



Lead Center Diaphragms Overview 2013

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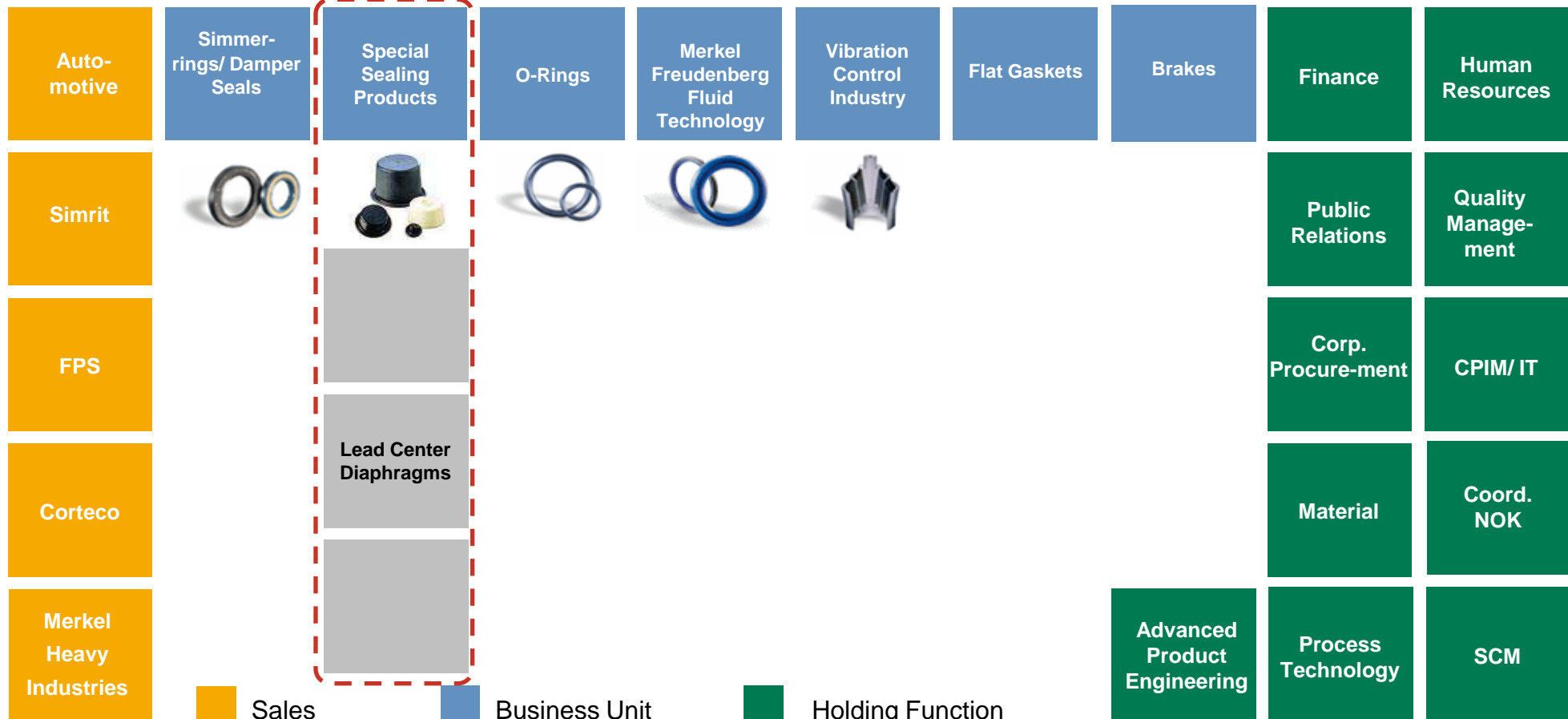
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Organisation Chart – Europe

Freudenberg Sealing Technologies

Board of Management

Möhlenkamp | Dr. Barimani | Schäfer | Neuwinger-Heimes



How to define a diaphragm?

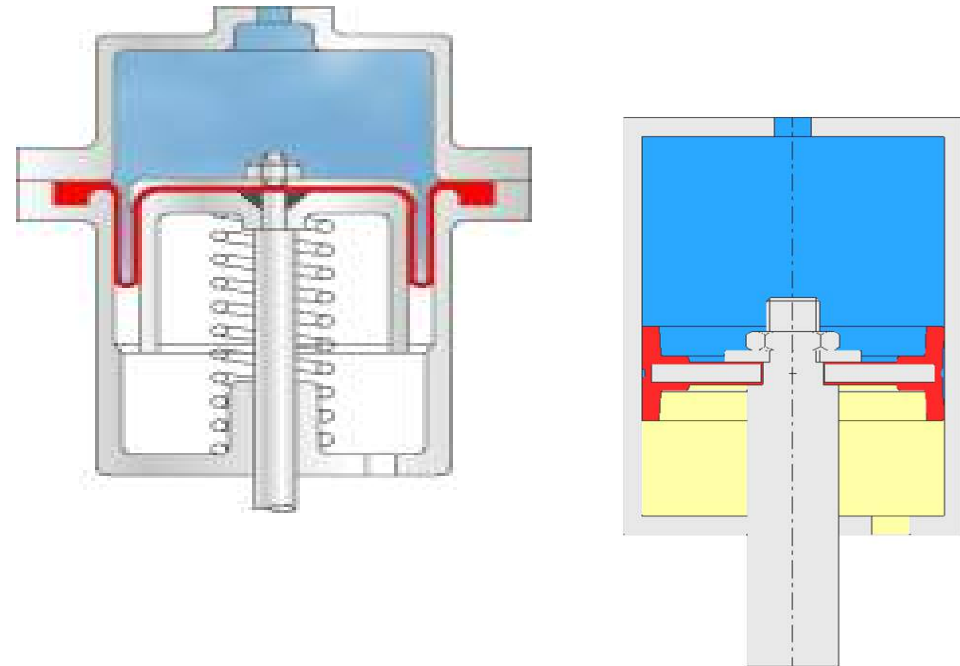
An elastic flexible wall

- **between two different medias**
and / or
- **between two different pressures**

