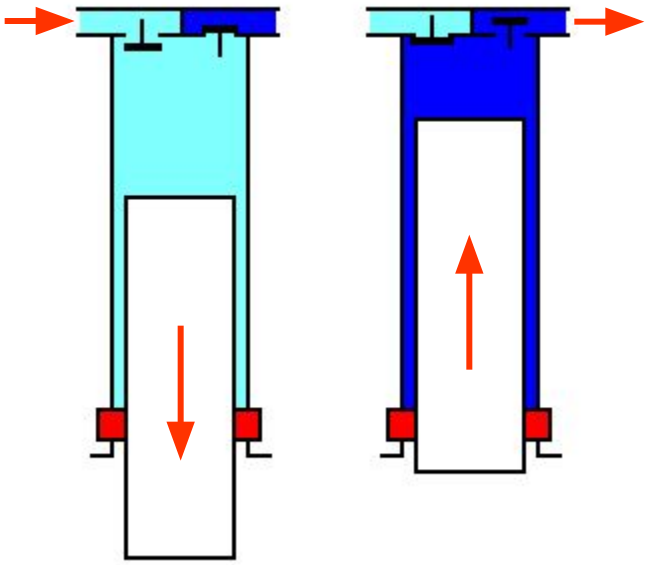
HAMMELMANN high pressure pumps

The basics

HAMMELMANN high pressure pumps

Piston pumps are displacement pumps used for conveying and compressing fluids and gases.



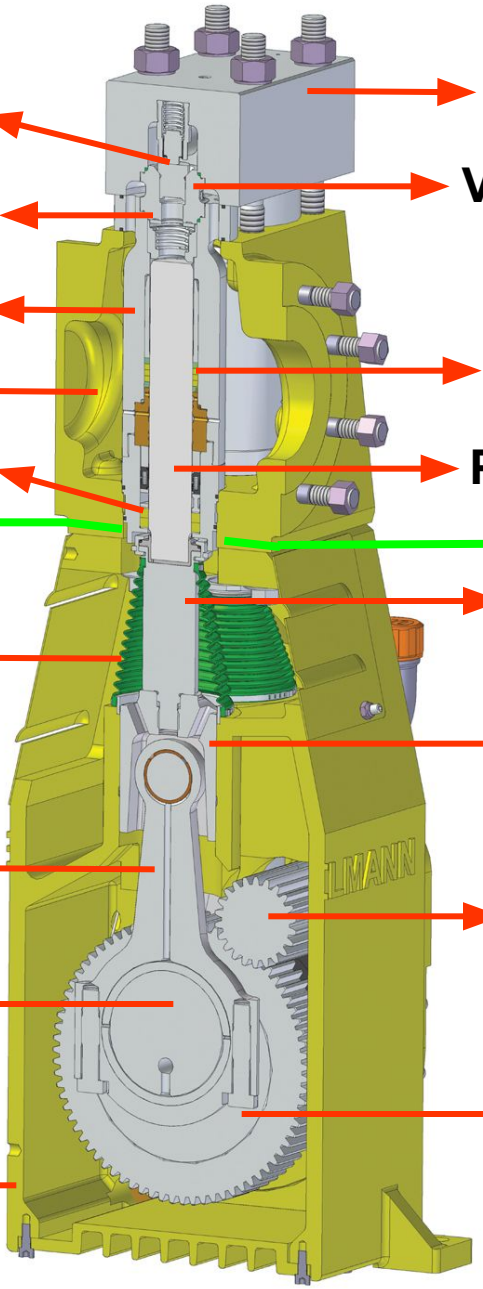
Plunger pump design:

The piston moves within the working chamber (sleeve) and displaces the medium to be conveyed. The seal is made within the sleeve and not on the piston;

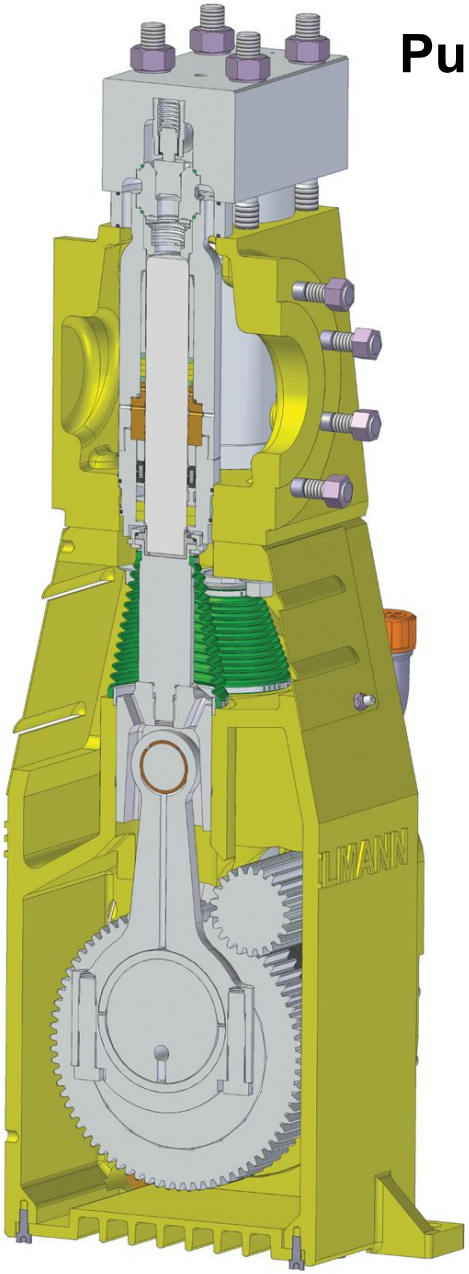
The oscillating motion of the plunger (piston) is generated by a crank shaft;

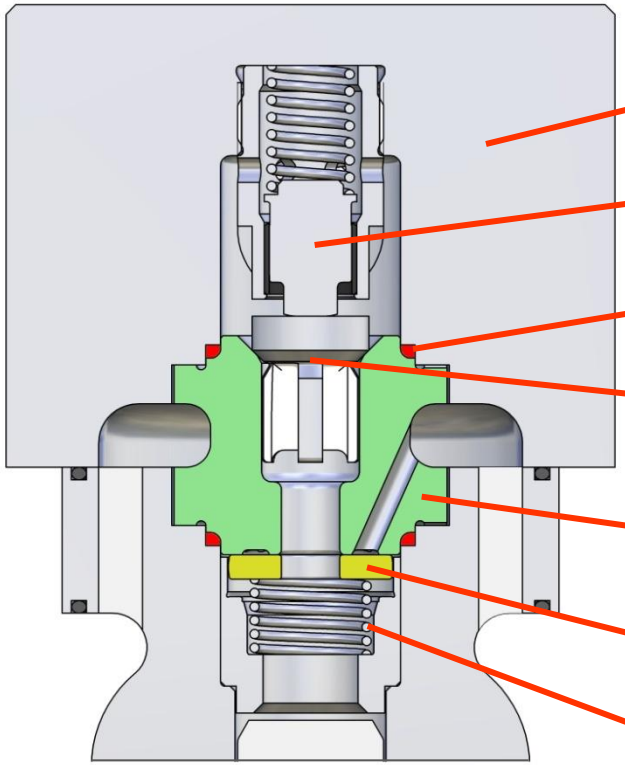
The flow motion and the differental pressure of the medium operates the valves;

Configuration



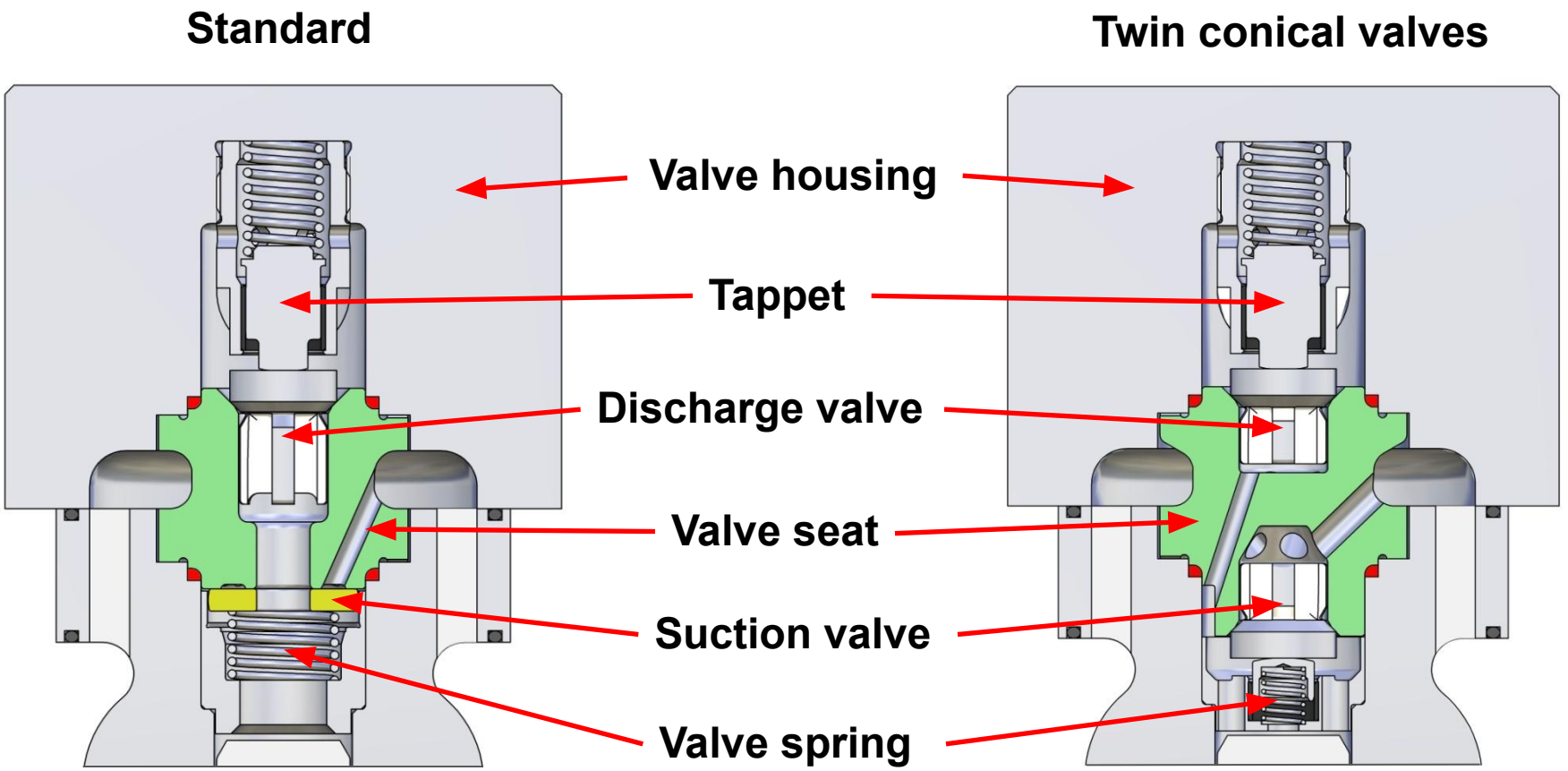
Pump head





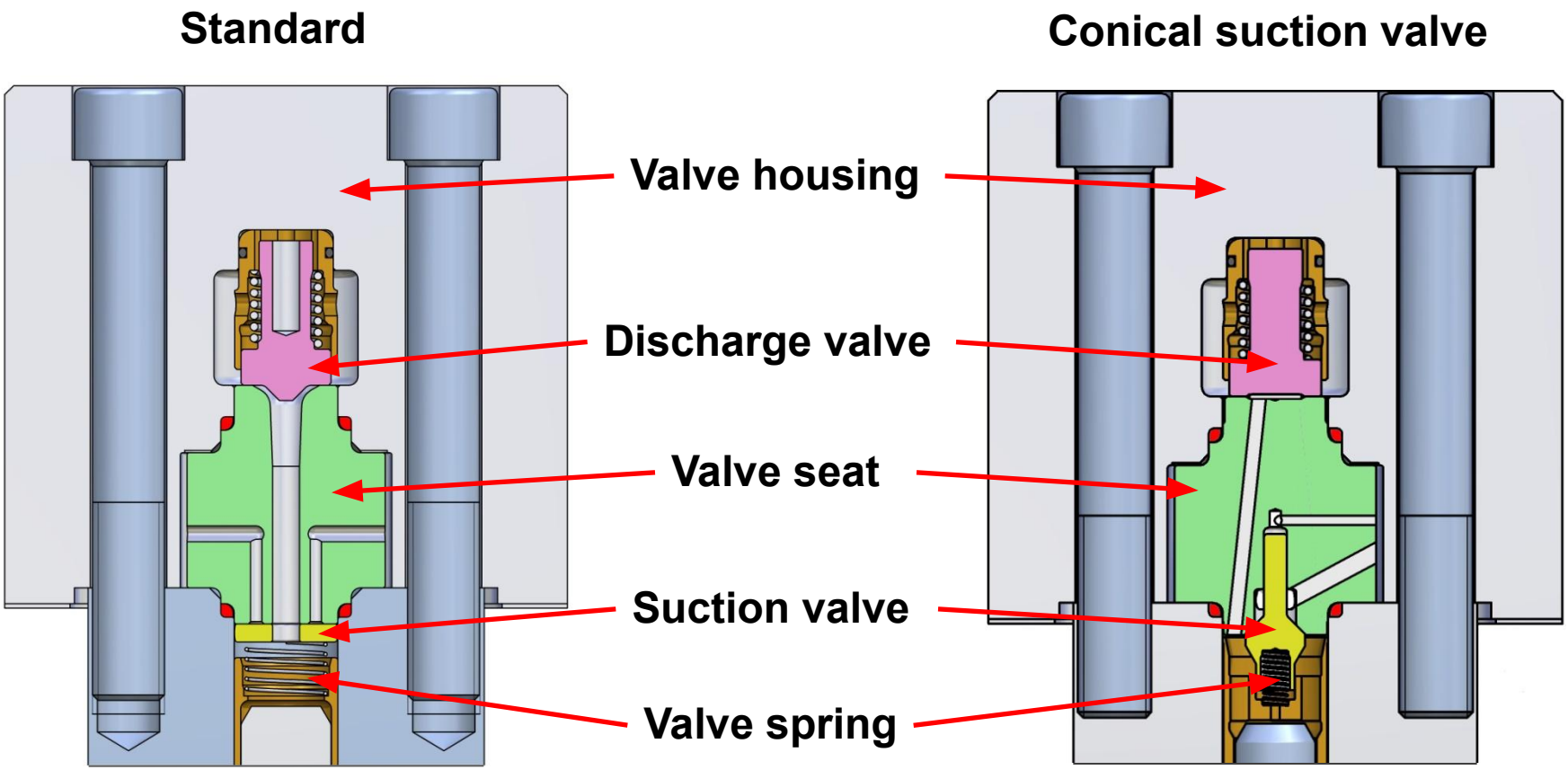
- Minimal dead space ⇒ High volumetric efficiency
- No alternating load in the valve housing

