



ITT Brands

Pumps for CO₂ Capture, Transportation and Storage



CO₂ Capture

In most cases, carbon dioxide captured and purified for commercial applications would be vented into the atmosphere at the production point if not recovered for transport or beneficial use at other locations.

Goulds Pumps and Rheinhutte
Pumpen have proven experience
meeting highly challenging
applications like these. From initial
pump selection or design to
aftermarket support, we will
support your carbon capture
needs:

- Complete line of process pumps, including high-efficiency units for virtually every CO2 service
- Customized onboard diagnostics that improve efficiency, reduce downtime and optimize life cycle costs
- Unmatched expertise in a broad range of materials of construction and advanced surfacing technologies.
- Vast global service network with unrivaled experience performing hydraulic re-rates and upgrades, regardless of OEM

The most common operations from which commercially-produced carbon dioxide is recovered are industrial plants which produce hydrogen or ammonia from natural gas, coal, or other hydrocarbon feedstock, and large-volume fermentation operations in which plant products are made into ethanol for human consumption, automotive fuel, or industrial use. Breweries producing beer from various grain products are a traditional source. Corn-to-ethanol plants have been the most rapidly growing source of feed gas for CO2 recovery. CO2-rich natural gas reservoirs found in underground formations found primarily in the western United States and in Canada are another source of recoverable carbon dioxide.



Experience You Can Trust

Goulds Pumps and Rheinhutte
Pumpen are leading global solution
providers with strong expertise in
pump design, quality and technical
innovation. With over 160 years of
experience, Goulds Pumps and
Rheinhutte Pumpen offer a a full
line of pumps, equipment and
service to major industries,
including Oil and Gas, Chemical
Processing, Hydrocarbon
Processing, Power Generation, Pulp
and Paper, and General Industry.

As the only manufacturer to make digital monitoring standard on every process pump, we continue to lead the industry in both mechanical pump design and the adoption of smart technologies.

Goulds Pumps and Rheinhutte Pumpen provide comprehensive pump solutions to Carbon Capture and Storage (CCS) applications. Building on our history of being a strong partner to our customers with proven engineering expertise, we have expanded our development of pump solutions for CCS.







CO₂ Capture

Pump Supplier of Choice for Carbon Capture and Storage (CCS)

ITT Goulds Pumps and Rheinhütte Pumpen boasts unrivaled expertise in developing and implementing pumping technologies and systems for capturing, transporting and storing carbon dioxide(CO2). ITT Goulds Pumps and Rheinhütte Pumpen also possess unsurpassed experience in pumping the many solvents used to capture CO2 is uniquely qualified to be the primary pump partner for customers wishing to reduce their carbon emissions.

Pump Designs

Offers a wide range of pump types to meet the varied and numerous applications in CCS. These include:

- Single stage process
- Single and multistage between bearings, axially split
- Single and multistage between bearings, radially split
- Double case
- Vertical
- Slurry

Available Standards

Pumps comply with the most stringent industry standards, including:

- ISO 13709/API 610
- ASME (ANSI) B73.1
- ISO 2858
- ISO 5199
- Hydraulic Institute







CO₂ Capture

Advanced Solutions to Reduce Carbon Footprints

Combines technical expertise with cutting edge technology to reduce the carbon footprint of industry through reduced emissions, lower energy use and greater mechanical and process reliability.

Technical Services

Technical Services works with plant operators to maximize productivity and minimize greenhouse gas (GHG) intensity. Nearly 200 design and application engineers stationed on six continents help to proactively identify and implement equipment and system modifications that reduce energy usage and improve reliability while lowering safety, health and environmental (SH&E) costs.

Technology Advantage™

Technology Advantage combines state-of-the-art data collection and analytical technologies with advanced equipment diagnostic solutions to identify and implement proactive maintenance, upgrades and system modifications that reduce equipment shutdowns and process flaring.





Goulds Pumps and Rheinütte Pumpen - y

Providing increasingly crucial technologies

If industrial enterprises and energy providers are to achieve their ambitious climate protection goals, they will need to find a way to isolate, transport and safely store or process the CO2 they produce. The separation and sequestration of CO2 is known internationally as carbon capture and storage (CCS), and its subsequent use instead of storage is referred to as carbon capture and utilisation (CCU).

The full course of action is a process chain, the links of which consist of carbon capture, compression, transport and injection for subsequent storage or utilization.

