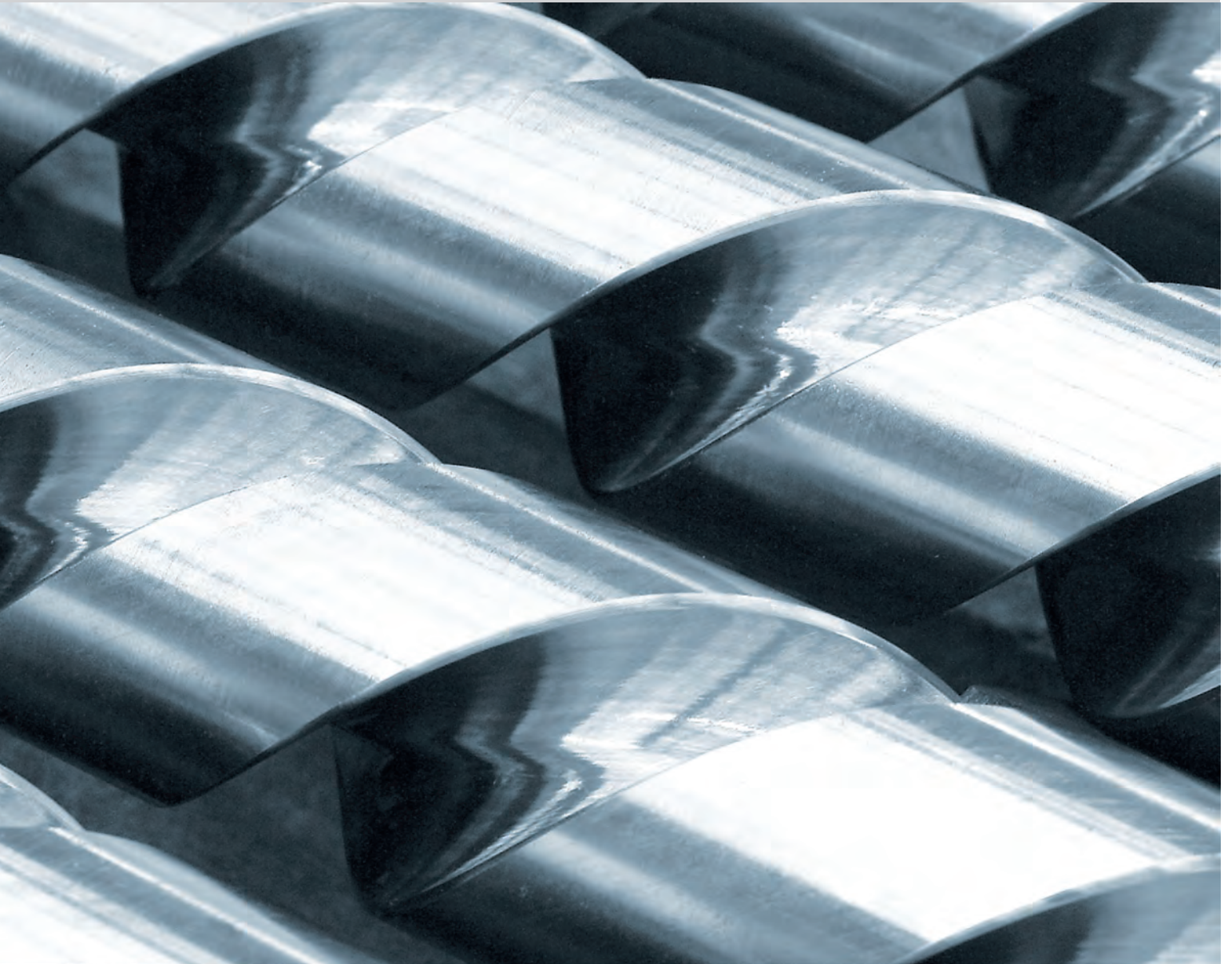


Leistritz

LEISTRITZ PUMPEN GMBH

Leistritz Screw Pumps & Systems



**Multiphase
Pumps
and
Systems**



Leistritz Screw Pumps & Systems

Leistritz Pumpen GmbH

Leistritz Pumpen GmbH, with its headquarters in Nuremberg/Germany, has been producing and selling Screw Pumps since 1924. The first Leistritz Screw Pumps were developed by Paul Leistritz as main lube oil pumps for bearings of turbine generator sets.

