

# SULZER

## Cutting-edge pumping solutions for the **geothermal power generation**

Sulzer solutions help geothermal plants around the world harness the earth's natural heat, enabling geologically active regions to meet their renewable energy goals. [sulzer.com/geothermal-power](https://sulzer.com/geothermal-power)









# The Sulzer advantage

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Around the world, the power industry is taking on the challenge to produce clean, dependable energy from renewable resources. Combining its expertise in geothermal power and other renewable technologies with its experience in industrial power, Sulzer develops and tailors pumps and auxiliaries that meet the unique demands of geothermal power generation.

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## Understanding your process

- With years of experiences in the geothermal pumping solutions, Sulzer is a single-supplier with a comprehensive portfolio which fulfills all the needs of all major processes in a geothermal plant
- From a single pump to a total system solution, Sulzer works closely with customers to develop the most optimized solution
- Sulzer focuses on delivering efficient, total life cycle performance to enable customer to produce competitive geothermal power

## Focused on efficiency

- Selecting the right pump is one key factor for boosting operational efficiency; Sulzer is the specialist to provide efficient pumping solutions
  - Thanks to leading-edge products, Sulzer contributes to improve customers' equipment efficiency
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## Improvement of environmental footprint

- Sulzer's high-efficiency pumps and services contribute to reduce overall emissions
- Sulzer aims at maintaining the balance between economic success, social responsibility and environmentally friendly solutions in short- and long-term decision making