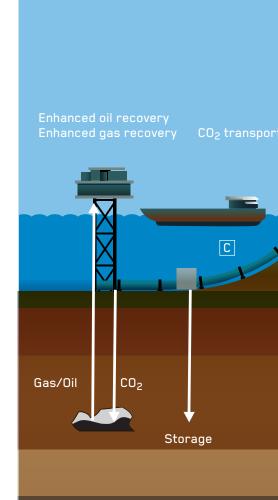
Perfect products, special consultancy

Our long-standing experience makes us your ideal partner to reliably and efficiently find and implement individual solutions for all points of the process, for all methods of capture and for all types of plant. As a global market leader for pumps and systems, we also make a perfect partner for all operators, consultants and engineering contractors.

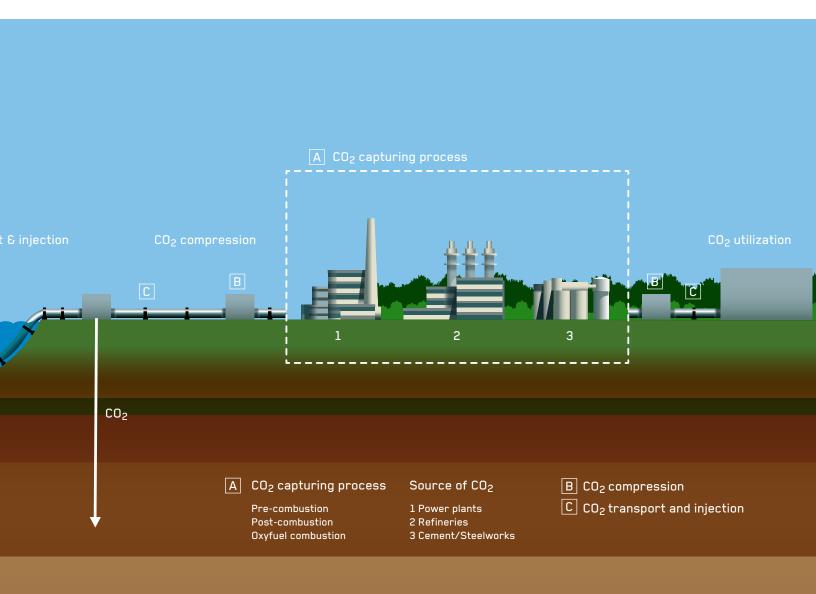
Our full solids non-metallic material offers a strong corrosion and wear resistance in Scrubber systems with optimized sealing solutions for corrosive and solid loaded scrubber fluids.

We have optimum application-specific pump designs that meet the high requirements in the field of flue gas cleaning. Our pumps are characterized by long service intervals, operational reliability and extremely favorable life cycle costs.

Give us a call today and have a chat with one of our specialists.



our partner for CO2 applications.



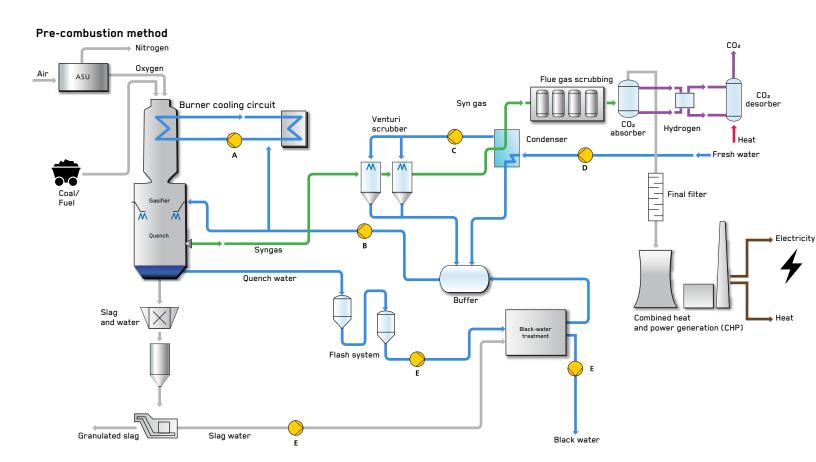
Capture » Compression » Transport » Injection

The Pre-combustion Method

In the pre-combustion method, the CO2 is captured prior to combustion. This involves subjecting coal to high temperatures and high pressure in a gasifier, hence converting it to syngas consisting primarily of hydrogen (H2) and carbon monoxide (CO).