With the worldwide widest product range of Screw Pumps, Leistritz offers today complete pump packages, being a perfect partner for the Oil & Gas Industry.

Latest technology in combination with strictly controlled quality is the basis for the globally known Leistritz Screw Pump reliability and efficiency.



Leistritz Screw Pumps and Systems for the Oil & Gas Industry

The Oil & Gas Industry is divided into three major sectors, Exploration, Upstream and Downstream. However, Exploration activities are usually simply included in the Upstream category.

The Upstream sector includes the search for potential onshore or offshore oil and gas reservoirs, drilling of exploration wells and the operation of the wells producing oil, gas and reservoir liquids or mixtures thereof. Today, an increasing number of versatile Leistritz Twin Screw Multiphase Pump Systems are installed Upstream to enhance the oil and gas production.



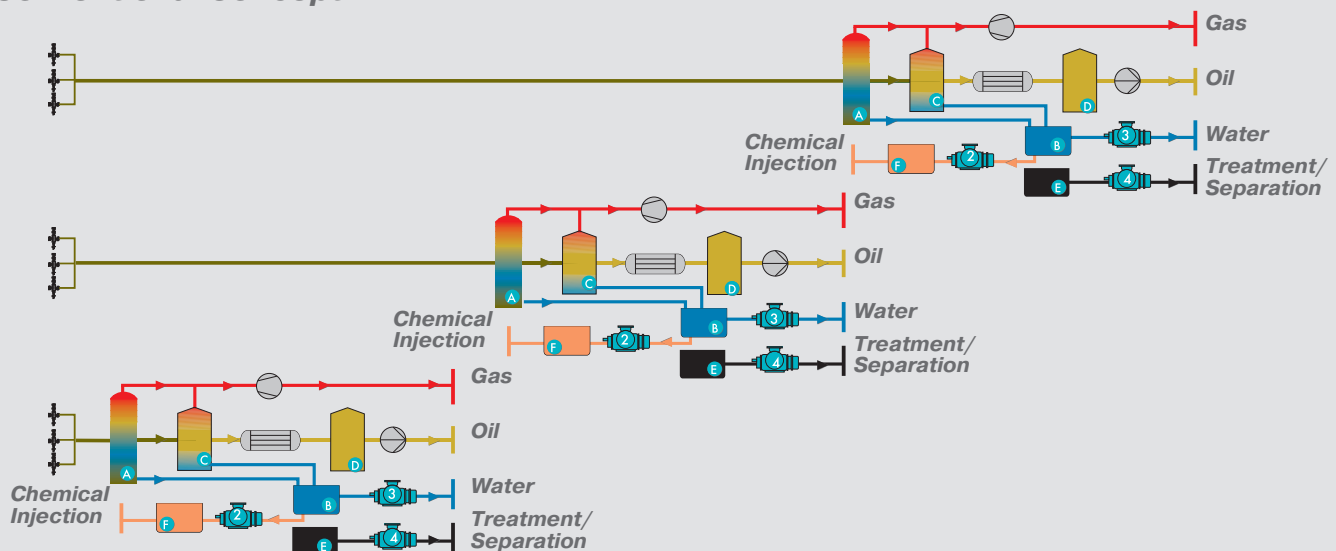
Multiphase Pumps and Systems

Multiphase Pump Systems

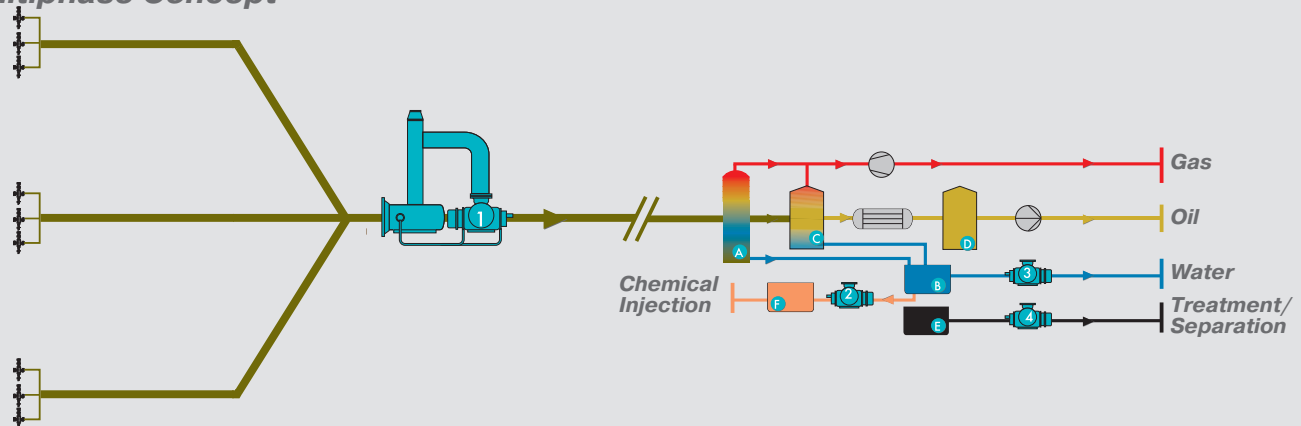
Leistritz Multiphase Pump Systems are globally used for the handling of untreated well flow with gas volume fractions (GVF) between 0 and 100 %, flow rates in excess of 5000 m³/h at differential pressures up to 150 bar.