Pump head variations

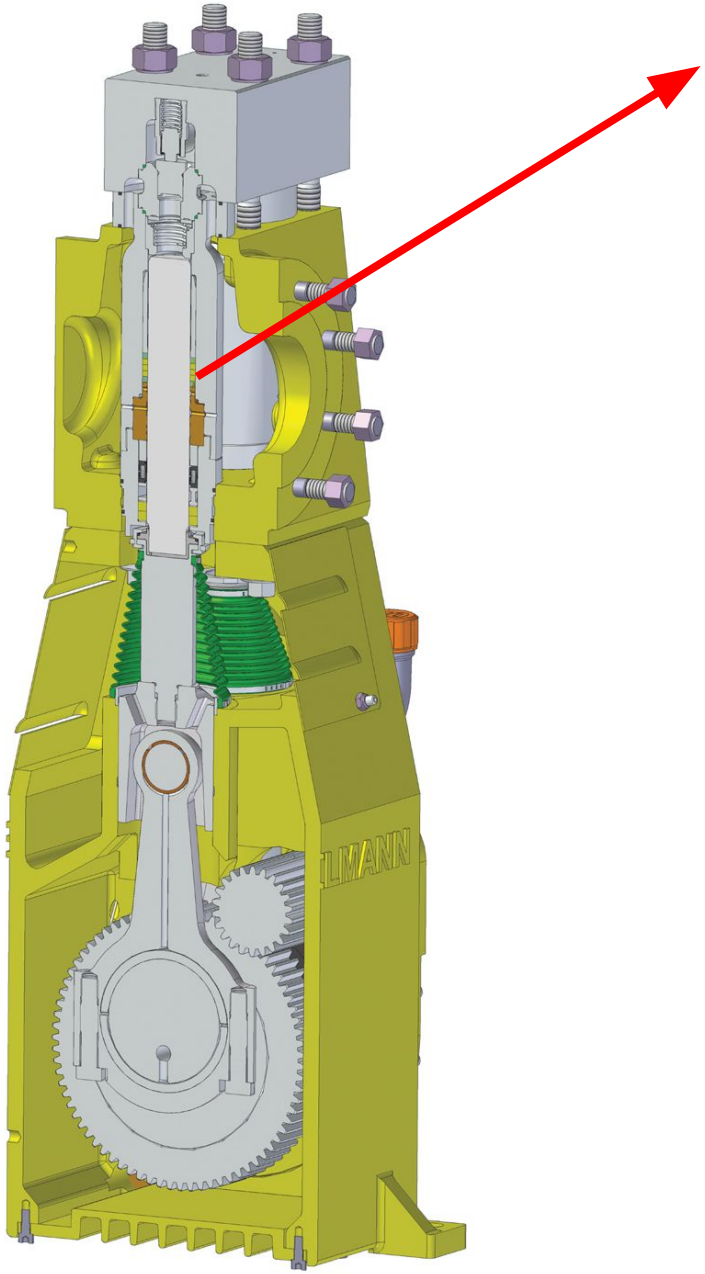


- Considerably longer component life with polluted mediums

Pump head variation for ultra high pressure



- Longer component life



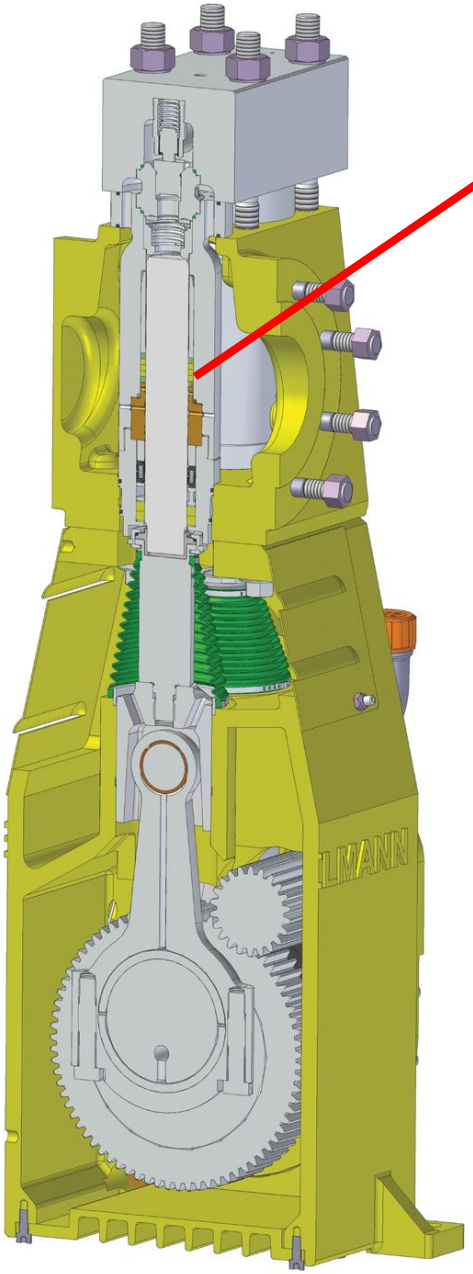
Piston sealing

Metallic sealing

- No packing or sealing elements on the high pressure side
- „Non contacting“ sealing
- Low wear⇒ long component life
- Friction free
- Hammelmann Patent

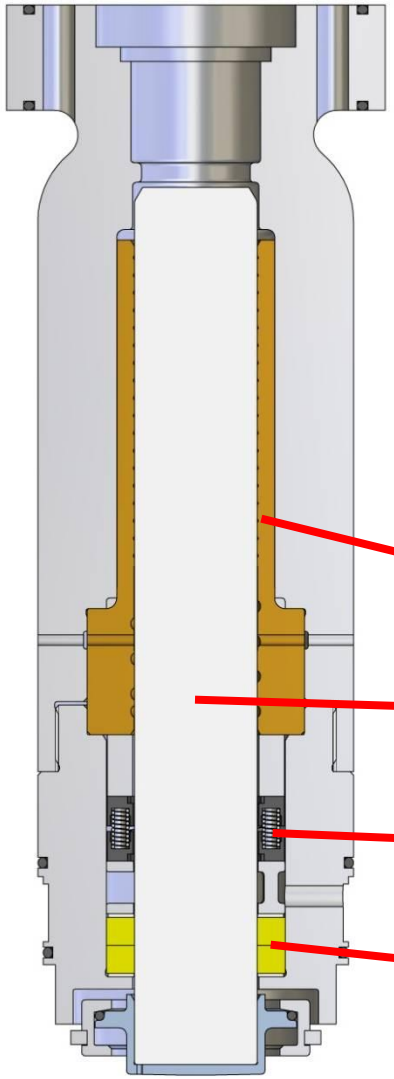
Packed sealing

- Resistant to dirt in the medium
- Long life
- Choice of seal materials



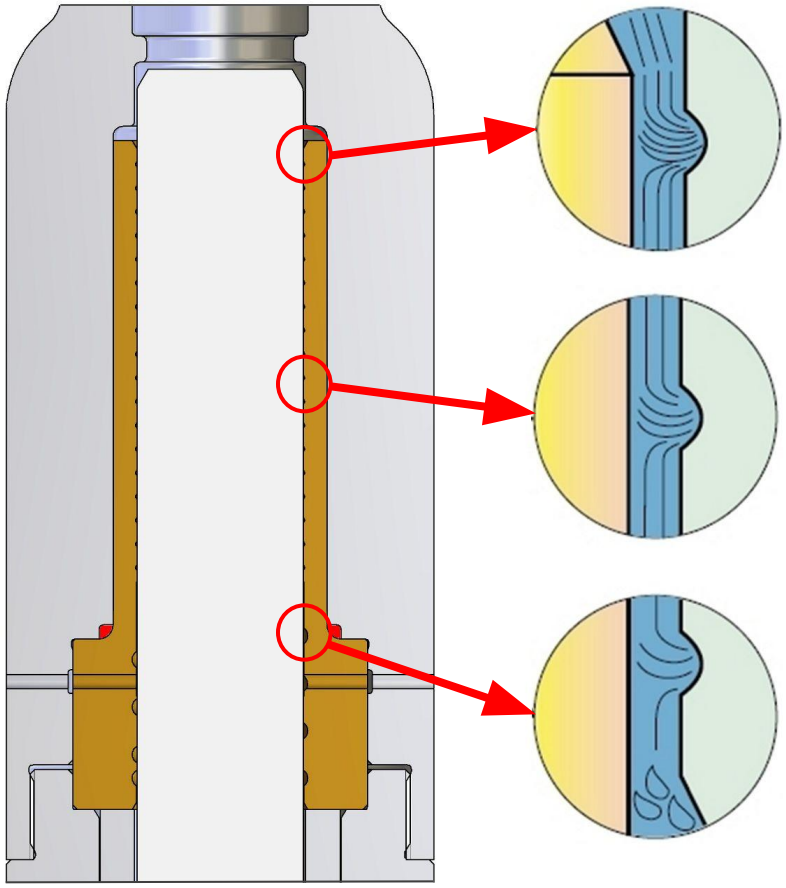
Metallic sealing

Labyrinth seal



- Operating pressures up to approx. 1200 bar
- Low wear
- Friction free

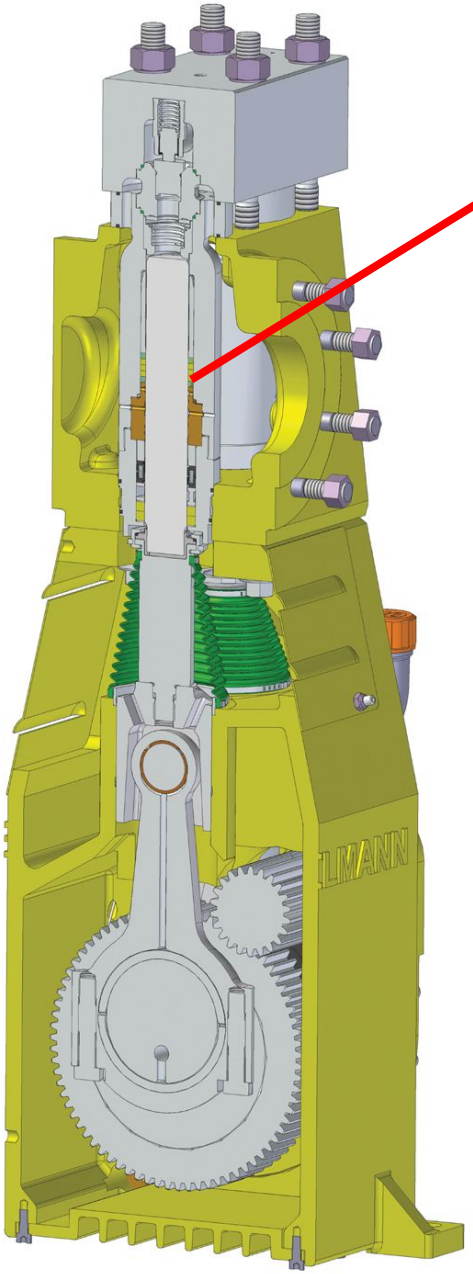
Function description of a non contacting seal



During the pressure (upward) stroke a tiny amount of medium is forced into the very fine cylindrical gap between the plunger and the labyrinth insert.

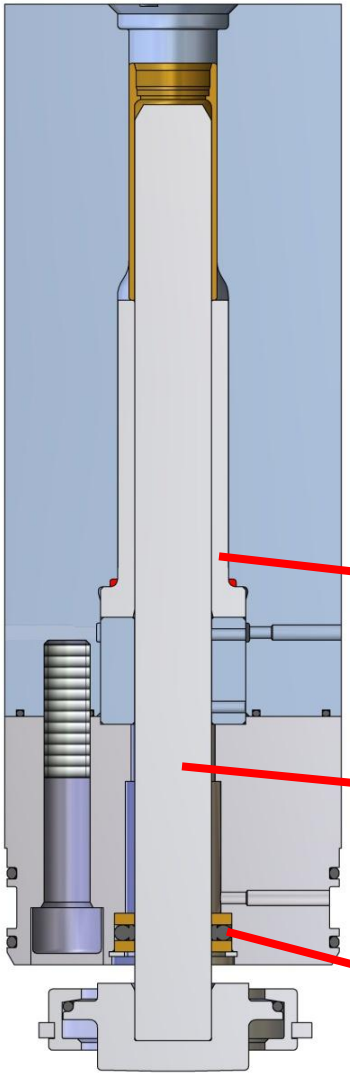
There are grooves in the insert all along its‘ length into which some of the medium flows. The resultant turbulence reduces the flow velocity in the gap and therefore the pressure as it travels downwards.
The medium in the gap also keeps the plunger centralised.

This tiny amount of medium also acts as a lubricant for the components before returning to the suction chamber .