Energy recovery included

In a downstream shift reaction, the syngas is converted to hydrogen and CO2 that can be captured. The hydrogen serves as fuel for generating energy in a gas turbine. Referred to as the integrated gasification combined cycle (IGCC), this process is best suited for new plants.



Goulds Pumps & Rheinhütte pumps

- A. Pump for cooling-water circuits (burners)
- B. Pump for cooling -water circuits (syngas)
- C. Pump for flue gas scrubbing
- D. Pump for feed-water and fresh-water applications
- E. Pump for black-water treatment







model RCNKu+ | model RCNKu



Heavy-Duty, Axially Split Between Bearings Pump

model 3600 | model 7200SB | model 3620/40



Multistage/Double Suction

model 3409 | model 3393 | model 3410



model VICR | model VIT | model VIC | model VCW



Sealed Lined & Non-Metallic

model 3296 | model 3298



Process Pump

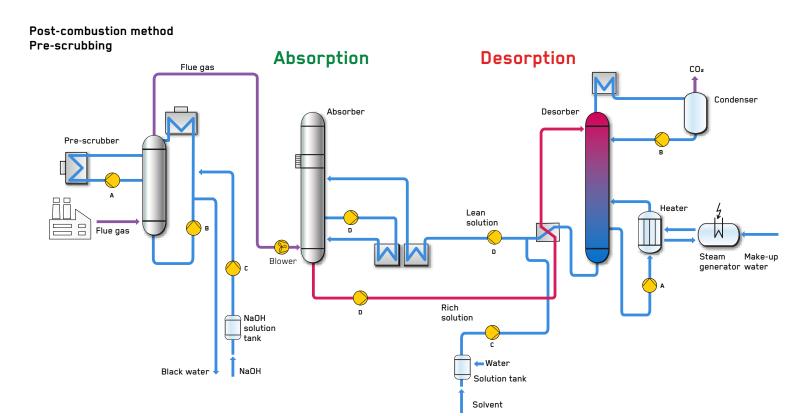
model 3180

The Post-Combustion Method

The post-combustion process is a method of separating CO2 out of flue gas from a combustion process. Several different variants are available, and there are physical as well as chemical methods for scrubbing the flue gas.

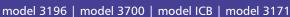
Readily Retrofitted

First, the flue gas is relieved of its ash, sulphur and nitrogen oxides and cooled. Then, it is put through a scrubber (absorber), where a solvent captures the CO2. The CO2-laden solvent is then pumped through a desorber, where heat is added to separate the CO2 from the solvent and make it ready for further treatment. The solvent can then be returned to the process.



Goulds Pumps & Rheinhütte pumps					
A. Pump for flue gas scrubbing					
B. Pump for cooling -water circuits					
C. Pump for solvent handling					
D. Pump for solution transport					