Advantages and disadvantages of diaphragms

Advantages opposing face seals

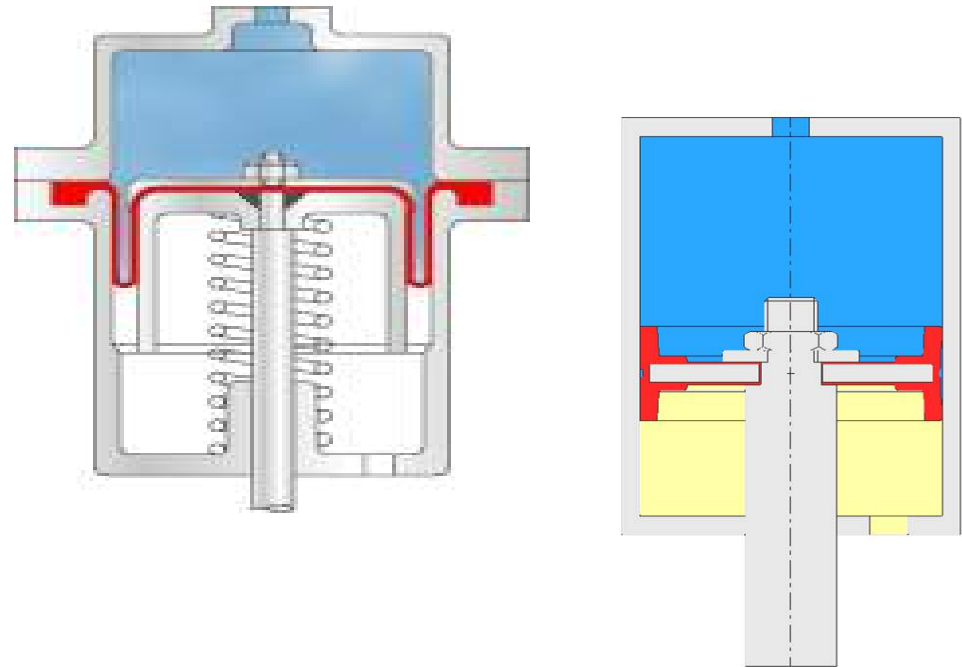
- absolutely tight (technical)
- minimal wear
- maintenance-free use
- low inner resistance causes slight hysteresis (depending on fabric)
- no rest point in working stroke
- minimal surface condition for metal parts in contact



Advantages and disadvantages of diaphragms

Disadvantages opposing face seals

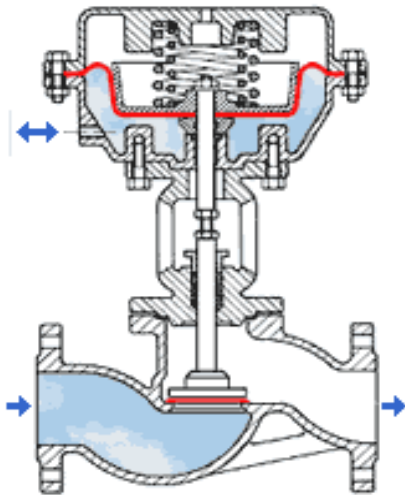
- working pressure max. 25 bar
(with fabric reinforcement)
- limited stroke
(depends on fabric presence)
- effective diameter smaller
than diameter of housing
- effective diameter depending
on stroke position



2. Definition and Function of Diaphragms

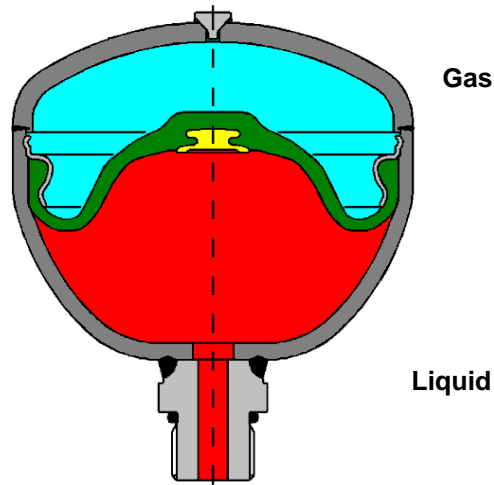
Basic functions of Diaphragms

Controlling or actuating



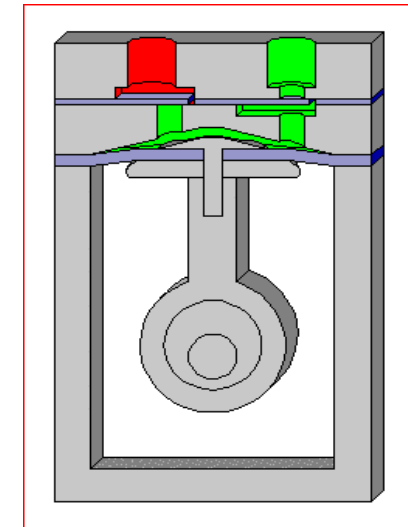
Converts pressure into actuating movement

Accumulation or separating



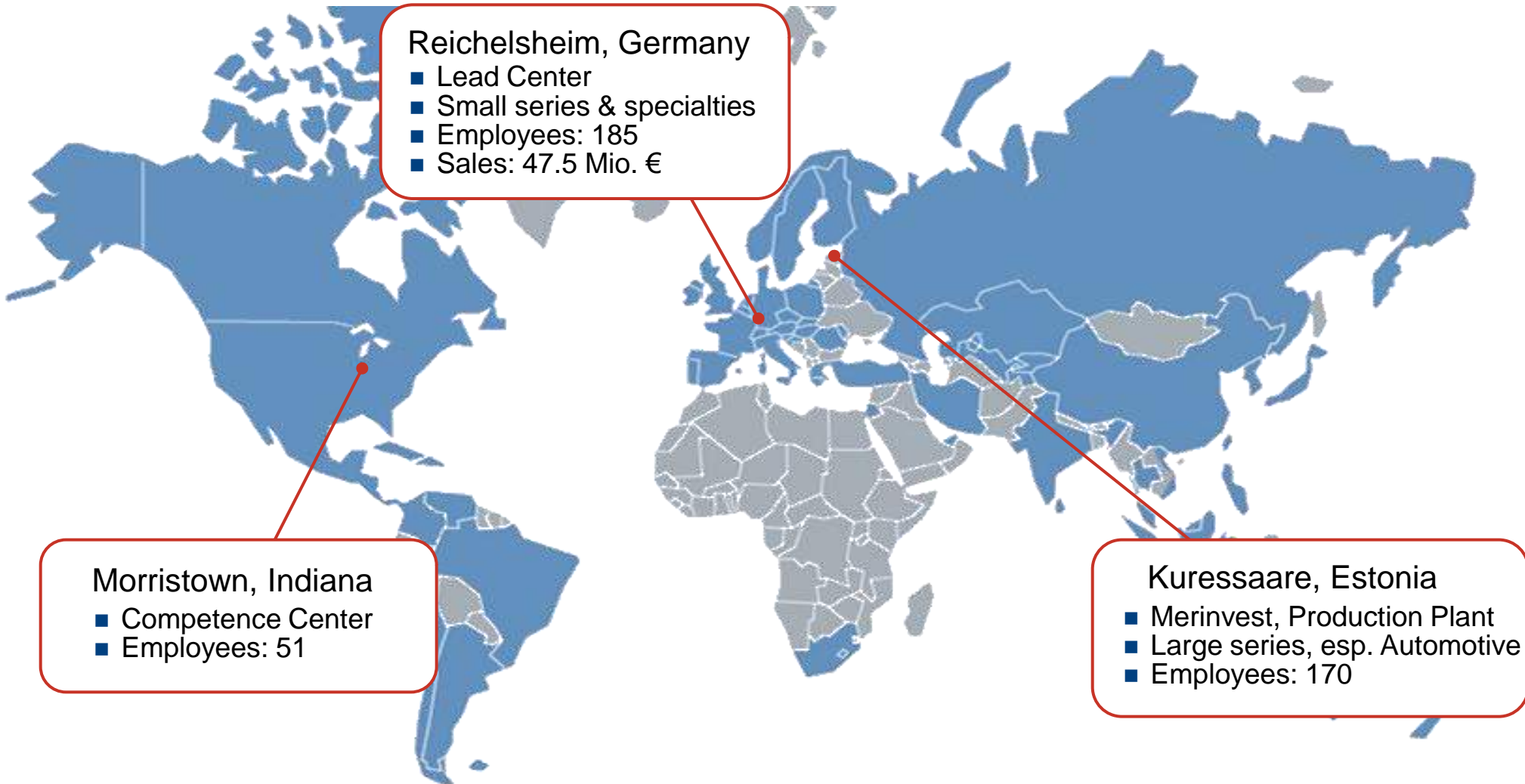
Works as a separating wall when standing still

