RUHRPUMPEN

Specialist for Pumping Technology

PUMPS FOR CONCENTRATED SOLAR POWER

Advanced pumping technology to harness the power of the Sun

All around the world, energy consumption is increasing exponentially. The escalating cost of fossil fuels, their decreasing availability, and environmental concerns are forcing the power industry to find alternative sources of energy.

Concentrated Solar Power is one of the fastest growing energy markets in the world, as the Sun is the cleanest, most abundant renewable energy source available. CSP plants convert sunlight into electricity though a series of processes in which Ruhrpumpen pump technology plays an important role.

A pumping solution for every application

Ruhrpumpen's experience includes the supply of pumps for critical applications found in CSP plants such as:

- Molten salt
- Heat transfer fluid
- Boiler feed water
- Condensate extraction
- Circulating water
- Closed cooling and service water
- Auxiliary services
- Fire protection

Commitment to quality

Our innovative solutions go beyond simple compliance with regulations and standards, reducing risks and improving performance. Ruhrpumpen uses state of the art manufacturing technology to ensure our products meet the highest standards for quality and reliability.

Ruhrpumpen pump systems and units are certified by SAI Global and ANAB EN ISO.

360°

Ruhrpumpen is your single source supplier

- Original Equipment
- Spare parts
- Installation and startup support
- Repair and maintenance
- Engineering, training and consulting
- Reverse engineering

Benefits of our pumps:

- Proven reliability
- High efficiency designs ensure lowest operating cost
- Robust design allows for long system life with minimal maintenance
- Optimized total cost of ownership

Efficient, flexible and environmentally friendly pumping solutions for concentrated solar power plants

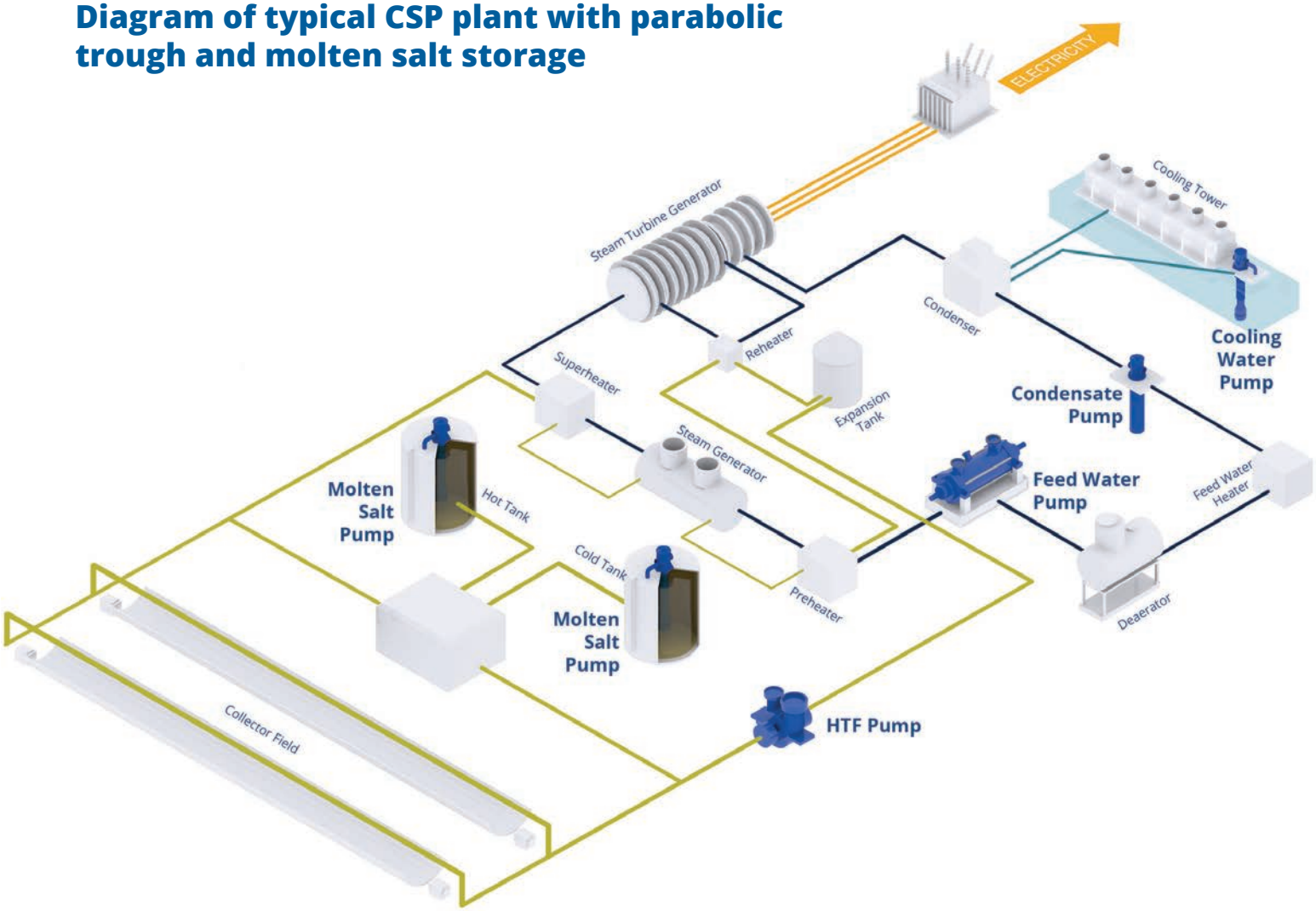
Concentrated Solar Power plants (CSP) combine three major systems to produce electricity by collecting and concentrating sunlight with mirrors and lenses in a Heat Transfer Fluid (HTF, e.g. synthetic oil, or molten salt). Through a heat exchanger system, pumps move the HTF and heat water to generate steam. The power block then produces electricity using a steam turbine and generator.