Heavy-Duty, **Axially Split** Between Bearings Pump

model 3620/40



Multistage/Double Suction

model 3409 | model 3393 | model 3410



model VICR | model VIT | model VIC | model VCW | model GVSO



Sealed Lined & Non-Metallic

model 3296 | model 3298



Process Pump

model 3180

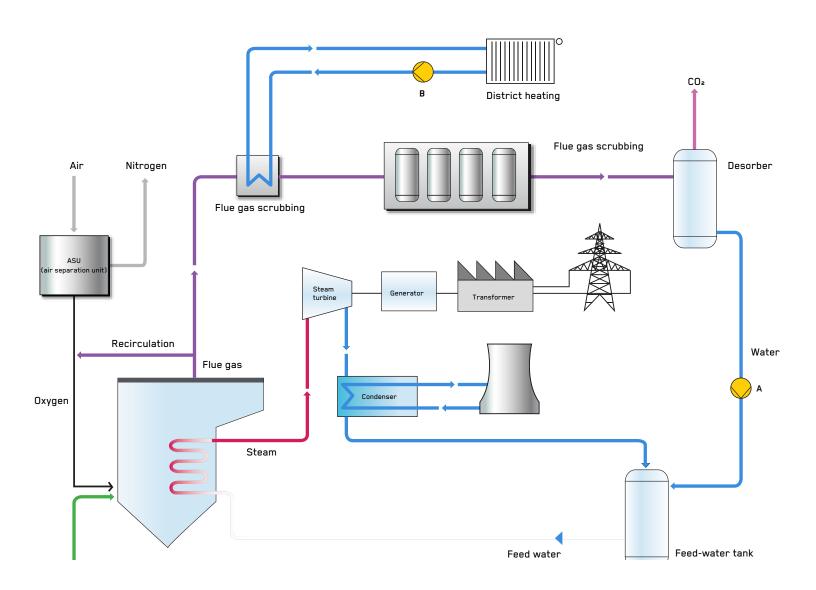
Application Solutions

						_
			3600	VICR	3393	7200SB 3600
SI	Pre-combustion	Cooling-water circuits (burners)				
		Cooling-water circuits (syngas)				
		Flue gas scrubbing				
		Feed-water and fresh-water applications				
ysten		Black-water treatment				
tion s	Post-combustion	Flue gas scrubbing				
Separation systems		Cooling-water circuits				
		Solvent handling				
		Solution transport				
	Oxy fuel	Cooling-water circuits				
		District heating				



3409	3180 ICB	3700 ICP	3620	3700 3196	3296	VIC VIT	3171 GVSO	RCNKu





Goulds Pumps & Rheinhütte pumps

A. Pump for cooling -water circuits

B. Pump for district heating



CO₂ Capture

CO₂ Capture Technologies

The process technologies we provide to capture CO2 have been well proven in the gas processing, chemical and petroleum industries for more than 50 years and has been there every step of the way.

With the growing worldwide emphasis on curtailing and regulating GHG, CO2 capture technologies may soon be applied on a much larger scale to fossil fuel power stations, oil and gas processing plants and general industrial manufacturing such as steel mills and cement plants. To comply with GHG limits, the industries will need to install CO2 capture absorption trains with reliable pumping solutions.

Experience, Technology and Support You Can Trust For Your Carbon Capture Needs

With one of the largest installed bases of CO2 solvent process pumps in the world, we have proven experience meeting highly challenging applications. From initial pump selection or design to aftermarket support, ITT Goulds Pumps and Rheinhütte Pumpen names you can trust for your carbon capture needs:

- The most complete line of process pumps, including high-efficiency units for virtually every CO2 service
- Customized diagnostics that improve efficiency, reduce downtime and optimize life cycle costs
- Unmatched expertise in a broad range of materials of construction and advanced surfacing technologies, including through hardening, HVOF and DLD overlays and ceramic coatings
- The largest global service network with unrivaled experience performing hydraulic re-rates and upgrades, regardless of OEM





ANSI, ISO and API Process Pumps

3196



- Capacities to 1,364 m³/h | 7,000 GPM
- Heads to 223 m | 730 ft
- Temperatures to 371° C | 700° F
- Pressures to 26 bar | 375 PSIG

Applications:

- Chemical
- Petrochemical
- Pulp & Paper
- Primary Metals
- · General Industries

Food & Beverage

Materials: Ductile Iron, 316SS, CD4MCu, Alloy 20, Monel, Nickel, Hastelloy B and C, Titanium

ICP



- Capacities to 450 m³/h | 1,980 GPM
- Heads to 150 m | 492 ft
- Temperature ranges from -40° C to 280° C | -40° F to 535° F
- Pressures to 25 bar | 363 PSIG

Applications:

- Hot Water
- Thermal Oils
- Heat Transfer Fluids
- Die/Mold Pre-Heating Systems
- Pilot Plants
- · Electronic Heating and Cooling
- Reactor Heating
- Urea

Materials: Carbon Steel, 316SS, Alloy 20, Duplex SS, Hastelloy C

3700



- Capacities to 1930 m³/h | 8,500 GPM
- Heads to 360 m | 1,200 ft
- Temperatures to 425° C | 800° F
- · Pressures from full vacuum to 60 bar | 870 PSIG

Applications:

- Column Reflux
- Column Bottoms
- Reboiler
- Injection
- Fuel Blending
- Heat Transfer
- Slop Gas Oil · Heavy Gas Oil
- Stripper Overhead

Hot Oil

- Column Charge
- Reactor Feed
- · Stabilizer Overhead
- Scrubber Circulation
- Tower Bottoms
- Offsite Hydrocarbon Transfer

Materials: All API

materials, custom

materials available

3171



- Capacities to 722 m³/h | 3,180 GPM
- Heads to 95 m | 344 ft
- Temperatures to 232° C | 450° F
- Pit Depths to 6 m | 20 ft