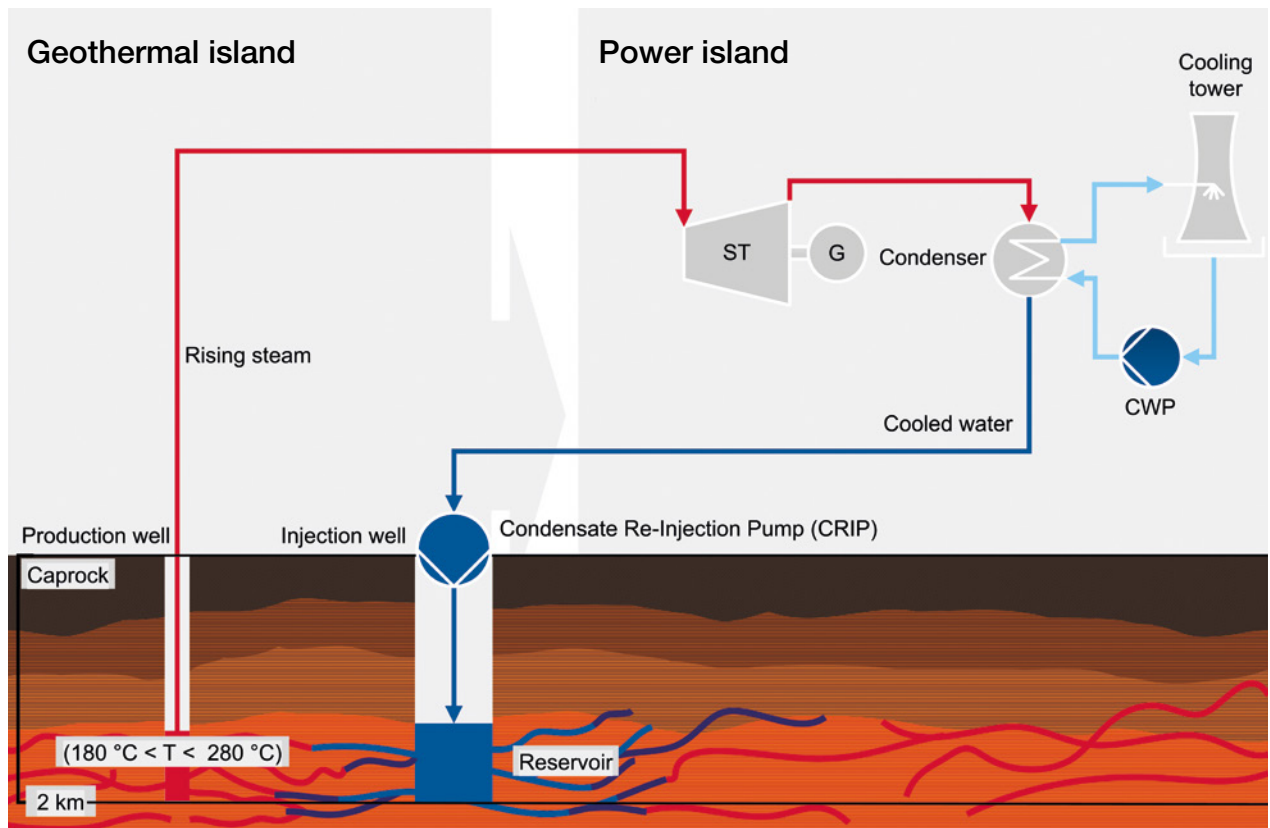




# You set out the challenge, we present the solutions

## Dry steam geothermal plant

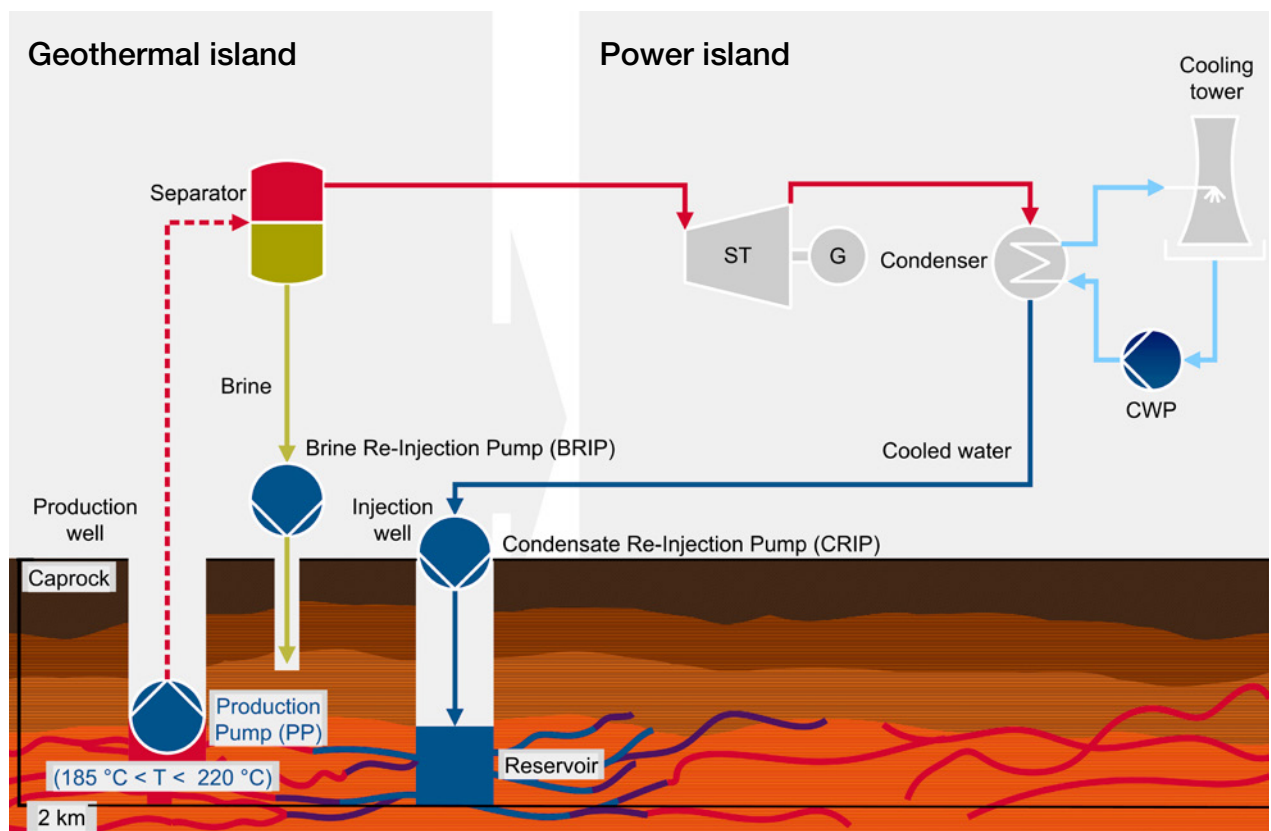
A dry steam plant has production wells that are drilled down to the geothermal reservoir. The superheated pressurized steam ( $180^{\circ}\text{C} < T < 280^{\circ}\text{C}$ ) is brought to the surface at high speeds and passed through a steam turbine to generate electricity. The steam passes through a condenser and is converted into water. The condensate is then re-injected into the ground through wells. Sulzer supports these processes with Condensate Re-Injection pumps (CRIP), Cooling Water pumps (CWP) and auxiliary pumps.



G = Generator  
ST = Steam Turbine  
CWP = Cooling Water Pump

## Flash steam geothermal plant

In a flash steam plant, hot and high-pressure water ( $185^{\circ}\text{C} < T < 220^{\circ}\text{C}$ ) is converted into steam by flashing the extracted liquid through reduced pressure. The liquid is separated into steam and brine. This brine is pumped back down into the reservoir and the steam is sent to the turbine, which drives a generator. After passing through the turbine, the steam enters a condenser, is cooled to a liquid state and pumped back down into the reservoir. Sulzer supports these processes with Production pumps (PP), Brine Re-Injection pumps (BRIP), Condensate Re-Injection pumps (CRIP), Cooling Water pumps (CWP) and auxiliary pumps.