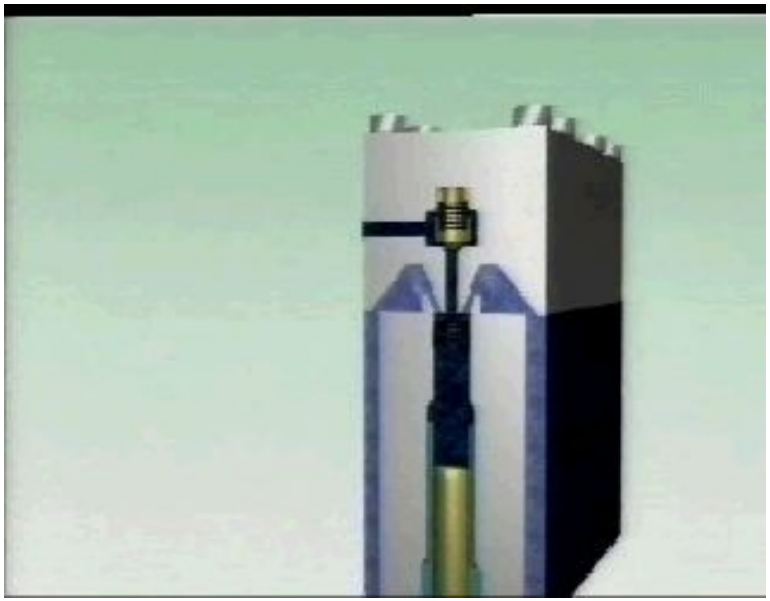
Metallic sealing

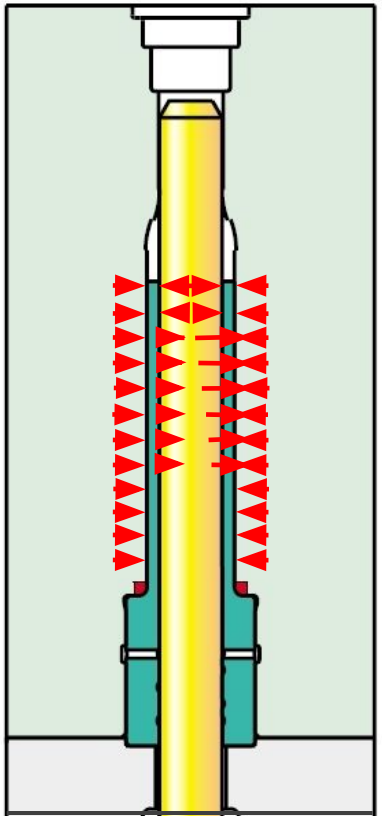
Dynamic plunger seal



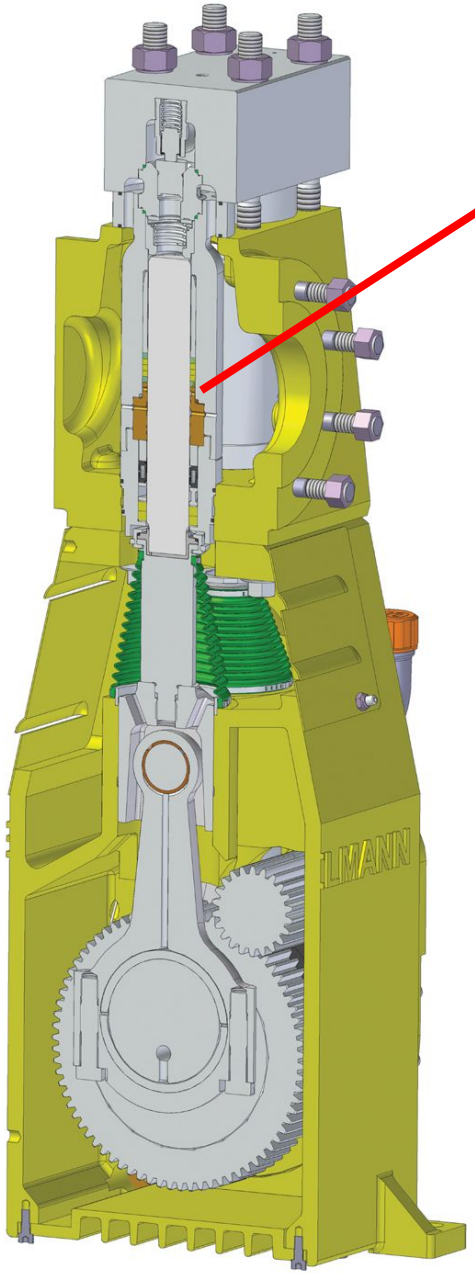
- Operating pressures up to 4000 bar
- High volumetric efficiency
- Very long life

Function description of the dynamic plunger seal

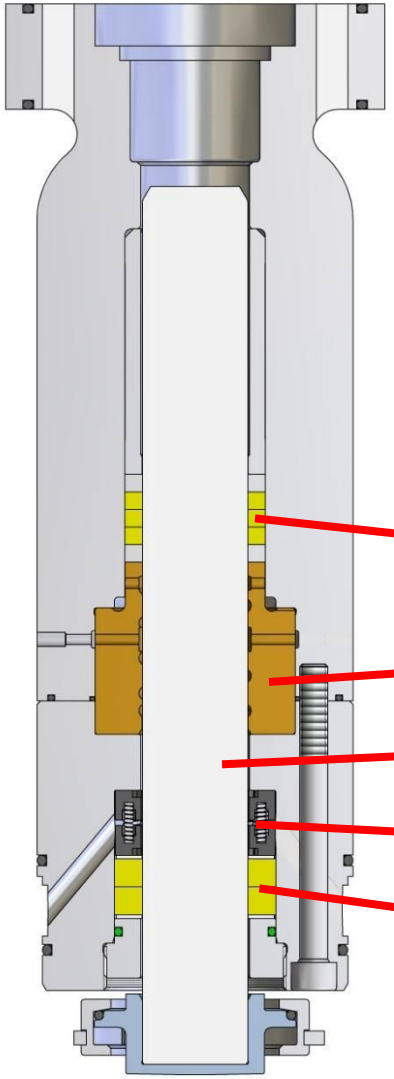




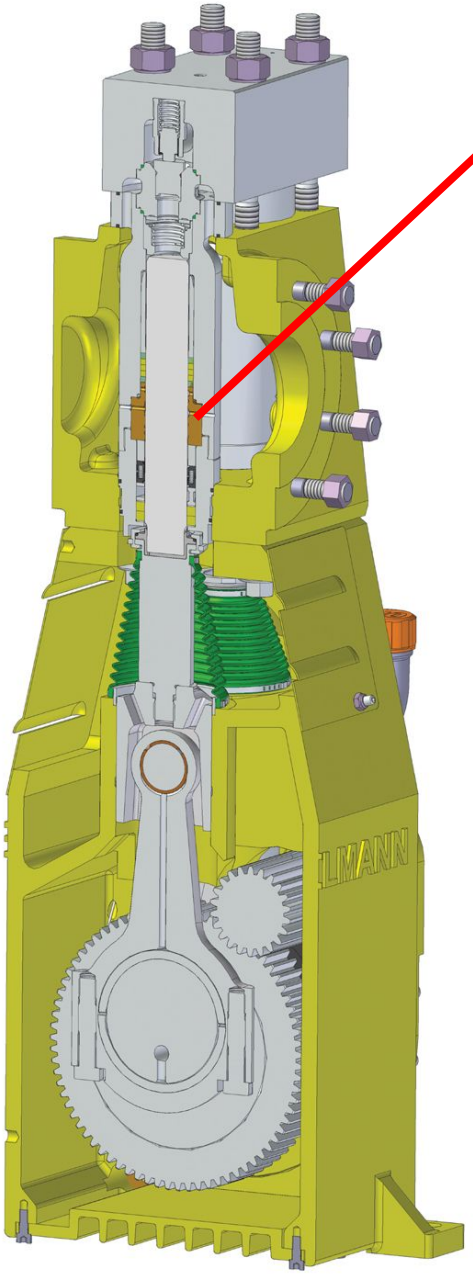
On the pressure stroke this further development of the labyrinth seal forcibly reduces the gap between the plunger and the labyrinth bush by dynamic distortion.
The distortion is achieved by forcing ultra high pressure medium between the sleeve and the outer diameter of the labyrinth bush.



Packed sealing

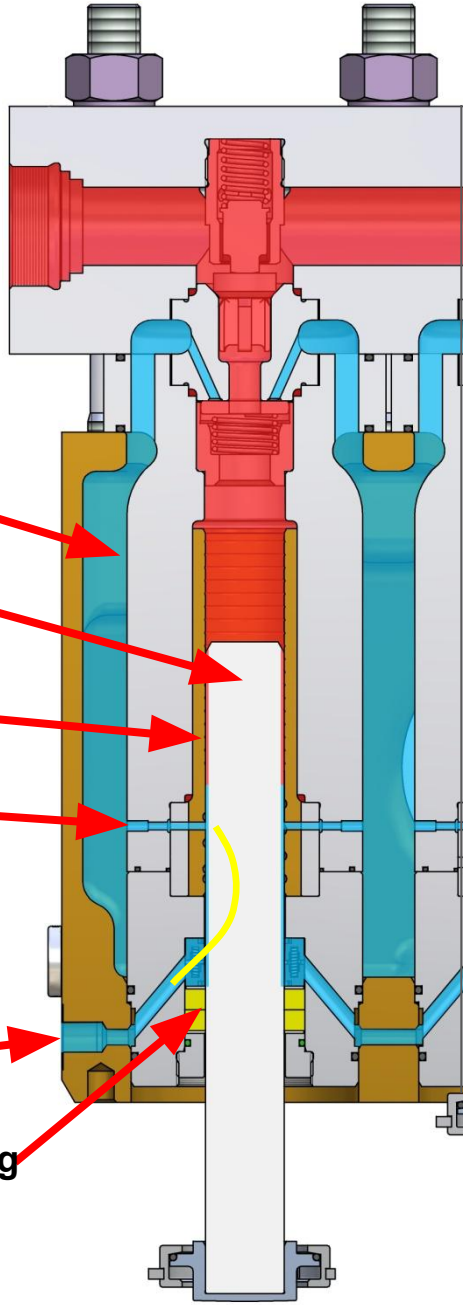


- Operating pressures up to 1200 bar
- For abrasive and corrive mediums
- Self adjusting low pressure seal pack