Compared to conventional upstream installations, Multiphase Production does not require space consuming separation of the well flow, individual rotating equipment such as pumps and compressors and multiple flow lines to transport gas and liquid to the downstream processing facilities.

Conventional Concept



Multiphase Concept



oversimplified illustration

Pumped Liquids

- Multiphase Well Flow
- Oil
- Gas
- Water
- Chemicals
- Slops & Drains

Symbols

- Heater/Treater
- Export Oil Pump
- Gas Compressor

Screw Pumps

- 1 Leistritz Multiphase Pump
- 2 Leistritz Chemicals Handling Pump
- 3 Leistritz Produced Water Pump
- 4 Leistritz Slops & Drains Pump

Storage- and Processing Containers

- A Production Separator
- B Water Treatment
- C Wash Tank
- D Crude Oil Storage
- E Slops & Drains Tank
- F Chemical Storage Tank



Leistritz Multiphase Pumps

Design and Operation

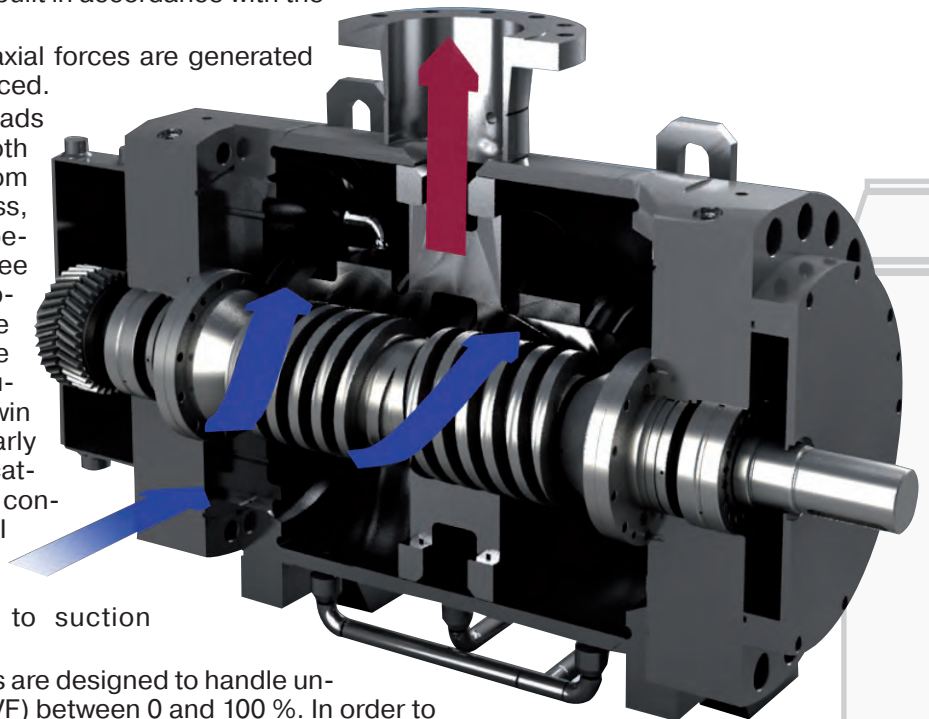
Leistritz Multiphase Pumps are rotary positive displacement pumps based on Twin Screw Pump Technology and built in accordance with the requirements of API 676.