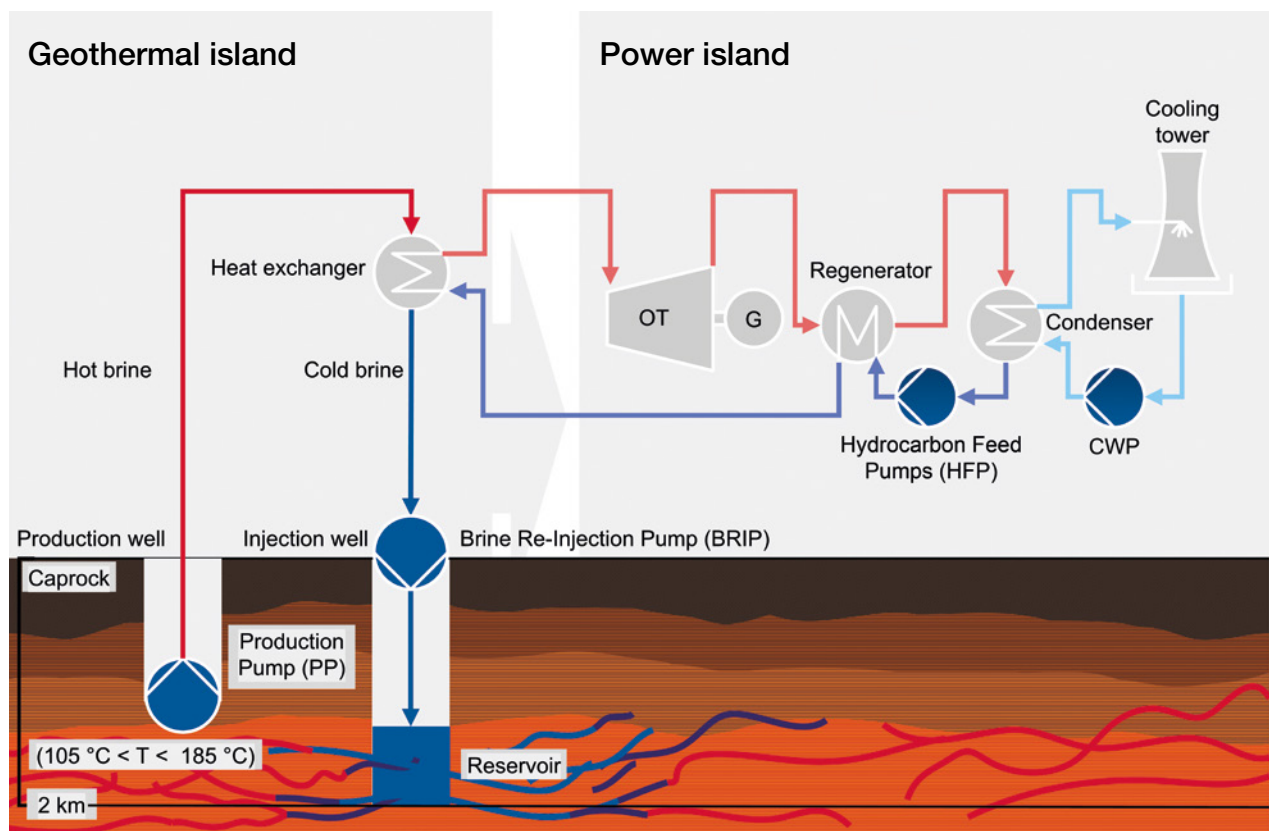


- G = Generator
- ST = Steam Turbine
- CWP = Cooling Water Pump



## Binary cycle geothermal plant, organic Rankine or Kalina cycle

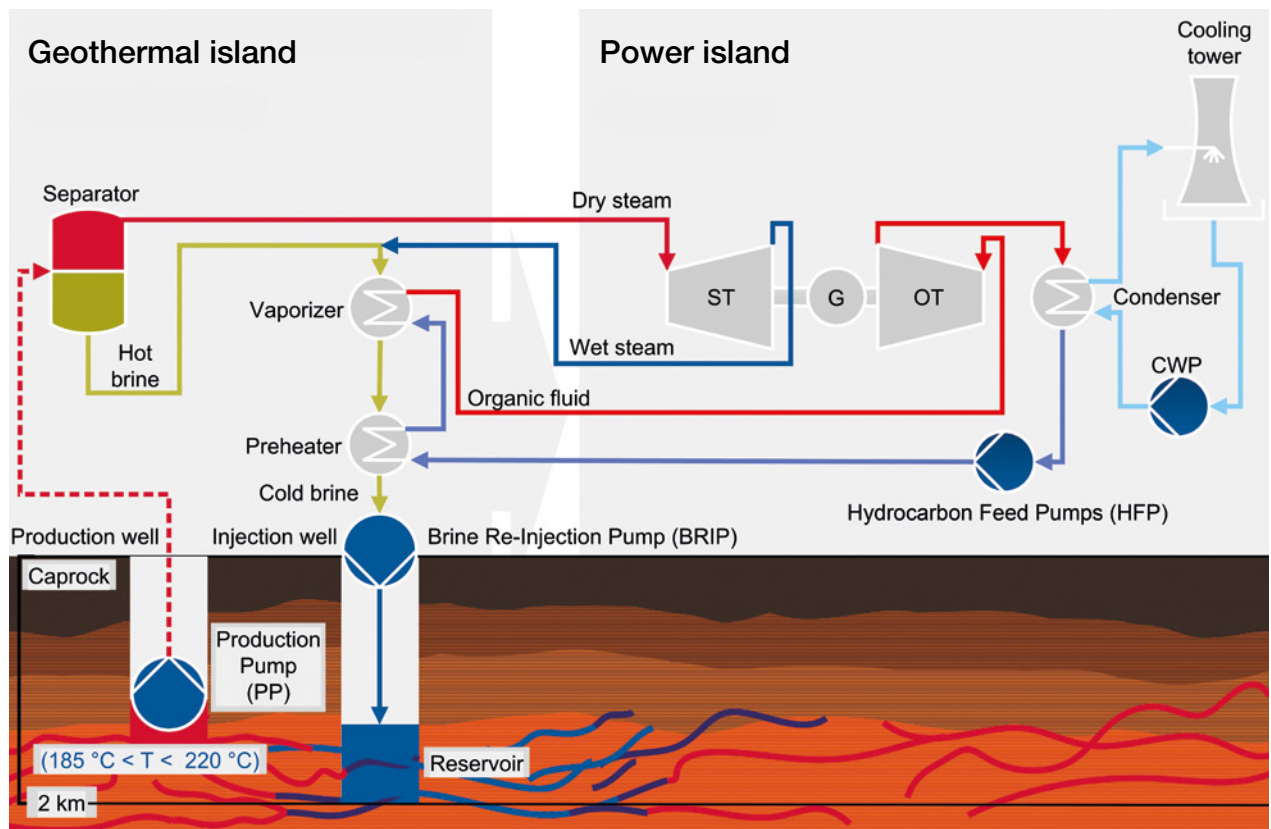
A binary cycle plant transfers heat from the hot geothermal fluid ( $105^{\circ}\text{C} < T < 185^{\circ}\text{C}$ ) that is sent through a heat exchanger to vaporize a secondary working fluid such as pentane, iso-butane in the organic Rankine cycle, or ammonia in the Kalina cycle. The working fluid is then expanded in a turbine, condensed and reheated in a closed loop cycle. The brine is disposed of by re-injection into the ground. Sulzer supports these processes with Production pumps (PP), Brine Re-Injection pumps (BRIP), Hydrocarbon Feed pumps (HFP), Cooling Water pumps (CWP) and auxiliary pumps.



- CEP = Condensate Extraction Pump
- CWP = Cooling Water Pump
- FWP = Feed Water Pump
- G = Generator
- ST = Steam Turbine

## Flash/binary cycle geothermal plant

A flash/binary cycle plant uses a combination of flash and binary technology. The portion of the geothermal fluid ( $185^{\circ}\text{C} < T < 220^{\circ}\text{C}$ ) which “flashes” to steam under reduced pressure is first converted to electricity with a back-pressure steam turbine. The low-pressure steam exiting the back-pressure turbine is condensed in a binary system. Sulzer supports these processes with Production pumps (PP), Brine Re-Injection pumps (BRIP), Hydrocarbon Feed Pumps (HFP), Cooling Water pumps (CWP) and auxiliary pumps.

