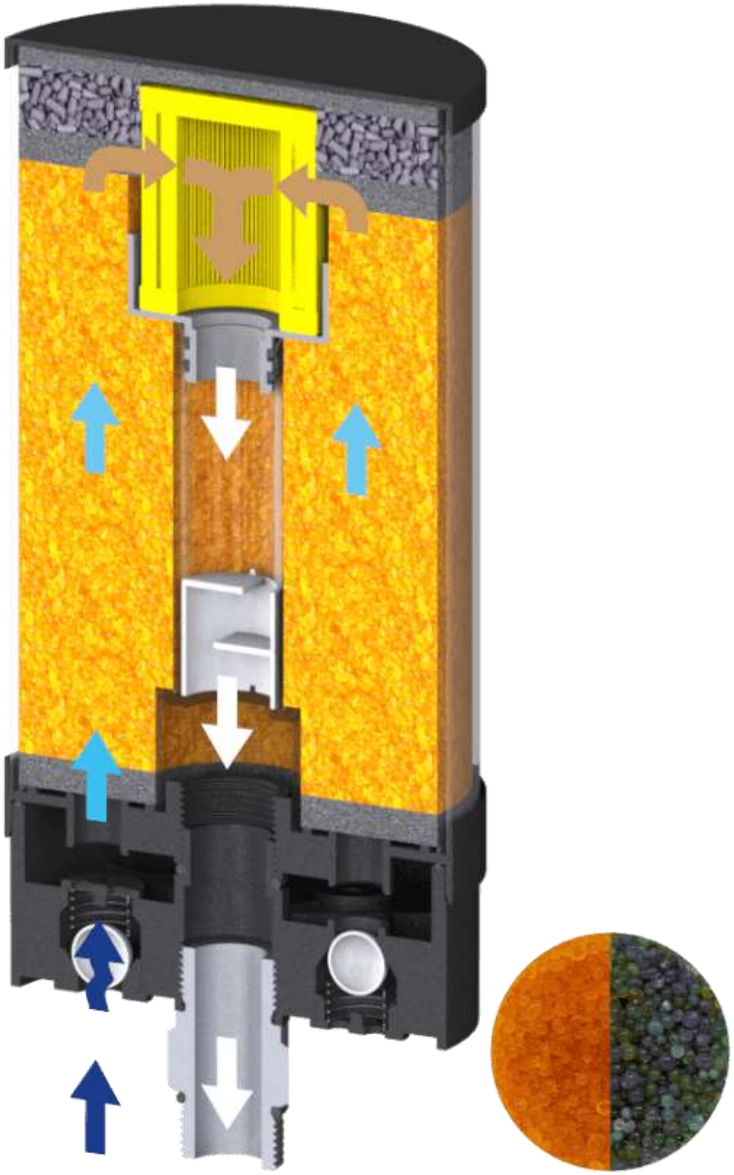
… and many more!!

Content

Life Cycle Extension

Protection during downtimes. No unnecessary loading

→ **Extension of the maintenance intervals!**



Particle Filter

Standard version 3µm filter in every GIEBEL Adsorber

→ **Protection from moisture and dirt!**

3 µm paper

3 µm / 1 µm
glas fiber

0,3 µm
ePTFE membrane

Easy Maintenance - Reusable

- No oil template to replace
- No tools necessary
- Performed by one person
- No cleaning of several glass vessels

Recycling Cycle - Disposable

Returning to GIEBEL the loaded cartridge

Renewed use of the **reconditioned cartridge**

Breather Dryer

VV, MA and **ME** series

aeration dryers protect the gear from moisture.

Optimally designed and

optimized to the gear solution with a high amount of desiccant.

Standard Breather Dryers

Adsorber	VV-D	VV-DV	VV-R	VV-RV
Operating fluids	All common oils, mineral oils, biodegradable oils, insulating oils			
Rechargeable	✗	✗	✓	✓
Valves	✗	✓	✗	✓

Special Breather Dryers

Adsorber	MA-RV	ME-RV
Operation fluids	All common oils, mineral oils, biodegradable oils, light and hardly flammable fluids	
Valves	✓	✓
Rechargeable	✓	✓
Use according ATEX 2014	✓	✓
Offshore suitable	✗	✓

Oil mist separators

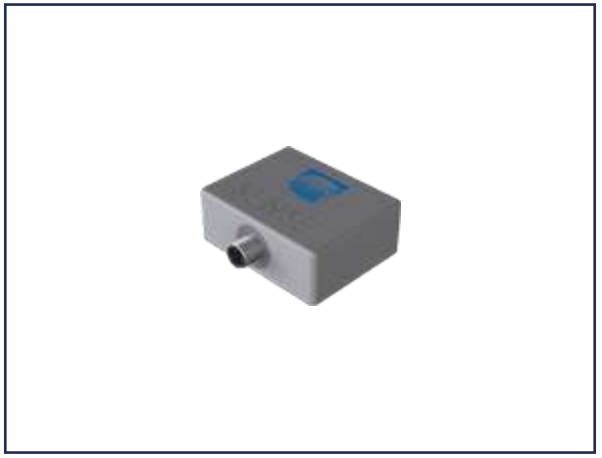
The VG series is used in the case of heavily escaping oil mists.