Due to the double volute design no axial forces are generated and the pumps are hydraulically balanced.

Screw packages with opposed threads are installed in a replaceable liner. Both screws, which are manufactured from single piece bar stock for max. stiffness, are not in contact with each other. Special Leistritz Screw Profiles guarantee minimum vibration over the entire operating envelope of the pumps. The drive torque is transmitted from the drive screw to the idler screw via oil lubricated timing gears. This makes Twin Screw Multiphase Pumps particularly suitable for the handling of non-lubricating products with high gas fractions, contaminations and crude oils with low API gravity. The pump shafts are sealed with either single or double acting mechanical seals which are exposed to suction pressure only.

Leistritz Twin Screw Multiphase Pumps are designed to handle untreated well flow with gas fractions (GVF) between 0 and 100 %. In order to maintain a dynamic seal between the screw packages and the pump casing at high GVF rates a small liquid flow must be provided at all times. An external liquid management system for continuous liquid injection guarantees uninterrupted operation with high GVF content and gas slugs and ensures dissipation of the compression heat.

The size of the external liquid management system can be adapted to the actual operating conditions.



Leistritz Multiphase Pumps

The Benefits of Leistritz Twin Screw Multiphase Pumping Technology

- The entire well flow is handled with one machine
- Low inlet pressures allow extended well life and increased production
- High pressure capability to boost the well flow to remote processing facilities
- Reduction of artificial lift requirements due to low permissible inlet pressure
- Decrease of the production time
- Low shear, non-emulsifying pumping
- Gas handling capability (GVF) up to 100 %
- Elimination of flaring
- Low capital investment costs and quick payback due to production increase
- Low operational and maintenance cost
- Ideal for installation on Offshore Platforms due to small footprint and low weight

Leistritz User Advantages

- The pump screws are made from single piece bar stock for minimum shaft deflection, higher pressure capability and higher reliability
- The components of low, medium and high pressure pumps are manufactured to a modular system – thus easy interchangeability of key parts
- The max. permissible shaft deflection is limited to 50 % of the radial clearance between screw tips and liner for max. operational safety
- Herringbone style timing gears for easy screw alignment and quick maintenance
- Interchangeable liner for easy and low cost maintenance
- Special screw profile for minimized vibration
- Low axial flow velocities for gentle product handling with low emulsifying action
- Suitable for dry running when seal flush and bearing lubrication are maintained
- All mechanical seals are exposed to suction pressure only for extended seal life

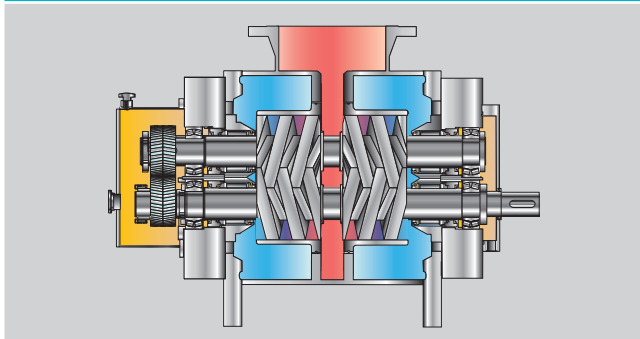


Leistritz Multiphase Pumps on an Oilfield at the Caspian Sea



Leistritz Multiphase Pumps Operating Data

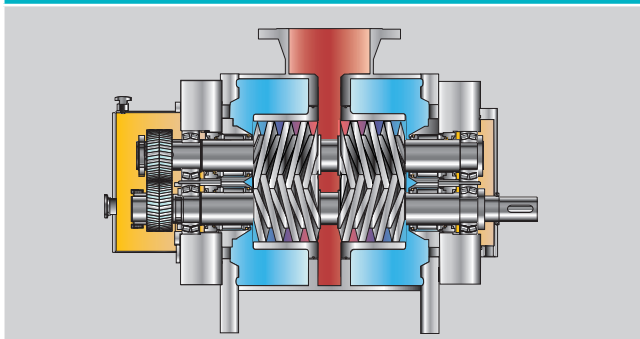
Cross Sectional Drawing L4NG



Performance Data L4NG

Capacity:	Max. 5,000 m ³ /h (755,300 bpd)
Differential Pressure:	Max. 16 bar (222 psi)
Viscosity:	Max. 150,000 cSt
Pumping Temperature:	Max. 350°C (662°F)