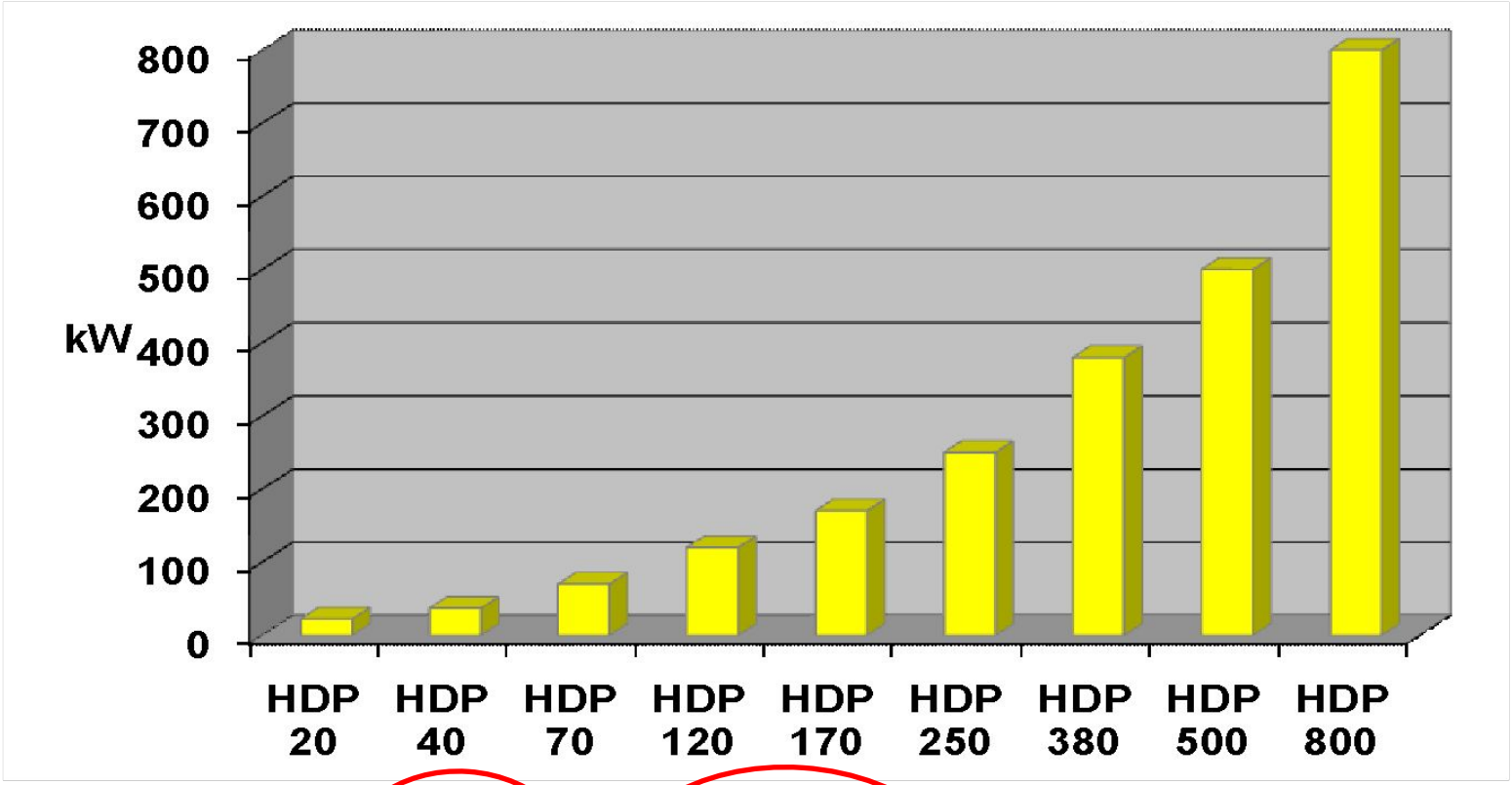


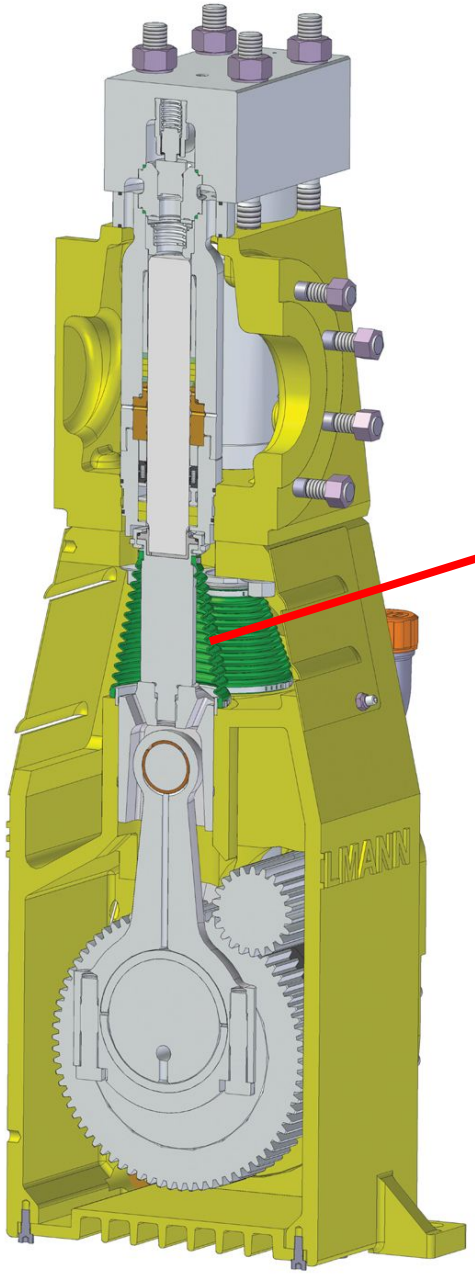
Plunger cooling

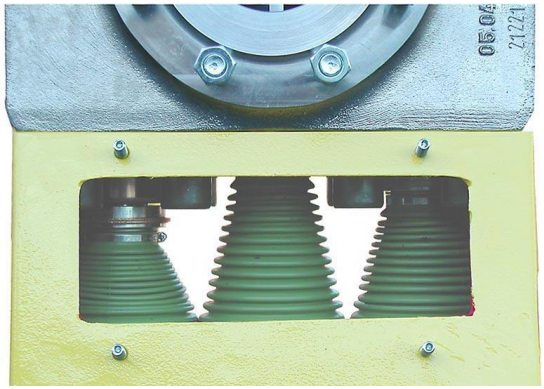
As the plunger makes the high pressure seal it is cooled by the medium



Power ratings available

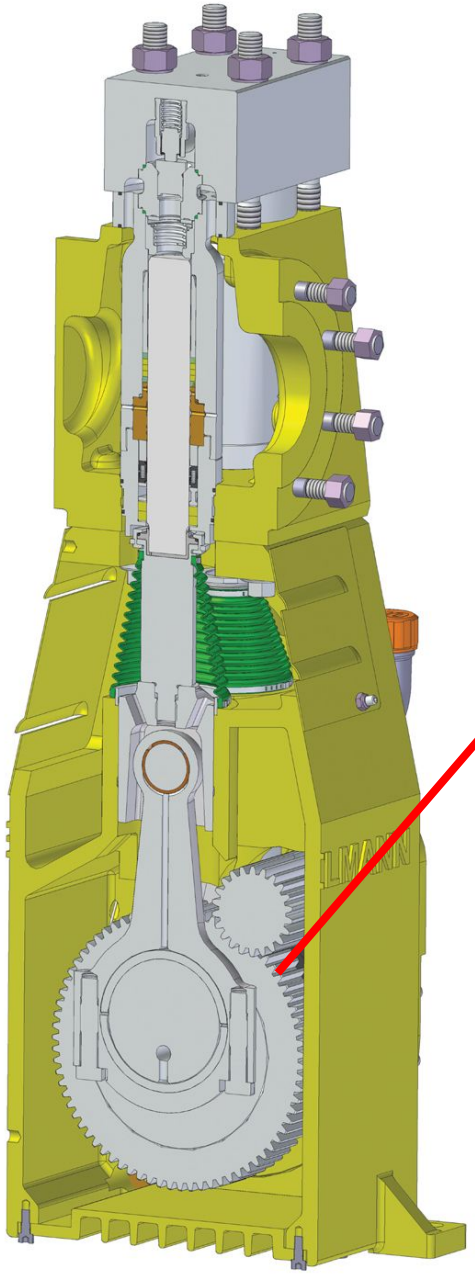






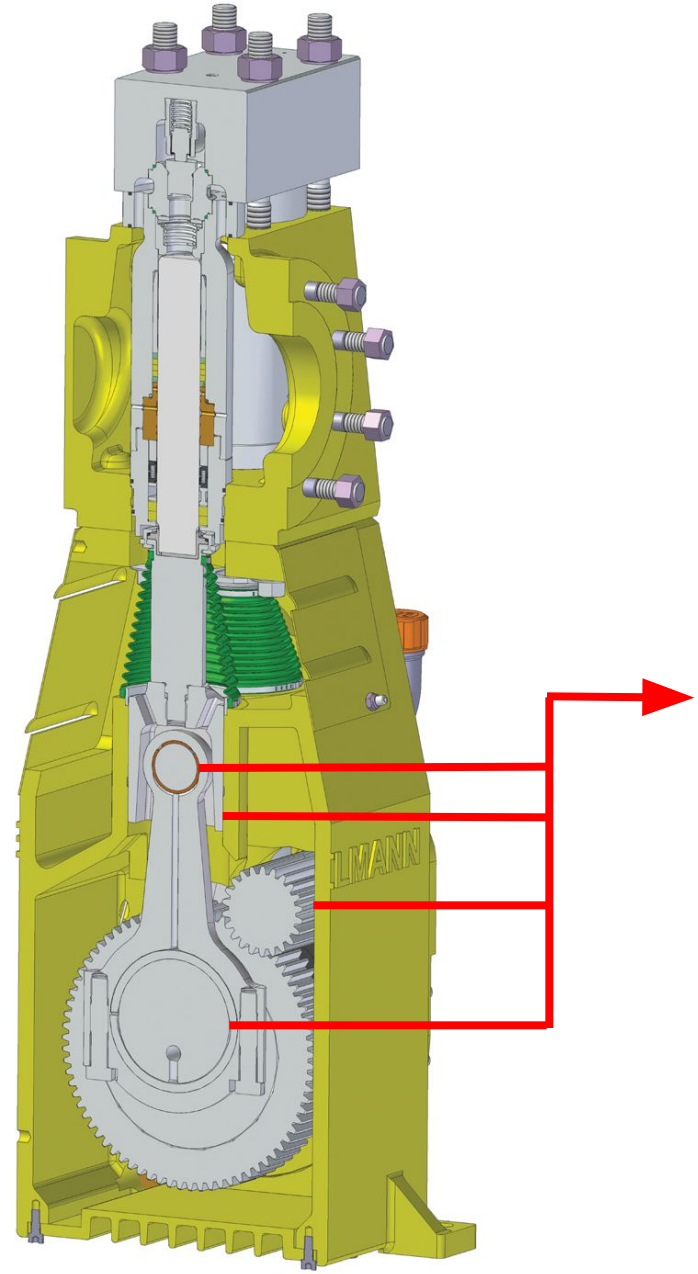
Bellows seal

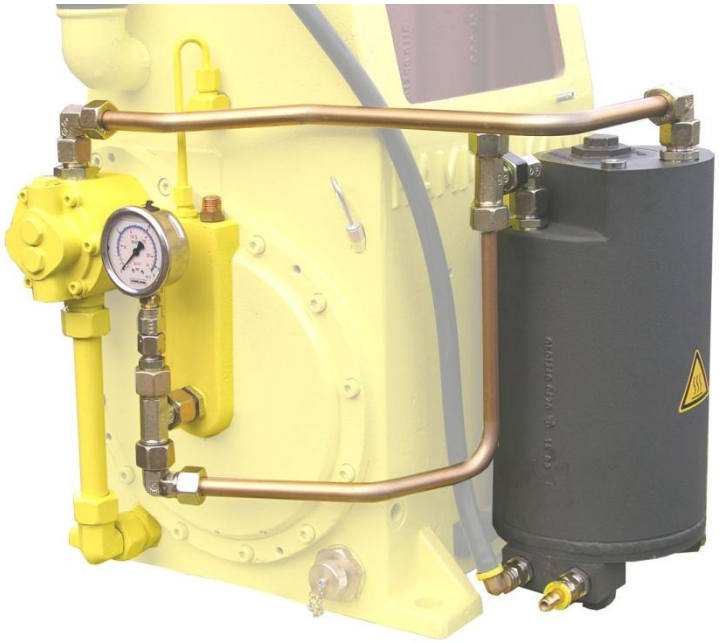
- **Hermetically separates medium end from power end**
- **Prevents oil from emitting the power end**
- **Prevents medium and dirt entering the power end**



Intergral speed reduction gear

- With pressurised oil lubrication (Pump, Filter, Cooler)
- Centrally located helical gear wheels
- Crank shaft supported by roller bearings
- Compact construction, small footprint





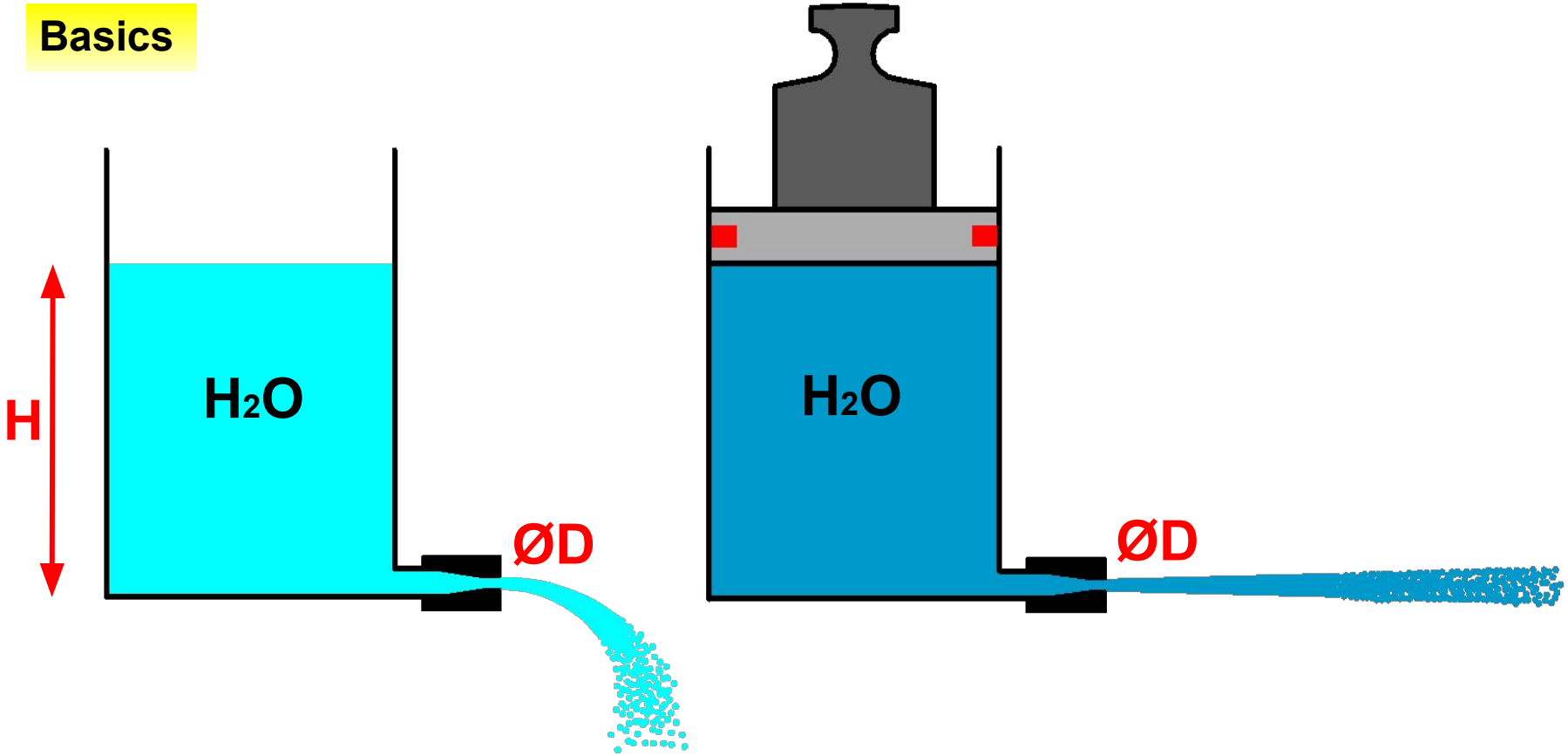
Pressurised oil lubrication system

- Forced lubrication of all rotating and sliding parts
- Maximum operating safety
- Constant temperature level
- Cooled and filtered oil

Vertical pump configuration

- The crosshead and plunger weights are neutralised within the sealing system reducing wear on all oscillating components
- Automatic air venting of wetted parts decreases risk of cavitation
- The pump is completely within the base frame resulting in compactness
- Oscillating forces are vertically absorbed by the base frame

