Brass Engineering Slurry Pipeline Seminar, Bhubaneswar, day 2

Feluwa Presentation:

Piston Diaphragm Pumps for pipeline slurry transfer: How does a piston diaphragm pump work and what are its major components

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Feluwa Pumps

Piston Diaphragm Pumps for pipeline slurry transfer

- Content:

  - **When to apply a piston diaphragm pump**
  - **Development of Piston Diaphragm Pumps**
  - **Pump Particulars**
  - **References**
  - **Conclusion**

When to apply a piston diaphragm pump

Piston Diaphragm Pumps for pipeline slurry transfer

- When to apply a piston diaphragm pump:
  - At discharge pressures exceeding 3.000 to 4.000 kPa
  - At slurry abrasivity index number 60 or higher

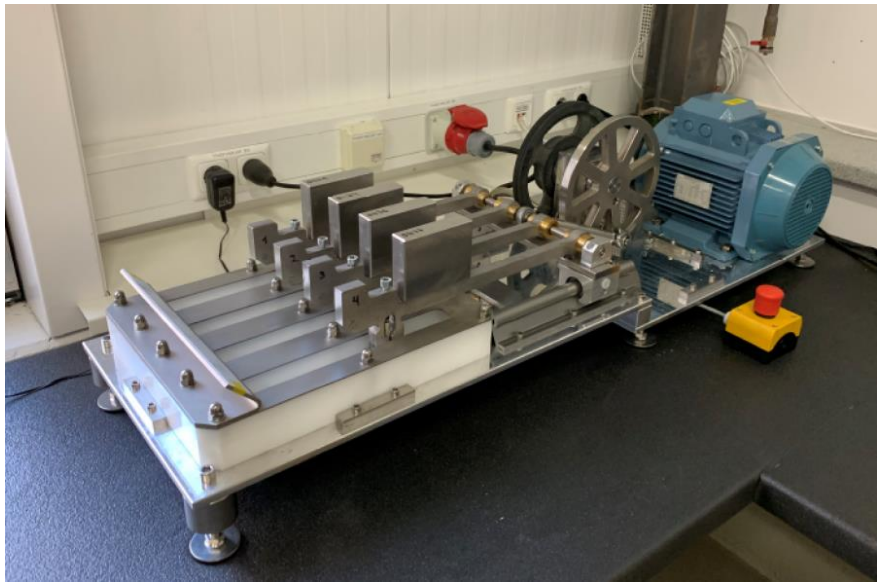
Piston Diaphragm Pumps for pipeline slurry transfer

- When to apply a piston diaphragm pump:
  - **At discharge pressures exceeding 3.000 to 4.000 kPa**
    - As shown piston diaphragm pumps are a feasible alternative for multistage centrifugal pumps at pressures of 3.000 to 4.000 kPa and higher

Summary		Centrifugal	PD Pump
Annual power consumption		**1.189.743,59**	**814.035,09**
Spare parts costs	in $	450.000,00	99.000,00
Labour costs	in $	36.000,00	4.500,00
Total operating costs	in $	1.675.743,59	917.535,09
Difference of total operating costs per month	in $	63.184,04	
Total investment	**in $**	**1.800.000,00**	**3.000.000,00**
Amortization period of diffence in investment	in months		**18,99**
	in years		**1,58**

Piston Diaphragm Pumps for pipeline slurry transfer

- When to apply a piston diaphragm pump:
  - **At abrasivity index number 60 or higher**
    - Miller number:
      - Miller number is an indication of the abrasivity of a slurry
      - Miller number is examined in a Miller Machine



Piston Diaphragm Pumps for pipeline slurry transfer

- When to apply a piston diaphragm pump:
  - **Miller Machine:**
    - Is used to measure the relative abrasivity of various slurries consists in general of a standard ½" x 1" metal wear block, driven at a rate of 48 strokes per minute, with a 200 mm stroke, riding in the bottom of a tray containing a 50% by weight slurry of the solids mixed in water. A dead weight of five pounds is applied.
  - Formula:

Abrasivity Units = Relative Rate of Weight Loss

$$\text{Abrasivity} = C\,\frac{d\ \text{Weight Loss}}{d\ \text{Hours}} = (C)(A)(B)(H)^{B-1} \qquad (2)$$

Where: $\frac{d\ \text{Weight Loss}}{d\ \text{Hours}}$ = First Partial Derivative of Weight Loss with respect to Time in Hours.

C = Constant
H = Hours (Use 2 Hours)

Piston Diaphragm Pumps for pipeline slurry transfer

- When to apply a piston diaphragm pump:
  - **Miller Numbers:**

Material	Miller Numbers
Alundum 400 mesh	241
Alundum 200 mesh	1058
Ash (fly)	83, 14
Bauxite	9, 22, 33, 45, 50, 76, 134
Clay	34, 36
Coal	6, 7, 9, 10, 12, 21, 28, 47, 57
Copper concentration	19, 37, 58, 68, 111, 128
Gypsum	41
Iron Ore	28, 37, 64, 79, 122, 157, 234
Kaolin	7, 7, 30
Lignite	14
Limestone	22, 27, 29, 30, 33, 39, 43, 46
Limonite	113
Magnetite	64, 67, 71, 134
Mud, drilling	10
Phosphate	68, 74, 84, 134
Potash	0, 10, 11
Pyrite	194
Sand/sand fill	51, 59, 75, 85, 93, 116, 138, 149, 246
Shale	53, 59
Sewage (raw)	25
Sulfur	1
Tailings (all types)	24, 61, 76, 91, 159, 217, 480, 644

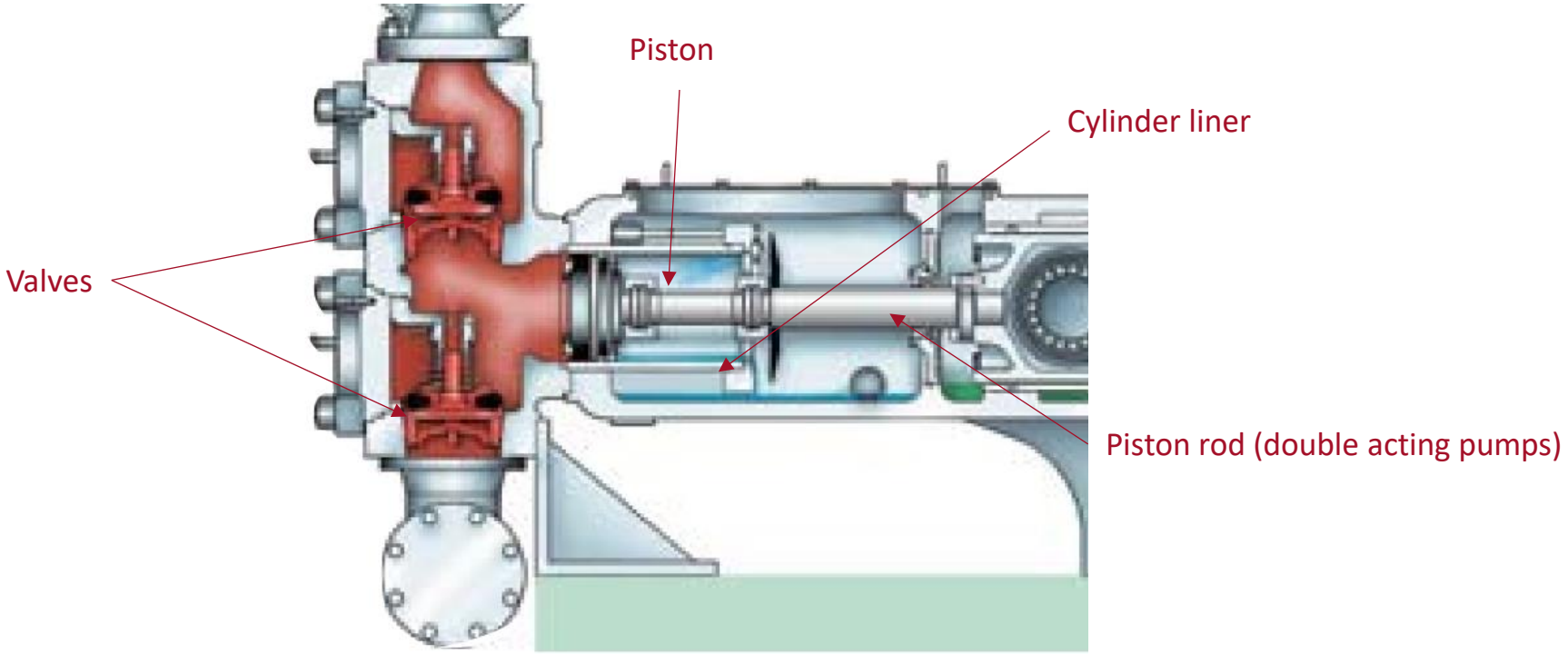
Rule of thumb:

If Miller number is ≤ 60:
Piston pump

If Miller number is ≥ 60:
Piston diaphragm pump

Piston Diaphragm Pumps for pipeline slurry transfer

- When to apply a piston diaphragm pump:
  - **Piston pump**, wearing parts:

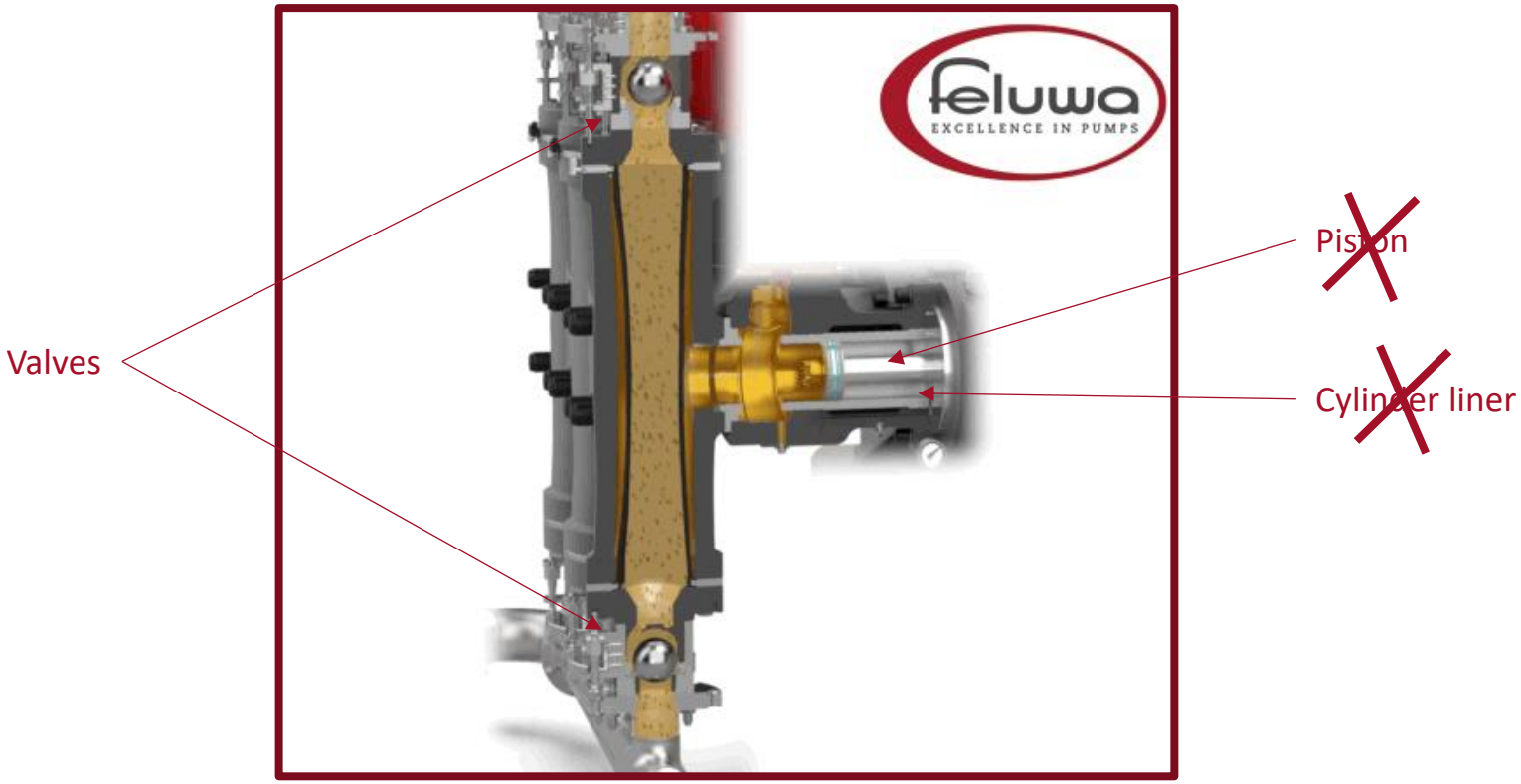


Piston Diaphragm Pumps for pipeline slurry transfer

- When to apply a piston diaphragm pump:
  - Piston pump transferring abrasive slurry (Miller number ≥ 60)
    - High wear parts costs (frequent replacement of cylinder liner, piston, piston rod, valves)
    - Low availability

Piston Diaphragm Pumps for pipeline slurry transfer

- When to apply a piston diaphragm pump:
  - **Piston diaphragm pump**, wearing parts:



Piston Diaphragm Pumps for pipeline slurry transfer

- When to apply a piston diaphragm pump:
  - Piston diaphragm pump transferring abrasive slurry (Miller number ≥ 60)
    - Low wear parts costs (only valves)
    - High availability