Applications:

- Industrial Process
- Industrial Sump Wastes
- Molten Sulfur
- Tank Unloading
- Corrosive and CorrosiveLiquids

Materials: Cast Iron, Bronze-fitted, Carbon Steel, 316SS, Alloy 20, Hastelloy B and C, **Duplex SS**



GVSO



- Capacities to 4000 m3/h | 17612 GPM
- Heads to 150 m | 492 ft
- Temperatures to from -40 °C to 600 °C | -40 °F to 1112 °F
- Pressures to 40 bar | 580 PSIG

Applications:

Aggressive, also contaminated fluids, liquefied gases and melts like e.g. sulphuric acid at all concentrations, oleum, molten sulfur, Phthalic acid and molten salts

Materials:

- 1.0619 (A 216 Grade WCA / WCB)
- 1.4136S (Rheinhütte material)
- 1.4306S (A 743 CF-3 (Type 304L))
- 1.4408 (A 743 CF-8M (Type 316))
- 1.4517 (A890 Grade 1B / A743 Gr. CD4MCuN)
- 1.4529S (A 743 CN3MN (AL-6 XN))
- 1.4581 (A 743 CF-8M (+Nb) / A 351 CF10MC (Type 316Cb)
- 1.7357 (A 217 Grade WC6)
- R30.20 (A 743 CN7M (Alloy 20))
- RH-SX (alloy SX)

ICB



- Capacities to 340 m³/h | 1,490 GPM
- Heads to 160 m | 525 ft
- Temperature ranges from -40° C to 140° C | -40° F to 280° F
- Pressures to 16 bar | 230 PSIG

Applications:

- Specialty Chemicals
- Batch Chemical Process
- Reactor Feed
- Seal Water
- Shower Service
- Boiler Feed
- Condensate
- High Pressure Process
- Column Bottoms
- Hot Oil
- Column Reflux

Materials: Ductile Iron, Carbon Steel, 316SS, Duplex SS

Heavy-Duty, Axially Split Between Bearings Pumps

3600



- Capacities to 1,930 m³/h | 8,500 GPM
- Heads to 2,740 m | 9,000 ft
- Temperatures to 205° C | 400° F
- Pressures to 275 bar | 4,000 PSIG

Applications:

- Refineries
- Injection offshore platforms
- Pipeline
- Boiler feed
- Descaling
- Mine dewatering
- · Process transfer
- Desalination
- Water injection

CO² injection

Materials: All API materials, custom materials available

3620/3640



- Capacities to 4,540 m³/h | 20,000 GPM
- Heads to 455 m | 1,500 ft
- Temperatures to 455° C | 850° F
- Pressures to 70 bar | 1,000 PSIG

Applications:

- Refinery Tower bottoms, process feed, column reflux, circulation and pump around, process booster
- Power Plant Boiler feed booster, boiler circulation, ash sluice

Materials: All API materials, custom materials available

7200SB



- Capacity to 600 m³/h | 2,200 GPM
- Total Dynamic Head to 2430 m | 8,000 ft
- Temperature to 425° C | 800° F
- Pressure to 275 Bar | 4,000 PSIG
- Operating Speed to 3,600 RPM

Applications:

- Petroleum refining, production, and distribution
- Petrochemical and demanding chemical processing
- High temperature applications including boiler circulation
- General industrial requiring high temperature or high pressures

Materials: All API materials, custom materials available





Multistage/Double Suction

3393



- Capacities to 750 m³/h | 3,300 GPM
- Heads to 1,000 m | 3,300 ft
- Temperatures to 177° C | 350° F
- Pressures to 114 bar | 1,650 PSIG

Applications:

- Reverse osmosis
- Boiler feed
- Cogeneration
- Shower / spray service
- Pressure boosting
- High Pressure Cleaning
- Snow making

Materials: 12% chrome, duplex and super duplex stainless steels, Other materials available upon request.