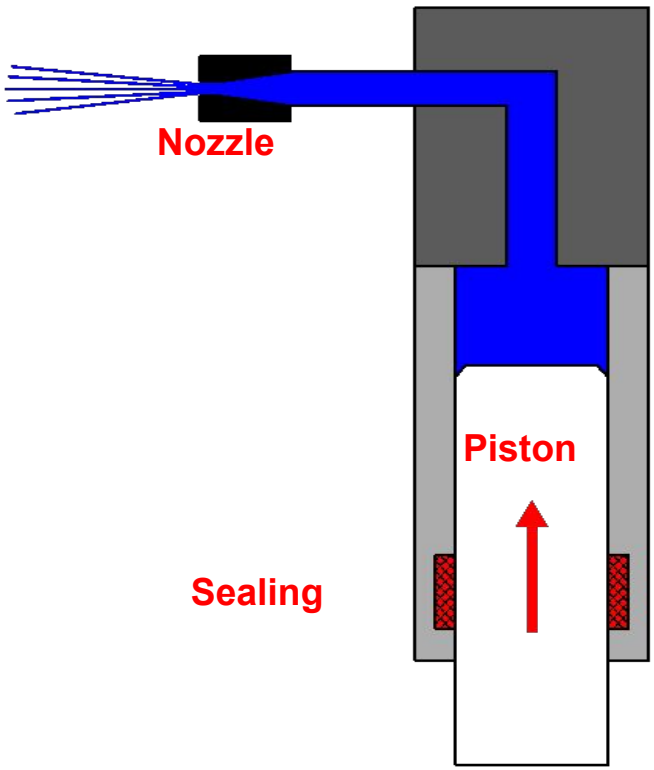
Basics

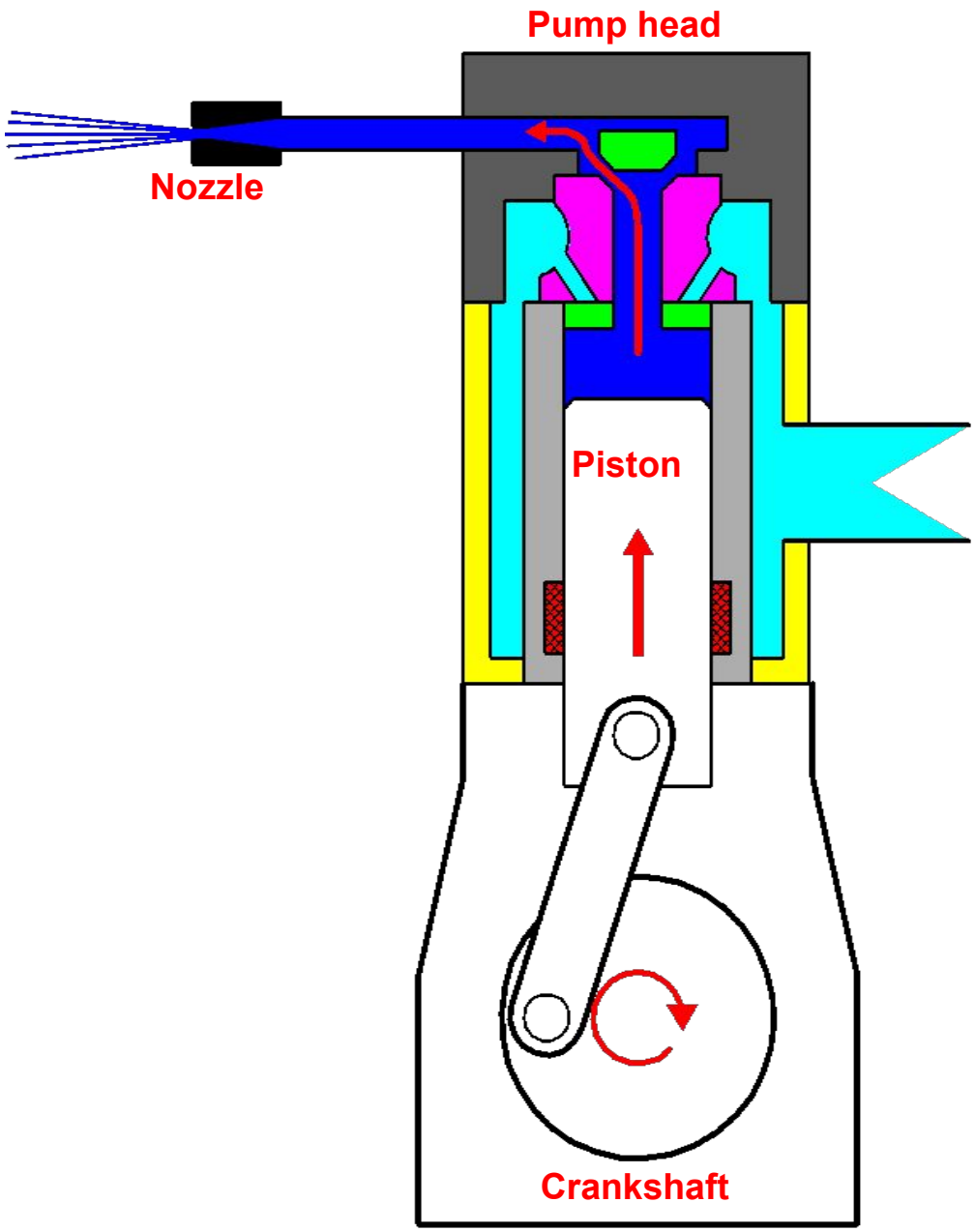


$$Q = A \cdot v$$

Q	A	v
Flow volume	Discharge cross section	Discharge velocity

Basics





Principles of function

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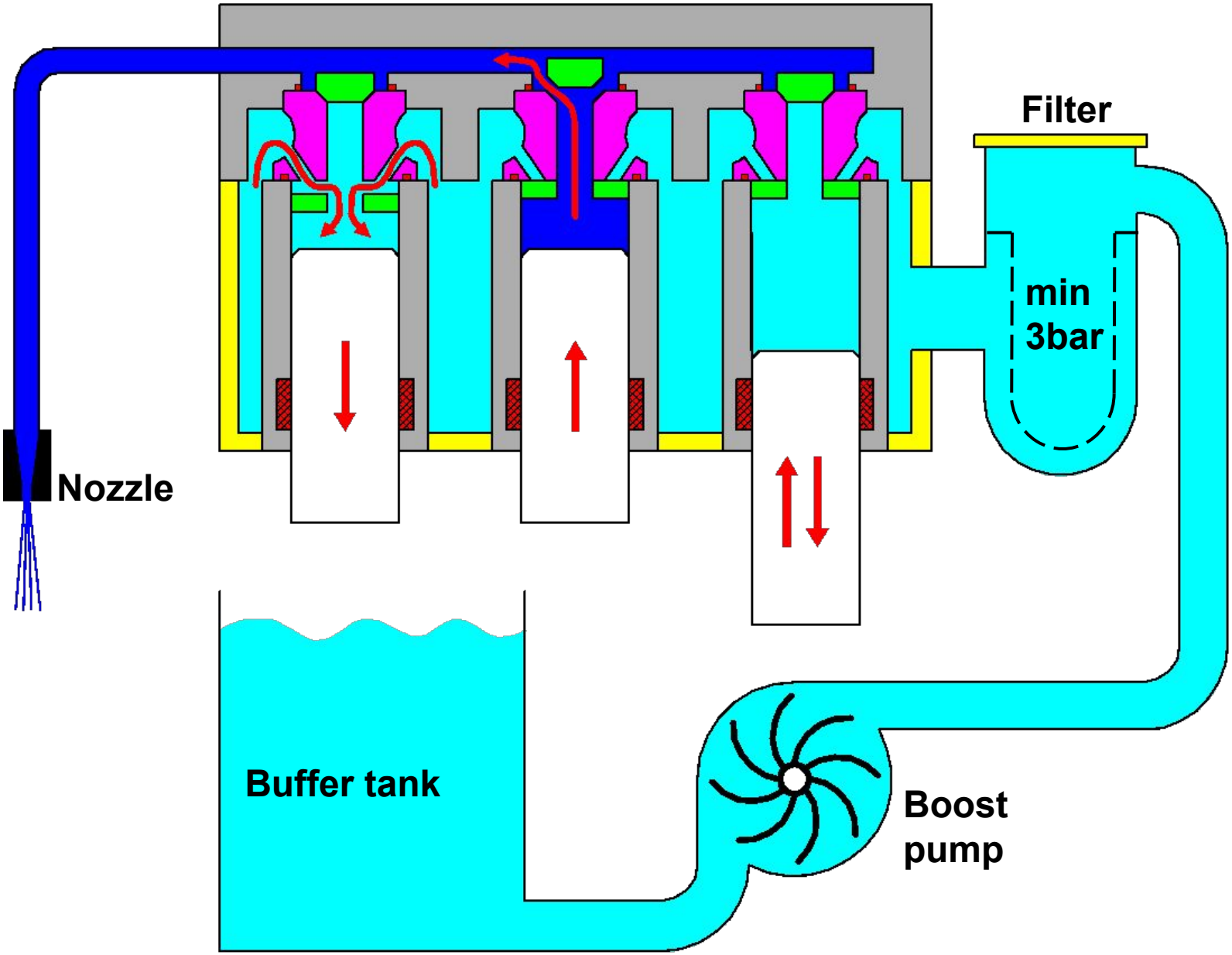


Regulating the operating pressure

Pressure regulating valve

Up to 1800bar

Maximum pressure limited by a pressure regulating valve

Excess flow volume of the pump emits via a bypass function

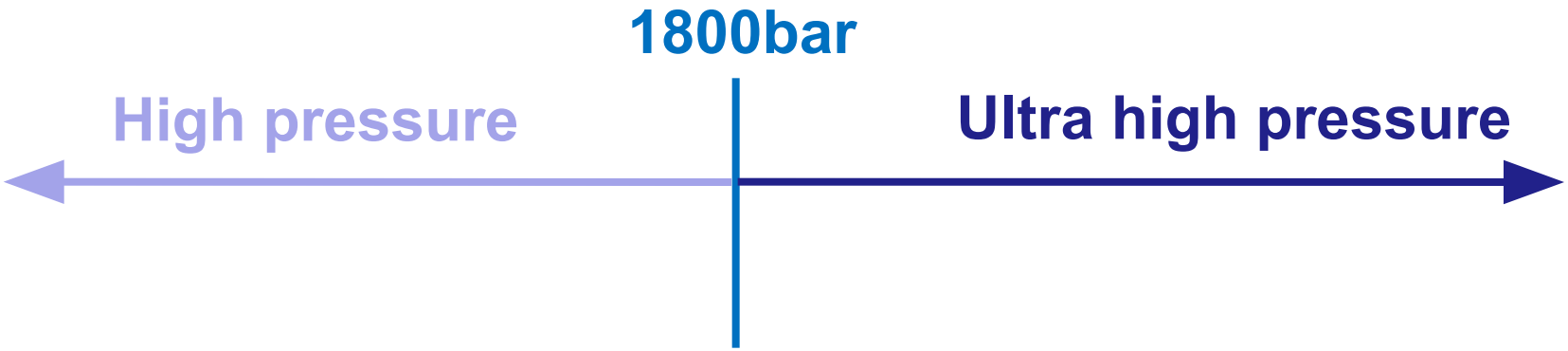
The operating pressure remains constant

Flow rate variation

Above 1800bar

The pressure is controlled by changing the flow rate (driver r.p.m.) and the cross section of the discharge (nozzle)

