用于油气行业的多螺杆泵

Multiple screw pumps for the oil and gas industry

雷士公司成立于1905年，总部位于德国纽伦堡，是全球最大的多螺杆泵厂商之一。其产品系列包括单蜗壳和双蜗壳双螺杆泵、三螺杆泵和五螺杆泵

螺杆泵是回转正排量泵，与其他泵设计相比，具有下列优势：

- 能够处理低粘度和高粘度流体。
- 效率高，功率低。
- 油/水混合物低剪切泵送。
- 泵的流率几乎不受背压影响。
- 自充。
- 操作流畅，几乎无波动，噪音等级低。
- 能够处理夹带气体的液体。多相泵所处理的气体体积分数(GVF)可高达100%。
- 通过变速装置可以很容易地控制流量。

在上游应用的各种负载中多采用多螺杆泵。

三螺杆泵

将一组三个螺杆安装在泵壳中。定心螺杆驱动位于两侧的惰轮螺杆。在三个螺杆和泵壳之间形成的空腔中，从泵的抽吸侧输送到排放侧。传动螺杆和惰轮之间的液力液膜可防止螺杆之间接触，确保螺杆运行期间无磨损。内部液力平衡可确保轴承上的低负载。为传动轴配备机械密封。

三螺杆泵凭借其良好的润滑性能输送液体，在差压高达250bar时，流量不超过700m3/h，粘性范围从3到15000mm2/s。

上游应用中的大多数三螺杆泵用于供应内燃机，涡轮机，压缩机和大型齿轮箱的润滑油。泵直接与设备，或者与润滑系统的一部分相连。

雷士三螺杆泵用作管道泵
Leistritz Triple Screw Pump as Pipeline Pump

Established in 1905, Leistritz with headquarters in Nuernberg, Germany, is one of the largest global manufacturer of multiple screw pumps. The product portfolio includes single and double volute twin screw pumps, triple screw pumps and five screw pumps

Screw pumps are rotary positive discplacement pumps that have certain advantages over other pump designs:

- The capability of handling low and high viscous liquids.
- High efficiences, hence, lower power requirements.
- Low shear pumping of oil/water mixtures.
- Pump flow rate almost independent of the back pressure.
- Self priming.
- Smooth and almost pulsation-free operation with low noise level.
- Capable of handling liquids with entrained gas. Multiphase Pumps can handle up to 100 % gas.
- Easy flow control by speed variation.

Multiple screw pump arrangements are used for a large variety of duties in upstream applications.

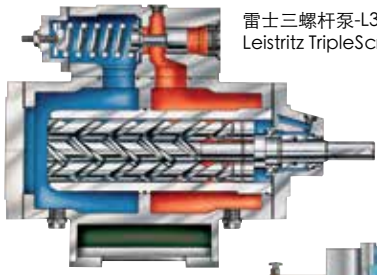
Triple screw pumps

A set of three screws is installed in a pump casing. The centre screw drives the idler screws which are located on either side. The pumped product is carried in cavities formed between the three screws and the casing from the suction to the discharge side of the pump. A hydrodynamic liquid film between the drive screw and the idlers prevents contact between the screws and ensures friction-free operation without wear. Internal hydraulical balancing guarantees low load on the bearing. A mechanical seal is provided for the drive shaft.

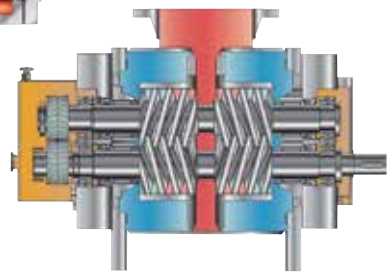
Triple Screw Pumps handle liquids with good lubricating properties and flow rates up to 700m³/h at differential pressures up to 250bar with viscosities from 3 to 15000mm²/s.

The majority of Triple Screw Pumps in upstream applications are used for the lube oil supply of combustion engines, turbines, compressors and large gear units. The pumps are either directly attached to the equipment or part of lube oil systems.

For crude oil with a low API gravity and differential pressures up to 130 bar, Triple Screw Pumps can also be employed as pipeline or booster pumps.