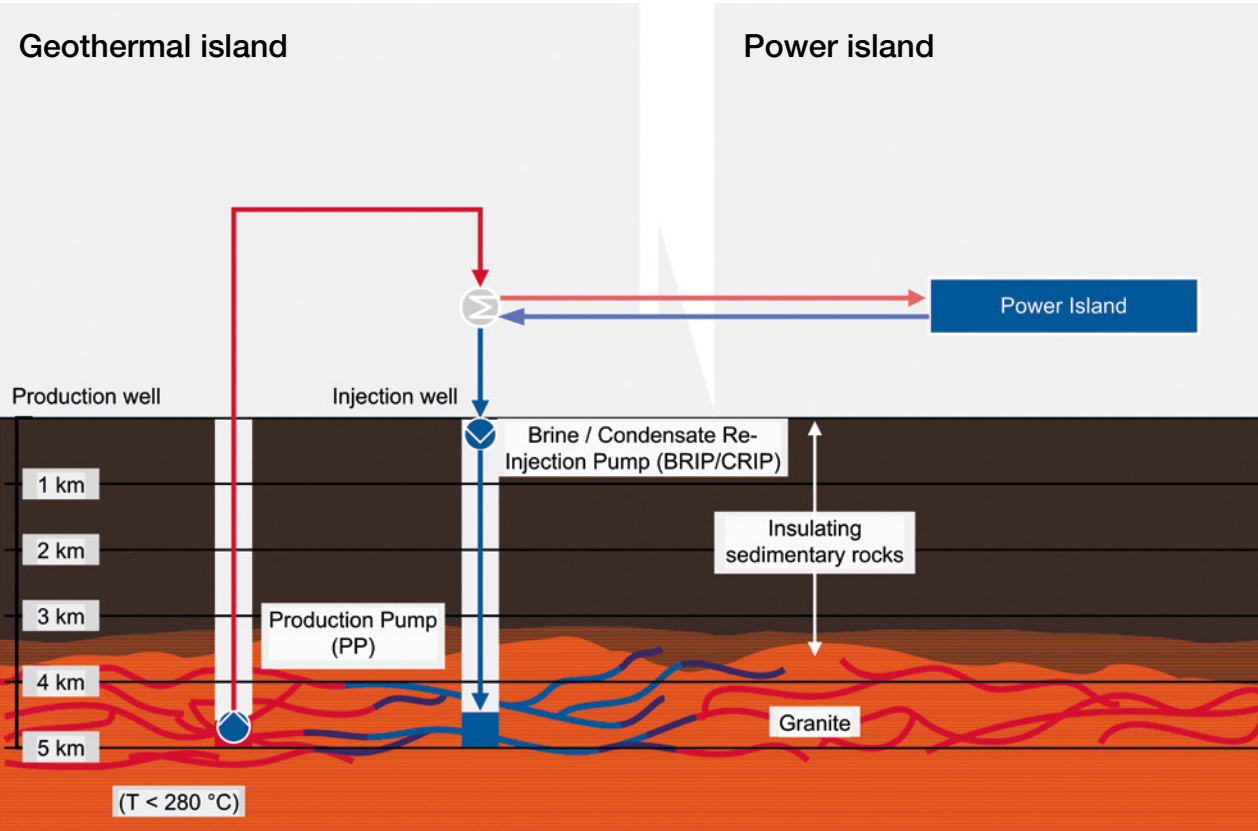


- G = Generator
- ST = Steam Turbine
- CWP = Cooling Water Pump
- OT = Organic Turbine



## Enhanced geothermal system (EGS)

Enhanced Geothermal Systems (EGS) have an injection well (deeper than the ground water tables) drilled into hot bedrock that has limited permeability and fluid content. Water is injected at very high pressure usually by reciprocating pumps, to ensure fracturing and re-opening of existing fractures some distance from the injection wellbore. The production well, which intersects the stimulated fracture network, has water circulated to extract the heat from the hot rock. The temperature of the water extraction can be higher than in the natural geothermal fields, resulting in higher vaporization pressures and thermodynamic efficiencies. Depending on the production hot water temperature ( $T < 280^{\circ}\text{C}$ ), the EGS fields can be typically combined with binary cycle or flash steam power plants. Sulzer supports these processes with high pressure Brine Re-Injection pumps (BRIP), Condensate Re-Injection pumps (CRIP), Hydrocarbon Feed Pumps (HFP), Cooling Water pumps (CWP) and auxiliary pumps.





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# Our comprehensive product portfolio

Power plant type	Application					
	Geothermal island			Power island		
	Production pump	Condensate-Injection Pump (CRIP)	Brine Re-Injection Pump (BRIP)	Hydrocarbon feed pump	Cooling Water Pump (CWP)	Auxiliary pump
	Pump type					
	SJT-GEO	SJD-CEP ZE PRE	OHH PRE BBS MBN MC MSD HPcp	SJD-CEP SJD-API	SJT SMD SMN ZPP	AHLSTAR CPE SNS
Dry steam geothermal plant		●			●	●
Flash steam geothermal plant	●	●	●		●	●
Binary cycle geothermal plant	●		●	●	●	●
Flash/binary geothermal plant	●		●	●	●	●
Enhanced geothermal system (EGS)		●	●	●	●	●

# Geothermal island product overview

## Production pump

### SJT-GEO production hot water pump

#### Features and benefits

- Increased flow for higher geothermal hot water production capacity of 13 3/8" wells
- Increased power transmission capability
- Increased temperature for high enthalpy geothermal resources
- Water lubricated bearings or oil recovery system to protect environment
- Up to 5.5" end-play axial float for shaft adaptation to shallow geothermal wells

#### Applications

- Production hot water for geothermal power plants

#### Key characteristics

Capacities	up to 680 m <sup>3</sup> /h / 3'000 USgpm
Heads	up to 700 m / 2'300 ft.
Pressures	up to 100 bar / 1'450 psi
Temperatures	up to 220°C / 428°F





## Condensate re-injection pumps

### SJD-CEP vertical can mounted turbine type pump

#### Features and benefits

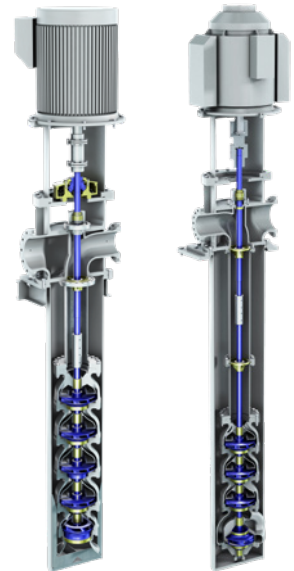
- Carbon graphite product lubricated bearing in bowls and columns for long maintenance-free periods
- Removable seal housing allows servicing throttle bushing without removing the head
- Separate fabricated driver stand allows using one suction and discharge head per pump size
- Spacer coupling allows servicing the mechanical seal and thrust bearing as needed
- Can is provided with lateral and anti-rotational ribs uniform inlet velocity along the can length
- Various options available for the first stage impeller hydraulics, including double suction impeller allowing optimum sizing of pump