Pressure ON/OFF by means of a bypass valve



Regulating the operating pressure

Ideal status

Conveyed medium volume of the pump = **Medium volume emitting the nozzle**

Influences

Rotation speed of the pump

Pressure
Nozzle internal diameter and number of nozzles

Regulating the operating pressure

Conveyed medium volume of the pump > **Medium volume emitting the nozzle**

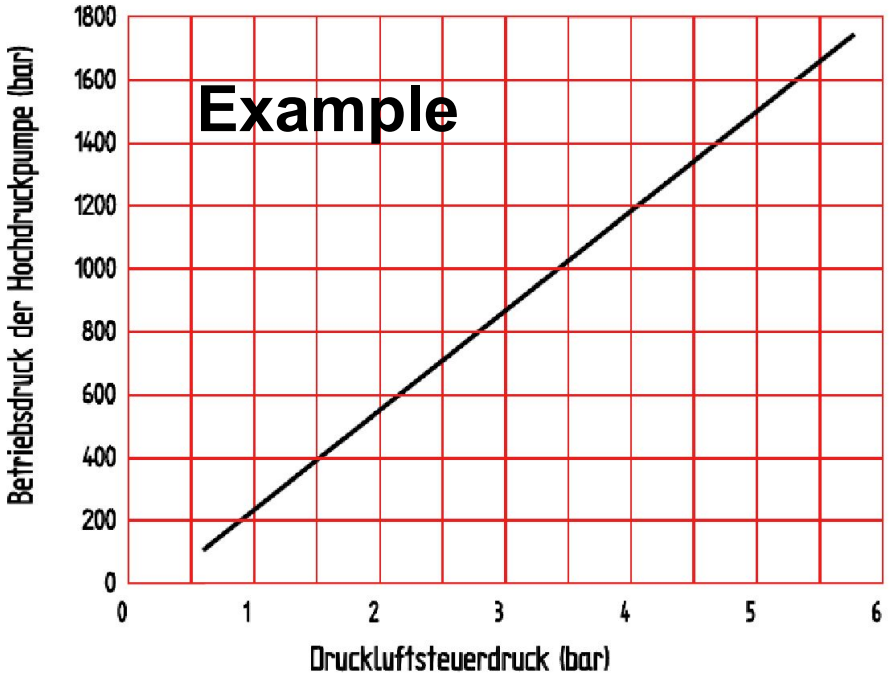
Status not ideal

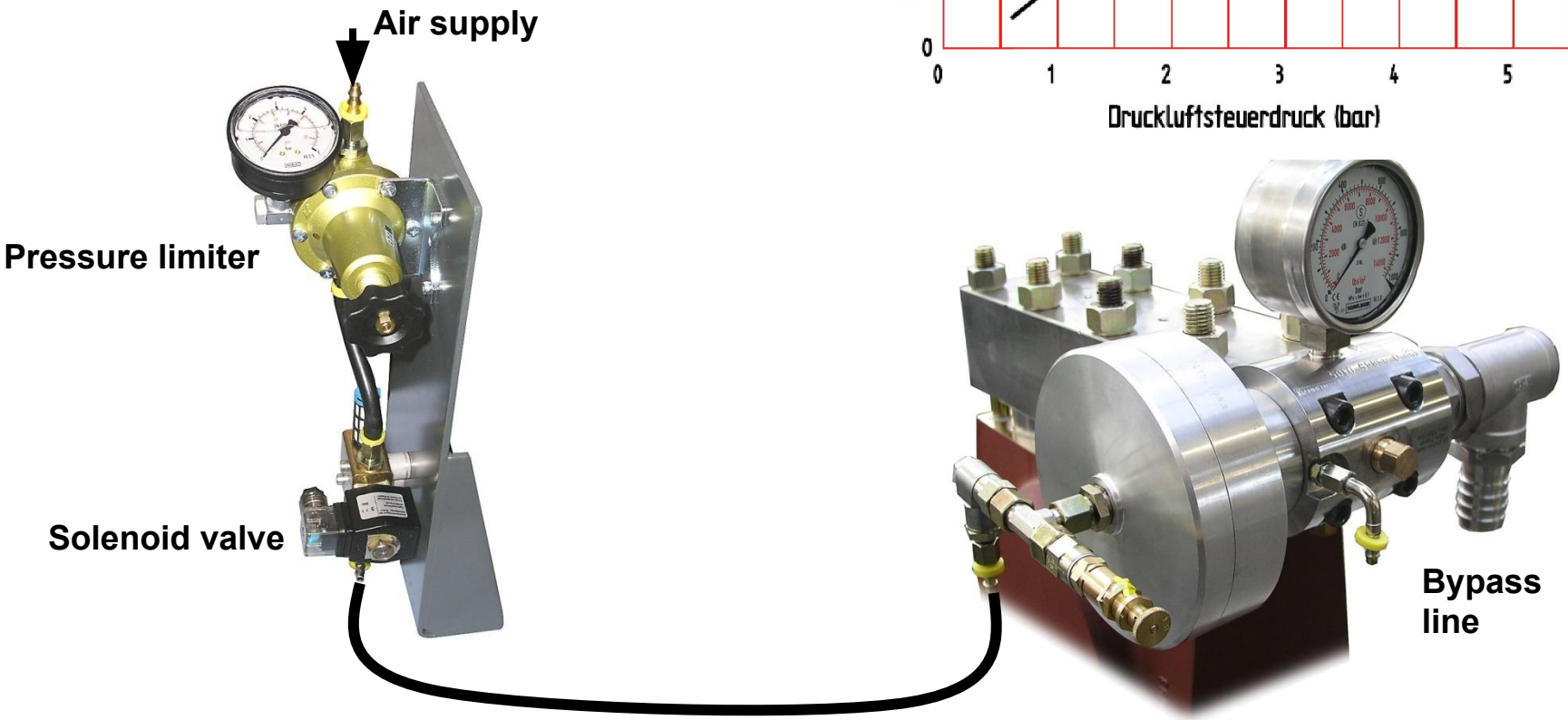
- Pressure regulating valve, up to **1800** bar
  Pressure limit set by a pressure regulating valve
  Excess medium volume emits via a bypass function
- Flow rate variation, above **1800** bar
  Excess medium volume must emit via an additional element (splitter nozzle)

