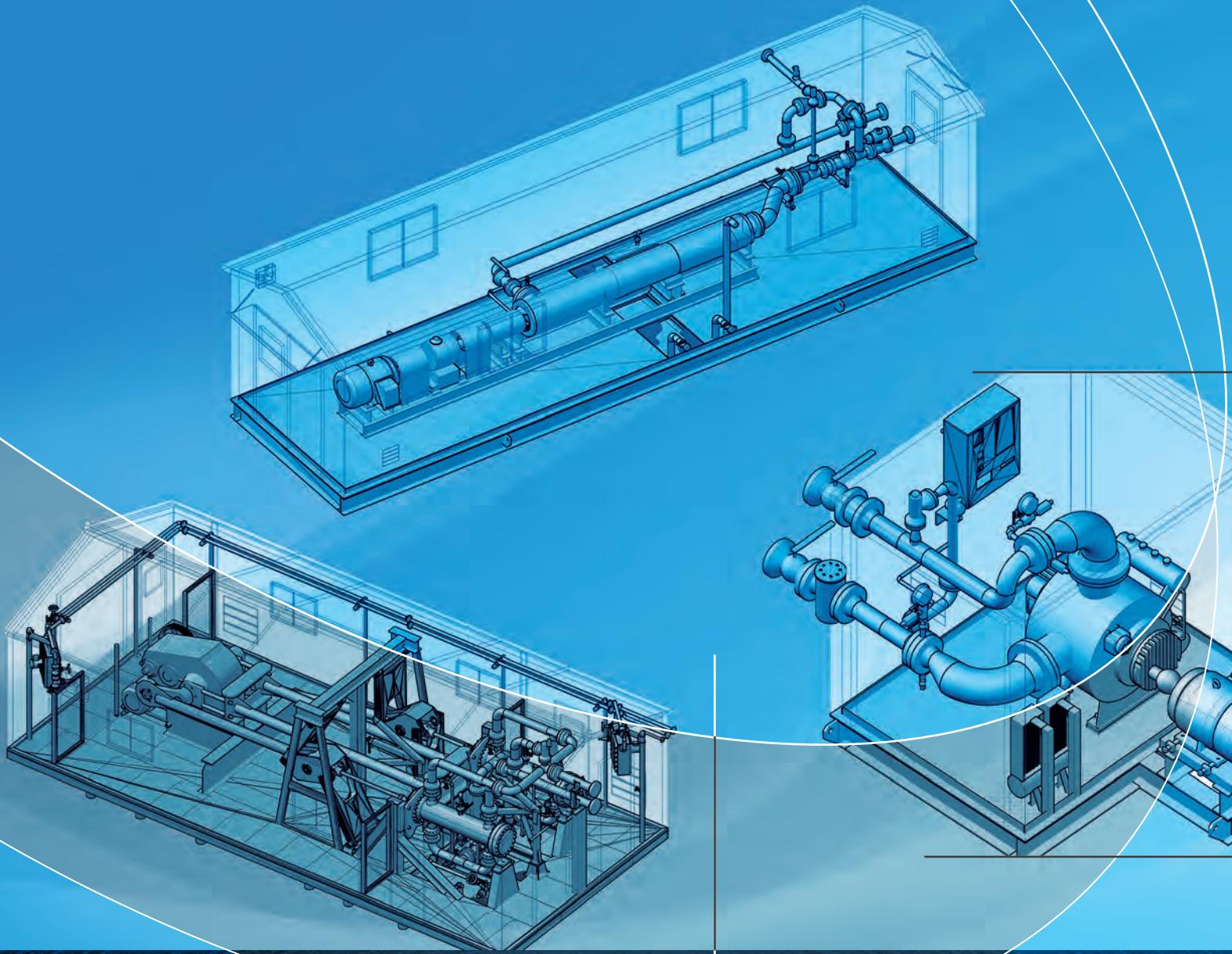


ROTATING RIGHT

MULTIPHASE SOLUTIONS



Rotating Right has decades of experience designing, manufacturing and applying complete multiphase solutions. We offer the broadest range of multiphase products on the market, allowing us to provide the best fit for purpose solutions.