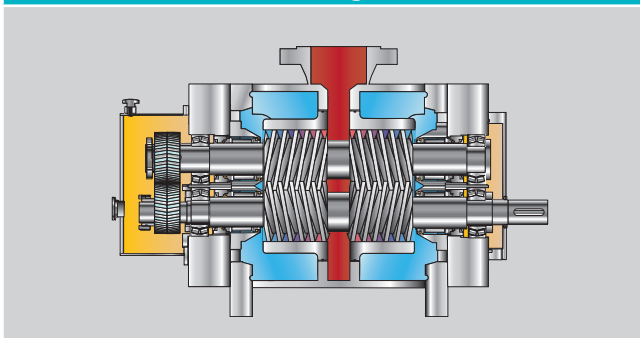
Cross Sectional Drawing L4MG



Performance Data L4MG

Capacity:	Max. 3,900 m ³ /h (589,100 bpd)
Differential Pressure:	Max. 40 bar (580 psi)
Viscosity:	Max. 150,000 cSt
Pumping Temperature:	Max. 350°C (662°F)

Cross Sectional Drawing L4HG



Performance Data L4HG

Capacity:	Max. 2,000 m ³ /h (302,100 bpd)
Differential Pressure:	Max. 150 bar (2,175 psi)
Viscosity:	Max. 100,000 cSt
Pumping Temperature:	Max. 350°C (662°F)

Leistritz Multiphase Pumps Design Materials & System Supply

Design Materials L4NG/MG/HG

Pump Casing:	Carbon Steel (1.0570, 1.0565, 1.0566) or Stainless Steel (1.4410, 1.4435, 1.4467, 1.4571, 1.4301, 1.4313)
Pump Liner:	Cast Carbon Steel (1.0619) or Cast Stainless Steel (1.4408, 1.4462, 1.4517, 1.4470) optional with Wear Resistant Coatings
Pump Screws:	Tool Steel (1.7139, 1.8550) or Stainless Steel (1.4021, 1.4057, 1.4401, 1.4404, 1.4462, 1.4501, 1.4542, 1.4547, 1.4570) surface hardened or with wear resistant coating
Gaskets and O-Rings:	FKM or FFKM
Mechanical Seals:	Single or Double Acting
International Standards:	DIN, EN, ASTM, NACE etc.

Leistritz System Supply

- Leistritz Multiphase Pump
- Single or Double Acting Mechanical Seals
- Customized Liquid Management System
- Skid Type Baseplate
- Electric Motors
- Combustion Engines (Gas or Diesel Engines)
- Flexible All Metal Coupling with Non-Sparking Coupling Guard
- On-Skid Instrumentation
- On-Skid Piping with Manually or Actuator Operated Block Valves, Suction Filter, Check Valve and Pressure Relief Valve
- Lube and Seal Oil Systems
- Variable Speed Drives
- PLC, Low and Medium Voltage Switch Gears, MCC, UPS
- Remote Control Systems
- Basic Application Software
- Transformers
- Container for Installation of the Multiphase Pump Skids and the Control Equipment
- Gas Detection and Fire Fighting Systems



Leistritz Multiphase Pump System for an Offshore Plattform in the Gulf of Mexico



Leistritz Multiphase Pump System on an Offshore Platform in Brazil

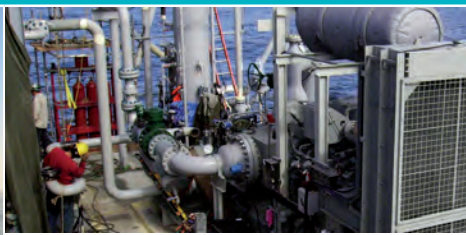


Leistritz Multiphase Pumps Applications



Leistritz Multiphase Pumps Applications

Offshore



Gas Engine driven Leistritz Multiphase Pump on a Wellhead Platform in the Gulf of Mexico