雷士三螺杆泵-L3系列
Leistritz TripleScrew Pump - L3 Series



雷士L4系列双蜗壳双螺杆泵剖面图
Cut-A-Way of a Leistritz L4-Series Double Volute Twin Screw Pump

对于API比重低且差压不超过130bar的原油，还可以将三螺杆泵用作管道或增压泵。

双蜗壳双螺杆泵

雷士L4系列双螺杆泵采用双蜗壳设计。在进入泵截面后，流量被分流，并且在螺杆包内部由相对侧的螺旋管对其加压，该螺旋管安装在可替换泵壳衬套中。泵采用液力平衡，不会在轴承上造成推力负载。润滑油润滑正时齿轮时，扭矩会从传动螺杆传输到惰轮螺杆上。两个螺杆彼此不接触。因此双螺杆泵适用于输送无需润滑的高粘度污染液体(粘度不超过150, 000mm2/s)。

可以在多个泵孔位置来焊接泵壳。从整根棒料上切下螺杆，以确保其刚度最大且主轴偏转最小。标准配置是用机械密封来封住泵轴。每根螺杆在重负载下工作，并采用工作寿命经过优化的轴承。

对于上游应用，双螺杆泵可用作原油管道泵、管道启动泵、采出水泵或者用来收集及传输陆上、海上平台或FPSO的负载。可处理差压高达150bar时不超过5, 000m3/h的流率。

多相泵

在过去二十年间，石油储量的下降以及油价的攀升加速了相泵技术的应用。它们能够从低井压的老气田中有效地采收油和气，提高了含水率和高综合生产气油比(GOR)。诸如分离器、压缩机、液泵、加热器或单个输油管等常规设备被经济的多相泵装置所取代，该装置只需要一根管道便可以提升流向中心处理设施的井口流量。不用燃烧天然气，有助于提升环保意识。多相泵的占地面积小并且重量轻，特别适用于海上平台作业。

多相泵可以输送原油、水和气体混合物，且气体分馏可达100%。它们基于L4系列的双蜗壳双螺杆泵技术，两者具有相似的流量和压力性能。多相泵所处理的气体体积分数(GVF)可高达100%。配备液体管理系统，以克服较长的气体塞流。系统位于泵排放口上游以及滑动限位挡块范围内。气体压缩期间，不断的液体喷射可以在螺杆和衬里之间形成内部液封。

多相泵系统可采用多种结构材料制作。在酸气应用环境中，所有湿式空气泵组件可选用符合NACE要求的材料。

除了泵和电动机之外，还在滑动限位挡块上配备了润滑和/或油密封系统、带阀门和过滤器的管道以及多种仪表设备。在没有电力供应的地点如井口平台处，还可以提供发动机驱动泵。

本文由德国雷士螺杆泵公司的Hans – Juergen Schoener撰写

Double volute twin screw pumps

Leistritz L4-Series twin-screw pumps are of double volute design. The flow splits after entering the pump section and is pressurised within the screw packages with opposed helix, which are installed in a replaceable casing insert. The pumps are hydraulical balanced with no thrust loads on the bearings. The torque from the drive screw is transmitted to the idler screw by oil lubricated timing gears. Both screws are not in contact with each other. This makes twin-screw pumps suitable for handling non-lubricating, contaminated and high viscous liquids (up to 150,000mm²/s).

The pump casings are welded with options for various port positions. The screws are cut from single piece bar stock for maximum stiffness and minimum shaft deflection. The pump shafts are sealed by mechanical seals as a standard. Each screw is carried in heavy duty and lifetime optimised bearings.

For upstream applications, twin screw pumps are used as pipeline pumps for crude oil, pipeline start-up pumps, produced water pumps or for gathering and transfer duties onshore, offshore platforms or FPSO's. Flow rates up to 5,000m³/h at differential pressures up to 150bar can be handled.

Multiphase pumps

The decreasing oil reserves and the increasing oil price accelerated the acceptance of multiphase pump technology during the past two decades. They offer the possibility to recover efficiently oil and gas from matured fields with low well pressure, increasing water cut and high GOR's. Conventional equipment like separators, compressors, liquid pumps, heaters or individual flow lines are replaced by economical multiphase pump units which also boosts the well flow to a central treatment facility through only one pipeline. The vast elimination of flaring contributes to the growing environmental consciousness. Their small footprint and the low weight compared makes multiphase pumps particularly suitable for the installation on offshore platforms.

Multiphase pumps are pumps which have been designed to handle oil, water and gas mixtures with gas fractions as high as 100 per cent. They are based on the double volute twin-screw pump technology of the L4 –Series with similar flow and pressure capabilities. The gas volume fraction (GVF) handled by multiphase pumps can be as high as 100 per cent. A liquid management system is provided to overcome longer gas slugs. The system is located upstream of the pump discharge and within the skid limits. Constant liquid injection provides an internal liquid seal between screws and liner during the compression of the gas.

The multiphase pump systems are offered in a wide range of constructions materials. For sour gas applications, NACE compliant materials are selected for all wetted pump components.

Beside the pump and electric motor, lube and/or seal oil systems, piping with valves and strainers and extensive instrumentation is provided on the skids. Engine driven pumps can be offered for locations with no electric power supply such as wellhead platforms. ■

This article was written by Hans-Juergen Schoener, Leistritz Pumpen