3409



- Capacities to 2,725 m3/h | 12,000 GPM
- Heads to 259 m | 850 ft
- Temperatures to 120° C | 250° F
- Working Pressures to 2758 kPa |

Applications:

- Process Quench water, Stripper bottoms, Reboiler circulation, Cooling
- Pulp & Paper Primary and secondary cleaner, filtrate, mill water supply Fan pump, Headbox supply, Shower
- Primary Metals Cooling water, quench and leaching
- Municipal High lift, low lift, wash water, waste water, raw water
- Power Generation Cooling tower, Component cooling, Service water, Ash Sluicing, Heater drain
- Marine Bilge and ballast, cargo, cooling water, fire pump
- General River water, Brine, Sea water

Materials: Cast Iron / Bronze, All Iron, Cast Iron / Stainless Steel, Cast Iron / Ni-Al-Br. All Stainless Steel. Other materials available upon request.

3410



- Capacities to 1,817 m3/h | 8,000 GPM
- Heads to 174 m | 570 ft
- Temperatures to 177° C | 350° F
- Pressures to 1,724 kPa | 250 PSIG

Applications:

- Process Quench water, Stripper bottoms, Reboiler circulation, Cooling
- Pulp & Paper Primary and secondary cleaner, filtrate, mill water supply shower, fan pump
- Primary Metals Cooling water, quench and leaching
- Municipal High lift, low lift, wash water, waste water, raw water
- Utilities Cooling tower, component cooling, service water
- Marine Bilge and ballast, cargo, cooling water, fire pump

Materials: Cast Iron / Bronze, All Iron, Cast Iron / Stainless Steel, Cast Iron / Ni-Al-Br, All Stainless Steel. Other materials available upon request.



Vertical Mixed

VICR



- Capacities to 636 m3/h | 2,800 GPM
- Heads to 1,372 m | 4,500 ft
- Temperatures to 204°C | 400° F
- Discharge flange sizes from 38 mm to 203 mm | 1.5" to 8"
- Powers to 3,000 KW | 4,000 hp

Applications:

- Pentane, Propane, LPG and other light hydrocarbons with specific gravities ranging from 0.2 to 1.0
- Hotwater applications such as Boiler feed water

VIT



- Capacities to 15,900 m3/h |70,000 GPM
- Heads to 1,067 m | 3,500 ft
- Pressures to 176 kg/cm2 | 2,500 psi
- Bowl sizes from 152.4 mm to 1,400 mm | 6" to 55"
- Temperatures to 204°C | 400° F
- Horsepower to 3,730 KW | 5,000 HP

Applications:

- Cooling Water
- Seawater & River Water Intake
- Industrial Process Pumps
- Utility Circulating Water
- Condenser Circulating Water Pumps
- Fire Service
- Reclaimed Water

VIC



- Capacities to 15,900 m3/h | 70,000 GPM
- Heads to 1,067 m | 3,500 ft
- Pressures to 176 kg/cm2 | 2,500 psi
- Bowl sizes from
 152.4 mm to 1,400 mm | 6" to 55"
- Temperatures to 204°C \mid 400° F
- Horsepower to 3730 KW | 5,000 HP

Applications:

- Pipeline Booster
- Product Transfer, Refinery Blending
- Injection-Secondary Recovery
- Chemical Transfer
- Boiler Feed
- Condensate
- Cryogenics
- LNG Transfer
- Light Hydrobarbons
- Water Services

VCW



- Capacities to 91,000 m3/h |400,000 GPM
- Heads to 180 m | 600 ft
- Powers to 7,500 KW | 10,000 hp

Materials: Bronze Fitted, All Bronze, SS Fitted, Ni Resist, All SS

Materials: Any Machinable Alloy

Materials: Any Machinable Alloy



Sealed Lined & Non-Metallic

3296



- Capacities up to 159 m³/h | 700 GPM
- Heads to 213 m | 700 ft
- Temperatures to 280° C | 535° F
- Pressures to 19 bar | 275 PSIG

Applications:

Materials: 316SS, others upon request

- Batch Chemical Process
- Rail Car or Tank Unloading
- · Specialty Chemicals

3298



- Capacities to 270 m³/h | 1,200 GPM
- Heads to 162 m | 500 ft
- Temperatures to 121°C | 250° F
- Pressures to 16 bar | 225 PSIG

Applications:

Materials:

- Rail Car or Tank Unloading • ETFE
- Batch Chemical Process
- Specialty Chemicals
- Column Reflux or Bottoms
- Reactor Feed

RCNKu



- Capacities to 2500 m³/h | 11007 GPM
- Heads to 100 m | 328 ft
- Temperature ranges from -40 °C to 190 °C | -40 °F to 374 °F
- Pressures to 16 bar | 232 PSIG

