

UNI-LOK[®] Zero

SEALING TECHNOLOGY FOR RECIPROCATING PUMPS





SPX - An introduction

SPX is a Fortune 500 multi-industry manufacturing leader, headquartered in Charlotte, North Carolina. SPX manufactures and markets products, components, services and technologies that are integral to meeting today's challenges and tomorrow's needs. We are a place where innovation is fostered, and the real needs of business are understood. We transform ideas into powerful solutions to help our customers meet their goals, overcome business challenges and thrive in a complex, always changing marketplace.

SPX's Flow Technology segment designs, manufactures and markets engineering solutions and products used to process, blend, meter and transport fluids. We also offer equipment for air and gas filtration and dehydration. Our leading brands have global operations which service the food + beverage, power + energy, and industrial processes.



CLYDEUNION PUMPS, AN SPX BRAND - GENERATIONS OF EXPERIENCE

Whilst the name is relatively new, the ClydeUnion Pumps brand is known worldwide for supplying reliable and robust engineered pumping solutions stemming from over 140 years of industry expertise. Our experience spans across several complex industries including oil and gas, nuclear and conventional power generation, desalination and other key markets relevant to our product portfolio.

›ClydeUnion Pumps



Weir Pumps - Clyde Pumps - Mather & Platt -
Drysedale - WH Allen - Girdlestone -
Allen Gwynnes - Harland



Union Pump - David Brown Pumps
DB Guinard Pumps - American Pump - Pumpline



›ClydeUnion Pumps

High technology pumps for the most demanding services

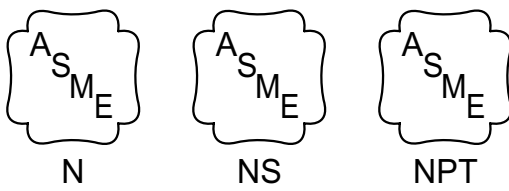
ClydeUnion Pumps, an SPX Brand, specializes in the design and manufacture of API 674 reciprocating pumps and pumping packages. At ClydeUnion Pumps you will find a commitment to quality throughout the company. Our Quality Management System is fully approved to ISO 9001:2008 and independently verified to comply with the latest quality standards. ClydeUnion Pumps has a worldwide reputation for providing optimized reliability in the most severe duty applications.

SEAWATER REVERSE OSMOSIS

Worldwide demand for clean water continues to increase. With very high efficiency and reliability, our reciprocating power pumps are ideally suited for seawater reverse osmosis. ClydeUnion Pumps reciprocating pumps, combined with energy recovery systems, provide the industry's most efficient solution for your high pressure reverse osmosis pumping needs. They also offer the added benefit of delivering filtered seawater at constant flow to the membranes at varying system pressures.

GENERAL INDUSTRY

At ClydeUnion Pumps we have supplied reciprocating power pumps for a wide range of industrial services including high pressure water blasting, cleaning and cutting, metals descale, mine dewatering, hydraulic charge, hydrostatic test, chemical processing and high pressure mixing. The experience gained in these segments enable us to offer our customers engineered products tailored to their specific requirements.



OIL + GAS PRODUCTION

Our pumps can be found operating wherever there are oil fields, both onshore and offshore. High efficiency and reliability are major benefits of ClydeUnion Pumps equipment - both of which are vital considerations in the oil and gas industry. Pumps have been supplied to satisfy a wide range of pumping services including: high pressure seawater injection and disposal, methanol injection, blowout preventer charge pumps, subsea hydraulic systems, gas processing systems for dehydration and gas sweetening. ClydeUnion Pumps reciprocating pumps are designed to handle all types of industry related fluids.

REFINERIES

Today's complex refinery processes demand specialized pumping solutions. Extremes of temperature, high-pressure and the ability to handle volatile fluids, calls for highly engineered pumps that can perform reliably in such arduous conditions. ClydeUnion Pumps has many years of worldwide experience in the supply of special reciprocating pumps to the refinery industry and is committed to providing its customers with solutions for the most complex of pumping requirements.

UNI-LOK® Zero - Sealing technology for the 21st century

A growing demand for energy, and an increasingly important corporate responsibility to combat fugitive emissions of toxic and volatile organic compounds (VOCs) to the atmosphere, sees ClydeUnion Pumps at the forefront of delivering innovative engineering solutions, raising the bar on our own sustainability commitments.

At ClydeUnion Pumps we have over 40 years experience in the development and application of innovative sealing solutions for reciprocating pumps and our UNI-LOK® Zero stuffing box designs have proven to be the most successful for applications handling toxic and volatile liquids.