Pressure regulating valve up to 1800 bar

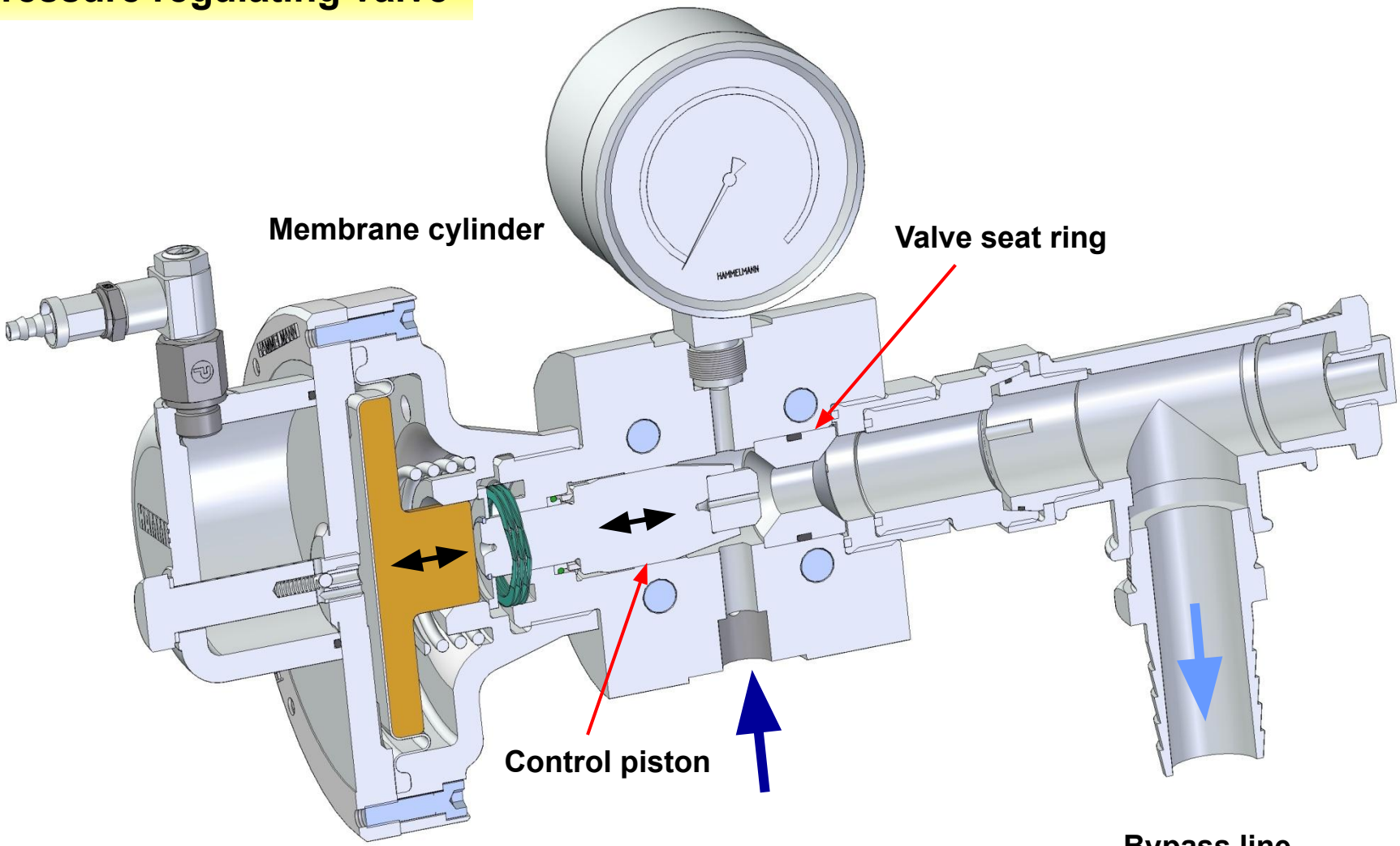
Adjustable

Manually or pneumatically actuated

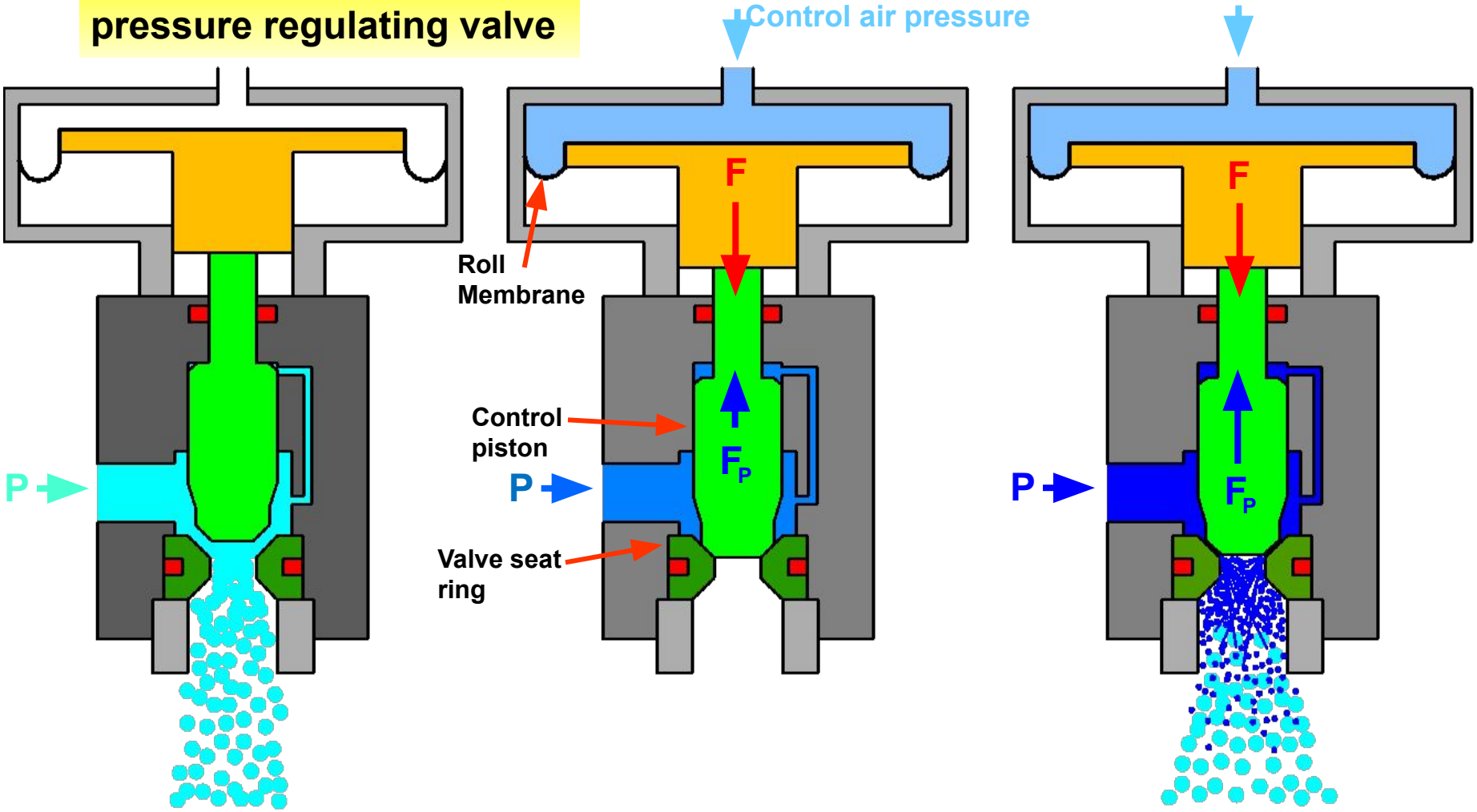




Pressure regulating valve



Function of a pressure regulating valve



Open and depressurised

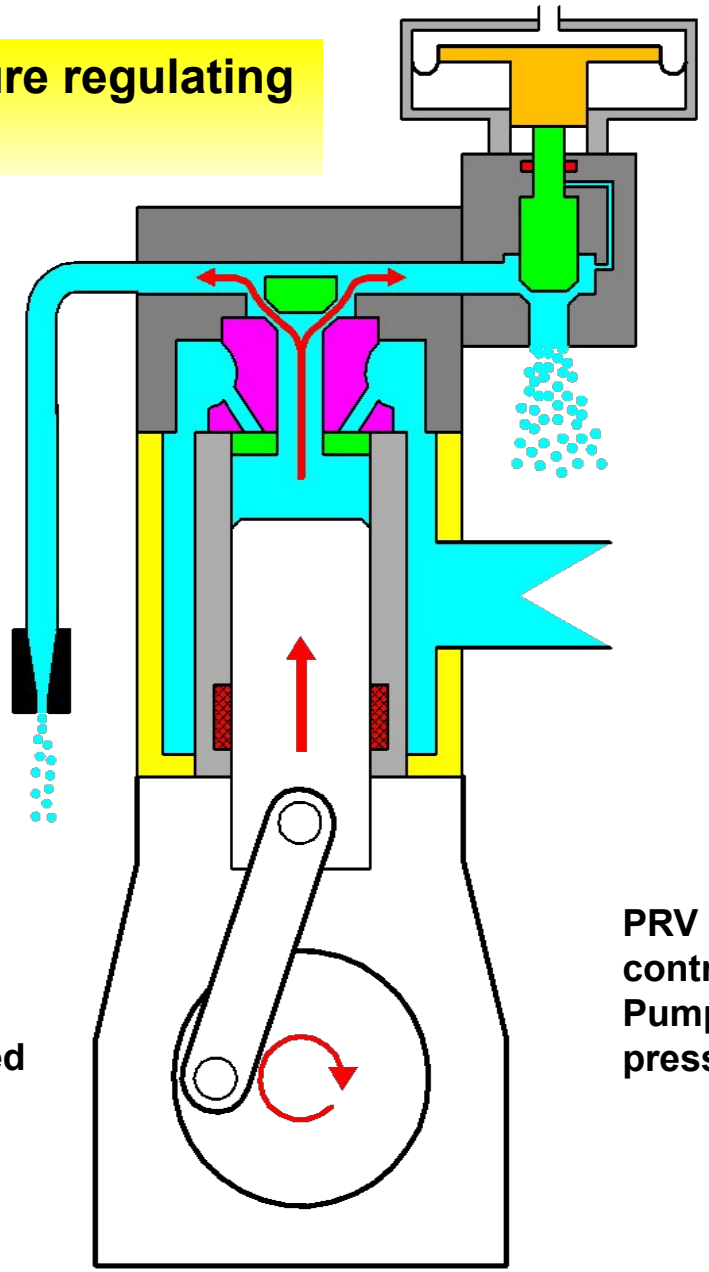
Closed

$F > F_p$

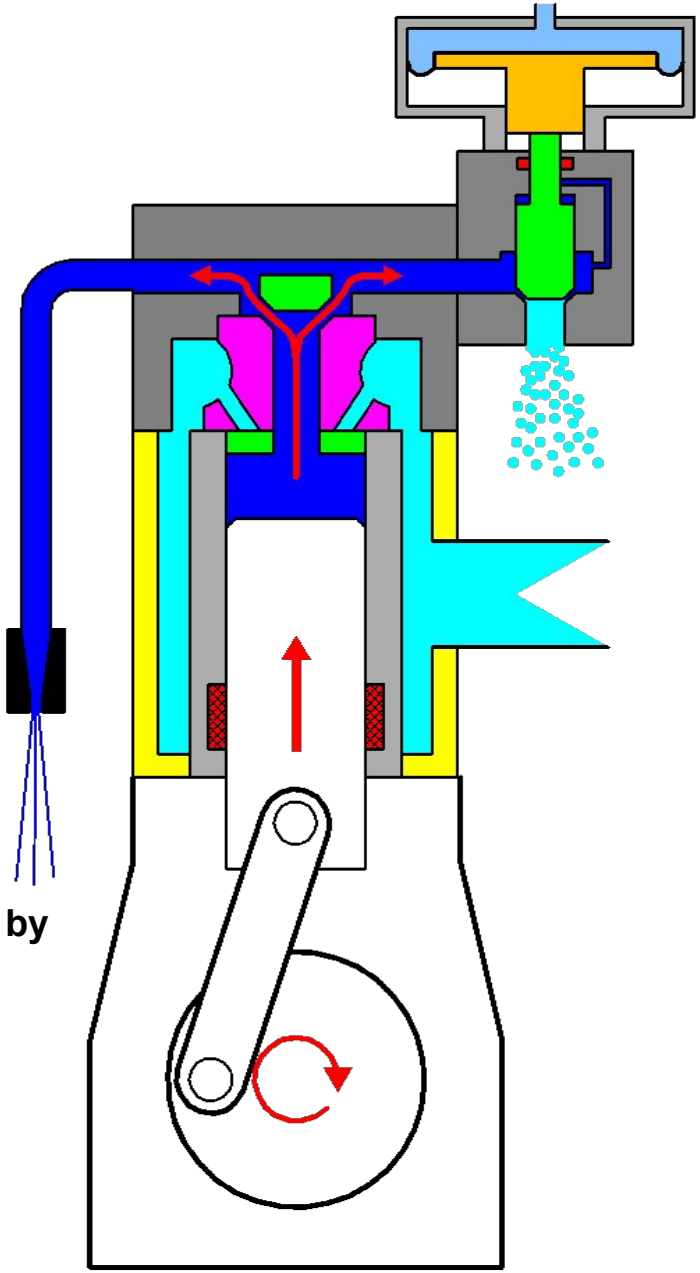
Bypass function

$F = F_p$

Pressure regulating valve



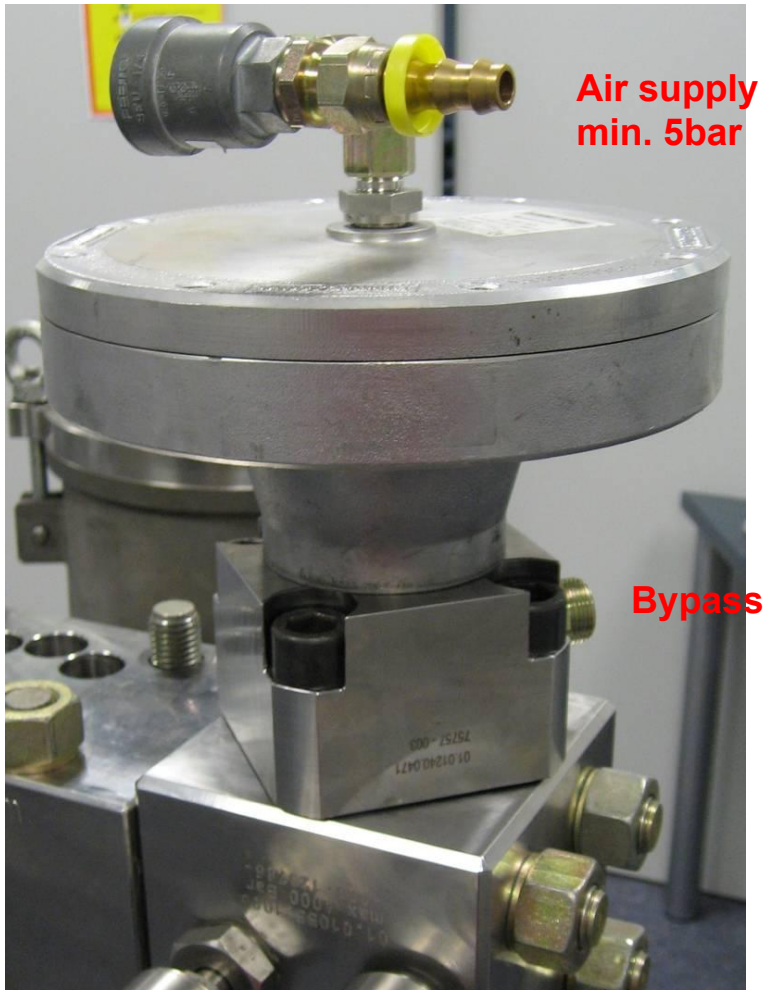
PRV without control air
Pump unit depressurised



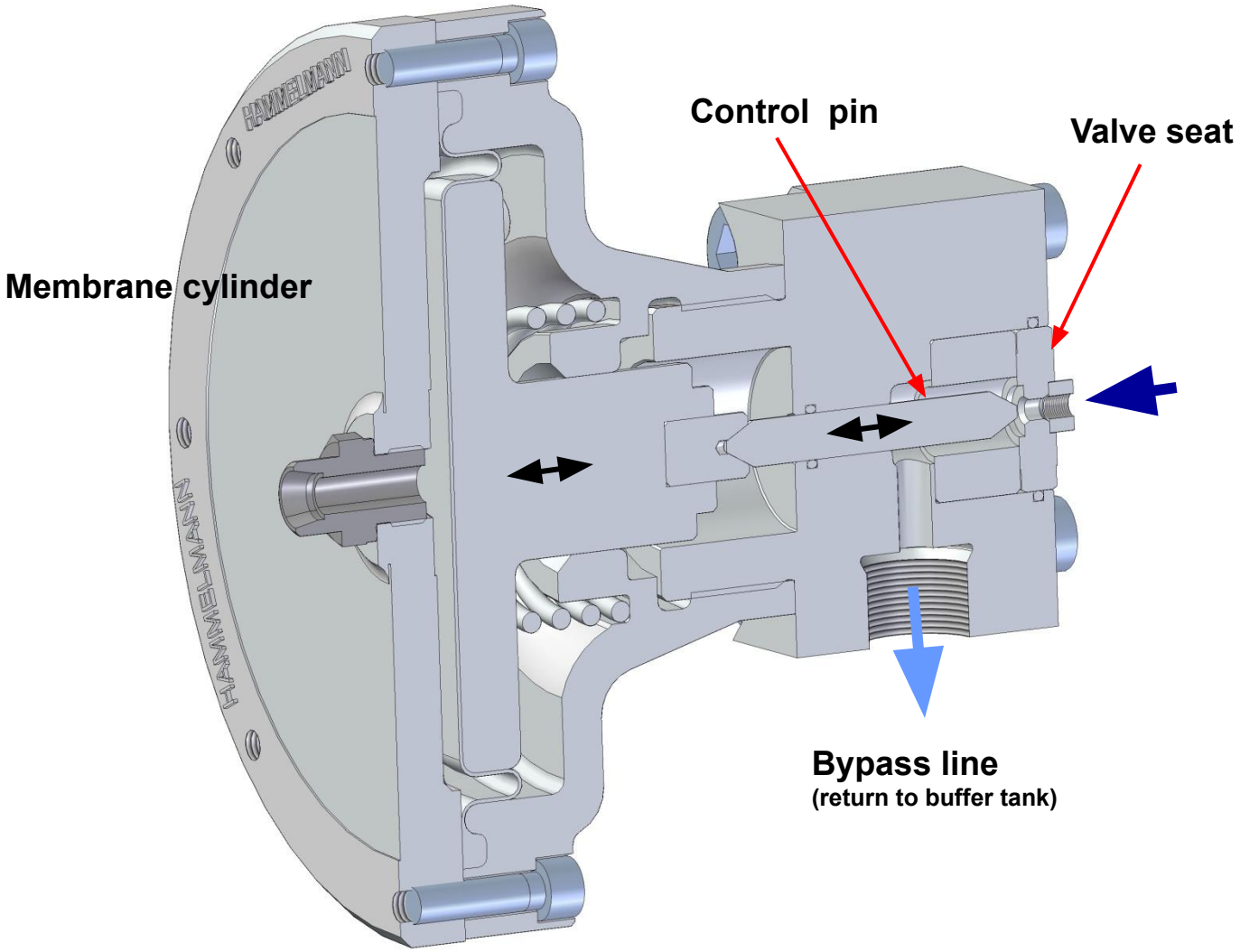
PRV actuated by control air
Pump unit is pressurised

Bypass valve above1800bar

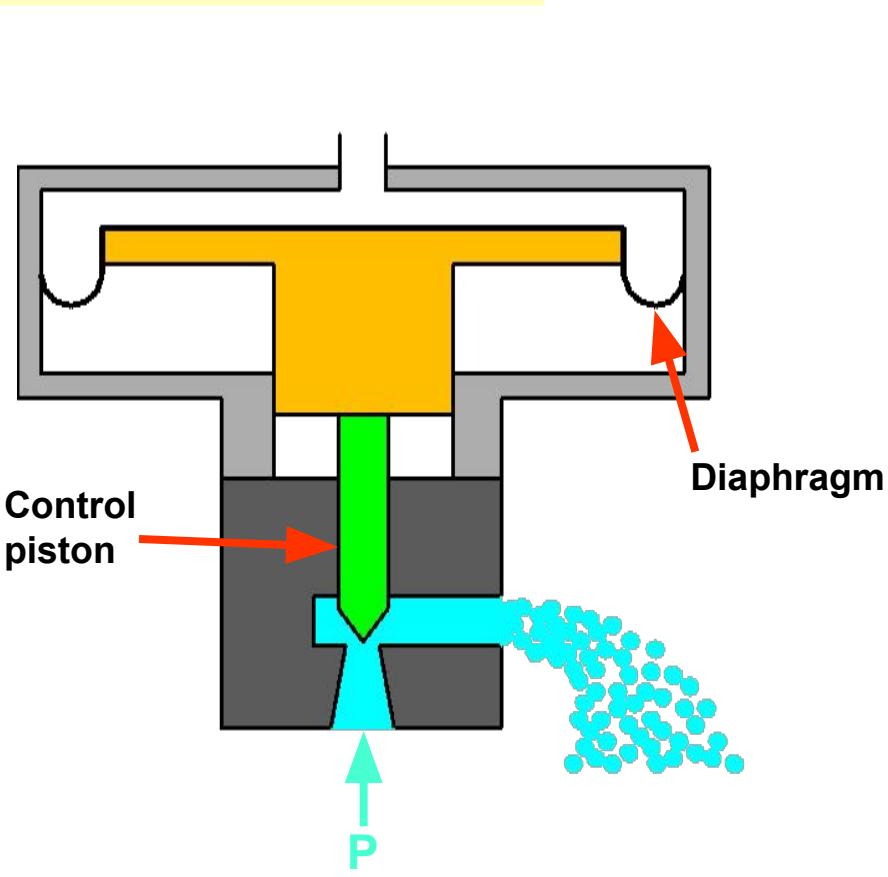
- Only two switch positions
- No regulating function
- Pneumatically actuated
- Only to switch the unit pressure ON and OFF



