Enhanced Oil Recovery

Oil Well Service Equipment
Enhanced Oil Recovery

ACD’s high pressure nitrogen pumps are used in Enhanced Oil Recovery (EOR) operations to restore formation pressure and also to improve oil displacement or fluid flow in the oil reservoir. One of the major types of enhanced oil recovery operations is miscible displacement thru the injection of nitrogen into the well.

ACD’s pumping units are capable of delivering high-purity nitrogen gas for use in oil or gas wells at extremely high pressures and flows. A typical nitrogen converter includes one of five different ACD high pressure cryogenic reciprocating pumps.

Features & Benefits
- 4” stroke cold end allows for higher flows at lower speeds
- Lower operating speeds extend product life
- Shaft design integrates eccentrics to eliminate parts and reduce maintenance costs
- Drive end design allows connecting rods to be disassembled without teardown of complete assembly

Nitrogen Lift - Coiled Tubing Operations

Nitrogen lifting is a common technique used to initiate production on a well following workover or overbalanced completion. ACD’s GUPD pumps inject nitrogen into the fluid column to displace liquids and reduce the hydrostatic pressure created by the fluid column. A coiled tubing string is generally used to apply the treatment, which involves running to depth while pumping high-pressure nitrogen gas. Once the kill-fluid column is unloaded and the well is capable of natural flow, the coiled tubing string is removed and the well is prepared for production.

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Oil Well Service Equipment

Pump Performance Map

SG Cold End

3-GUPD Cryogenic Reciprocating Pump

1.25”Ø, 1.625”Ø, and 2”Ø Bore Cold Ends

0.5 HD4

HD4

Features & Benefits
- Main shaft is pressure lubricated minimizing wear and tear on bearings/crosshead piston while keeping all components cool
- Compatible with SG cold ends expanding capabilities. All cold ends have minimal material for quick cool-down and minimal wear and tear at start-up
- Digital Tachometer Port

Digital Tachometer Connection
3/4” Square x 31/8” Long Key

Vent & Brady Pocket: 1/2”

Mounting Flange

Oil Inlet
1/2” Flared Tube per SAE-AS4395

Oil Return
2” NPT(F)

Vent to Tank: 1/2” Flared Tube per SAE-AS4395

Suction Inlet
1” Flared Tube per SAE-AS4395

High Pressure Discharge
1” Flared Tube per SAE-AS4395

Picture

Pump Performance Map

Discharge Pressure [psig]

Discharge Pressure [bar]

Fluid Flow [gpm]

Fluid Flow [lpm]
**Features & Benefits**

- Improved drive end design allows for longer life and cooler temperatures during operation.

- Multiple configurations enable adaptability and conformity to mobile and/or stationary applications using a standard base model.

- Better than 30 to 1 turndown ratios allow for a wide range of operating parameters, including low enough flows to meet coil tubing applications.

- Non Key Polygon Design (3-SLS) reduces drive and failure risk due to shaft key.

**5-SLS High Temperature Nitrogen**

Delicate operations such as furnace bake-outs, catalyst regeneration and hydrocarbon and solvent stripping have been safely performed using high temperature inert nitrogen as the control medium.

**Leak testing**

The safety and environmental integrity of oil and gas processing and refining facilities can be verified through the use of nitrogen, with a trace of Helium, at final commissioning. Some service companies claim to be able to accurately detect leaks of 0.1 SCF/year.

**T-5SLS**

- counter balance optional
- left or right hand
- diverted cooling

**5-SLS/6RO**

- counter balance optional
- gear reduction
- external oil pump
- diverted cooling

**Nitrogen Purging**

Nitrogen purging using ACD pumps is a technique used to replace hydrocarbon vapors, flammable and toxic gases or air with an environmentally safe and inert dry atmosphere. The two most common methods of purging are displacement and dilution. The geometry of the process system determines which method is used. For simple systems, displacement purging is usually more effective in terms of time and cost, but for more complex systems, dilution purging is used.

**ACD’s high flow/pressure nitrogen pumps are used for pipeline and process applications, onshore and offshore, in the oil, gas and petrochemical industries.**
**TOP-215**

**Features & Benefits**
- Cartridge seal design for quick replacement
- Oil lubricated bearing housing ensures lubricity of components and improves life
- Cylindrical roller bearings strengthen capacity for lateral loads

**Pipe Freezing**

The boiling point of liquid nitrogen is -320°F (-195°C) and as such it has an application as a coolant in indirect pipe freezing systems. Users of ACD’s cryogenic pumps have reported that on pipe-work compatible with cryogenic liquids, liquid nitrogen can be used as the direct cooling medium. The benefits of this approach over conventional methods reportedly are:
- More effective use of plant/platform personnel
- No interruptions to the process system while repairs are carried out
- There is “no draining operation” thus, saving time
- Liquid waste is limited resulting in cost savings
- Isolation for pressure or leak testing is provided

**Pressure Testing**

In some instances where hydrostatic testing may not be possible, systems or components may be tested with nitrogen. If considering this as an alternative, it is mandatory that the system design specifications be reviewed and a risk analysis be conducted before using a compressible medium for the test.

**Flow Range:** 5-500 GPM / 20-1,900 lpm
**NPSHR:** 3-35 Feet / 1-10 Meters
**Differential Head:** 40-780 Feet / 13-240 Meters
**Pump Design Rating*: 1-85 hp / 0.75-60 kw

**RPM Range:**
- 1 x 2 x 4.5 & 1.5 x 2.5 x 6A 2,000-7,200 RPM
- 2 x 3 x 6 & 2 x 4 x 6 2,000-8,100 RPM

**Features & Benefits**
- Rapid cooldowns
- Foam inerting
- Long term preservation

**Rapid Cooldowns**

Refinery maintenance, expansions or other activities sometimes call for the shutdown of the plant, at which point it is desirable to reduce the temperature of process catalysts as quickly as possible. ACD’s high flow nitrogen pumps can be used as a controlled cooling agent to reduce the time before remedial work begins. The risk of fire is also reduced because of the inert properties of nitrogen.

**Foam Inerting**

Some of our customers have developed processes to enable work that generates heat to be carried out on hydrocarbon handling systems without endangering workers or facilities. The nitrogen foam is injected into a process system at a low point and allowed to completely fill the vessel and pipe work, rendering the internal atmosphere inert. Once the work operations that generate heat have been completed, the nitrogen foam degenerates into surfactant, some water nitrogen gas.

**Long term preservation**

Because nitrogen is an inert gas it is ideal for the long term preservation of installations that may not be in operation immediately (mothballing). For example, on completion of a process system or pipeline commissioning, it is occasionally necessary to protect the system from corrosion or degradation for a period of time.

**Flow Range:**
- 5-500 GPM / 20-1,900 lpm
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- 1 x 2 x 4.5
- 1.5 x 2.5 x 6
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**Features & Benefits**
- Compact design is lightweight and reduces installation time
- Hydraulic drive allows operators to use truck PTO system
- Bearing housing designed for well service, heavy duty applications
- Composite Face Seal (CFS) more tolerant of cavitation

**Right Hand Discharge**

**Left Hand Discharge**

1x24.5 & 1.5x2.5x6A

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