UNI-LOK ZERO SEALING SYSTEM

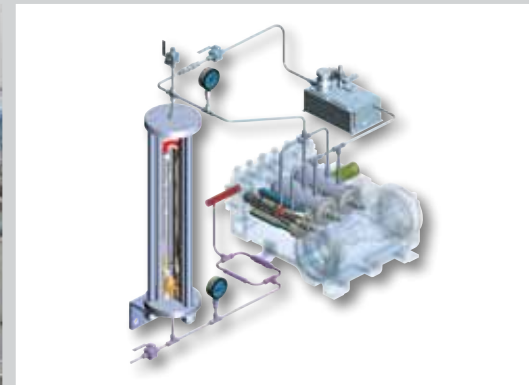
Our latest innovation, the UNI-LOK® Zero sealing system, dramatically reduces VOC fugitive emissions to the atmosphere from reciprocating pump stuffing boxes, significantly extending the seal life achieved through this unique stuffing box. This innovation incorporates a device that references the peak discharge pressure from the pump and a reservoir that delivers a pressurized barrier fluid to the stuffing box, forcing leakage inward rather than allowing outward flow through the seals. The UNI-LOK® Zero provides a simple means of pressurizing the stuffing box to 24 to 41 psi (1.8 to 2.8 Bar) above the peak discharge pressure of the pump, thus eliminating any migration of the pumpage past the primary seal of the stuffing box and into the atmosphere. (Similar to API 682 Plan 53C).

UNI-LOK® ZERO SYSTEM IS:

- Designed per ASME Section VIII, Division 1
- Meets requirements of the European Pressure Equipment Directive 97/23/EC
- Available for application pressures up to 10,000 psi (689.5 Bar)

THE SYSTEM COMPRISES 4 MAIN COMPONENTS:

- A device that references only the peak discharge pressure from the discharge line of the pump
- A patented CP barrier fluid reservoir that takes peak discharge reference pressure and adds 24 to 41 psi (1.8 to 2.8 Bar) to the barrier fluid that is injected into the stuffing box
- This is accomplished without the need for external nitrogen gas supplies, external pumps, power supplies or bladder accumulators
- A unique stuffing box designed to accommodate reverse pressure sealing
- Automated "top-up" system with pump and reservoir