Piston Diaphragm Pumps for pipeline slurry transfer

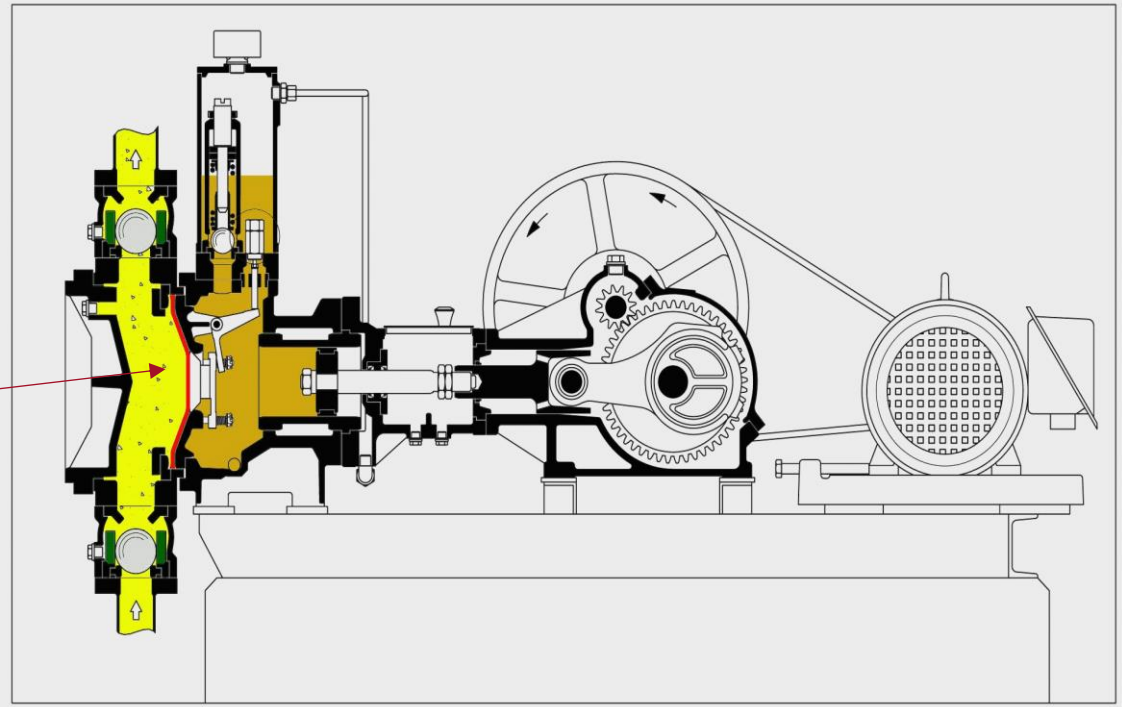
- When to apply a piston diaphragm pump:
  - Piston diaphragm performance capabilities
    - Capacitiy: 0,5 – 1.000 m³/hr
    - Pressure: ≤ 35.000 kPa
    - Viscosity: ≤ 8.000 cP
    - Solids concentration: ≤ 78%
    - Yield stress: ≤ 150 Pa
    - Temperature: ≥ 200 degrees C
    - Particle size: ≤ 8 mm

Development of Piston Diaphragm Pumps

Piston Diaphragm Pumps for pipeline slurry transfer

- Development

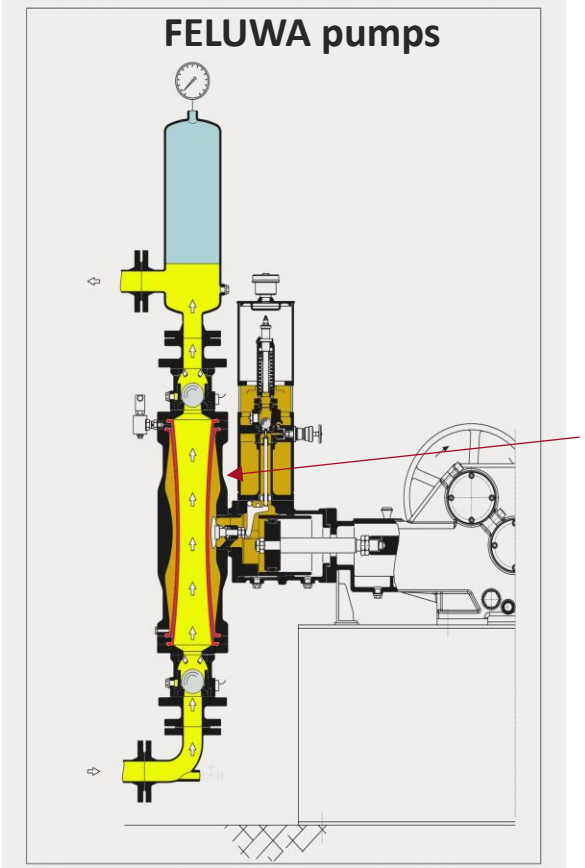
Conventional pumps



Single flat diaphragm

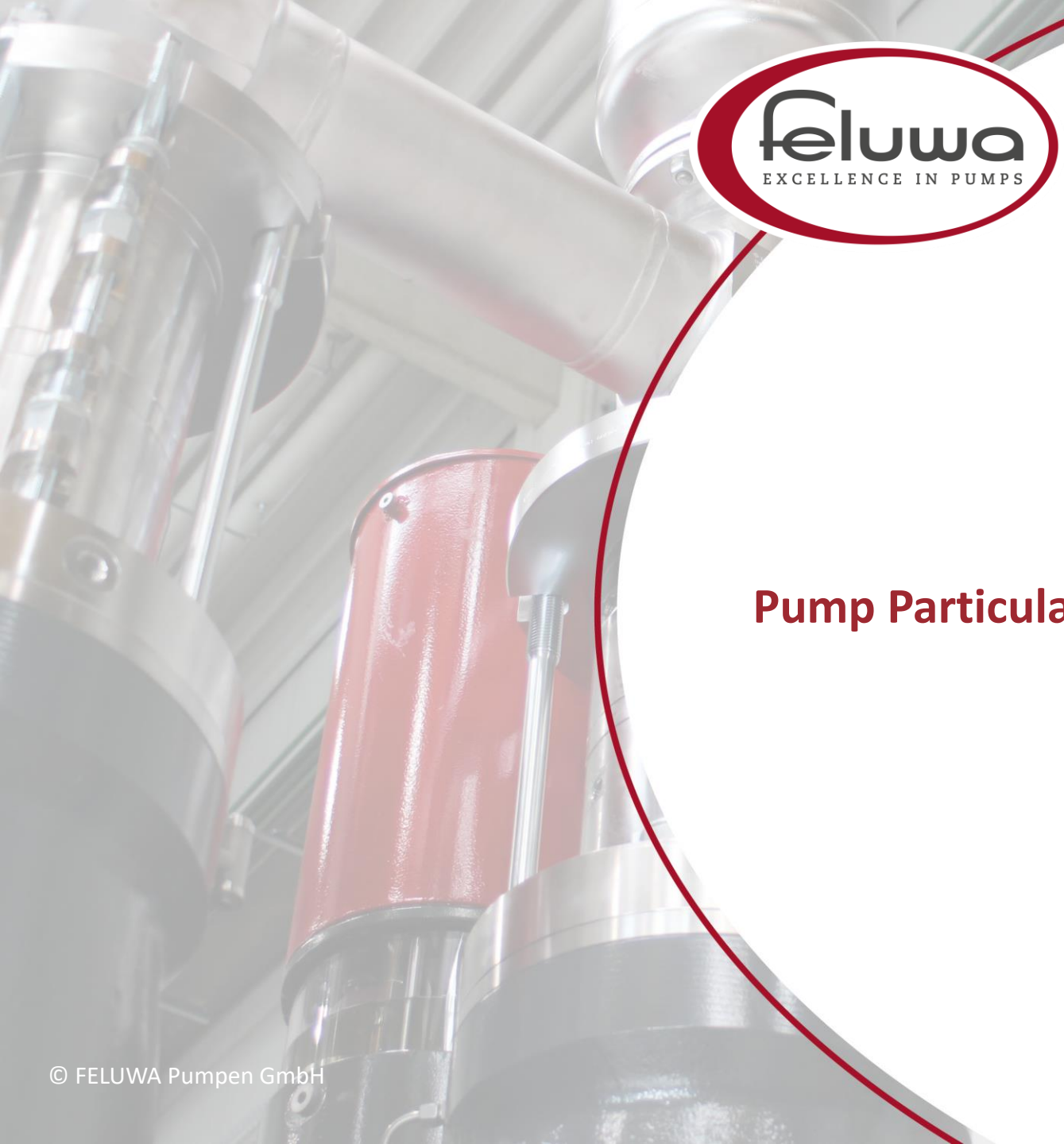
Single flat diaphragm

FELUWA pumps



Double hose diaphragm

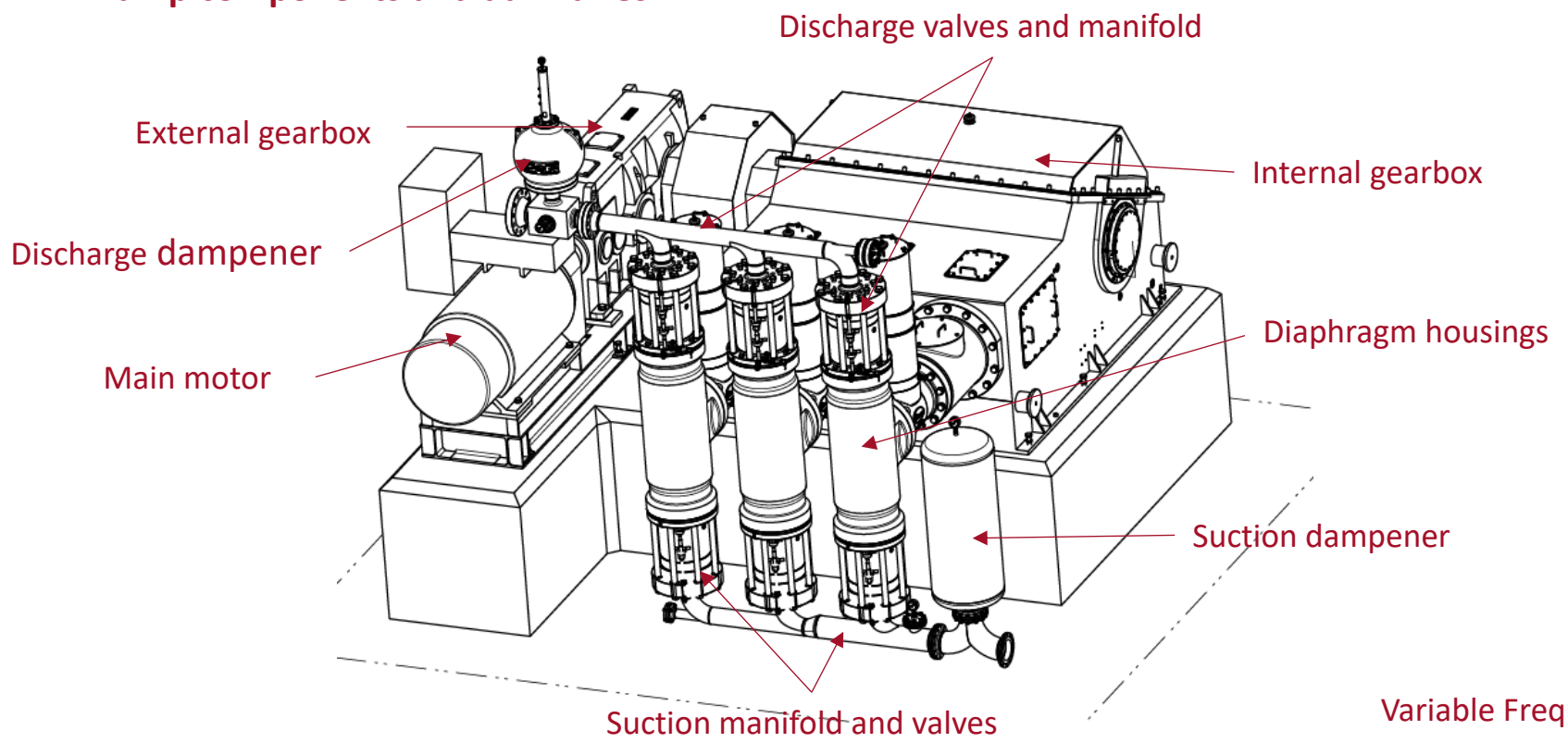
Double hose diaphragm



Pump Particulars

Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Pump components and auxiliaries**



Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Materials of construction**
    - Material selection for wetted parts of a piston diaphragm pump depends mostly on:
      - Corrosivity of the slurry
      - Discharge pressure

Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Materials of construction**
    - Corrosivity of slurry
      - pH value of slurry
      - Chloride content of slurry
    - Concentrate slurries are in most cases not corrosive
    - Tailings can be mixed in seawater which makes tailings slurry corrosive
    - If slurry is corrosive, wetted parts need to be made out of stainless steel (duplex or super duplex)

Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Materials of construction**
    - Wetted parts of piston diaphragm pumps (in contact with slurry)

Suction dampener (only in case of air vessel type dampener)