Pumping

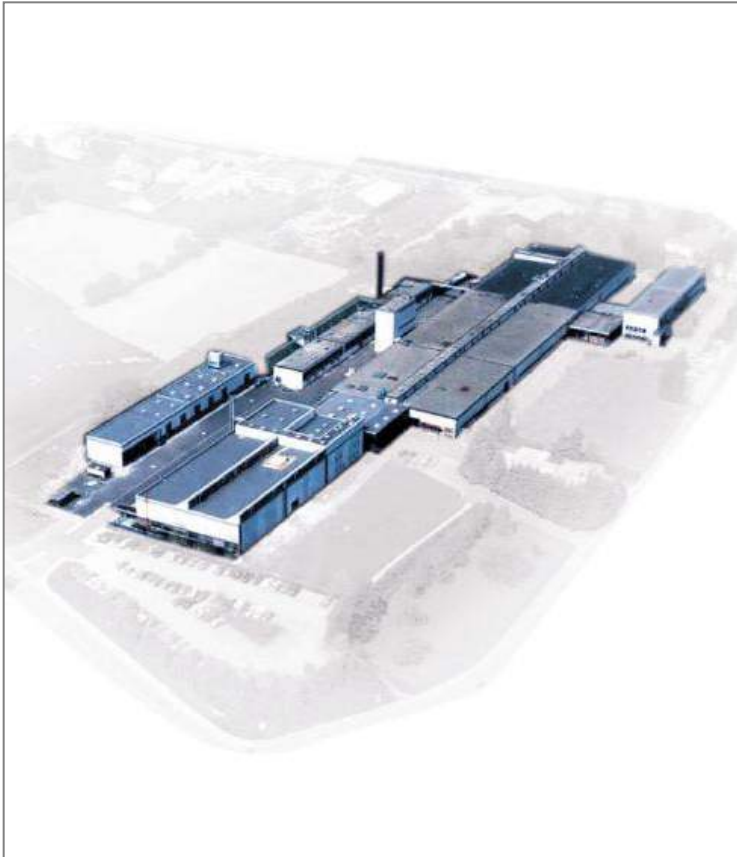


Converts forces into pressure or liquid flow

Lead Center Diaphragms: Global Site Overview



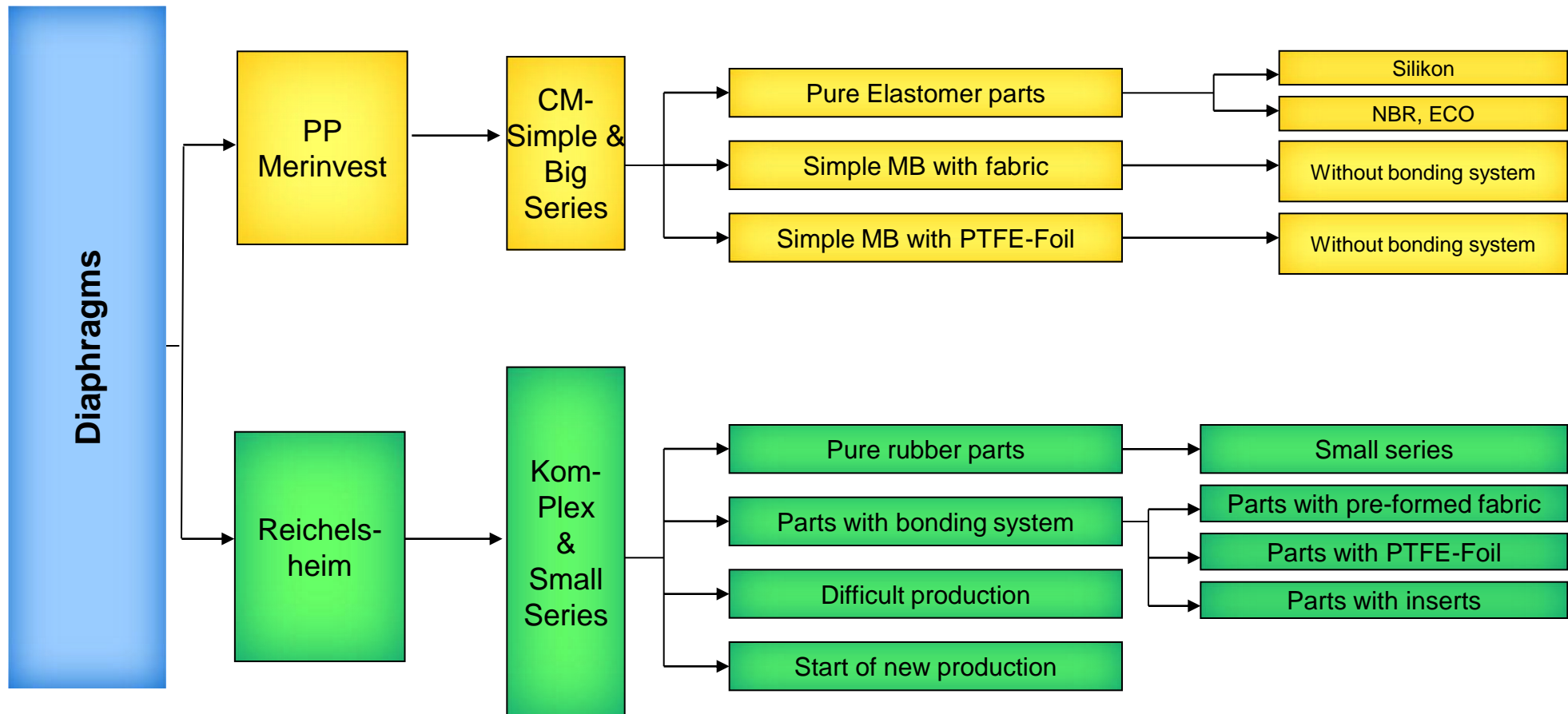
Lead Center Diaphragms: Key figures



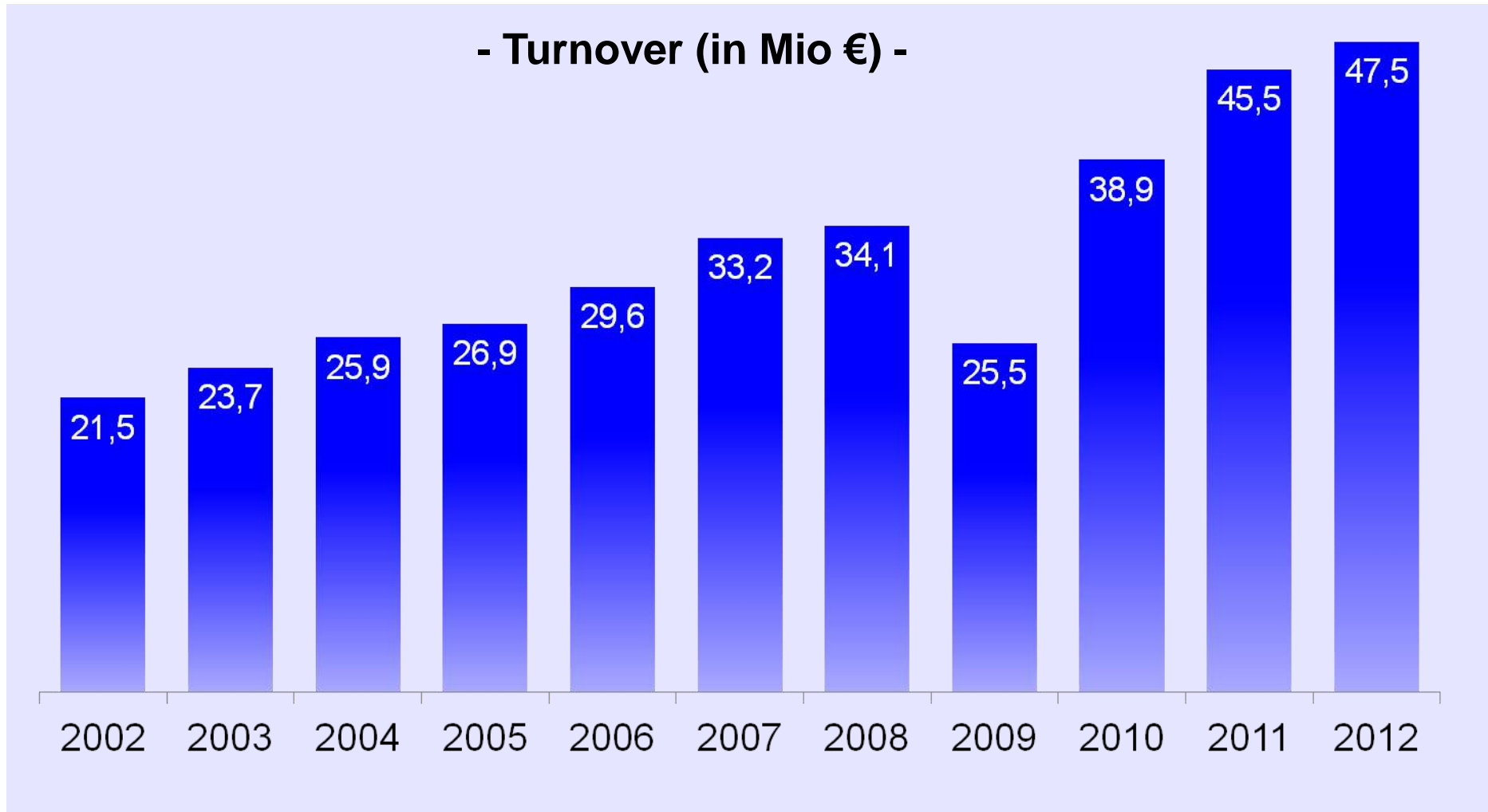
Site in Reichelsheim

- **Foundation:** 1966
- **Turnover 2012:** 47.5 Mio. €
- **Production Sites:** Reichelsheim (small series & specialties)
Estonia (large series, esp. automotive)
- **Number of articles:** > 1.900 customer specific,
200 standard parts
- **Production process:** CM (95 %), IM (4 %)
- **Materials:** > 350 different elastomeric compounds,
11 PTFE/TFM- films
20 fabric types,
different plastic + metal inserts
- **Quality certificate:** ISO/TS 16949:2009,
Environmental certificate: DIN EN ISO 14001:2004,
Safety certificate: OHSAS 18001:2007