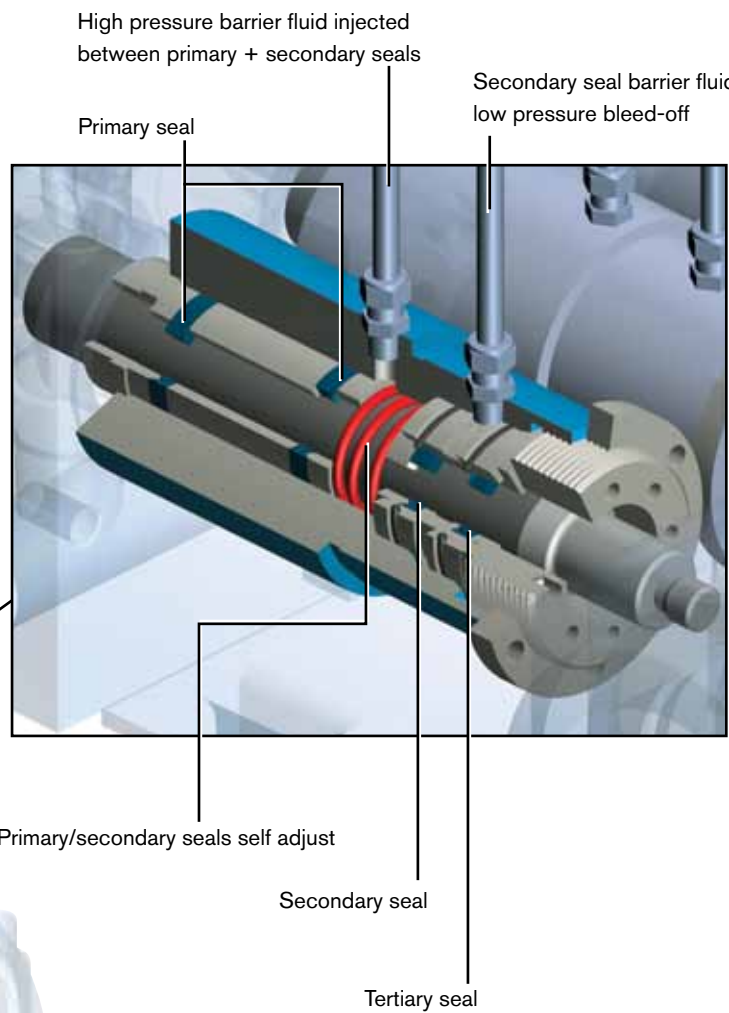
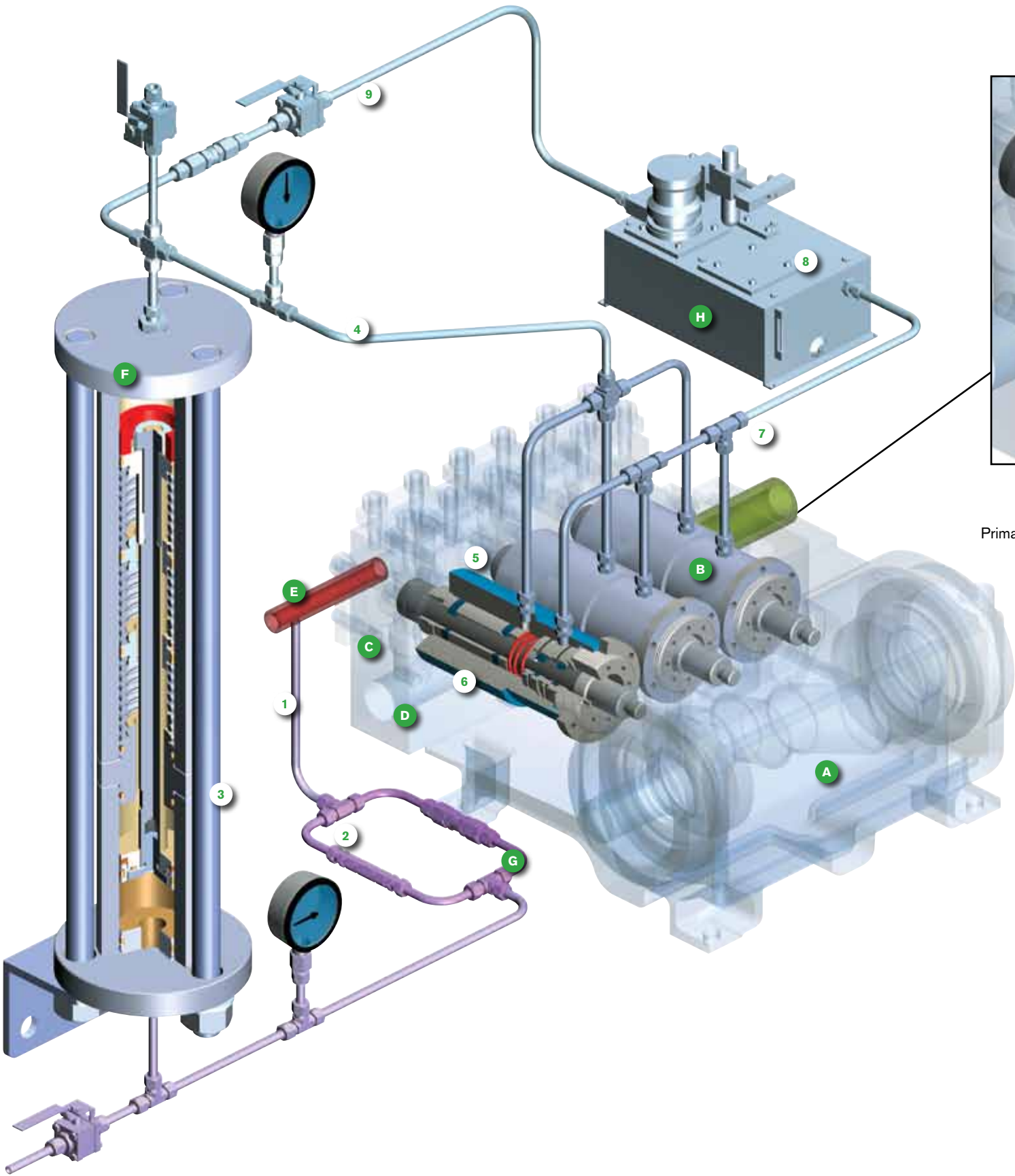
UNI-LOK® Zero - Features