MULTIPHASE PUMPING SOLUTIONS

WHAT IS MULTIPHASE PUMPING

Multiphase pumping refers to the transfer of liquids, gas and solids from wellsite or satellite to a battery or processing facility without the need for separation. Multiphase pumping has proven to be an effective alternative to separation equipment resulting in lower capital and operating costs. Installation of multiphase pumps can help not only reduce cost but can also be used to increase production and extend the life of fields. This technology has been proven successful in conventional oil fields as well as in heavy oil applications.

WHY MULTIPHASE PUMPING

- Reducing pressure on formation allows increased draw down and increases production
- Well with Productivity Index PI of 1 producing into flowline pressure of 300 psi with installation of Multiphase Pump reducing wellhead pressure to 50 psi there will be an increase of 250 bbls/day in production from well
- Reduced cost of separation equipment and pipelines
- Eliminate gas flaring

MULTIPHASE TRANSFER PUMPS

Rotating Right's multiphase transfer pump (MTP) is a duplex, double-acting piston pump that is capable of handling up to 250,000 BOEPD of water, oil and gas mixtures. Our pump can handle up to 99.5% Gas Volume Fraction (GVF) continuously, and up to 100% gas on an intermittent basis. This pump can be designed up to 700 PSI differential pressure and up to 1,440 PSIG working pressure. With our design, the pump operates at a very low speed (less than 15 RPM) and can handle solids, high temperatures and high amounts of H₂S. Our housing, pistons and liners can be made from a variety of materials to suit your pumping application. Our shaft sealing is a very simple design that is used on thousands of critical wells throughout the world.





Rotating Right's employees have over 25 years of experience in the design, manufacturing and installation of multiphase piston pumps and systems. We have the applications and drafting experience and capability to build complete turnkey housed and piped, multiphase pump packages.

Multiphase Transfer Pump History:

1987 – Original concept developed

1988 – Prototype tested in Steelman, Saskatchewan

1989 – MTP built for Rainbow Lake

1991 – Patent granted for MTP pump design

2005 – Duplex pump design developed

2008 – Rotating Right obtains licence from IOR

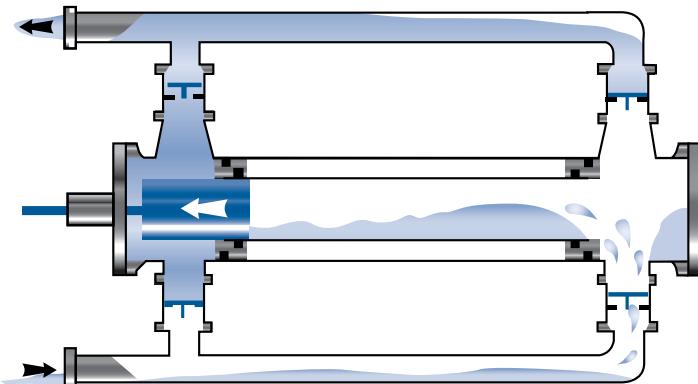
2008 – First Duplex MTP built and tested

MTP WORKING PRINCIPLE

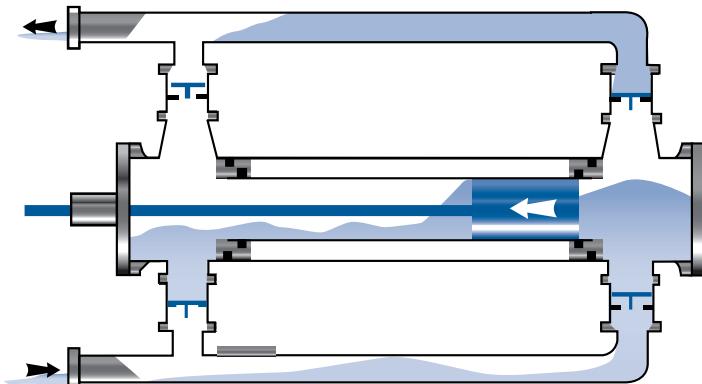
The Rotating Right MultiPhase Transfer Pump (MTP) is designed for high gas volume fraction (GVF) wells, by trapping liquid in the pump at the end of the stroke (see Figure 1) to reduce the gas expansion and maintain a seal between the piston and liner. During the stroke, the fluid enters the pump through a suction valve (see Figure 2) in one pumping chamber and is discharged through the discharge valve in the opposite pumping chamber. Gas is discharged from the pump prior to the liquid.