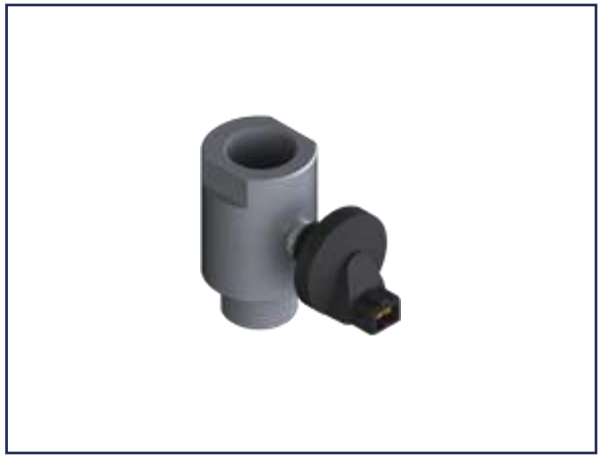
The combination of impeller and oil demister with a high amount of activated carbon, purifies the exhaust air and prevents contamination of the ambient air.

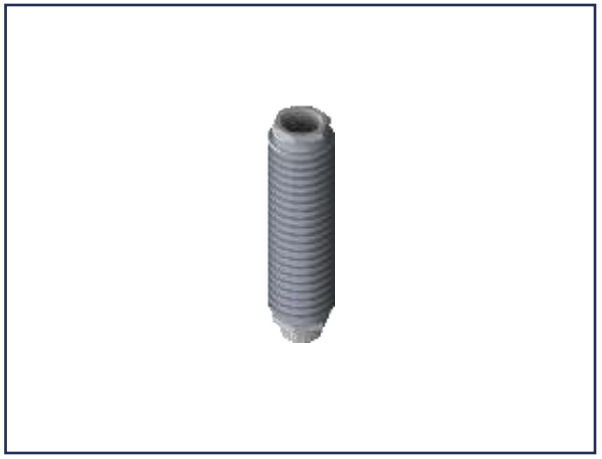
Oil Mist Separators

Adsorber	VG-D	VG-R
Operation fluids	All common hydraulic oils, mineral oils, biodegradable oils, insulating oils	
Rechargeable	✗	✓

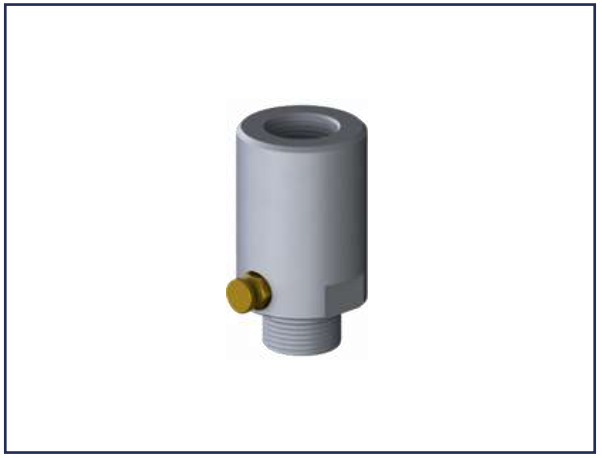
Accessories







Accessories



Adsorbents

Silica gel (SiO2)

Air drying
Indicator for color change
(orange -> green / white)
Capacity max. 37
Regeneration at 120°C

Activated Carbon (C)

Separation of oil particles
No indicator (black)
Large surface

Molecular Sieve (Sodium aluminium silicate)

Selective adsorption
Strong binding to water
No indicator (beige)
Capacity max. 25%
Regeneration at 300°C

Services

Customer label

Series call-offs can be supplied with your label

Refresh

Return of the adsorber cartridge

Plastic waste avoidance cycle

Sustainable

1. Reusable

Return of the adsorber cartridge

Plastic waste avoidance cycle

2. Long-term use

Robust metal housing for very long use

No plastic waste

3. Rechargeable

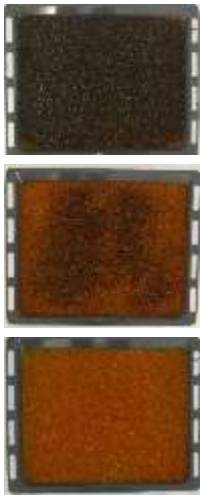
No disposal of plastic housing

Inexpensive and easy to maintain

4. Regenerable

Reusability of the desiccant

Regeneration in domestic oven



Thank you

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GIEBEL Adsorber®