#### Applications

- Condensate re-injection pump
- Hydrocarbon feed pump

#### Key characteristics

Capacities	up to 4'900 m <sup>3</sup> /h / 21'560 USgpm
Heads	up to 470 m / 1'540 ft.
Pressures	up to 47 bar / 680 psi
Temperatures	up to 100°C / 212°F



### ZE end suction pump

#### Features and benefits

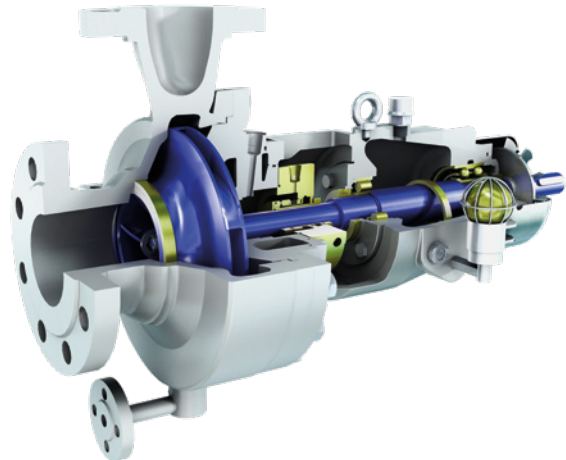
- Designed for hot or cold water medium design pressure applications with relatively low Net Positive Suction Head (NPSH) available
- Modular construction to provide maximum interchangeability of spares

#### Applications

- Condensate re-injection pump

#### Key characteristics

Capacities	up to 2'600 m <sup>3</sup> /h / 11'440 USgpm
Heads	up to 300 m / 1'000 ft.
Pressures	up to 100 bar / 1'450 psi
Temperatures	up to 425°C / 800°F



### PRE/PRER/PRETR end suction pumps

#### Features and benefits

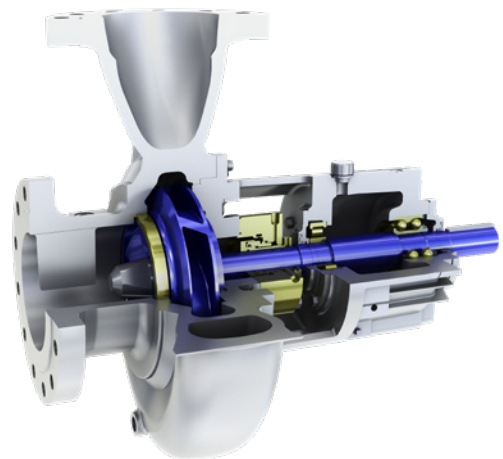
- Centerline mounted to allow thermal expansion without jeopardizing the shaft alignment
- Wear rings and balance holes optimized to maximize seal and bearing life
- Extra heavy-duty shaft for low shaft deflection and long life of seal and bearings
- PRER/PRETR reinforced designs available for very high pressure services (up to 200 bar)

#### Applications

- Condensate re-injection pump
- Brine re-injection pump

#### Key characteristics

Capacities	up to 4'500 m <sup>3</sup> /h / 19'800 USgpm
Heads	up to 320 m / 1'050 ft.
Pressures	up to 60 bar / 870 psi
Temperatures	up to 400°C / 752°F



## Brine re-injection pumps

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### OHH overhung single stage pump ISO 13709 / API 610 OH2

#### Features and benefits

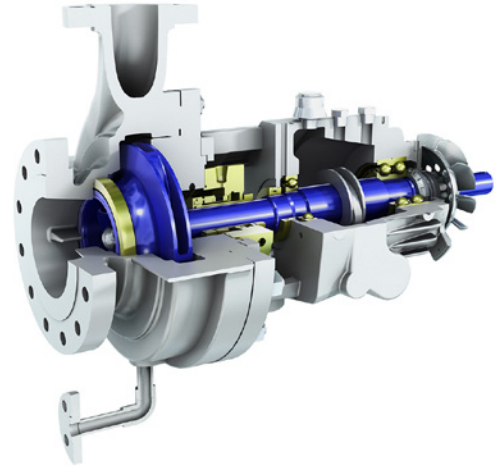
- Finned bearing housing and fan cooling for long bearing life
- Broadest range map in the industry for ISO 13709 (API 610) type OH2 pumps
- Heavy duty baseplates with 2x ISO 13709 (API 610) nozzle load option
- ISO 21049 (API 682) cartridge type mechanical seals for reduced emissions
- Electric motor, Variable Frequency Drive (VFD), engine and steam turbine drivers

#### Applications

- Brine re-injection pump

#### Key characteristics

Capacities	up to 2'250 m <sup>3</sup> /h / 10'000 USgpm
Heads	up to 360 m / 1'200 ft.
Pressures	up to 75 bar / 1'110 psi
Temperatures	up to 425°C / 800°F



### PRE/PRER/PRETR end suction pumps

#### Features and benefits

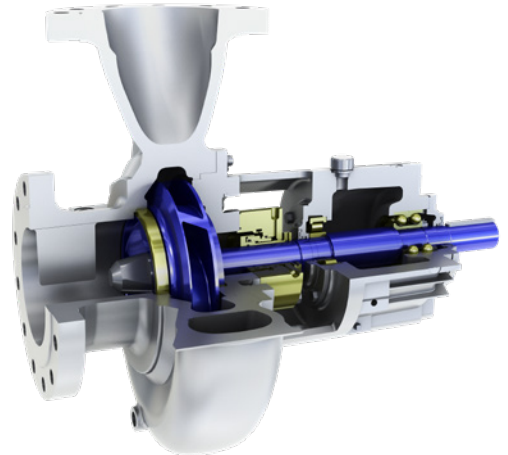
- Centerline mounted to allow thermal expansion without jeopardizing the shaft alignment
- Wear rings and balance holes optimized to maximize seal and bearing life
- Extra heavy-duty shaft for low shaft deflection and long life of seal and bearings
- PRER/PRETR reinforced designs available for very high pressure services (up to 200 bar)

#### Applications

- Condensate re-injection pump
- Brine re-injection pump

#### Key characteristics

Capacities	up to 4'500 m <sup>3</sup> /h / 19'800 USgpm
Heads	up to 320 m / 1'050 ft.
Pressures	up to 60 bar / 870 psi
Temperatures	up to 400°C / 752°F