At the end of the stroke (see figure 1) the gas has been displaced from the pump leaving liquid in the pump chamber. With very little gas remaining in the pump, high volumetric efficiencies can be maintained, even at high GVF.

The Rotating Right MultiPhase Transfer Pump (MTP) is especially suited for high temperatures and high gas fraction applications.



End of stroke

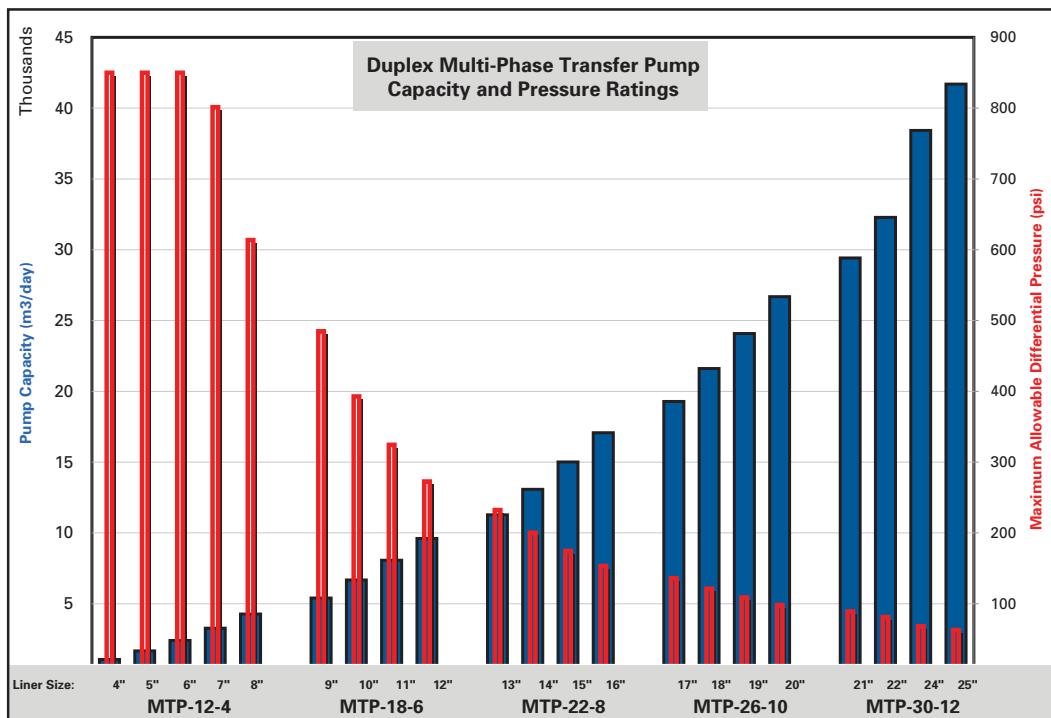


Middle of stroke

USER ADVANTAGES

- Simplex and duplex pump designs
- Variety of materials of construction
- 99.5% GVF continuous up to 100%
- Sizes to 250,000 BOEPD
- Differential pressures to 700 PSIG
- Slow speeds
- Up to 1,440 PSIG working pressure
- High temperature capability

OPERATING RANGE



MULTIPHASE PROGRESSIVE CAVITY PUMP

Our knowledge of multiphase pumping supports our ability to recommend the equipment best suited for the application. Progressive cavity pumps offer versatility and can be used in almost all branches of industry. Their pumping capabilities range from pumping low-viscous to high-viscous media with or without solids with differential pressures up to 350 psig with a flow rate below 150,000 BOEPD per pump. They can also be supplied with various rotor/stator geometries. With proper application, the progressive cavity pump allows for smoother operation, improved efficiency and increased service life making them the most cost effective form of multiphase pumping available.