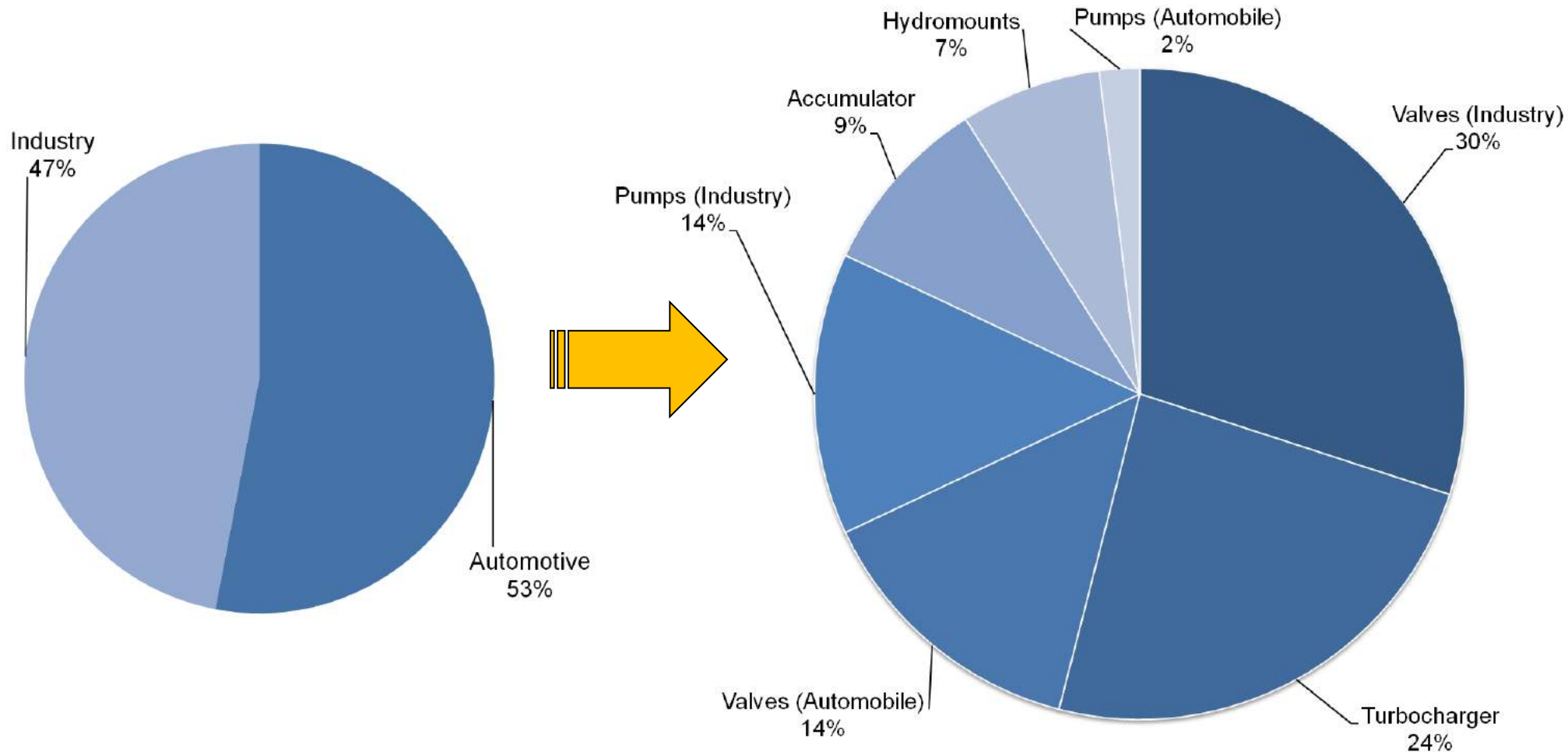
Lead Center Diaphragms: Production Strategy



Lead Center Diaphragms: Development of Sales



Lead Center Diaphragms: Sales Structure Segments



Product portfolio from Mini to Maxi



The smallest diaphragm produced to date has an outer diameter of 5.4 mm with a vulcanized metal insert of 1.8 mm in diameter.



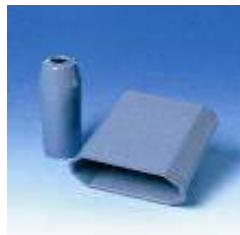
The biggest diaphragm produced to date has an outer diameter of 1115 mm with a vulcanized metal insert of 350 mm in diameter.

Our strengths

- Deep know how in basic materials
More than 350 elastomeric compounds for chemical, thermal and mechanical optimized diaphragms.
- Approved compounds for food & drink water
- Experiences of many years for design layout of pure elastomer diaphragms as well as a combination of elastomers with
 - Fabrics for reinforcement
 - PTFE foils to protect against attack from chemicals
 - Metal or plastic inserts
- Possibility to calculate products with Auto-FEA within our Lead Center as well as realization of complicated FEA calculations at Freudenberg Research Services.
- Tool maker for prototype tools within our Lead Center.



Applications in General Industry



■ Industry pumps and compressors

- Dosing pumps
- Feeding pumps
- Vacuum pumps
- Compressors

■ Industry valves and fittings

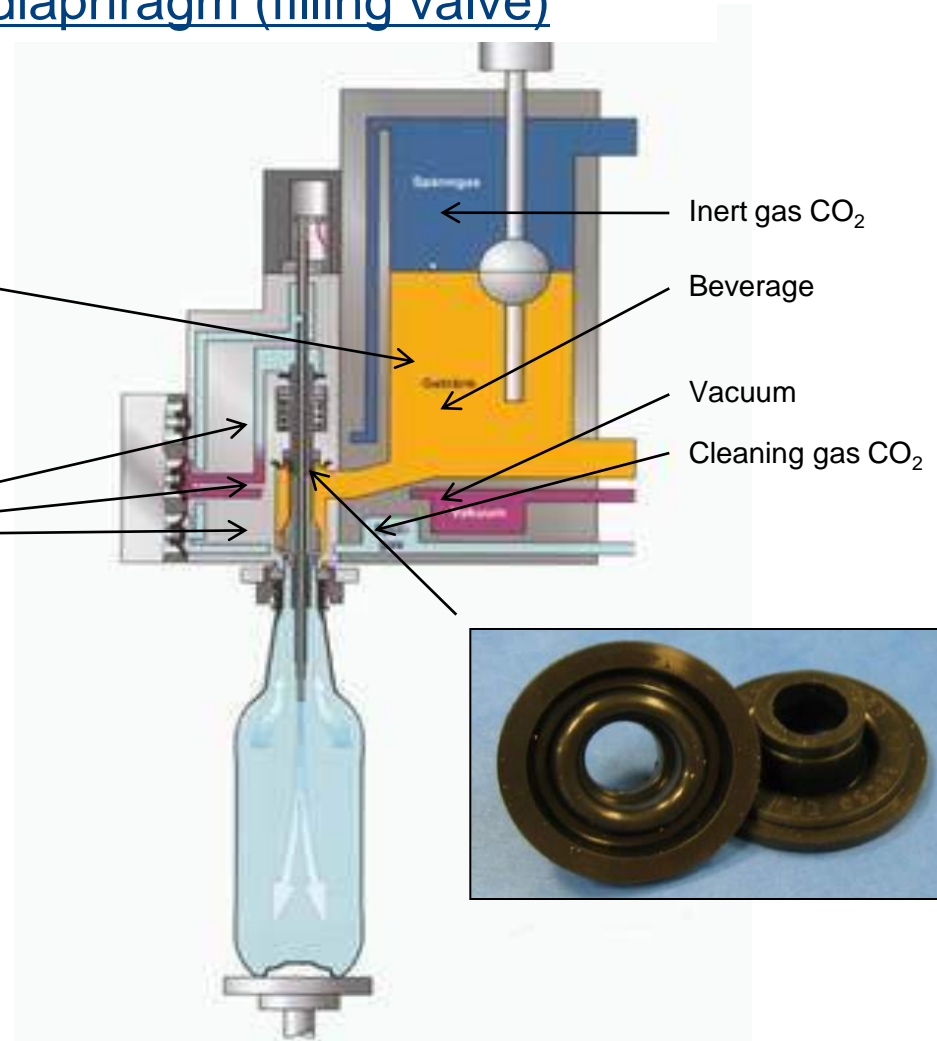
- Actuating and regulating valves
- Over pressure and safety valves
- Pressure reducing valves
- Diaphragm fittings
- Closing valves and valve drives