PROCESS

- 1 Manifold pressure at the pump discharge
- 2 Device to monitor the peak of the pressure pulsation and communicate this to the Mini-CP Unit
- 3 Mini-CP Unit designed to add 24 - 41 psi (1.8 - 2.8 Bar) above peak pump discharge pressure to barrier fluid
- 4 High pressure barrier fluid output from the Mini-CP Unit
- 5 Barrier fluid injected between first and middle seal sets to ensure direction of leakage is always into the process fluid rather than to atmosphere
- 6 Stuffing box with seal sets; the primary set sealing against the process fluid and secondary set sealing barrier fluid against atmosphere
- 7 Excess barrier fluid exiting through the secondary set is sealed by the tertiary set and returned to the reservoir
- 8 Auto top-up reservoir ensures that barrier fluid levels in the Mini-CP Unit are maintained
- 9 Barrier fluid is returned to the Mini-CP Unit to maintain barrier fluid levels

EQUIPMENT

- A Reciprocating pump power end
- B Stuffing box
- C Fluid end
- D Suction
- E Discharge
- F Mini-CP Pressurizing Unit
- G Constant register pressure device to monitor peak pump discharge pressure
- H Automated "top-up" system with pump and reservoir





FIELD TRIAL SUCCESS

Enterprise Products:

Port Allen Facility, Louisiana, USA

The challenge was to combat short packing life and high volatile organic compound emissions on a butane service, CUP-TD60 reciprocating pump

Following the installation of: UNI-LOK® ZERO SEALING SYSTEMS

emissions are now 33% of EPA allowable limits and packing life was extended by a factor of 4

“Enterprise Products is very pleased with the sealing arrangement ClydeUnion Pumps has developed. It has virtually resolved a recurring fugitive emissions issue that has always plagued positive displacement pumps in light hydrocarbon service”

The CP advantage is now available in reciprocating pumps



Engineered for new equipment + aftermarket applications

UNI-LOK® ZERO SEALING SYSTEM

Available for both new equipment and as an aftermarket retrofit to provide unparalleled protection from VOC emissions to comply with current and future environmental standards.

COMPONENTS REQUIRED

- Stuffing boxes with seals and plungers designed for the specific application
- A device to reference only the peak discharge pressure from the pump discharge. Average pressure cannot be used as this would lead to leakage at the pump maximum pressure
- A common barrier fluid system for all stuffing boxes; which includes a visual device showing the amount of fluid remaining in the reservoir and two switches, to activate the automated top-up system when necessary
- Pipe / tubing and fittings to connect the pump and stuffing boxes to the other system components

OPERATION PRINCIPLES

The Mini-CP Unit provides barrier fluid across the primary and secondary seals at a constant 24 to 41 psi (1.8 to 2.8 Bar) above discharge peak pressure. This is accomplished by the spring loaded piston which separates the pumpage (below the piston) from barrier fluid (above the piston). This results with a barrier fluid pressure always equal to pumpage peak discharge pressure plus the additional pressure generated by the spring load. This differential pressure across the primary and secondary seals is maintained regardless of changes in pump discharge pressure.

Barrier fluid leakage at the primary and secondary seals causes the piston to move upwards by spring force to maintain constant barrier fluid pressure above peak discharge pressure. A magnetically coupled level indicator provides clear visual indication of the piston's position during operation. When barrier fluid level is low a magnetically coupled position switch provides an alarm and / or trip signal. When the alarm level is reached, and even with the pump running, the CP System can be refilled with barrier fluid by use of an air driven “top-up” system.

A pressure limiting valve is located within the piston to prevent accidental overfilling of barrier fluid. When the piston reaches its lowest position, it is in contact with the bottom plate of the Mini-CP Unit and the pressure limiting valve is allowed to continue to descend and open. This allows high pressure barrier fluid above the piston to vent through the pressure limiting valve into the pumpage below the piston. Excess barrier fluid then moves down the pressure reference line into the pump discharge line, where it is carried away by the pumpage. The system is rated for maximum pump discharge relief valve pressure. Standard material for the outer pressure envelope is 300 series stainless steel. A duplex stainless steel option for wetted parts is available for corrosive pumpages.

Advantages of UNI-LOK® Zero sealing system

DESIGN FEATURE	BENEFIT
Zero fugitive emissions	Barrier fluid is at a higher pressure than pumpage
Increased seal life especially on light hydrocarbon pumpages	Primary and secondary seal lubrication film is barrier fluid not product
Increased seal life, reducing maintenance costs	Barrier fluid remains uncontaminated by pumpage throughout its life
Reduced load on plant vapor recovery system	No need for the seal system to be connected to plant flare system
Reduced installation and maintenance costs	Requires only one channel of instrumentation
Reduced pump shutdown time and gives the ability to keep a pump with leaking seal running	Barrier fluid can be refilled with the system pressurized and the pump running
Flexibility when retrofitting to existing pump assembly	Barrier fluid reservoir can be mounted off pump baseplate / skid
Able to service / replace instrumentation with the system full of barrier fluid and pump operating	Non-penetrating magnetic instrumentation