The seepex Multiphase pumps can be run continuously in applications up to 99% GVF. Seepex is one of the world's leading progressive cavity pump manufacturers and has many years of experience in the design and manufacturing of progressive cavity pumps with the capabilities and expertise to design a system for your specific application.

PUMP DESIGN



PERFORMANCE

- Sizes to 150,000 BOEPD
- Differential pressures up to 350 PSIG
- Even wall stator technology
- 95% GVF continuous and up to 99%
- Dry run protection available
- Slow speeds
- High solids capability



Even wall stator

The pump rotor/stator have been modified specifically for multiphase pumping applications. The use of advanced materials and an adjustment to the interference between the rotor and stator have been incorporated in the pump design for these applications. These modifications are intended to lower the heat build-up in the stator. Standard single mechanical seal and non-pressure sealed protecting system. Other sealing options available.

The progressive cavity multiphase pump is specially suited for applications that require flow rates below 150,000 BOEPD and can handle differential pressures up to 350 PSIG. With suitable mechanical seals it can be operate at higher suction pressures.

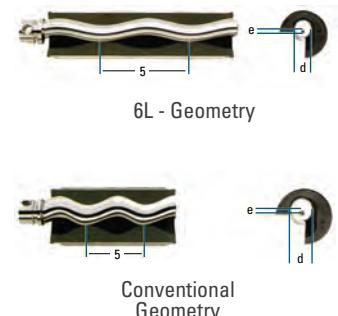
USER ADVANTAGES

Rotor - Stator - Geometries

seepex 6L - conventional geometry comparison

Smaller rotor diameter + reduced eccentricity + increased pitch length = 6L-Geometry with 20 % lower sliding velocity.

- Improved service life (+35-50%) due to lower sliding velocity and longer sealing line
- Better pressure stability due to wider sealing line
- Reduced thrust loads on universal joints and bearings due to smaller rotor diameter and lower eccentricity
- Thrust loads of the conventional design exceed the thrust loads of the 6L-Geometry by approx. 50 %
- Smooth and almost pulsation-free operation
- The "stretched cavities" have a positive influence on vibrations, turbulences, pulsation and shear rates



seepex Universal Joint Design

Benefits

- Only 4 hardened and wear resistant universal joint components (1 coupling rod bush, 2 guide bushes, 1 coupling rod pin)
- Positively sealed, gas and liquid tight elastomer universal joint sleeve
- Optional stainless steel universal joint sleeve protector with unconditioned - 10.000 h/24 months guarantee on the protected universal joint
- Simple and cost-effective to maintain
- Streamlined design, thus improved NPSH conditions
- Simple and cost-effective to maintain



seepex has The Optimum Rotor Surface

Benefits of the high quality seepex rotor surface

- Reduced starting and operating torque
- Improved efficiencies
- Smoother operations
- Increased service life
- The hardness of the coating is 1250 Vickers versus 180 of the base material
- The adhesion to the base material is excellent with no surface fissures

Conventional hard chrome plating

No diffusion zone between the base metal and the galvanically applied chrome plating (Hardness up to 600 Vickers)

seepex Duktil high density chrome plating

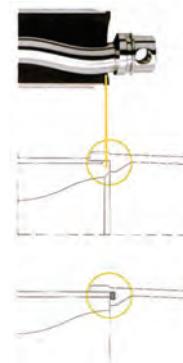
The duktil coating diffuses deep into the base material (Hardness up to 1250 Vickers)

seepex Molded to size stators

seepex molded to size stators are shrink compensated and have cast-on sealing surfaces.

High manufacturing standards guarantee low torque requirements and high efficiencies.

A wide variety of elastomers is available.