■ Accumulators and bladders

- Hydraulic accumulator
- Pressure regulation system
- Hydracine accumulator

Application “Controlling or actuating”

Control diaphragm (filling valve)



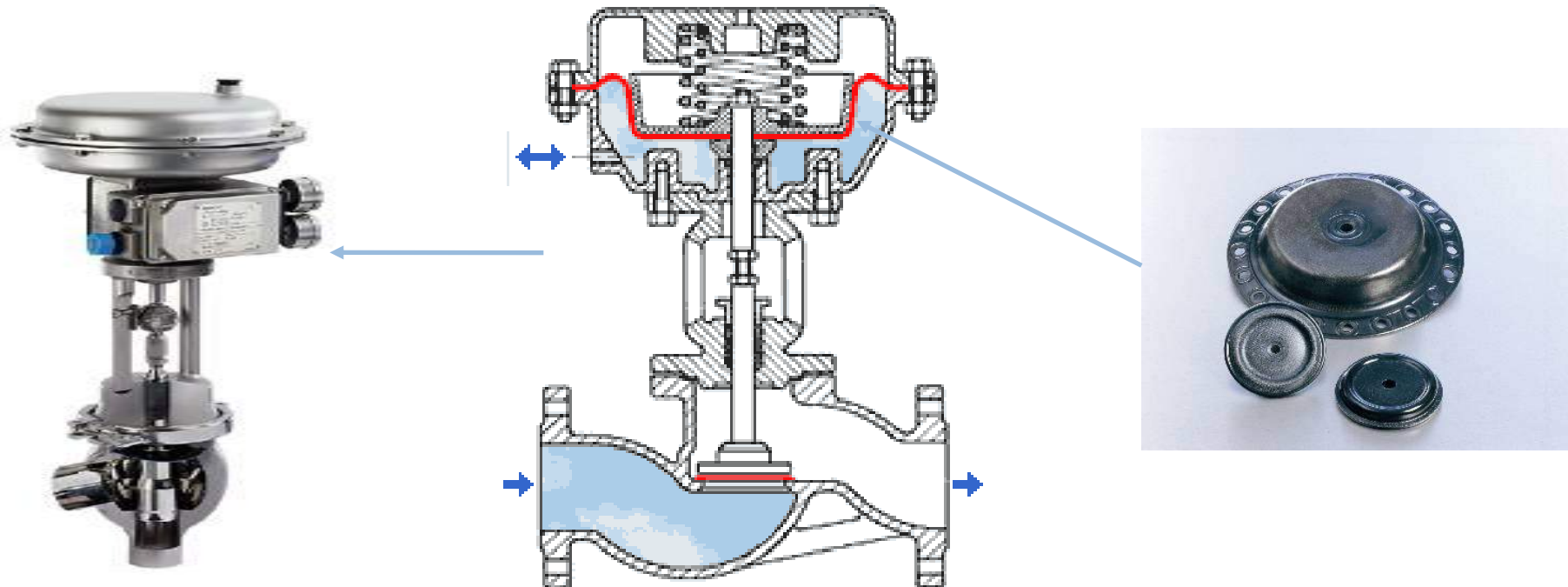
Customers:



Application “Controlling or actuating”

Control diaphragm (valve drive)

Conversion of an actuating pressure into a control process.



Customers: **SAMSON**

FLOWERVE

Application “Controlling or actuating”

Diaphragms designed for breathing equipment for fire services

Controls air supply from oxygen cylinder.

Produced from a new 35 Shore A hardness PVMQ blend.

Temperature range between -114°C and 200°C .

Very thin wall thickness => 0,2mm.



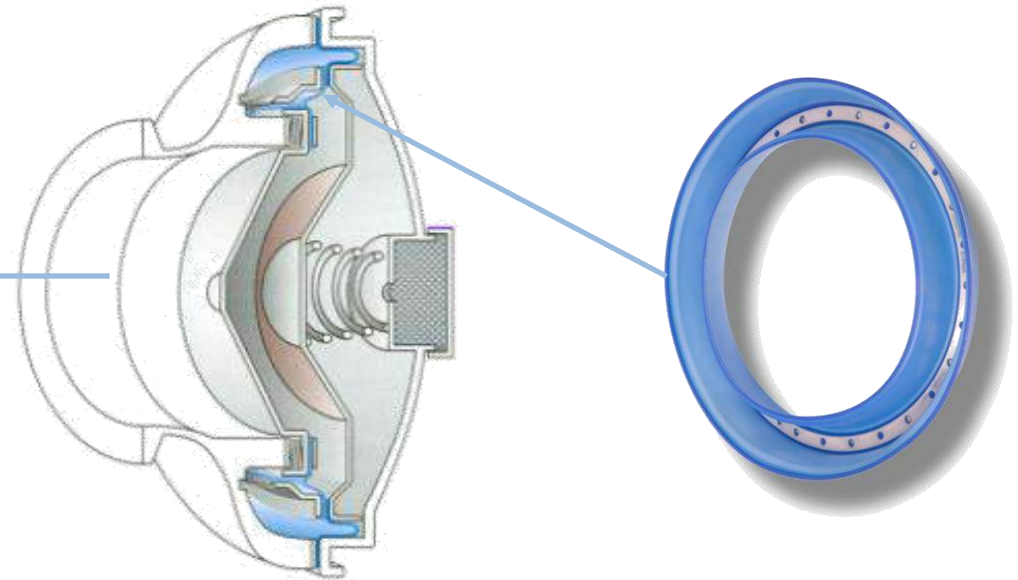
Customers: **MSA AUER**

Application “Controlling or actuating”

Diaphragms designed for Cabin pressure regulating system

Self regulating safety valve for the regulating of the inner pressure of passenger Cabins.

Very thin diaphragms made of PVMQ with integrated metal insert and fabric inlay
High function safety, high tightness, easy mounting and maintenance.