Manifolds

Valves and valve housings

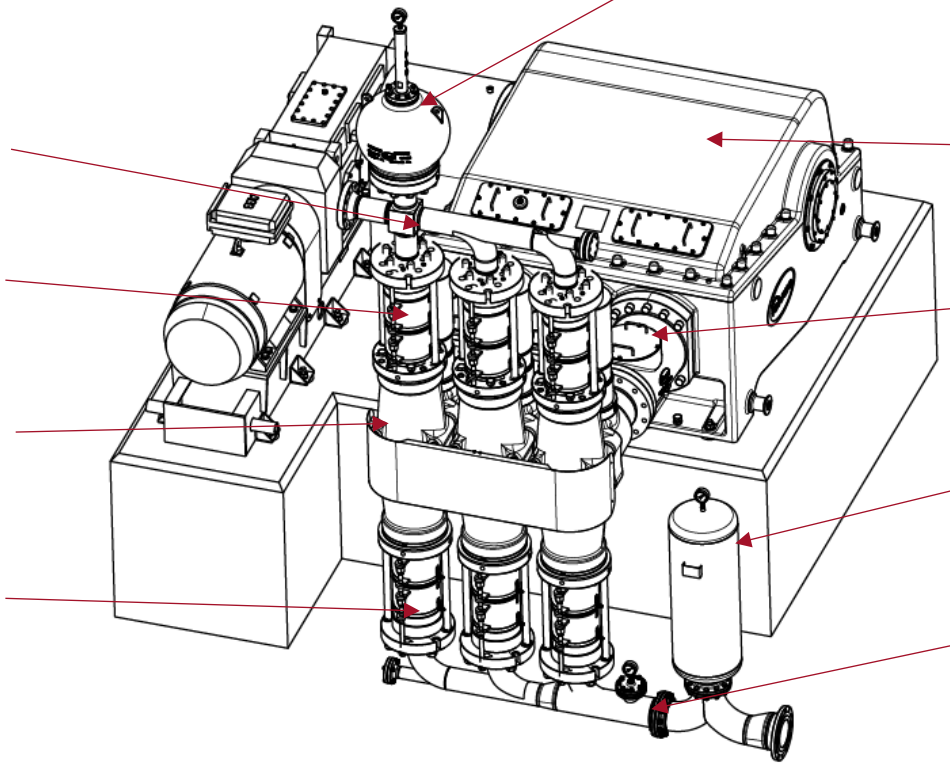
Note: diaphragms housings are (**for Feluwa**) not in contact with the slurry do not need to be made out of stainless steel)

Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Materials of construction**
    - Pressure class (discharge pressure)
      - Non-pressure bearing components can be made out of cast iron ore cast steel
      - Material selection of pressure bearing components depends on discharge pressure
        - ≤ 14.000 kPa: cast iron or cast steel
        - ≥ 14.000 to 15.000 kPa: forged steel

Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Materials of construction**
    - Pressure bearing pump components



Piston Diaphragm Pumps for pipeline slurry transfer

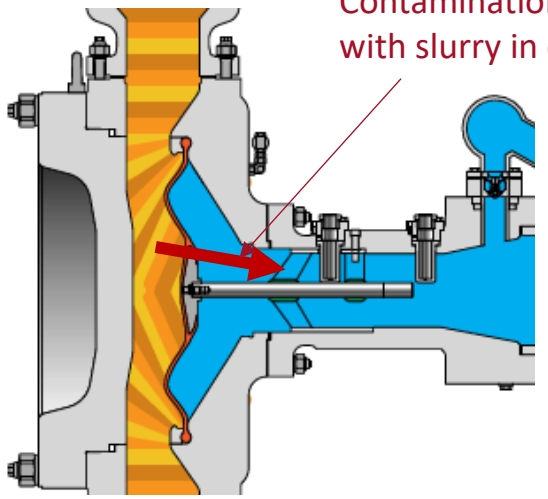
- Pump Particulars
  - **Diaphragms**
    - Diaphragms separate the abrasive slurry from the propelling liquid chamber
    - The propelling liquid chamber contains the following parts
      - Piston/piston rod (in case of double acting pumps)
      - Cylinder liner
      - Propelling liquid compensation system
    - These components operate in clean oil and are not subject to wear
    - There is no pressure difference between the hydraulic oil in the propelling liquid chamber and slurry in the diaphragm housing
    - Diaphragms are not subject to stress
    - Diaphragms have a lifetime of 8.000 to 16.000 operating hours and are not considered to be wearin parts

Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Diaphragms**
    - Diaphragms are made out of NBR
    - Diaphragms are available in 2 designs
      - Single flat
      - Double hose

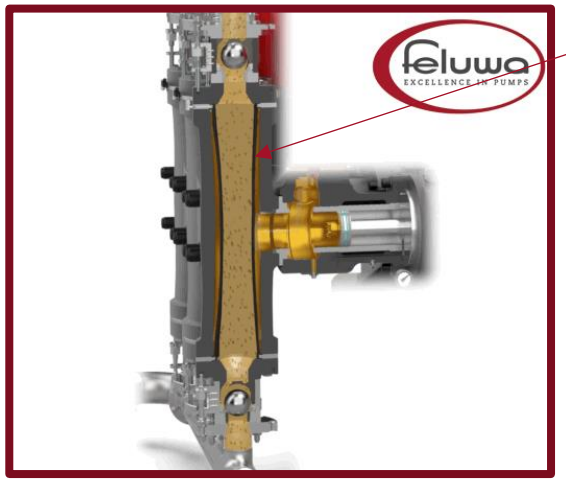
Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Diaphragms**
    - Single flat (conventional pumps)
      - In case of diaphragm rupture or leakage, hydraulic oil will be contaminated by slurry
      - Pump must be stopped immediately to prevent damage to internal components
      - Interruption of operation



Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Diaphragms**
    - Double hose (Feluwa Pumps)
      - In case of diaphragm rupture or leakage, secondary diaphragm will protect hydraulic oil from contamination by slurry
      - Pump operation can continue



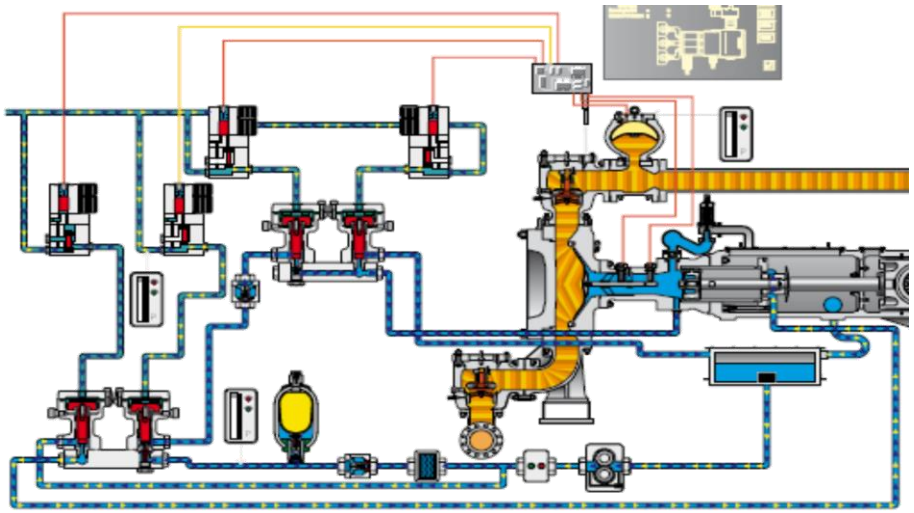
No contamination of propelling liquid with slurry in case of diaphragm damage

Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Diaphragm rupture indication**
    - In order to prevent contamination of propelling liquid, it is very important that damage to diaphragms is indicated as soon as possible

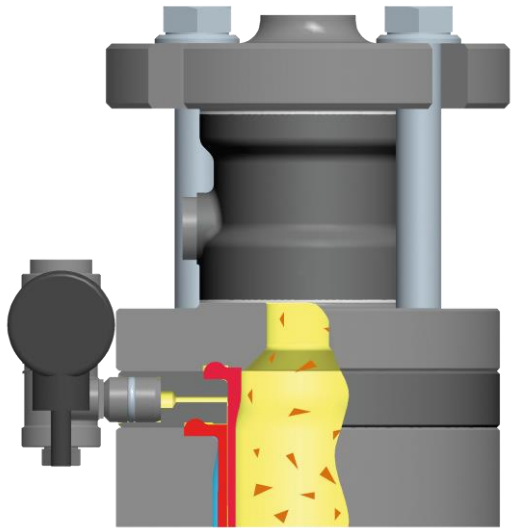
Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Diaphragm rupture indication**
    - Conventional pumps
      - For single flat diaphragms it takes 3 minutes before damage is discovered and signaled, damage to internal parts in propelling liquid is already done



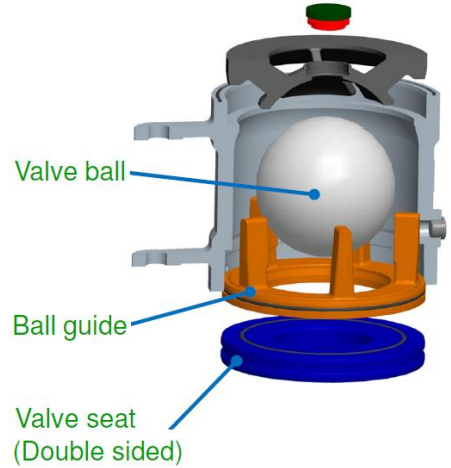
Piston Diaphragm Pumps for pipeline slurry transfer

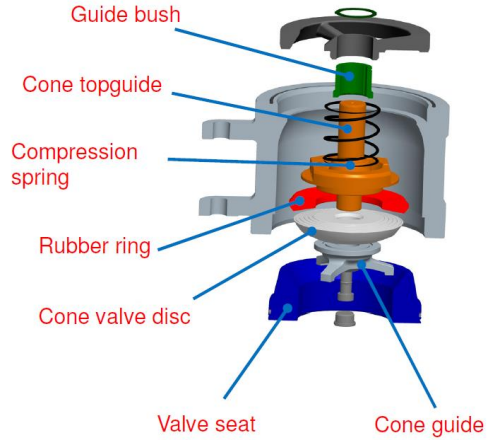
- Pump Particulars
  - **Diaphragm rupture indication**
    - Feluwa Pumps
      - For double hose diaphragm it takes 3 seconds, as propelling liquid is protected by secondary hose diaphragm, pump operation can continue



Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Valves**
    - Valves are the only pump parts in direct contact with the slurry
    - Valves are available in 2 configurations
      - Ball
        - Components: ball, seat, guide
        - Generally used for lower to medium capacities
      - Cone
        - Components: cone, seat, spring, guide, spring, nut
        - Generally used for higher capacities



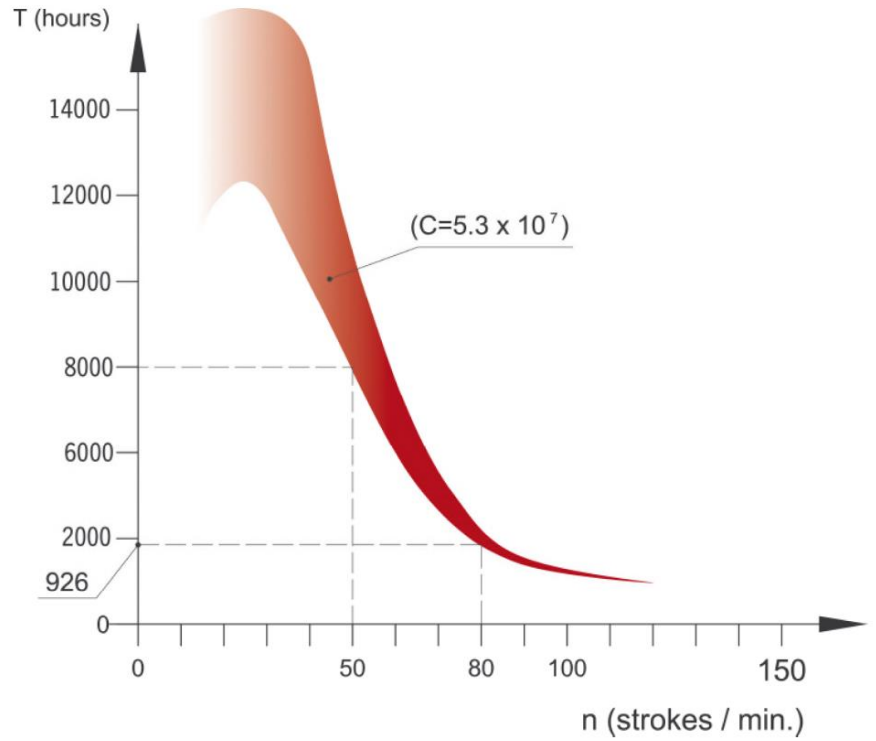


Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Valves**
    - Lifetime of valve components depends on
      - Stroke rate (wear increases with stroke rate exponentially)
      - Abrasivity (Miller number)
      - Particle size distribution
      - Pressure
      - Corrosivity
      - Maintenance
    - Typical valve component lifetime is in between 1.000 and 5.000 operating hours

Piston Diaphragm Pumps for pipeline slurry transfer

- Piston diaphragm pump selection
  - Pump capacity depends on:
    - Relationship between stroke rate and valve life

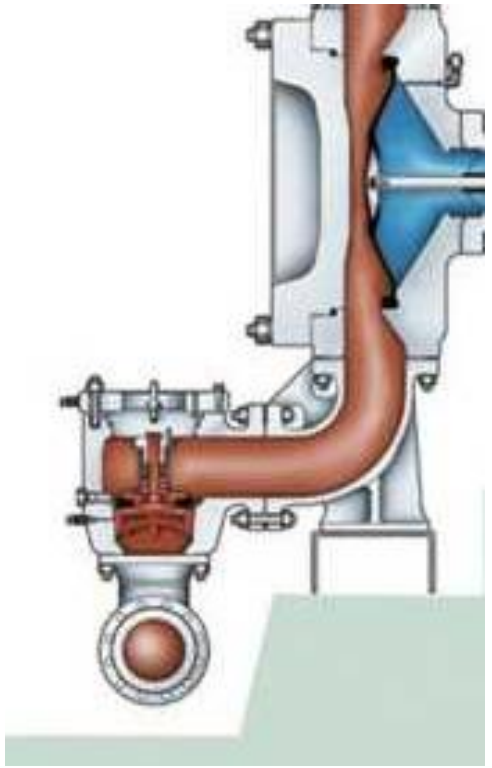


Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Valves**
    - As valve components need to be replaced regularly, accessibility of these parts is important to minimize downtime