Cut-to-size stators with separate gaskets or joints - unthinkable for seepex

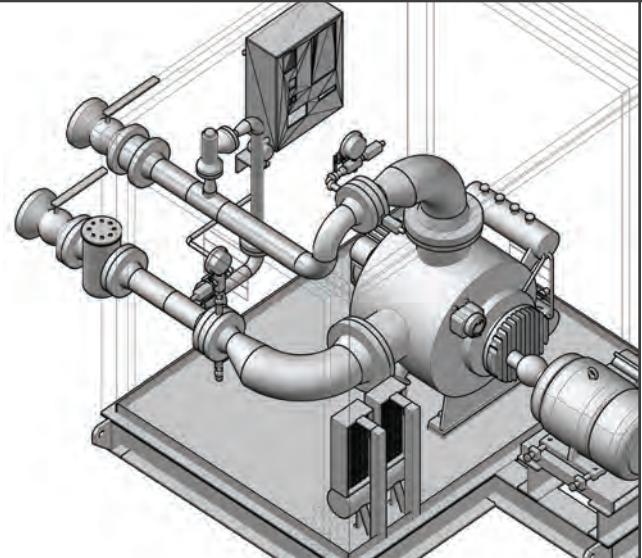
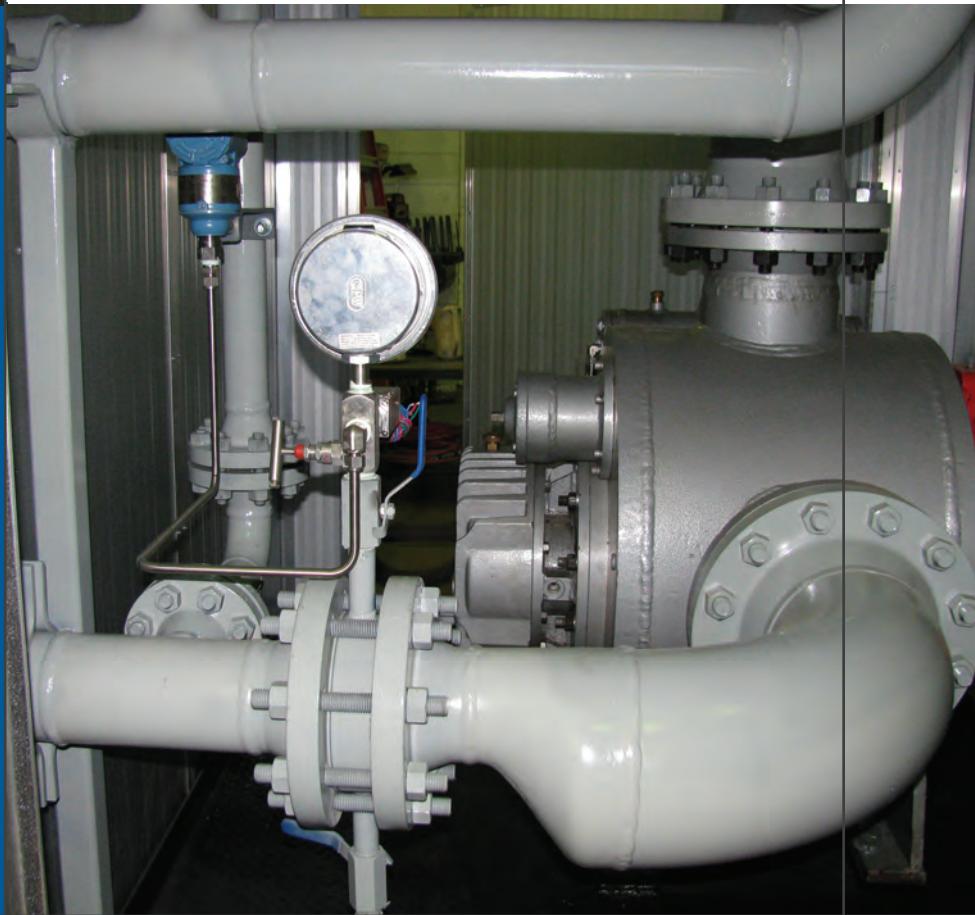
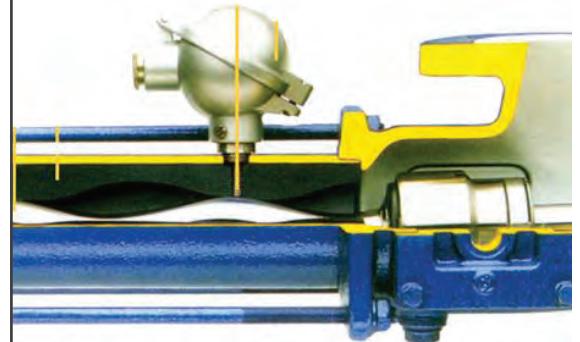
seepex Optional TSE Dry Run Protection