Application “Controlling or actuating”

Building engineering - Pressure regulator for domestic water systems

- Diaphragms made of NBR, EPDM with fabric on-lay
- Success factors:** Drinking water approvals, long service life, high resistance to pressure and pressure peaks



Customers:

Honeywell

grünbeck
WASSERAUFBEREITUNG

JRG Sanipex®

Danfoss

Application “Controlling or actuating”

Building engineering - Heating regulation valve

- Diaphragms made of EPDM
- Success factors: Sensitivity (= very thin diaphragms), reliable sealing function



Customers:

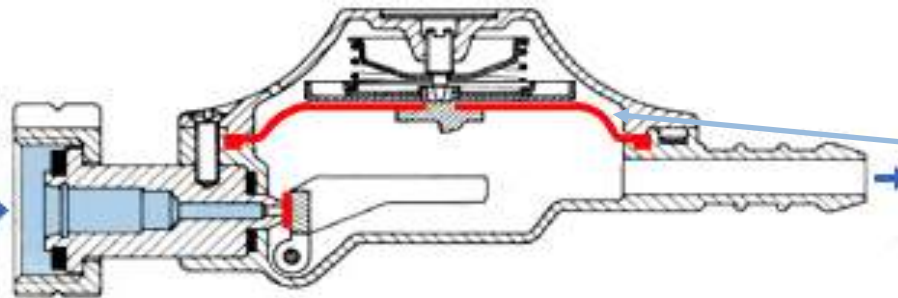
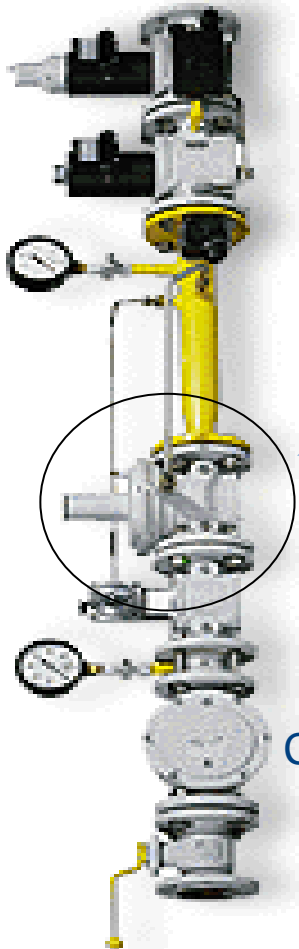
oventrop

Danfoss

Application “Controlling or actuating” Regulating gas pressure in households

Regulation of gas pressure by transferring a pressure in a regulating process.

Thin diaphragms, mostly made of NBR or VMQ for smooth responding behavior and high lifetime.



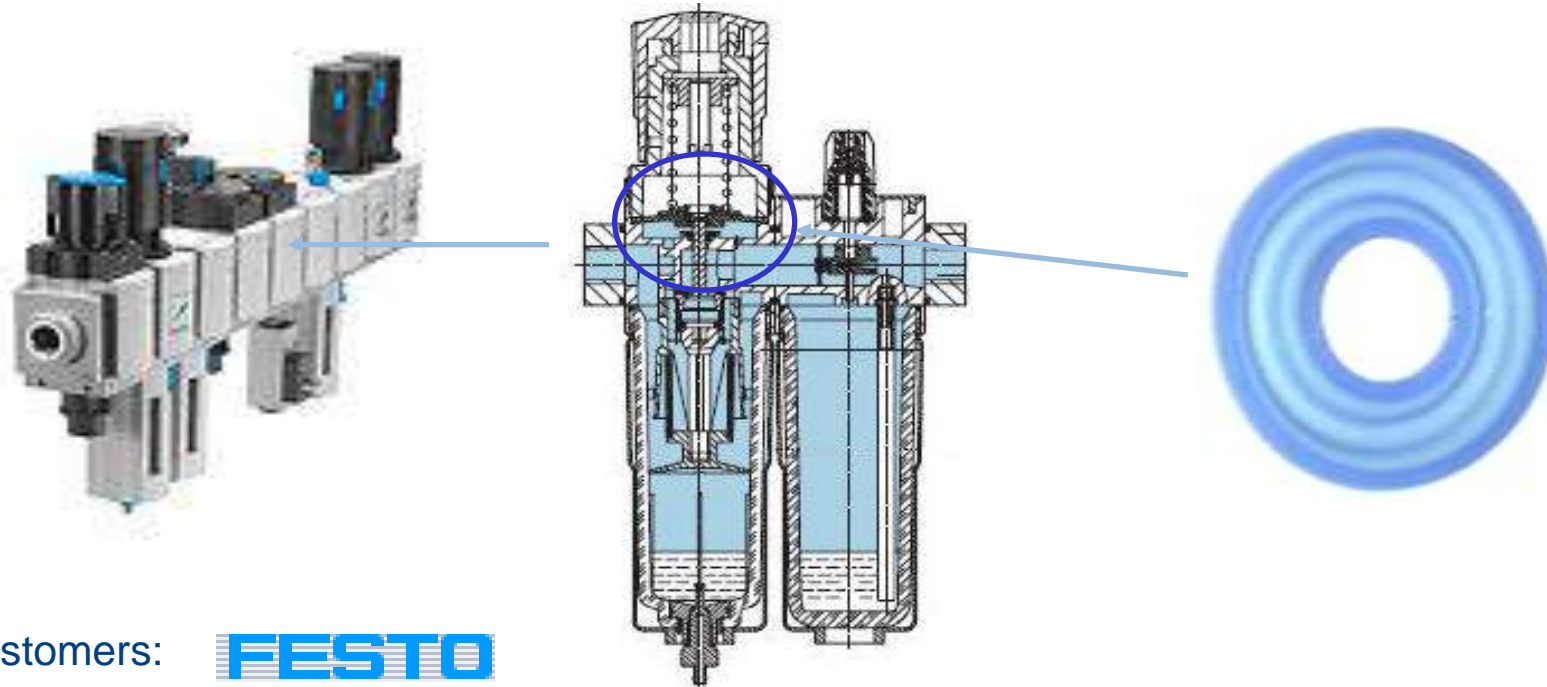
Customers:



Application “Controlling or actuating” Diaphragms for pneumatic applications

Regulates the pressure or separating of oil and water.

Thin diaphragms, mostly made of PU or NBR, with or without fabric reinforcement.



Customers:

FESTO

Rexroth
Bosch Group

Honeywell

Application “Accumulating and separating” Hydro accumulator in agricultural machinery

Accumulator diaphragm built in a mobile hydraulic TLS-front axle suspension.

Diaphragms made of ECO, NBR, CIIR to ensure comfort, gas tightness and high lifetime.



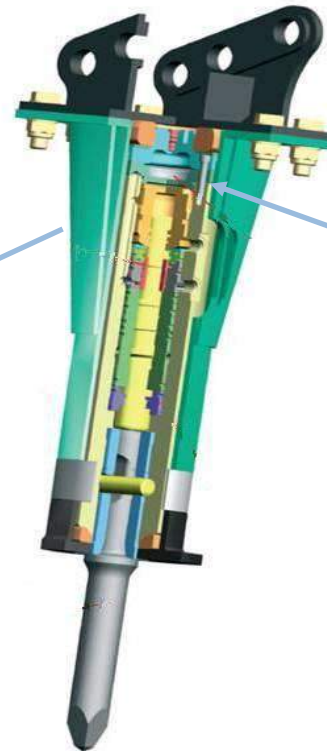
Customers:

HYDAC
INTEGRAL

Application “Accumulating and separating”

Accumulation diaphragm for mobile hydraulic in hammer drills.