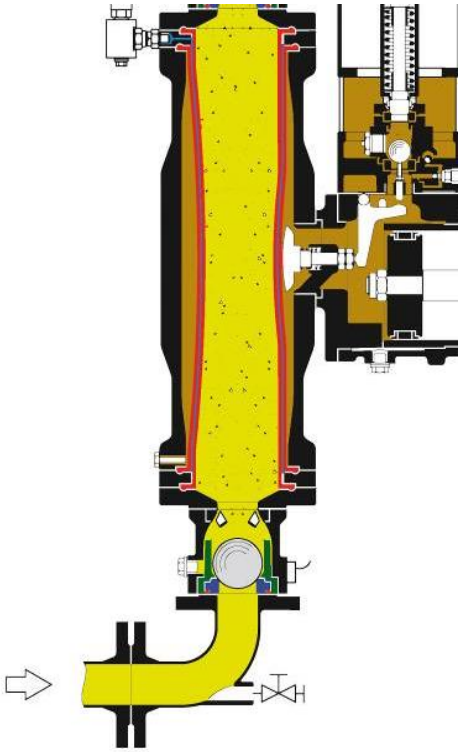
Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Valves**
    - Conventional pumps:
      - Difficult access, valve components replacement
      - Curved flow path requires more NPSH



Piston Diaphragm Pumps for pipeline slurry transfer

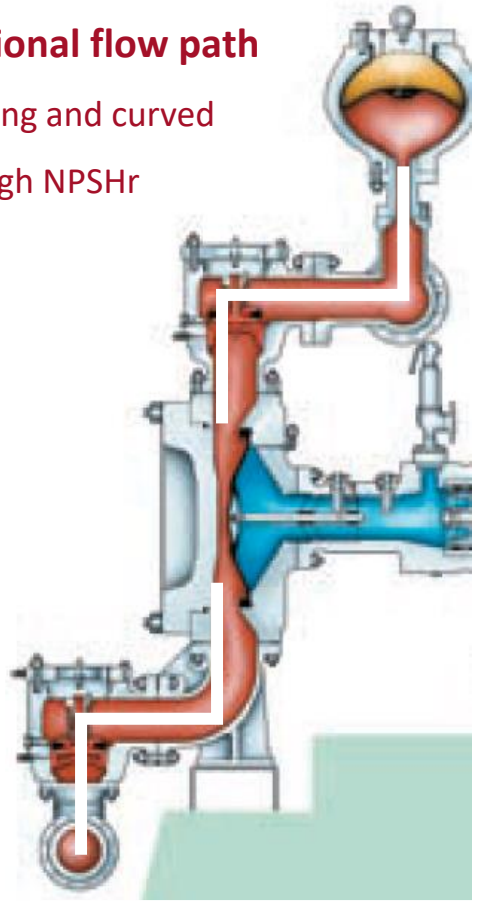
- Pump Particulars
  - **Valves**
    - Double hose diaphragm pumps
      - Easy access due to swingout cassette valves, valve components replacement takes less than 20 minutes per valve
      - Inline flow path requires less NPSH



Piston Diaphragm Pumps for pipeline slurry transfer

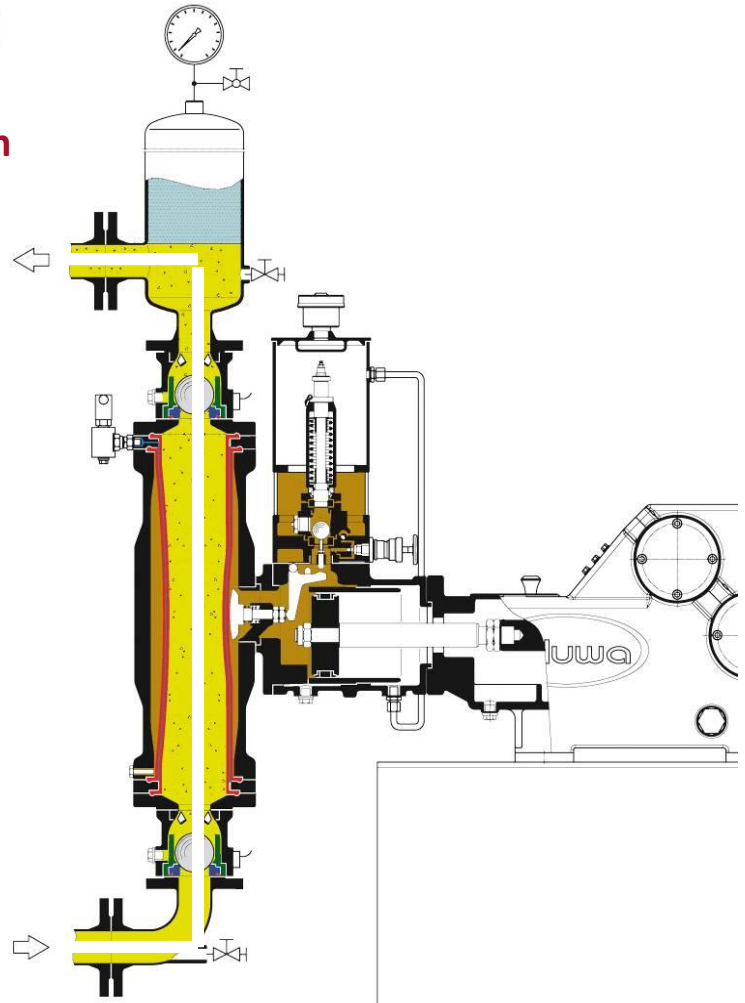
- Pump Particulars

- **Coventional flow path**
  - Long and curved
  - High NPSHr



Conventional piston diaphragm pump

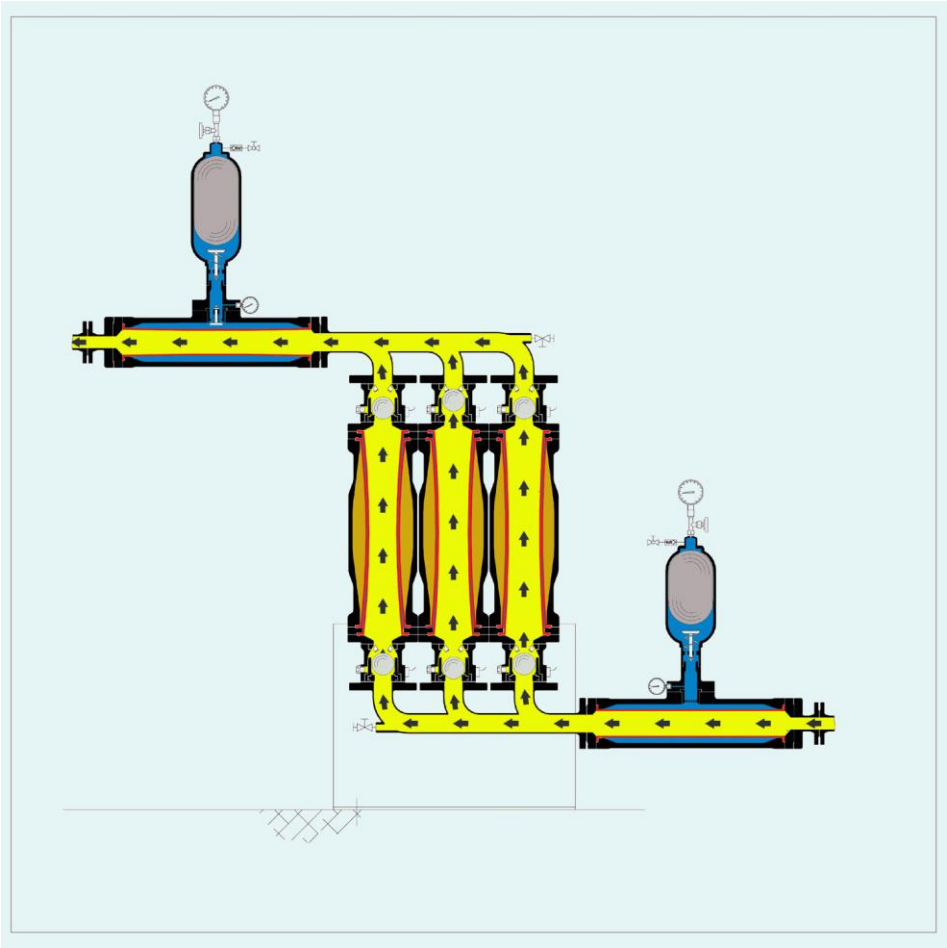
- **Feluwa flow path**
  - Linear
  - Low NPSHr



Feluwa Multisafe piston diaphragm pump

Piston Diaphragm Pumps for pipeline slurry transfer

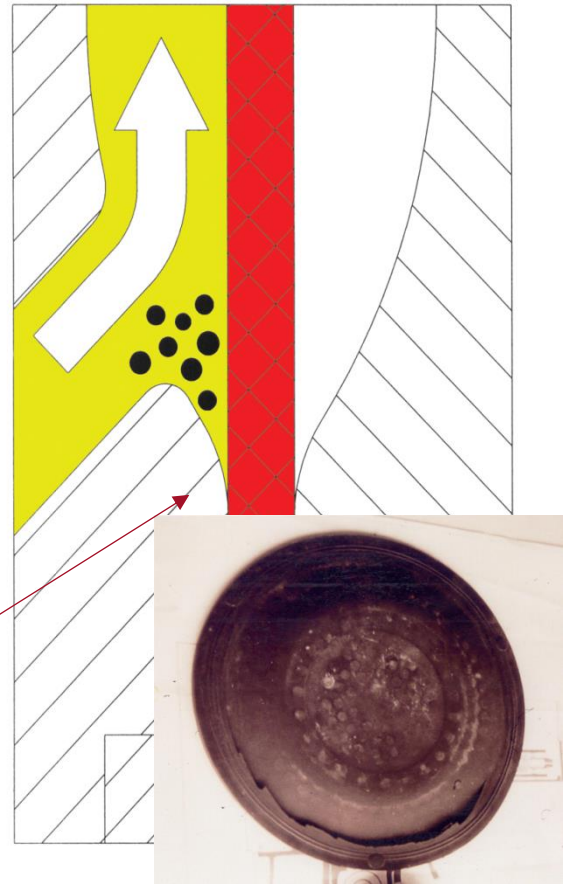
- Pump Particulars
  - **Linear flow path**
    - No dead pockets
    - No solids sedimentation
    - Long lifetime of components
    - Low cost for spares

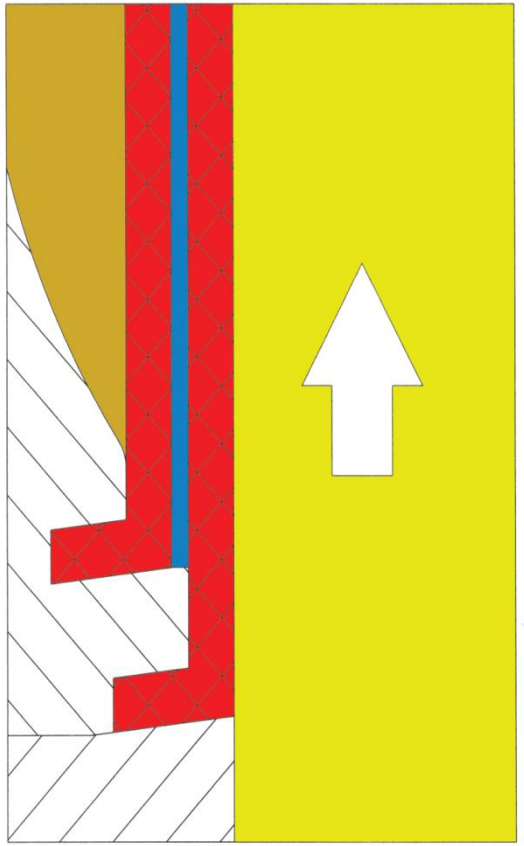


Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars

- **Flow path**
- Curved flow path
- Slurry sedimentation
- High mechanical wear
- Reduced lifetime
- High costs for spares