$Q = 879 \text{ m}^3/\text{h} \cdot \Delta p = 17.25 \text{ bar} \cdot \text{GVF} = 97.2 \%$



Leistritz Multiphase Pump Unit for a Wellhead Platform in Abu Dhabi

$Q = 113 \text{ m}^3/\text{h} \cdot \Delta p = 31.03 \text{ bar} \cdot \text{GVF} = 77 \%$

Arctic Environment



Leistritz Multiphase Pump on a Canadian Oil Field

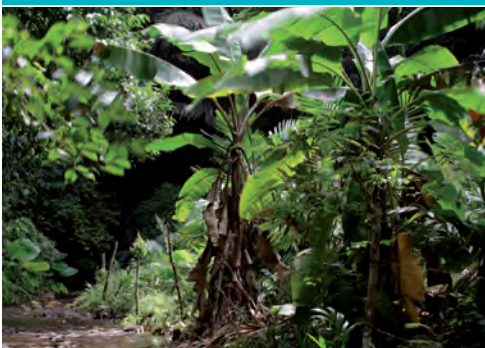
$Q = 100 \text{ m}^3/\text{h} \cdot \Delta p = 6.0 \text{ bar} \cdot \text{GVF} = 94 \%$



Containerized Leistritz Multiphase Pump in a Permafrost Area in Kazakhstan

$Q = 175 \text{ m}^3/\text{h} \cdot \Delta p = 38 \text{ bar} \cdot \text{GVF} = 86.6 \%$

Tropical Environment



Leistritz Multiphase Pump in a Tropical Forest in South America

$Q = 304 \text{ m}^3/\text{h} \cdot \Delta p = 15 \text{ bar} \cdot \text{GVF} = 59 \%$



Leistritz Multiphase Pump Installation on an Oil Field in Central Africa

$Q = 395 - 1000 \text{ m}^3/\text{h} \cdot \Delta p = 7.3 - 56.2 \text{ bar} \cdot \text{GVF} = 56 \%$

Deserts



Leistritz Multiphase Pump on an Oil Field on the Arabian Peninsula

$Q = 410 \text{ m}^3/\text{h} \cdot \Delta p = 36 \text{ bar} \cdot \text{GVF} = 90 \%$



Leistritz Multiphase Pump with Insulation on a Californian Oil Field

$Q = 966 \text{ m}^3/\text{h} \cdot \Delta p = 14.8 \text{ bar} \cdot \text{GVF} = 97 \%$



Leistritz Multiphase Pumps and the Environment

Multiphase Pump Technology and the Environment

Multiphase pump technology is helping to eliminate harmful emissions of carbon dioxide and methane on oil rigs.

Leistritz Twin Screw Multiphase Pumps are self-contained and generally leakage-free. With their ability to handle large gas volumes (GVF) along with the well fluids produced, they considerably contribute to the reduction of Greenhouse gas emissions into the atmosphere. With the replacement of well site separation by Multiphase Pumping Technology, flaring can be widely eliminated and the gas can be used for power generation, fuel for



vehicles, gas lift or feedstock for the chemical industry.

The installation of Multiphase Pumping Systems goes along with a considerable reduction of the equipment, the noise emissions and the power requirements on the well site. The lower visibility Multiphase Pumping Systems compared to conventional production equipment as tanks, separators, heat exchangers and various rotating equipment also contributes to the growing consciousness for our environment.