FAILURE MODE	CONSEQUENCE	RESULT
Failure of primary (inner) seal rings	Barrier fluid leaks past primary seal rings and into pumpage	Barrier fluid is lost and the piston in the CP System rises under spring pressure
Failure of secondary seal ring	Barrier fluid leaks past secondary seal ring and towards atmospheric collection point between secondary and tertiary seals	Barrier fluid is lost and the piston in the CP System rises under a combination of spring and reference fluid pressure
Failure of barrier fluid piping	Barrier fluid leaks to atmosphere	Barrier fluid is lost and the piston in the CP System rises under a combination of spring and reference fluid pressure
Failure of dynamic seal in CP System piston	Barrier fluid passes from the upper cylinder to the lower cylinder where it mixes with pumpage and passes down the reference line and back into the pump	Barrier fluid is lost and the piston in the CP System rises under spring pressure

ASSURANCE NO MATTER WHAT THE FAILURE

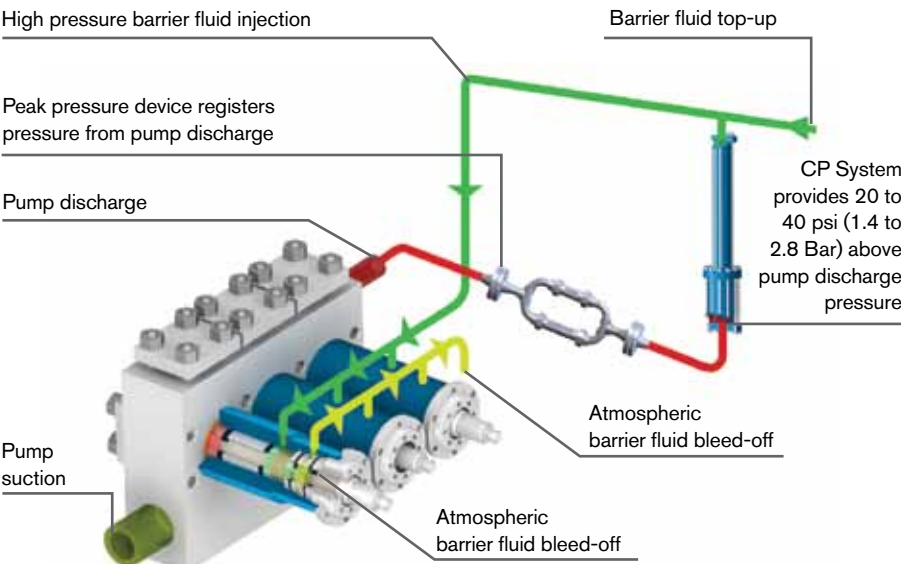
UNI-LOK® ZERO ACTION

Rising piston actuates Mini-CP Unit level switch to trip automated “top-up” pump ‘on’

The pressure limiting device is held shut by a combination of spring and reference fluid pressure

“Top-up” unit reservoir level reduces and becomes empty, the reservoir low level switch / transmitter actuates to alarm and trip ‘off’ process fluid pump

Note: In none of the above scenarios can pumpage leak to atmosphere. The reverse pressure sealing capability of the primary and secondary seals prevents leakage in the event of loss of barrier fluid volume or pressure





Parts + maintenance:

Any brand, any material, anytime. Heritage products, upgrades + improvements



Global aftermarket capability best in service + response

Our customer focused aftermarket organization is positioned to provide comprehensive care for our varied and diverse product lines. Heritage and obsolete products benefit from the same level of attention and expertise ensuring that reliability and availability is maximized irrespective of a pump's length of service.

GENUINE HIGH QUALITY

Original or upgraded specification spare parts, coupled with full engineering design capability, enables longevity of reliable operation. Highly skilled and experienced service engineers ensure accuracy in build and optimized performance. The worldwide presence of ClydeUnion Pumps offers local service facilities in over 40 countries.

SERVICE SOLUTIONS

ClydeUnion Pumps is committed to supporting our installed base wherever it may be. Depending on your location we will provide either direct service support or support via our local authorized service partners. Whichever option is provided, you can be assured of the best attention from fully qualified and experienced engineers.

- Upgrades + re-rates
- Service + overhaul
- Installation + commissioning
- Technical support
- Inventory management
- 3rd party equipment



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FLUID CONTROL