### BBS between bearings single stage pump ISO 13709 / API 610 BB2

#### Features and benefits

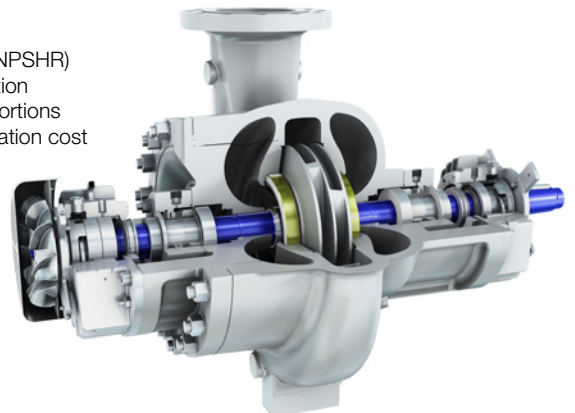
- Centerline support for reduced thermally induced misalignment
- Double suction impeller for low low Net Positive Suction Head Required (NPSHR)
- First critical speed is well above operating speed range for smooth operation
- Casing designed for 2x API 610 nozzle loads for freedom from piping distortions
- Grouted or ungrouted, 1x or 2x nozzle load baseplates for reduced installation cost

#### Applications

- Brine re-injection pump

#### Key characteristics

Capacities	up to 5'000 m <sup>3</sup> /h / 22'000 USgpm
Heads	up to 450 m / 1'500 ft.
Pressures	up to 50 bar / 740 psi
Temperatures	up to 425°C / 800°F





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## MBN medium pressure stage casing pump

### Features and benefits

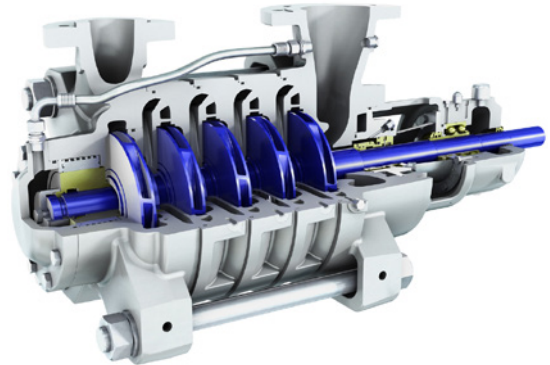
- Simple construction to minimize dimensions and reduce investment and maintenance costs
- High quality investment cast impellers and diffusers for better efficiency
- Fast and easy impeller mounting
- Bearing unit can be serviced without disassembling the pump
- Wide range of materials including duplex stainless steel grades

### Applications

- Brine re-injection pump

### Key characteristics

Capacities	up to 700 m <sup>3</sup> /h / 3'080 USgpm
Heads	up to 900 m / 2'950 ft.
Pressures	up to 140 bar / 2'030 psi
Temperatures	up to 180°C / 355°F



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## MC high pressure stage casing pump

### Features and benefits

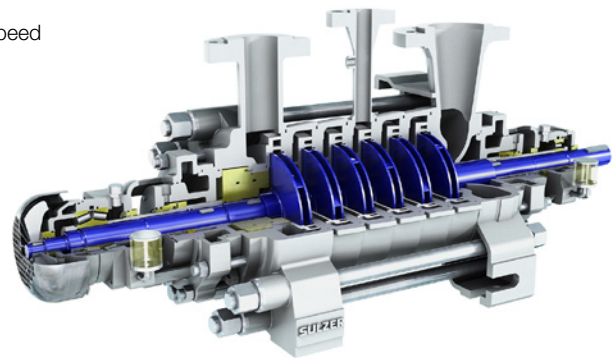
- Modular hydraulics for high efficiency in a wide range of operating conditions
- Large branch sizes for optimized inlet flow, low noise level and higher allowable forces and moments
- Unaffected by rapid temperature variations
- Easy access for cleaning to the seal cooling chambers
- Stiff shaft design for critical speeds above the maximum operating speed

### Applications

- Brine re-injection pump

### Key characteristics

Capacities	up to 1'700 m <sup>3</sup> /h / 8'500 USgpm
Heads	up to 1'750 m / 5'500 ft.
Pressures	up to 180 bar / 2'610 psi
Temperatures	up to 180°C / 355°F



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## MSD and MSD2 axially split multistage pumps BB3

### Features and benefits

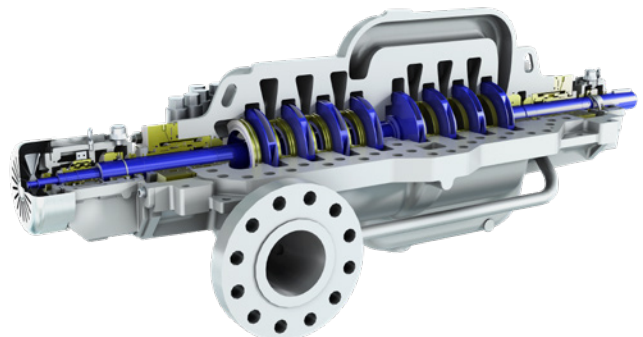
- Broadest hydraulic coverage of any BB3 type multistage pump in the market
- Axially split casing means rotor balance is not disturbed when rotor is installed
- Opposed impellers balance axial thrust, saving lube system costs on most applications
- Double suction, first-stage available on most sizes for reduced Net Positive Suction Head (NPSH)

### Applications

- Brine re-injection pump

### Key characteristics

Capacities	up to 3'200 m <sup>3</sup> /h / 14'000 USgpm
Heads	up to 2'900 m / 9,500 ft.
Pressures	up to 300 bar / 4'400 psi
Temperatures	up to 200°C / 400°F



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## HPcp diffuser style high energy pump ISO 13709 / API 610 BB5