Offshore Wellhead Platform with Leistritz Multiphase Pump Skid in the Gulf of Mexico

Leistritz - Services

Customer Service

Leistritz Screw Pumps are products of continuous customer oriented optimization and development. Professional Leistritz Customer Service is based on worldwide close and long term partnerships with engineers, operators and endusers. Leistritz performs:

- Delivery and Installation of Genuine Leistritz Spare Parts
- Inspection, Maintenance and Repair
- Service and Maintenance Contracts
- Installation, Commissioning and Retrofits
- Training, Advisory
- Pump Operations under Test Conditions
- Project Supervision
- 24h Service: +49 911/ 43 06 - 690



Leistritz Overhaul Team



Professional Site Inspection

Oil- and Water- Test Fields

Leistritz Test Fields are suitable for individual parameter check and control

- 5 Test Fields
- 4 MW Test Field
- Computer Controlled Recording of Measurement Reading
- Large Volume Tanks allow Long Testing Periods



Leistritz Multiphase Test Field

Quality Assurance

Latest technology in combination with strictly controlled quality is the basis for the worldwide known Leistritz Screw Pump reliability and efficiency. Our Quality Assurance concentrates on compliance with highest quality standards, e.g.:

- Use of latest CMM Technology
- Constant Monitoring of all Manufacturing Processes for Tight Tolerances
- Strict Tolerance Compliances for High Pump Efficiency and Low Life Cycle Costs
- Know-How-Transfer Due to Close Collaboration with Universities and Independent Institutes



Monitoring of all Manufacturing Processes

Certificates

Leistritz Pumpen GmbH is certified according to:

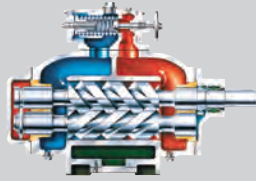
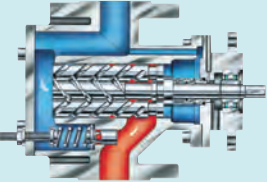
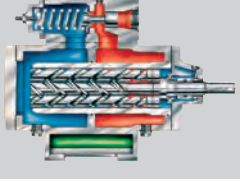
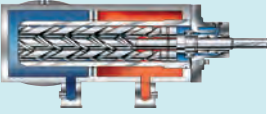
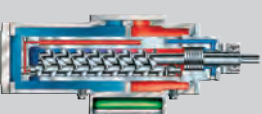
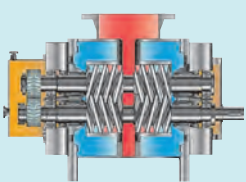
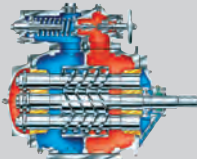
- DIN EN ISO 9001:2000
- DIN EN ISO 14001:2005
- OHSAS 18001
- RS Supervisor
- ROSTECHNADZOR
- GOST-R
- GOST-K



Leistritz Certificates



Leistriz Screw Pump Programm

Series	Use for	Leistriz Screw Pump	Maximal Performance Data			
			Capacity	Differential Pressure	Viscosity	Pumping Temperature
L2	Low pressure duty, suitable for transport of light abrasive and corrosive, high or low viscous fluids with poor or good lubricity.		900 m ³ /h [3,960 gpm]	16 bar [232 psi]	100,000 cSt	280°C [536°F]
L3N	Low pressure duty, suitable for transport of non abrasive lubricating fluids.		700 m ³ /h [3,100 gpm]	16 bar [232 psi]	15,000 cSt	180°C [356°F]
L3M	Medium pressure duty, suitable for transport of non abrasive lubricating fluids.		300 m ³ /h [1,320 gpm]	80 bar [1,160 psi]	10,000 cSt	280°C [536°F]
L3H	High pressure duty, suitable for transport of non abrasive lubricating fluids.		200 m ³ /h [880 gpm]	160 bar [2,320 psi]	10,000 cSt	280°C [536°F]
L3V/U	Ultra high pressure duty suitable for transport of light abrasive and corrosive, high or low viscous fluids with poor or good lubricity.		180 m ³ /h [792 gpm]	280 bar [4,060 psi]	1,000 cSt	280°C [536°F]
L4	Low, medium and high pressure duty, suitable for transport of abrasive/non abrasive, corrosive/non corrosive, lubricating/non lubricating, high or low viscous fluids.		5,000 m ³ /h [22,000 gpm]	150 bar [2,175 psi]	150,000 cSt	350°C [662°F]
L5	Low pressure duty, suitable for transport of light abrasive and corrosive, high or low viscous fluids with poor or good lubricity.		1,700 m ³ /h [7,500 gpm]	10 bar [145 psi]	100,000 cSt	280°C [536°F]

Exceeding operating conditions upon request.

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Your Leistriz Partner