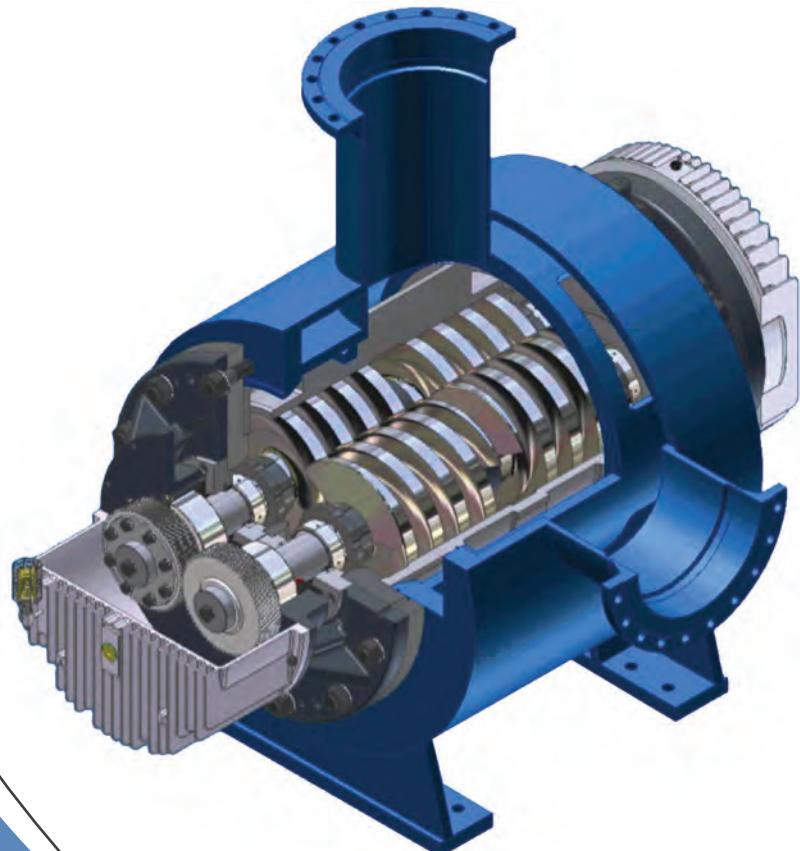
Benefits

- Universal solution for all applications protects pump and stator against damages caused by frictional heat due to lack of liquid pumped
- Highly efficient low cost dry running protection system

MULTIPHASE TWIN SCREW PUMP

Twin screw pumps are excellent for loading and unloading because of their ability to pump highly viscous fluids and their effectiveness when utilized in heavy crude oil and crude oil/ water emulsion applications. Unlike reciprocating pumps, they have extremely low pulsation and do not require pulsation dampeners or complicated pipeline support systems. They are a great fit for flow and pressure applications that fall between centrifugal and reciprocating pump capabilities.





- **Rotating Right MP8 Series of twin screw pumps (TSP) is designed specifically for multiphase applications and covers flows of over 160,000 BPD and pressures up to 720 psi.**
- **Comes standard with single acting mechanical seals with non-pressurized buffer fluid system and wear resistant silicon carbide seal faces.**
- **Integrated relief valve**
- **Oil lubricated external bearings and timing gears provide maximum life**
- **System designed specifically for your application**
- **PLC control and full SCADA capability available**