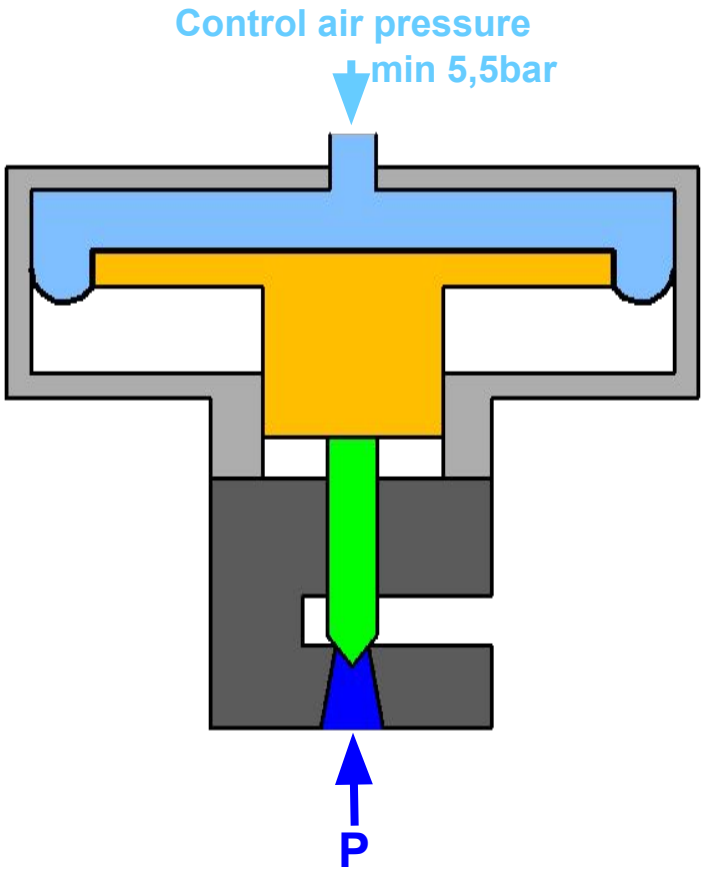
Bypass valve



Function Bypassvalve



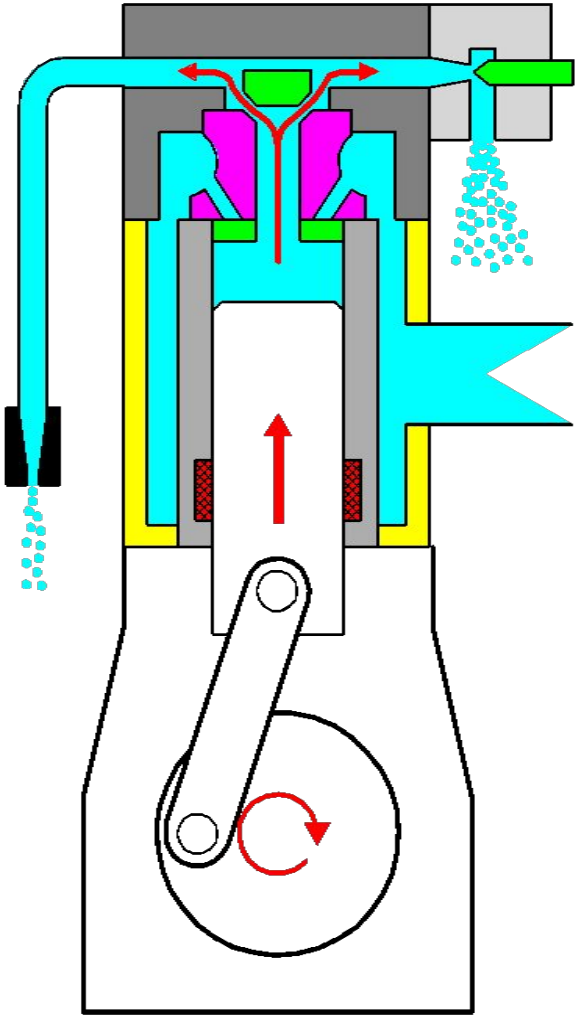
Open - depressurised



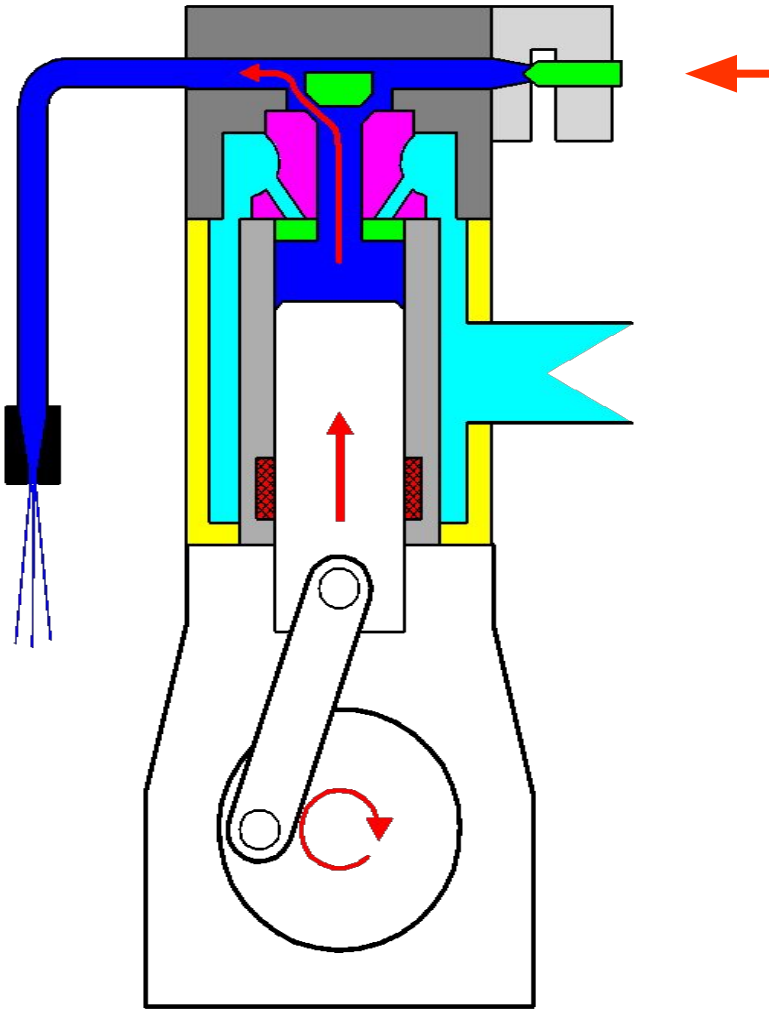
Closed -pressurised

Bypass valve

Bypass valve open

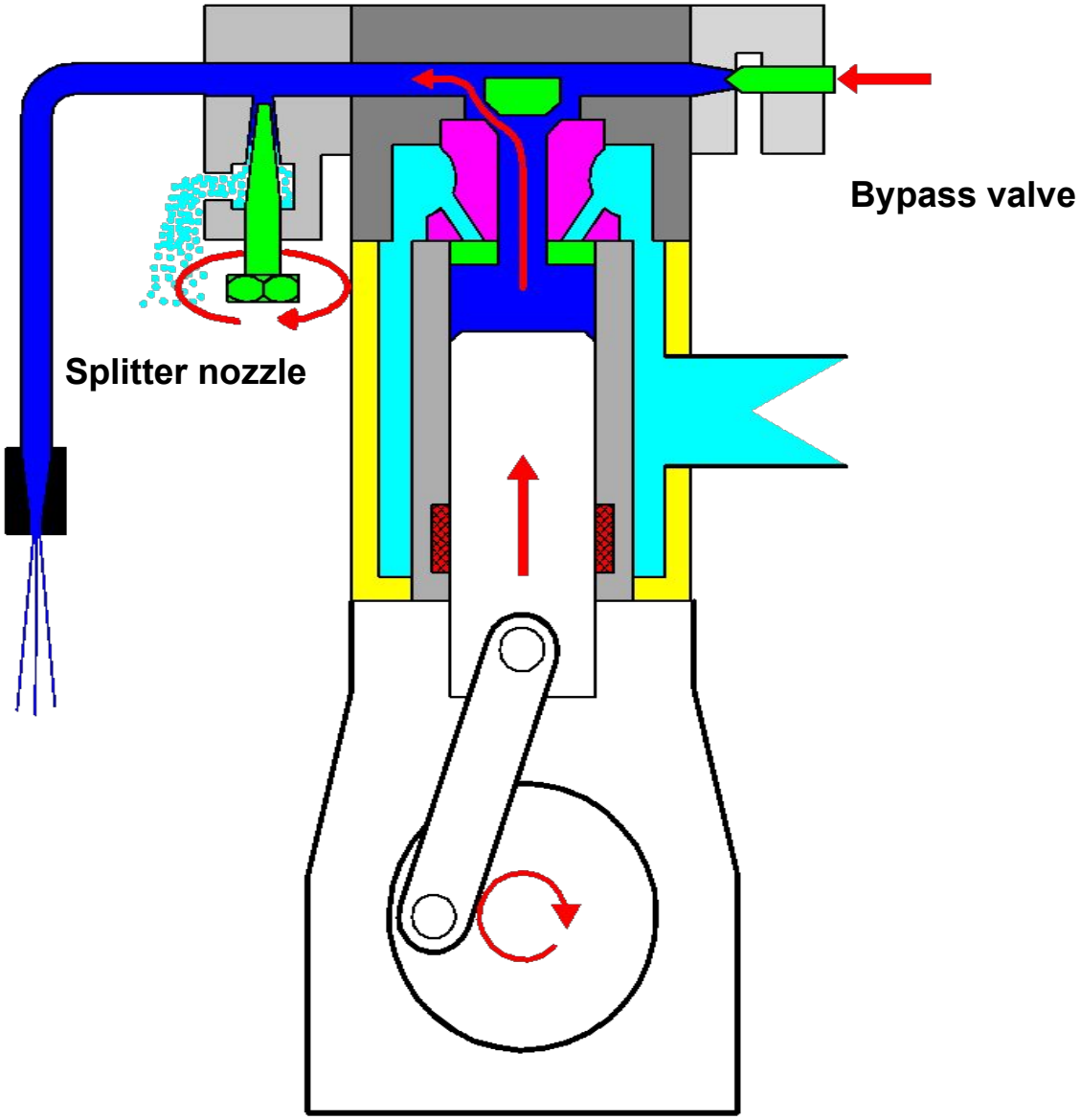


Bypass valve closed

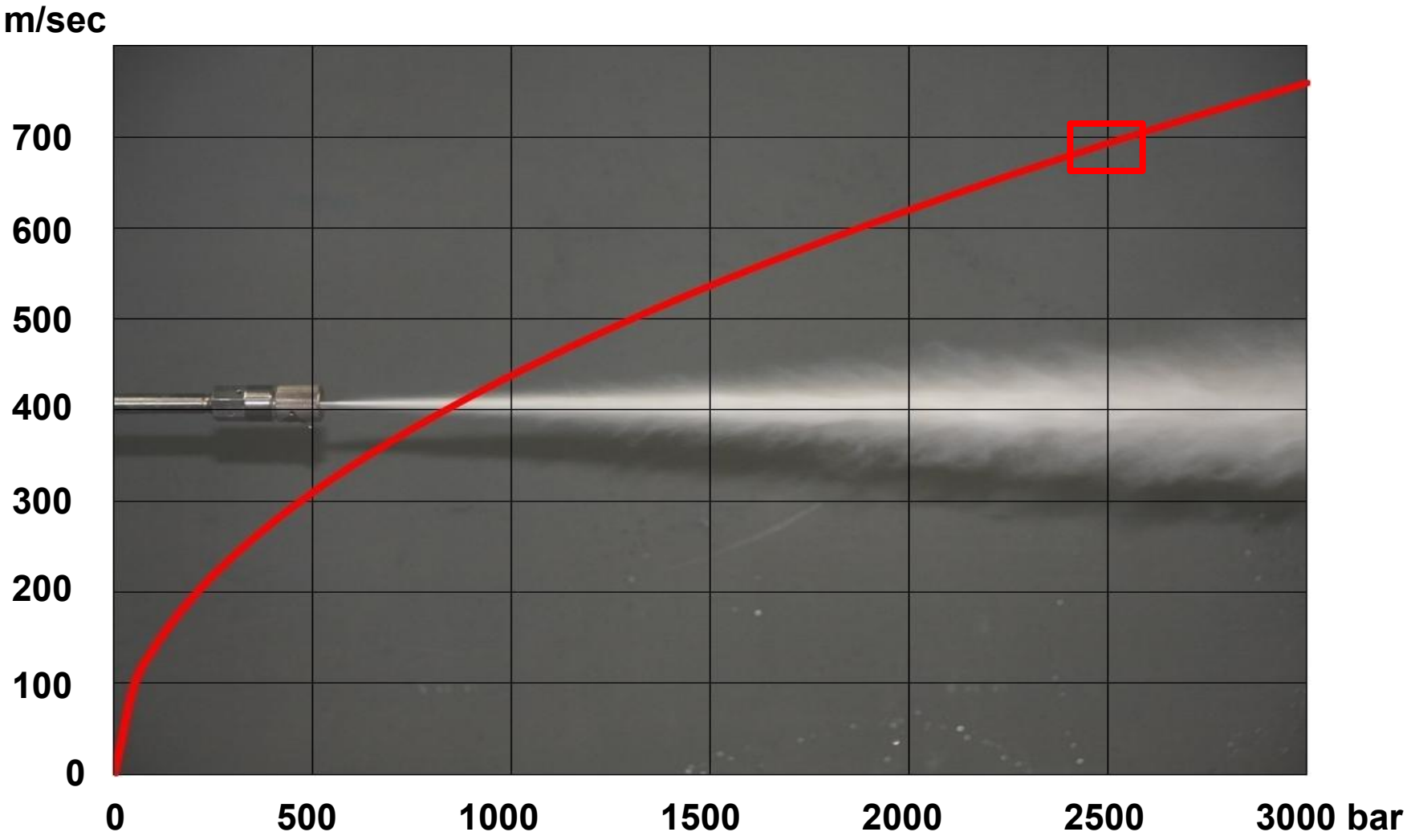


Bypass valve

Ultra high pressure pump with splitter nozzle

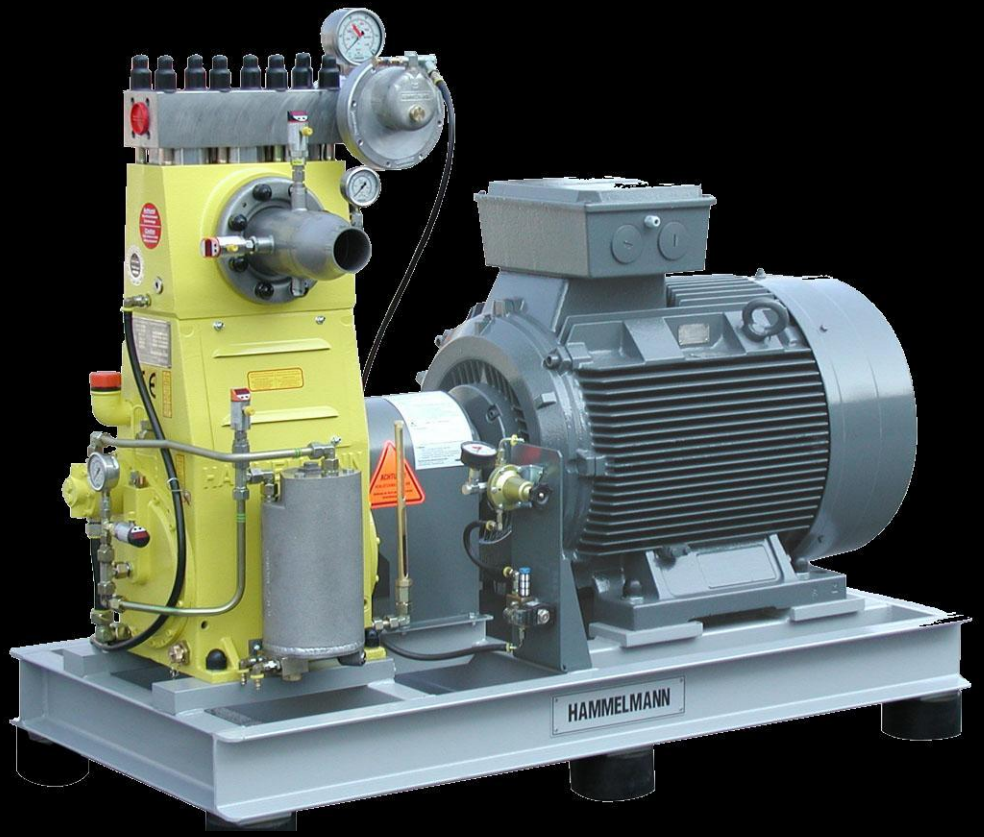


Nozzle discharge velocity



Many thanks

for your attention!



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