Diaphragms made of NBR, HNBR, AU for accumulating and separating hydraulic fluid & gas.



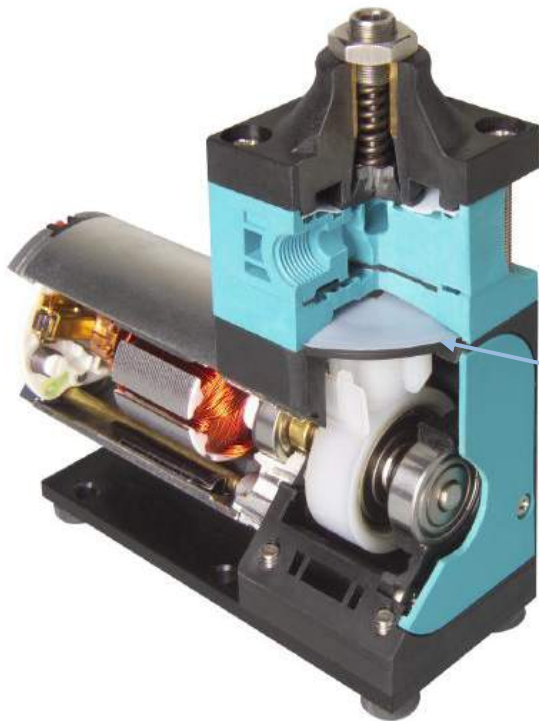
Customers:



Application “Pumping”

Mechanical or pneumatic driven diaphragm for exact dosing of fluids and gases

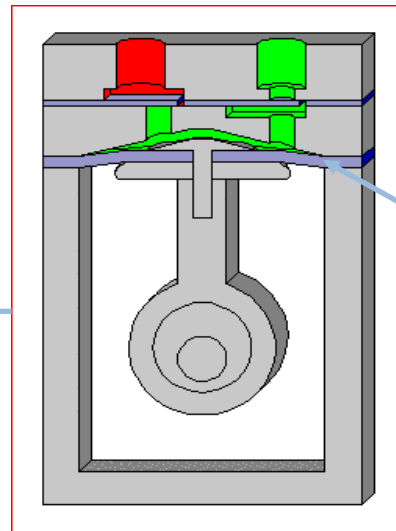
Composite diaphragms made of NBR, HNBR or EPDM; with/without fabric; with/without PTFE-onlay.



Application “Pumping”

Vacuum pump diaphragm

Vacuum pump for medical, process and other technologies.
Structure and shaped diaphragms made of EPDM or CR with/without PTFE-onlay.
For max. vacuum, high life time, High temperature, different gases.



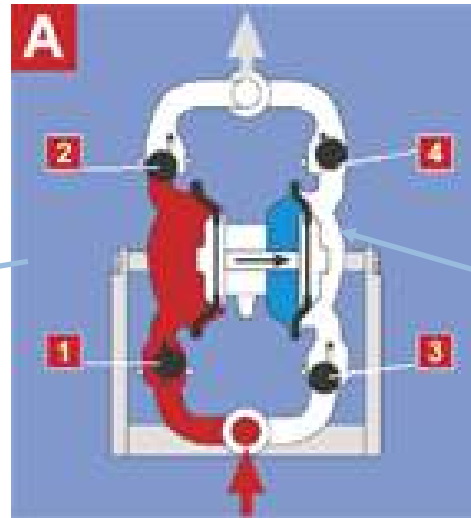
Customers:



Application “Pumping”

Pneumatic double diaphragm pumps

- Composite diaphragms made of NBR, HNBR or EPDM; with/without fabric; with/without PTFE-on lay.
- Delivering of all fluids. High volume, high lifetime.



Customers:



Applications in Automotive



■ Turbocharger regulation systems

Regulating / Control valve

Blow-off valve

Manifold Actuator



■ Automotive valves

Exhaust gas recirculation valves (EGR)

Crankcase ventilation systems

Manifold Actuator

Air brake (pneumatic brake) systems

Pneumatic actuating valves for central locking systems,

Back light switch in a gearbox

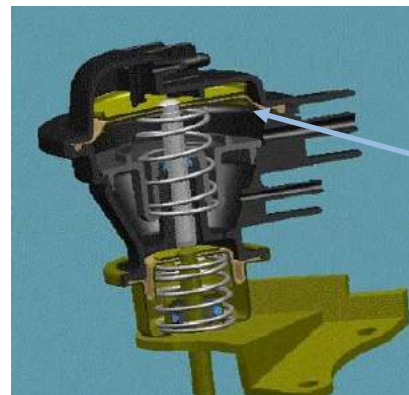
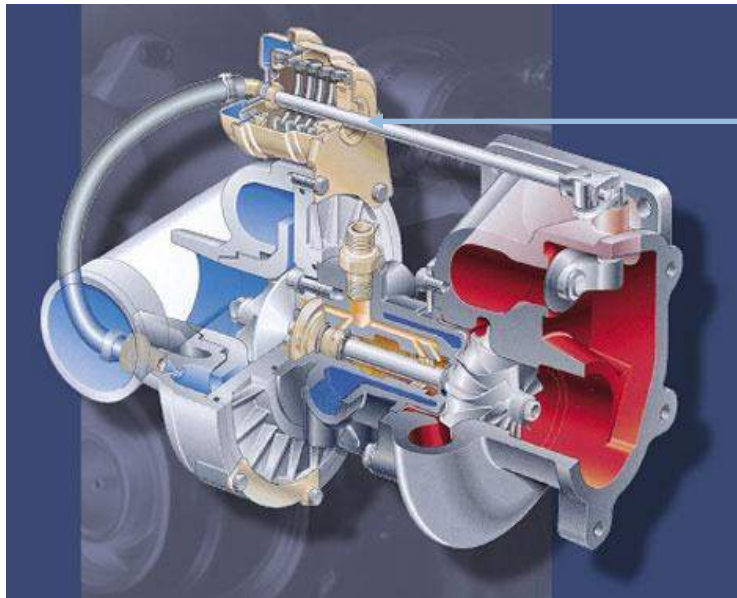
6. Market Segments and Applications

Application “Controlling or actuating”

Diaphragms for turbo charger actuators

Regulation of the charging pressure.

Thin diaphragms with fabric on lay made of FVMQ, VMQ. Smooth responding behavior, high lifetime.



Customers:



**Thank you
for your attention!**