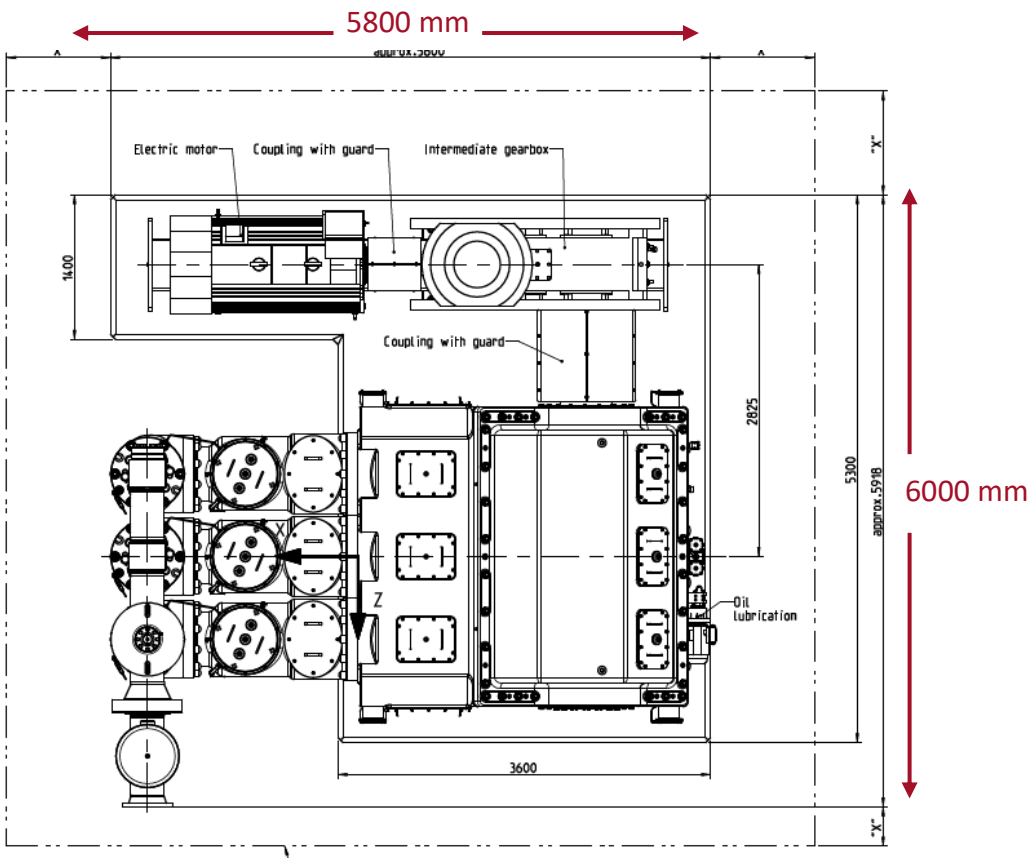




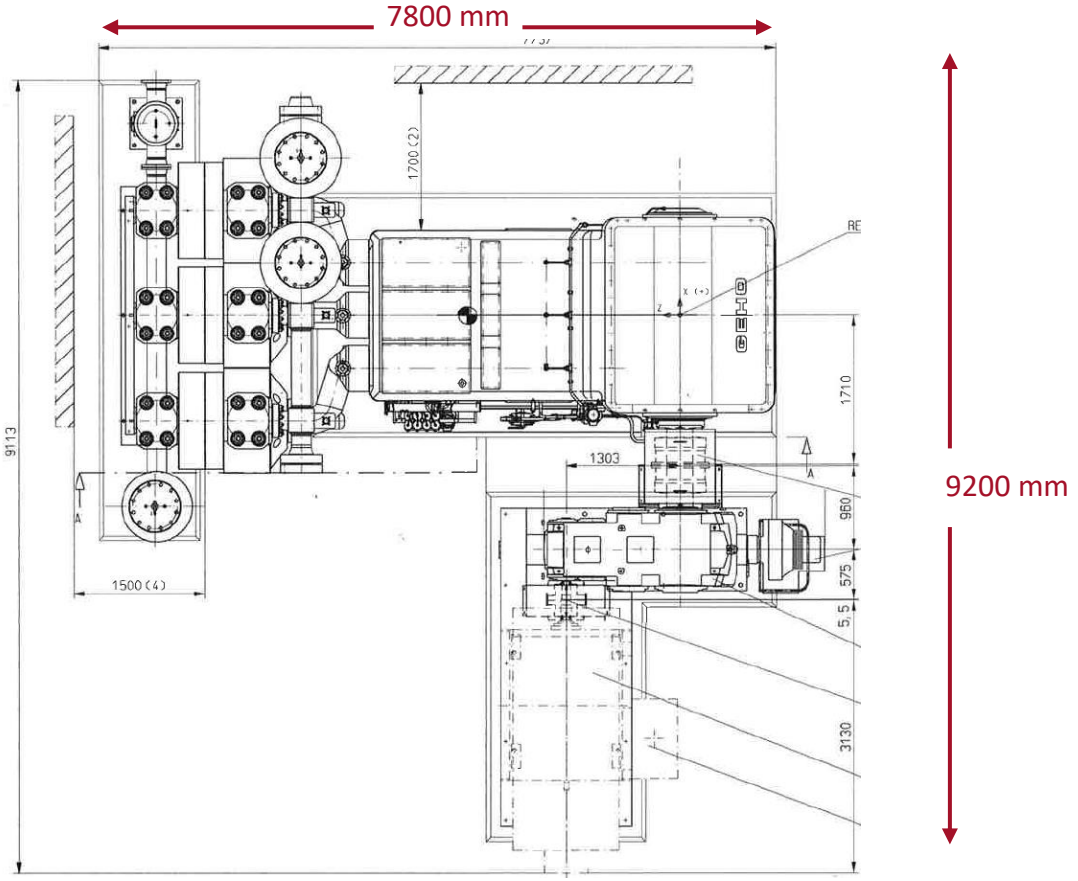
- Linear flow path
- No dead pockets
- No slurry sedimentation
- Long lifetime
- Low cost for spares

Piston Diaphragm Pumps for pipeline slurry transfer

- Footprint



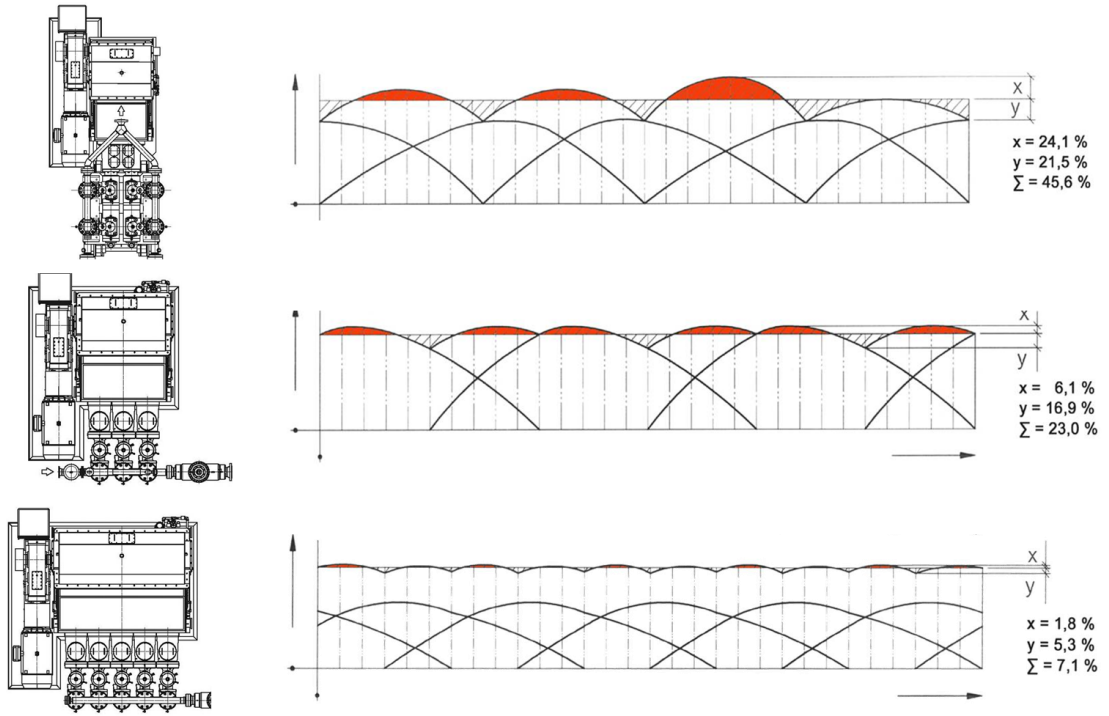
Feluwa: 34,8 m²



Conventional: 71,7 m²

Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Pulsation dampening,** part of pump supply
    - Piston diaphragm pumps create pulsations (on suction as well as discharge side):



Duplex double acting: 45%

Triplex single acting: 23%

Quintuplex single acting: 7%

Piston Diaphragm Pumps for pipeline slurry transfer

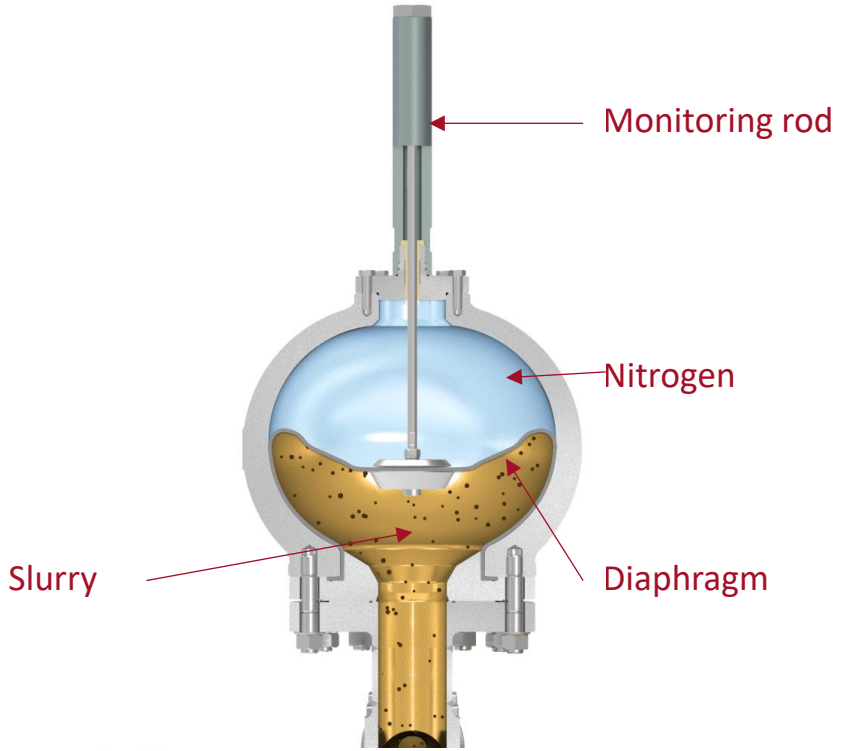
- Pump Particulars
  - **Pulsation dampening,** part of pump supply
    - Pulsation dampeners need to be installed at suction as well as discharge side

Airvessel type suction dampener for pressures up to 1.000 kPa, to reduce NPSHr

Bladder type discharge dampener for pressures up to 35.000 kPa, to protect pump and pipeline

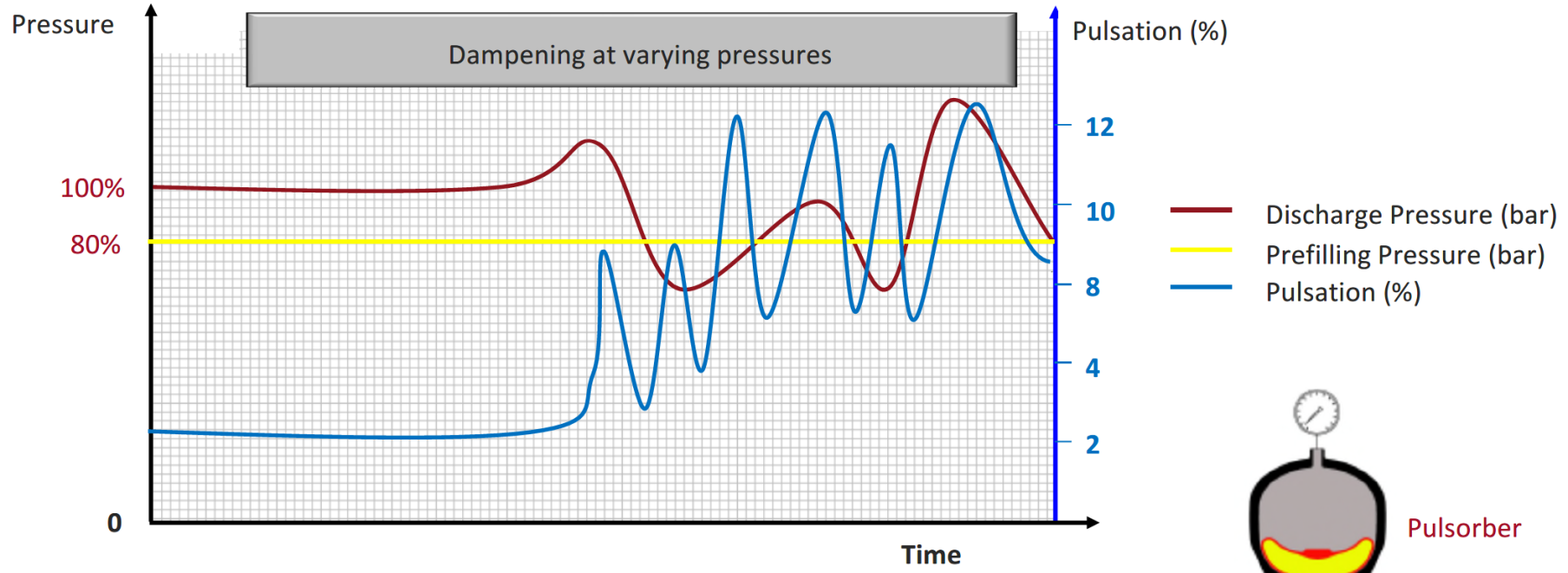
Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Pulsation dampening,** part of pump supply
    - Pulsation dampeners need to reduce pulsations to ≤ 3% (peak to peak)