### Features and benefits

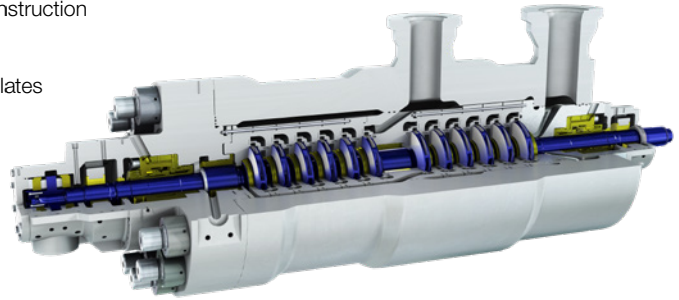
- Inline or back-to-back rotor stack designs for rotordynamic stability
- Forged Carbon steel, Duplex SS, HIP's and overlaid barrel construction
- Twistlock or bolted barrel closure with Superbolts™
- Sleeve, pocketed, or tilt pad bearings
- Grouted, ungrouted and offshore 3- or 4-point support baseplates

### Applications

- Brine re-injection pump

### Key characteristics

Capacities	up to 4'000 m <sup>3</sup> /h / 20'000 USgpm
Heads	up to 10'200 m / 33'500 ft.
Pressures	up to 1'100 bar / 16'000 psi
Temperatures	up to 200°C / 400°F



# Power island product overview

## Hydrocarbon feed pumps

### SJD-CEP vertical can mounted turbine type pump

#### Features and benefits

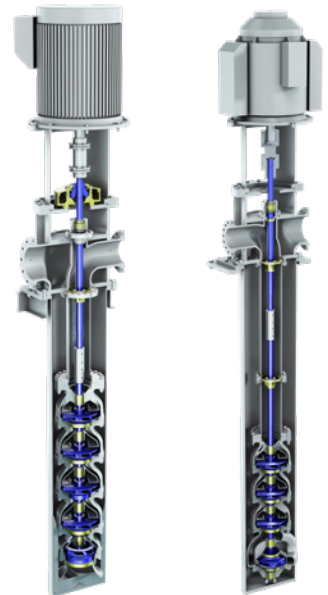
- Carbon graphite product lubricated bearing in bowls and columns for long maintenance-free periods
- Removable seal housing allows servicing throttle bushing without removing the head
- Separate fabricated driver stand allows using one suction and discharge head per pump size
- Spacer coupling allows servicing the mechanical seal and thrust bearing as needed
- Can is provided with lateral and anti-rotational ribs uniform inlet velocity along the can length
- Various options available for the first stage impeller hydraulics, including double suction impeller allowing optimum sizing of pump

#### Applications

- Condensate re-injection pump
- Hydrocarbon feed pump

#### Key characteristics

Capacities	up to 4'900 m <sup>3</sup> /h / 21'560 USgpm
Heads	up to 470 m / 1'540 ft.
Pressures	up to 47 bar / 680 psi
Temperatures	up to 100°C / 212°F





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## SJD-API vertical can mounted turbine type pump

### Features and benefits

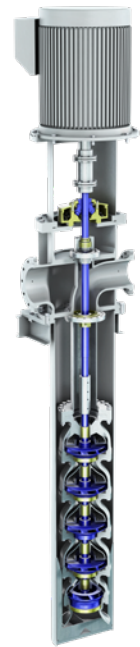
- Can be built as VS 1 construction
- Reduced number of stages results in shorter, more reliable pumps
- Double suction on larger sizes can reduce pump length
- High efficiency with reduced power consumption
- Modular construction to fit project nozzle location requirements
- High head per stage means process conditions can be reached with slower speeds
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### Applications

- Hydrocarbon feed pump

### Key characteristics

Capacities	up to 3'800 m <sup>3</sup> /h / 20'000 USgpm
Heads	up to 900 m / 3'000 ft.
Pressures	up to 75 bar / 1'100 psi
Temperatures	up to 205°C / 400°F



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## Cooling water pumps

### SJT vertical pump

#### Features and benefits

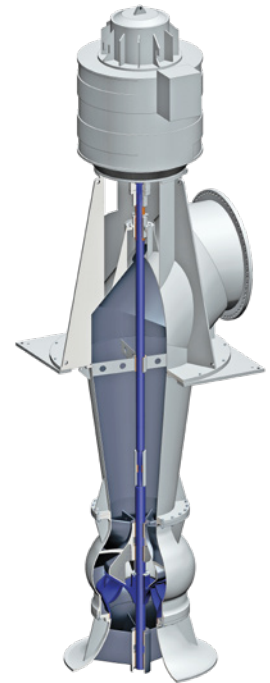
- Optimized hydraulics for high efficiency
- Packed stuffing box for reliable sealing and simple maintenance; mechanical seal is optional
- Rubber-lined product-lubricated bearing in bowls and columns for long maintenance-free periods; other bearing materials are also available
- Optional spacer coupling allows servicing the seal and thrust bearing as needed

#### Applications

- Cooling water pump

#### Key characteristics

Capacities	up to 12'000 m <sup>3</sup> /h / 52'840 USgpm
Heads	up to 1'830 m / 6'000 ft.
Pressures	up to 78 bar / 1'130 psi
Temperatures	up to 100°C / 212°F



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## SMD axially split casing double suction pump

### Features and benefits

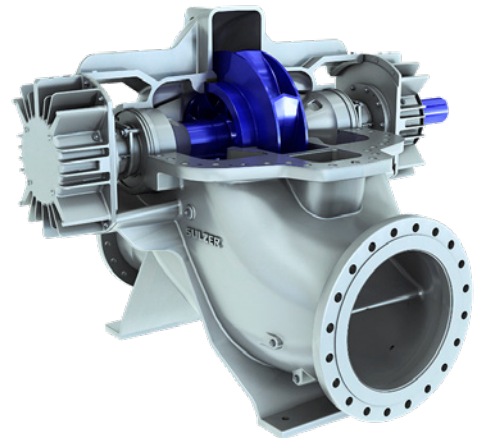
- Optimum hydraulic fit with high efficiency maintained over a wider flow range
- Exceptionally low Net Positive Suction Head Required (NPSHR) value not only at the best efficiency point but also on overload
- Maintenance-friendly features; excellent interchangeability of parts
- Horizontal and vertical constructions

### Applications

- Cooling water pump

### Key characteristics

Capacities	up to 24'000 m <sup>3</sup> /h / 106'000 USgpm
Heads	up to 260 m / 850 ft.
Pressures	up to 34 bar / 490 psi
Temperatures	up to 140°C / 280°F



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## SMN axially split casing double suction pump BB1