Applications:

- Brine
- Chemical Wastewater
- Chloralkali
- Flue gas scrubbers
- Waste incineration plants
- Hydrochloric acid
- Sea water
- · Steel industry
- Sulphuric acid

Materials:

- PP
- PE 1000
- PE 1000R
- PVDF
- PTFE

Sealed Lined & Non-Metallic

RCNKu+



- Capacities to 400 m³/h | 1761 GPM
- Heads to 110 m | 361 ft
- Temperature ranges from
 -40 °C to 130 °C | -40 °F to 266 °F
- Pressures to 16 bar | 232 PSIG

Applications:

- Brine
- Chemical Wastewater
- Chloralkali
- Flue gas scrubbers
- Waste incineration plants
- Hydrochloric acid
- Sea water
- Steel industry
- Sulphuric acid

Materials:

- PP
- PE 1000
- PE 1000R
- PVDF

Process Pumps

3180



- Capacities to 9,000 m³/h | 40,000 GPM
- Heads to 125 m | 410 ft
- Temperatures to 230° C | 446° F
- Pressures to 16 bar | 232 PSIG

Applications:

- Paper Stock
- Black Liquor
- Chemical Process
- Wastewater

Materials: AI/CD4MCuN, CD4MCuN, 316SS, 317SS, Hast-C, Alloy 20, Super Duplex. Other materials available upon request.



Monitor & Control





Monitor

Tracks vibration, temperature & run-time hours 24/7/365.

Alarm

Takes high resolution data when an alarm condition occurs and stores it for later analysis.

Trend

Captures data every 1-60 minutes and has up to 170 days of hourly on-board storage.

Analyze

Diagnose machine faults with vibration tools Fast Fourier Transform (FFT) & Time Wave Form Analysis.

Environment

Rated for any industrial environment. water & dust resistant. Intrinsically Safe with a 3-year battery life (use dependent).

• ATEX Zone 0 AEx ia IIB Ga (Groups C & D)

Wireless

Sync data via Bluetooth Smart enabled smartphones and tablets.

Online Monitoring

Monitor and manage all of your i-ALERT enabled machines in one place - i-ALERT Ai Online Platform. This subscription service requires no software to download or dedicated hardware to run.



PS220

Smart Control and Protection



The industry award-winning and patented pump control logic delivers real-time control and protection of your pumps while also providing valuable process insight. By protecting against pump failure due to process upsets, PumpSmart keeps your operation running longer and reduces unplanned repair activities and expense. By right-sizing your pumps to your system, we can reduce not only your energy consumption, but also wear & tear on your process systems.

Features:

Smart Flow

This patented feature allows PumpSmart to accurately control a process flow WITHOUT a flow meter.

Pump Protection

Provides the operator the ability to set protection for low flow, no flow, run-out and cavitation.

Flow Economy

Calculates process efficiency by flow of product versus energy consumption (gpm/kW).

Multi-Pump Control

Provides control for up to four pumps in a parallel for automatic lead/lag changeover, redundancy back-up and synchronized torque control while still communicating to a field bus or DCS system.

Options and Engineered Solutions

Available in a low-harmonic configuration guaranteed to meet IEEE519 harmonic specifications for industries requiring low-harmonic distortion on the utility line.

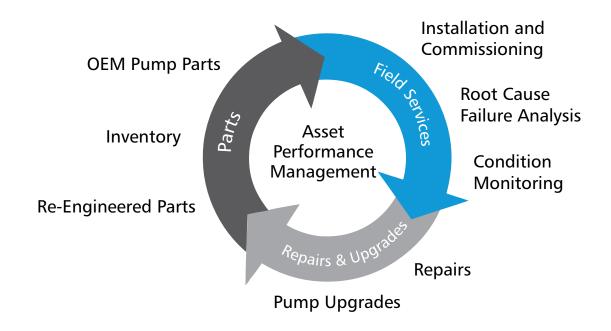




Reliability has no quitting time.



Building on centuries of pump design experience, **PRO Services** provides an array of services focused on reducing equipment total cost of ownership (TCO) and increasing plant output, including condition monitoring, predictive maintenance contracts, field service, engineered upgrades, inventory management, and overhauls for pumps and other rotating equipment.



https://www.ittproservices.com/About/Service-Locations





ITT Brands

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