Piston Diaphragm Pumps for pipeline slurry transfer

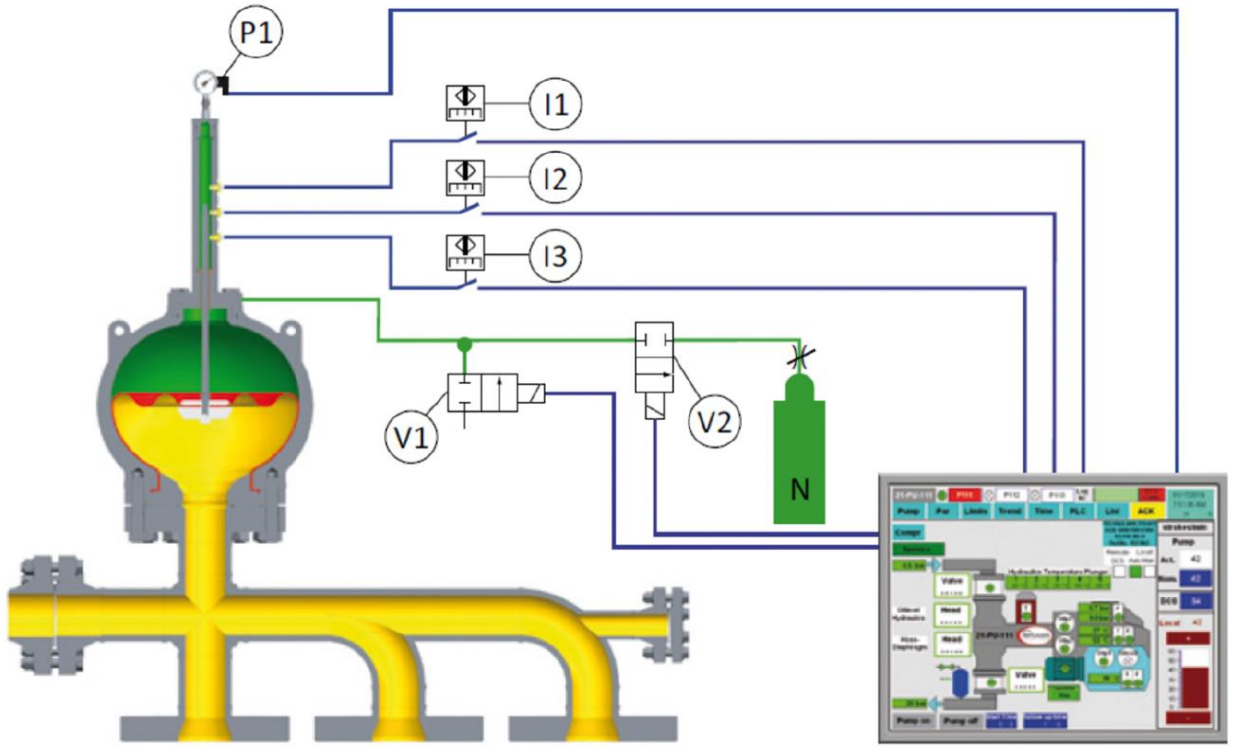
- Pump Particulars
  - **Pulsation dampening,** part of pump supply
    - Pulsation dampeners for pipeline applications (without adjustable nitrogen pressure)



Pulsorber

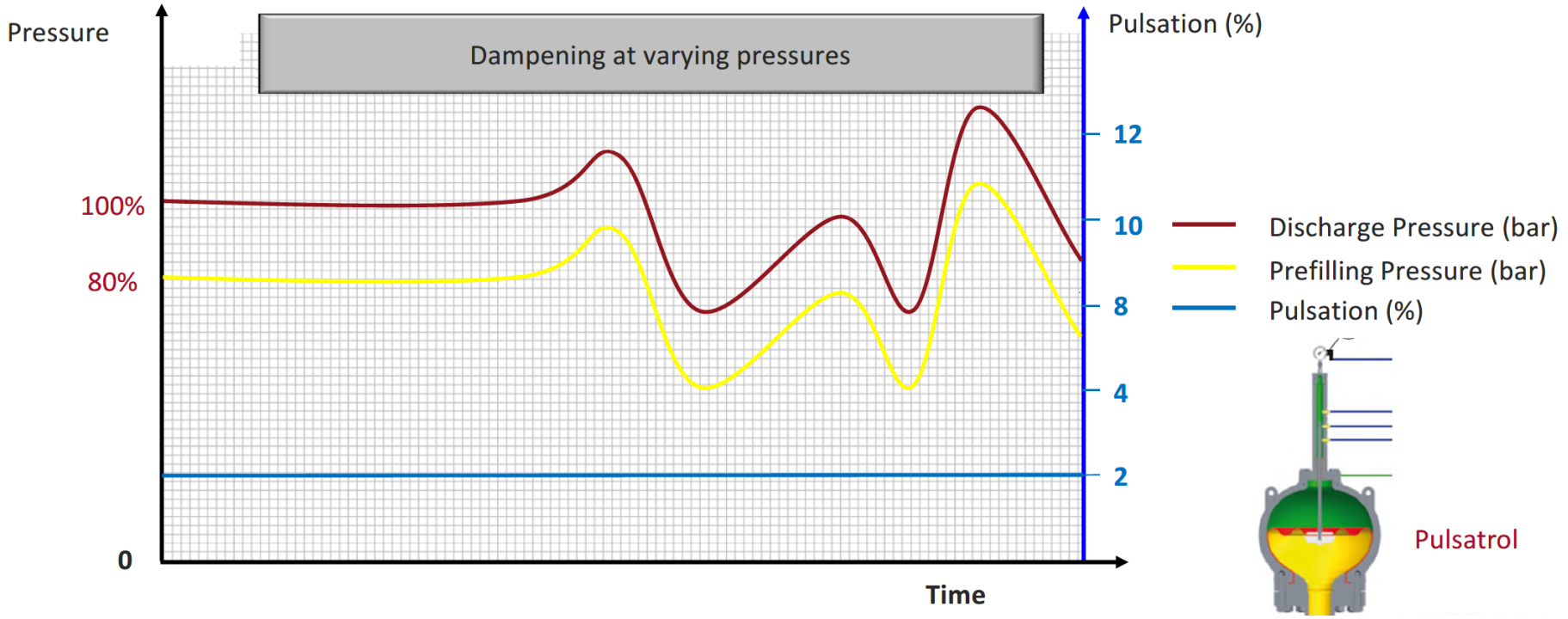
Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Pulsation dampening,** option
    - Pulsation dampeners for pipeline applications (with adjustable nitrogen pressure)



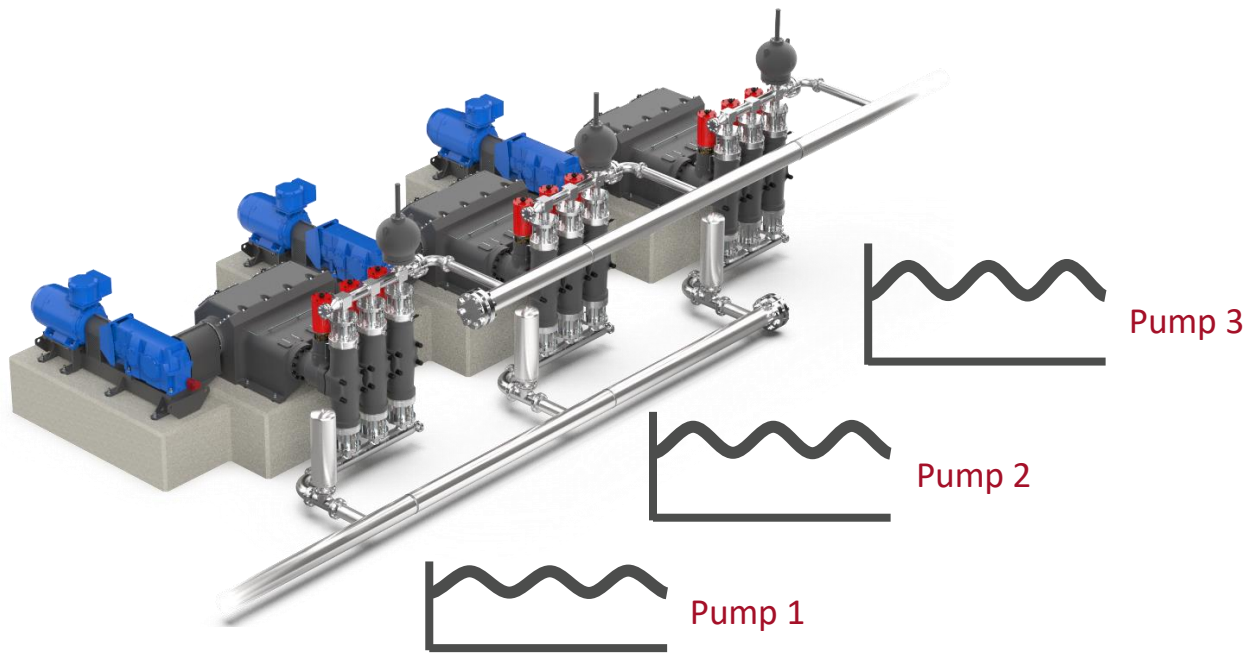
Piston Diaphragm Pumps for pipeline slurry transfer

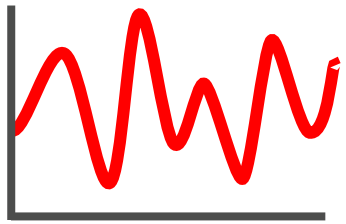
- Pump Particulars
  - **Pulsation dampening,** option
    - Pulsation dampeners for pipeline applications (with adjustable nitrogen pressure)



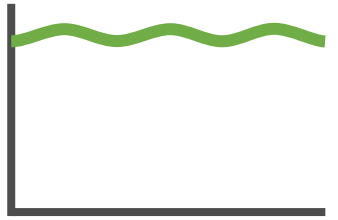
Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Multiple Pump Control/Phase Shift,** option
    - For multiple pumps discharging into one pipeline