### Features and benefits

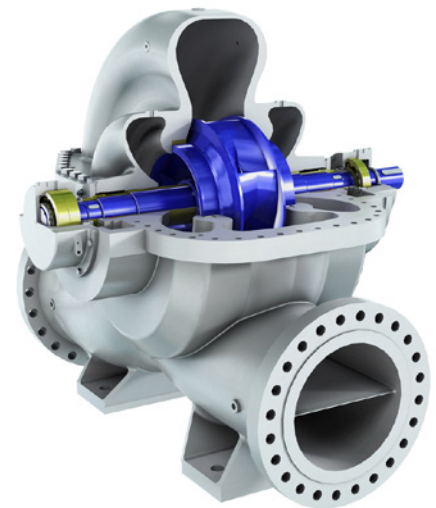
- Broad hydraulic coverage through over 50 different sizes
- High efficiency
- Robust design for long service life
- Easy maintenance
- Flexible layout enabled by clockwise and counterclockwise rotation / vertical and horizontal arrangements

### Applications

- Cooling water pump

### Key characteristics

Capacities	up to 10'000 m <sup>3</sup> /h / 44'000 USgpm
Heads	up to 200 m / 650 ft.
Pressures	up to 30 bar / 435 psi
Temperatures	up to 50°C / 120°F



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## ZPP double suction axially split single stage pump

### Features and benefits

- Exceeds requirements of international ISO 5199 standard
- Unique, patented and superior design features minimize life cycle costs
- Quick and easy installation, reliable operation, easy maintenance and service

### Applications

- Cooling water pump

### Key characteristics

Capacities	up to 25'000 m <sup>3</sup> /h / 130'000 USgpm
Heads	up to 160 m / 525 ft.
Pressures	up to 20 bar / 290 psi
Temperatures	up to 120°C / 250°F



## Auxiliary pumps

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### AHLSTAR end suction single stage long coupled centrifugal pump

#### Features and benefits

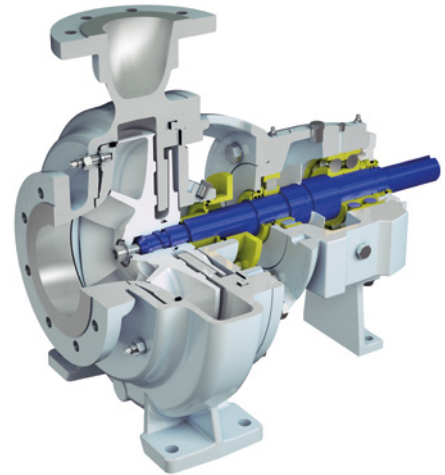
- Exceeds standard requirements of international ISO 5199 and ISO 2858 standards
- Suitable for the most demanding industrial applications
- Unique, patented and superior design features minimize life cycle costs
- Quick and easy installation, reliable operation, easy maintenance and service

#### Applications

- Auxiliary services

#### Key characteristics

Capacities	up to 11'000 m <sup>3</sup> /h / 48'400 USgpm
Heads	up to 160 m / 525 ft.
Pressures	up to 25 bar / 360 psi
Temperatures	up to 180°C / 355°F



### CPE end suction single stage centrifugal pump

#### Features and benefits

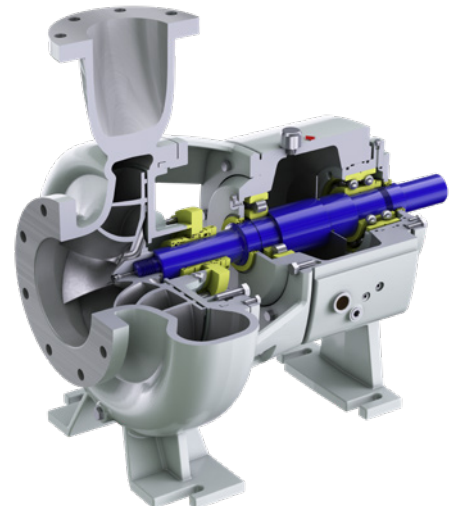
- Designed to exceed the strictest energy regulations for all the industries as well as the requirements of ASME B73.1
- Revolutionary hydraulics and high efficiency to offer the lowest life cycle costs
- Improved reliability
- Minimized total cost of ownership

#### Applications

- Auxiliary services

#### Key characteristics

Capacities	up to 1'650 m <sup>3</sup> /h / 7'000 USgpm
Heads	up to 275 m / 900 ft.
Pressures	up to 27.5 bar / 400 psi
Temperatures	up to 260°C / 500°F



### SNS end suction single stage centrifugal pump

#### Features and benefits

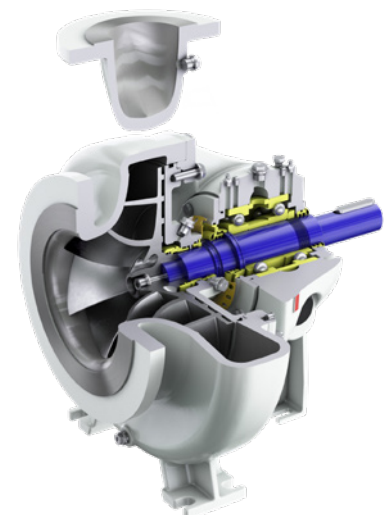
- Designed to meet the design requirement of EN ISO 5199 international standard
- Exceeding EU's (European Union) requirements for energy-related products (ErP)
- Highest efficiency across the whole pump range, exceeding the benchmark efficiency index MEI 0.7 (Minimum Efficiency Index)
- New, state-of-the art hydraulics ensure optimum capacity with low net positive suction head required (NPSHr)
- Low energy consumption, high standardization, easy installation and unique construction also equate to lower maintenance and operating costs

#### Applications

- Auxiliary services

#### Key characteristics

Capacities	up to 1'400 m <sup>3</sup> /h / 6'000 USgpm
Heads	up to 160 m / 525 ft.
Pressures	up to 16 bar / 230 psi
Temperatures	up to 120°C / 250°F





**The Sulzer Flow division keeps your processes flowing. Wherever fluids are treated, pumped, or mixed, we deliver highly innovative and reliable solutions for the most demanding applications.**

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The Flow division specializes in pumping solutions specifically engineered for the processes of our customers. We provide pumps, agitators, compressors, grinders, screens and filters developed through intensive research and development in fluid dynamics and advanced materials. We are a market leader in pumping solutions for water, oil and gas, power, chemicals and most industrial segments.

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