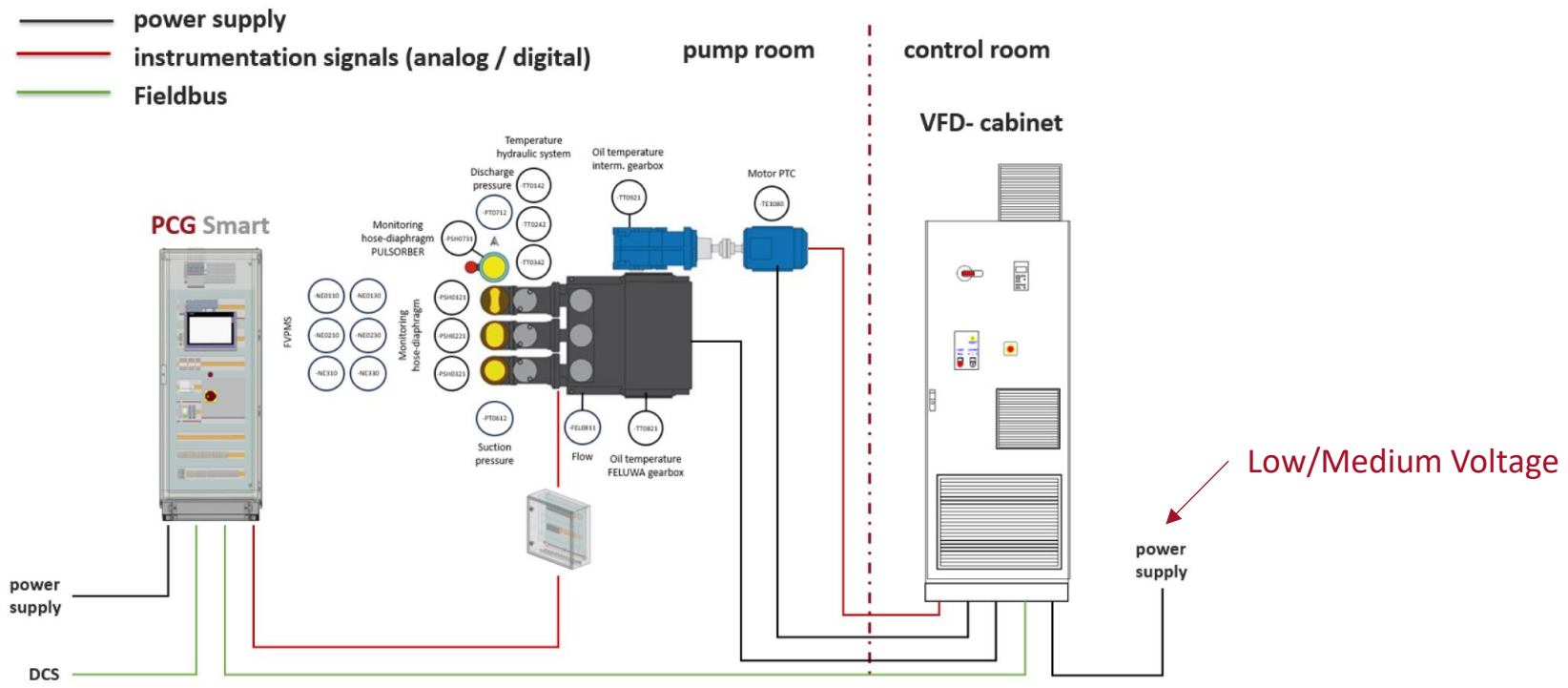
Without phase shift



With phase shift

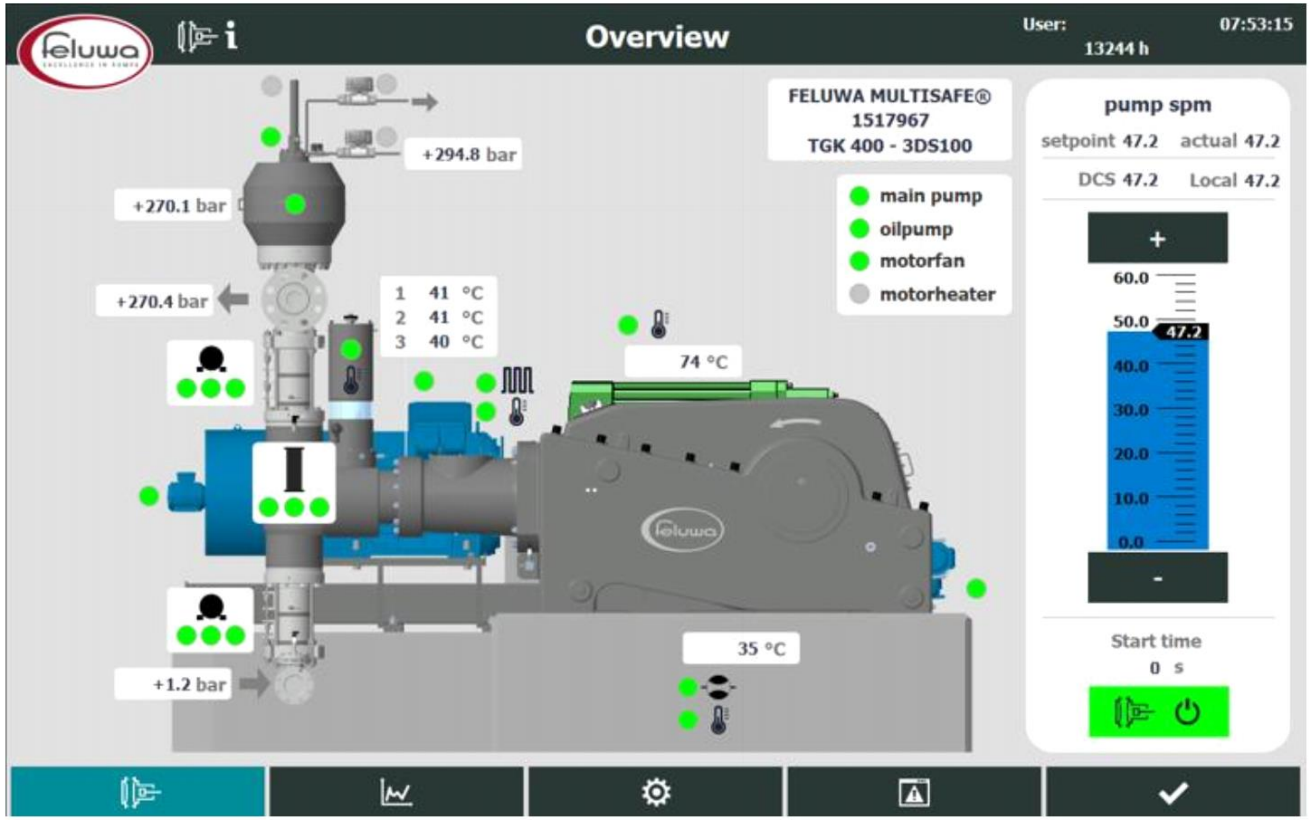
Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Monitoring and Control**
    - Typical layout



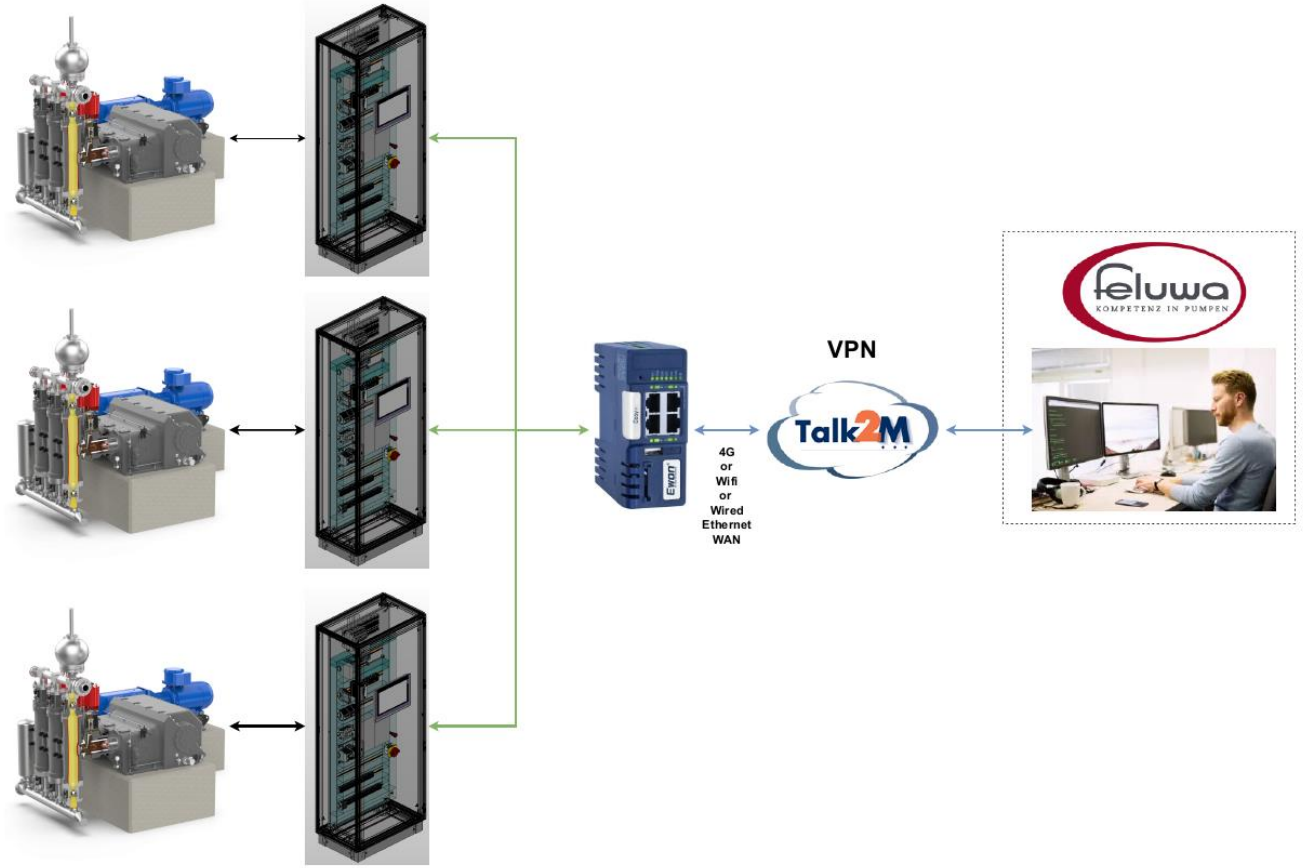
Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Monitoring and Control**
    - Typical HMI control panel
      - In Local Control panel
      - In DCS (via fieldbus)
      - Full control
      - Full monitoring



Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Monitoring and Control**
    - Remote monitoring
    - Remote control

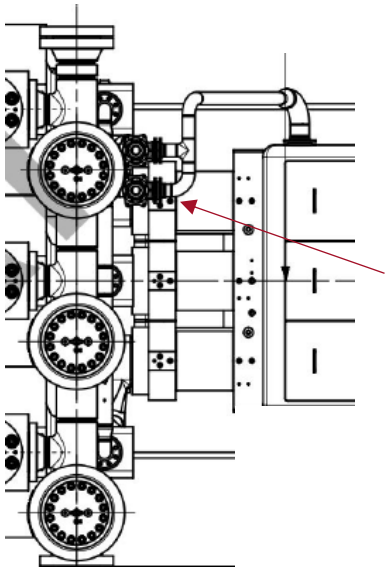


Piston Diaphragm Pumps for pipeline slurry transfer

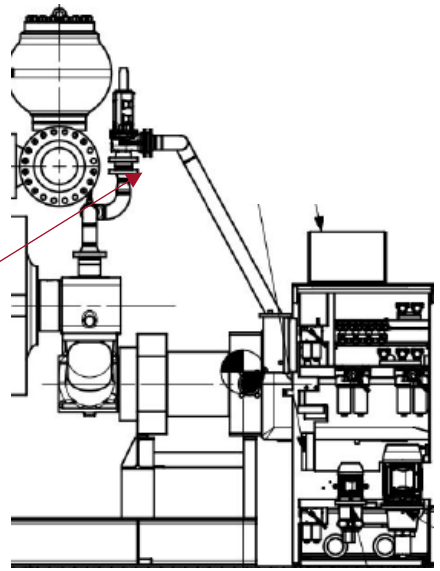
- Pump Particulars
  - **Over pressure relief valves**
    - Pump needs to be protected against pressures exceeding design pressure
      - Pressure relief valves are installed in the propelling liquid area
      - Pressure relief valve, in principle protects the pump, but also the pipeline

Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Over pressure relief valves**
    - Conventional pumps
      - 1 pressure relief valve for all pump cylinders
      - 1 common drain tank (oil reservoir) which feeds also other cylinders
      - Risk of cross contamination from one cylinder to the others

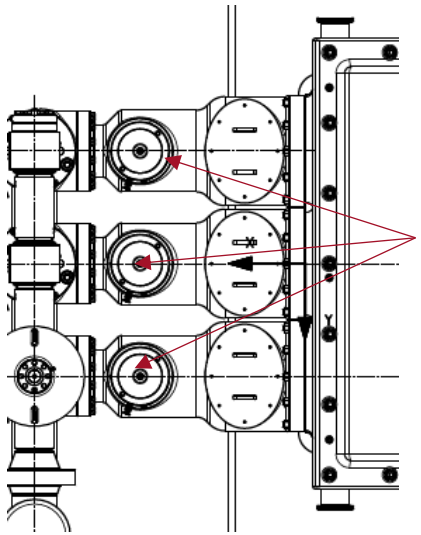


Single pressure relief valve

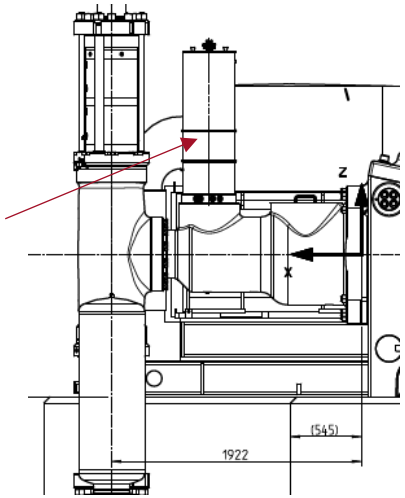


Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Over pressure relief valves**
    - Feluwa pumps
      - 1 pressure relief valve for all each pump cylinder
      - Each cylinder has its own oil reservoir
      - No risk for cross contamination from one cylinder to the others

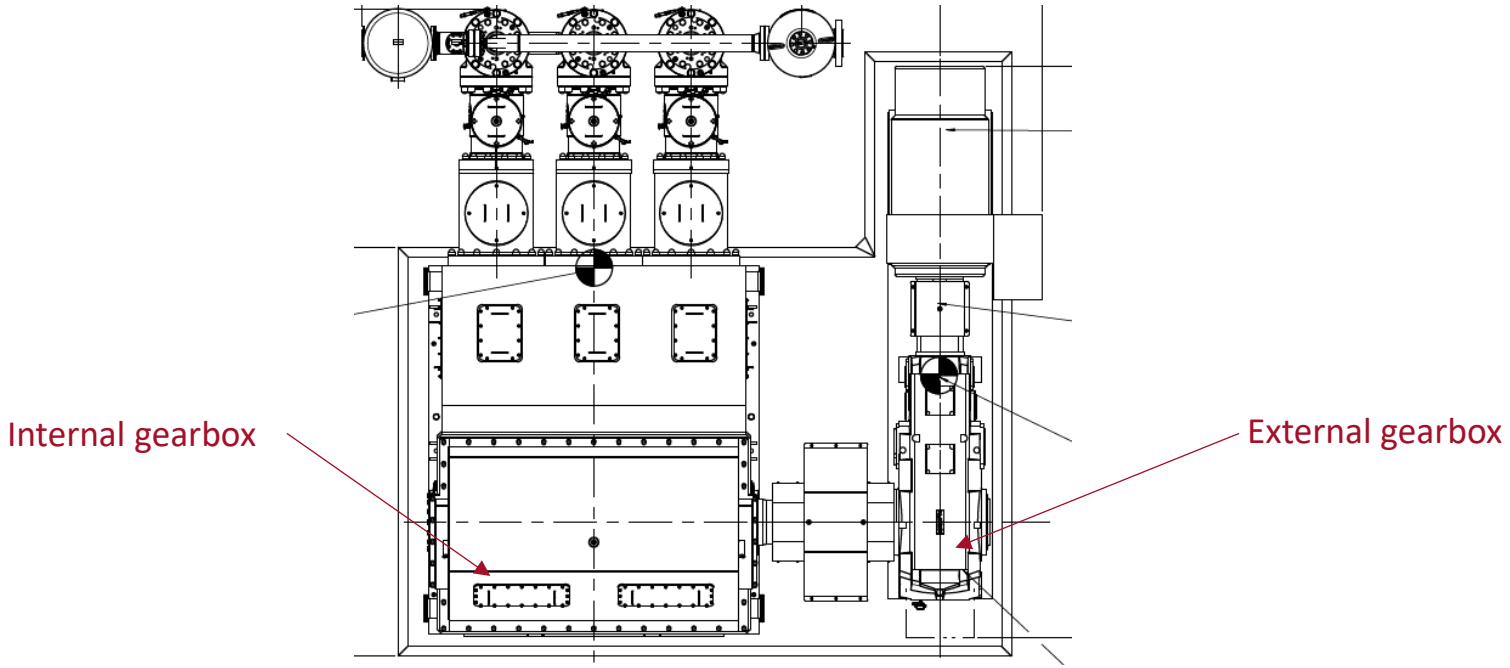


Single pressure relief valve



Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **External gearbox** (always included in scope of supply of pump manufacturer)



Piston Diaphragm Pumps for pipeline slurry transfer

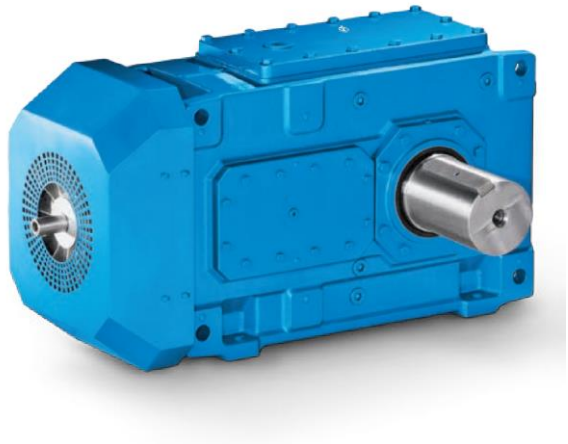
- Pump Particulars
  - **External gearbox** (always included in scope of supply of pump manufacturer)
    - Piston diaphragm pumps are equipped with 2 gearboxes on the power end:
      - Pump (internal) gearbox (assuming a maximum stroke rate of 50 per minute)
        - With internal gear reduction (including pinion shaft): i = 4 to 6
        - Without internal gear reduction (without pinion shaft: i = 1
      - External gear box, between motor and pump (assuming a maximum stroke rate of 50 per minute)
        - In case pump is equipped with gear reduction (depending on motor speed): i = 7 to 5 (1 stage reduction in gear box)
        - In case pump is not equipped with gear reduction (depending on motor speed): i = 30 (2 or 3 stages of reduction in gear box)

Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **External gearbox** (always included in scope of supply of pump manufacturer)
    - Typical suppliers:
      - Hansen, Flender, SEW
    - Depending on pumpstation configuration and available footprint/floor space

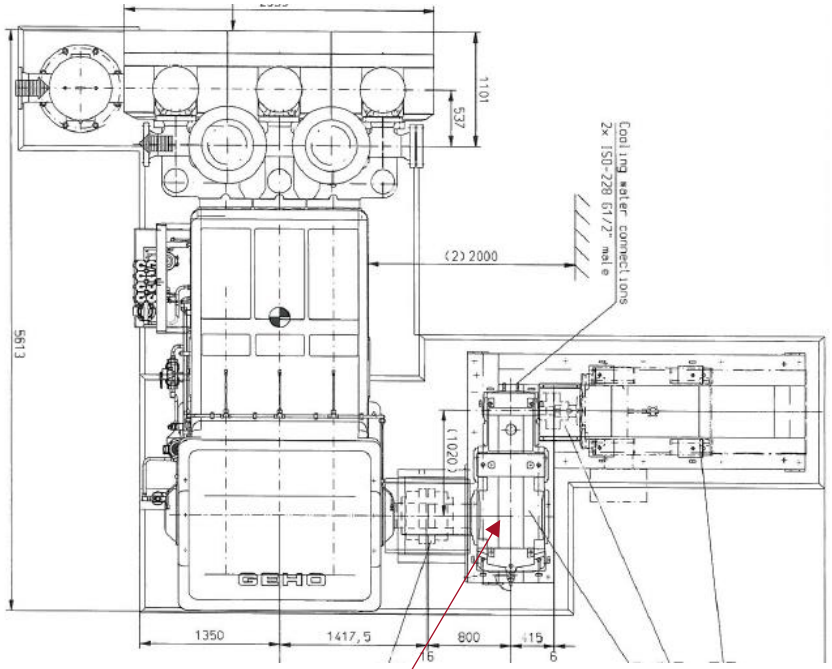
Helical (180 degrees)

Bevel (90 degrees)

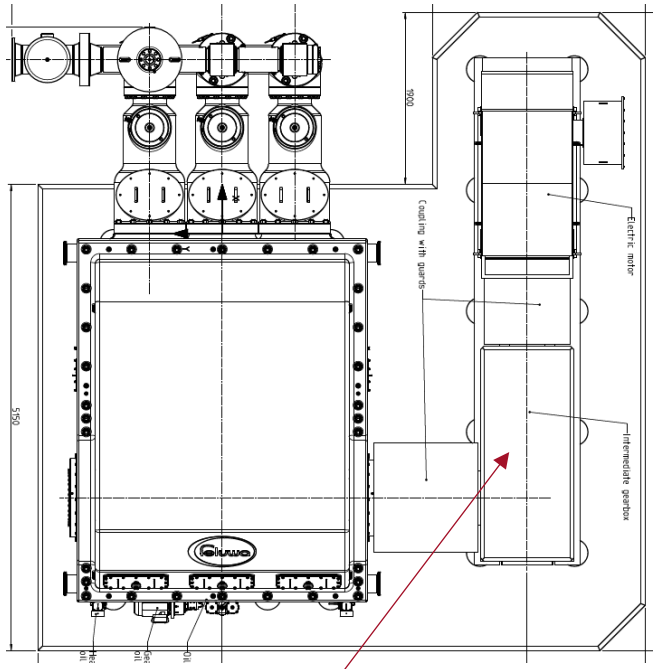


Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **External gearbox** (always included in scope of supply of pump manufacturer)



Helical gearbox



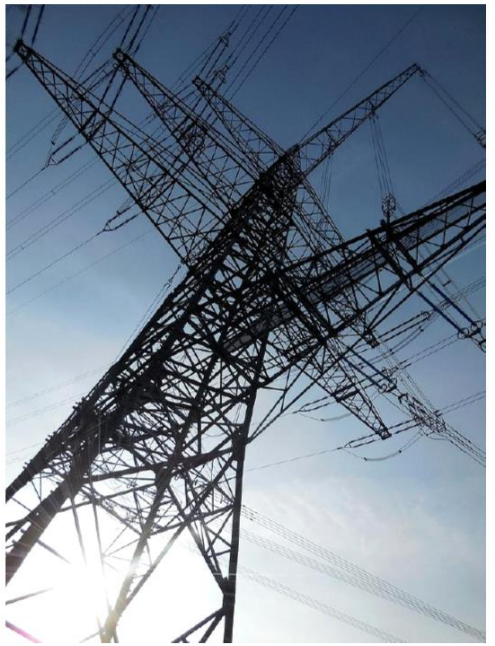
Bevel gearbox

Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Network supply voltage**
    - Typical supply voltages (based on 50 Hz)
      - 0 – 250 kW → 400 V
      - 315 – 1000 kW → 690 V

      } Typical low Voltage
      - 1000 – 3000 kw → 3,3 – 4,16-6,6 kV
      - ≥ 3000 kW → 10 – 11 kV

      } Typical medium Voltage
      - Optimal choice depends on voltage availability, cable length and copper prices
      - The supply voltage to the VFD may differ from the drive voltage of the motor (transformer is required)



Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Low- and Medium Voltage Variable Frequency Drive**
    - Design of frequency drives needs to be tailored to the pump. Due to the constant torque characteristics of PD pumps, a heavy duty VFD is required
    - Supply voltage 400 V to 13,8 kV
    - With integrated transformer
    - Consideration of local or/and customer specifications

Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars

  - **Low- and Medium Voltage motors**
    - IEC or NEMA standard
    - Supply voltage 400 V to 13,8 kV
    - Modifications such as RTD´s, vibration monitoring, heaters, encoders etc. are possible
    - Consideration of local or/and customer specifications
    - National approvals (CSA, UL, CCC, etc.) are possible

Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Utility Consumption**
    - Piston diaphragm pumps require the following utilities:
      - Power (low or medium voltage), to drive main motor, lubrication pump motors, controls
      - Air, to activate pneumatic propelling liquid compensation system (not applicable to Feluwa pumps which operates a purely mechanical propelling liquid compensation system)
      - Water, to flush the pump during prolonged periods of standstill of pump

Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Factory Acceptance Test** (FAT)
    - As standard, during FAT, pump will be string tested, including dedicated motor and VFD (if in scope of supply)
    - In case motor and/or VFD are not included in scope of supply, either:
      - Motor and/or VFD have to be made available by customer
      - Pump will be tested with slave motor and/or VFD (possibly at extra costs)
    - In principle, pump will be tested at specified contractual pressure at the specified contractual capacity
      - Available power for FAT is limited to 800 kW, in case the absorbed power exceeds 800 kW, a separate FAT protocol needs to be agreed upon
    - Test fluid is water

Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Factory Acceptance Test (FAT)**

Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Packing**
    - Packing for ocean transport and storage on site (up to 12 months)

Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Transportation to site**

Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Assembly on site**

Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Site Acceptance Test (SAT)**
    - During SAT, pump is string tested, including dedicated motor and VFD (if in scope of supply)
    - SAT procedure is defined by Acceptance Criteria and can in include:
      - Full capacity and pressure
      - Power consumption
      - Stroke rate
      - Hydraulic efficiency
      - Residual pulsations
      - Etc.
    - Test fluid is/should be slurry

Piston Diaphragm Pumps for pipeline slurry transfer

- Pump Particulars
  - **Charge pumps** (usually not included in scope of supply pumps supplier)
  - **External pressure relief valve** (usually not included in scope of supply of pumps supplier)
  - **Strainer** (usually not included in scope of supply of pumps supplier)

References

Slurry transfer

- TGK500-3DS350

  - Customer : Gaiski Gok, Russia
  - Number of pumps : 3
  - Application : Tailings transfer
  - Capacity : 455 m³/hr
  - Pressure : 8.800 kPa
  - In operation : 2020

Slurry transfer

- QGK500-5DS350

  - Customer : Boleo, Mexico
  - Number of pumps : 4
  - Application : Tailings transfer
  - Capacity : 750 m³/hr (capable of 1000 m³/hr)
  - Pressure : 4.600 kPa (capable of 8.000 kPa)
  - In operation : 2012

  - Largest piston diaphragm pumps in the world (150 ton)

Slurry transfer

- TGK400-3DS100

  - Customer : Kenmare, Mozambique
  - Number of pumps : 3
  - Application : HMC concentrate transfer
  - Capacity : 68 m³/hr
  - Distance : 15 km
  - Pressure : 27.000 kPa
  - In operation : 2019

  - Highest pressure slurry pipeline in the world

Slurry transfer

- DGK500-4DS350

  - Customer : ArcelorMittal, Mexico
  - Number of pumps : 2
  - Application : Iron Ore Tailings transfer
  - Capacity : 760 m³/hr
  - Pressure : 4.000 kPa (capable of 8.000 kPa)
  - In operation : 2025

India references

India references

- ArcelorMittal/Nippon Steel

  - Customer : AMNS, Dabuna, India
  - Number of pumps : 2
  - Application : Iron ore tailings slurry transfer
  - Capacity : 636 m³/hr
  - Pressure : 63.000 kPa
  - In operation : 2025

India references

- UCIL

  - Customer : Uranium Corp. India
  - Number of pumps : 3
  - Application : Autoclave feed
  - Capacity : 100 m³/hr
  - Pressure : 1.400 kPa
  - In operation : 2010

Piston Diaphragm Pumps for pipeline slurry transfer

- Nalco

  - Customer : Nalco
  - Number of pumps : 2
  - Application : Red mud transfer
  - Capacity : 250 m³/hr
  - Pressure : 13.000 kPa
  - In operation : 2025

Piston Diaphragm Pumps for pipeline slurry transfer

- Anrak/Pioneer

  - Customer : Anrak Aluminium
  - Number of pumps : 3
  - Application : Red mud transfer
  - Capacity : 170 m^3/hr
  - Pressure : 2.700 kPa
  - In operation : 2021

India references

- Kudgi

  - Customer : NTPC
  - Number of pumps : 8
  - Application : Fly ash transfer
  - Capacity : 174 m³/hr
  - Pressure : 4.000 kPa
  - In operation : 2016

Piston Diaphragm Pumps for pipeline slurry transfer

- Khurja

  - Customer : NTPC
  - EPCM Contractor : L&T
  - Number of pumps : 6
  - Application : Fly ash transfer
  - Capacity : 73 m^3/hr
  - Pressure : 4.000 kPa
  - In operation : 2021

India references

- Other references

  - More than 90 Feluwa pumps are currently in operation for various applications since 1984

After Sales Service, India

- After Sales Service

  - Millennium Impex Pvt Ltd
  - Feluwa Representative since 10 years
  - Experience with more than 50 Feluwa Pumps
  - Critical spare part storage in New Delhi
  - Trained mechanics in New Delhi
  - Response time within 24 hours

Conclusion

Piston Diaphragm Pumps for pipeline slurry transfer

- Conclusions
  - **Piston diaphragm pumps:**
    - Can be a feasible alternative for multistage centrifugal pumps
    - Should be used for pumping slurries with a Miller number exceeding 60
    - Consist of many modular components
    - Are always custom made in accordance with the customers specifications
    - Can be supplied with several auxiliaries and options
    - Feluwa has more than 90 pumps in operation in India

Piston Diaphragm Pumps for pipeline slurry transfer

- And remember, concerning the pumps:

SLURRY IS SLURRY!

Questions?

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