Concentrated solar power plants are subject to highly variable operation with daily stopping and starting, large temperature differentials and corrosive environments. This requires heavy-duty pumps that can manage temperatures as high as 1100 °F (600 °C). With special materials and design considerations, our HVN and J Line pumps are the perfect choice when handling HTF; while our VLT model can pump molten salt in heat transfer and thermal storage systems.

RP can supply pumps for CSP technologies such as:

- Linear fresnel reflectors
- Parabolic trough
- Central tower
- Beam down

Diagram of typical CSP plant with parabolic trough and molten salt storage



VLT / VCT

Molten salt pump

Single or multi-stage, vertical pumps

CHARACTERISTICS AND DESIGN FEATURES

- HI design, cryogenic and API 610 latest edition (VS1) constructions available
- Low NPSH “shockless entry” first stage impeller
- Integral fabricated column support bearings
- One-piece shaft construction for shaft lengths up to 6 m (20 ft)
- Materials of construction for high temperatures

CHARACTERISTICS FOR MOLTEN SALT APPLICATIONS

- The head is fitted with an all steel rigid coupling
- High temperature packing with nitrogen injection
- Metal-to-metal rabbeted fits between all components
- Cast iron or stellite bearings, with shaft sleeves
- Bleed-off pipes
- Thrust balanced impellers to reduce downthrust and allow proper drainage
- STL LC or stainless steel depending on the temperature that will be reached
- Metal “C” rings used in lieu of O-rings
- Finite element thermal analysis is performed as standard for all MSP

OPERATING LIMITS

Capacity	up to 45,000 gpm up to 9,500 m³/h
Head	up to 4,900 ft up to 1,494 m
Pressure	up to 2,020 psi up to 140 bar
Temperature	up to 1,500 °F up to 815 °C

OTHER APPLICATIONS

- Condensate extraction service
- Hydrocarbon processing
- Pipelines
- Municipal water systems

HVN / J / JS / JD

HTF pump

Radially split, single stage process pumps

CHARACTERISTICS AND DESIGN FEATURES

- Heavy-duty process design according to API 610 latest edition (BB2)
- Single stage, centerline mounted
- Double volute, centerline mounted casing
- Top-top nozzle arrangement, other arrangements on request
- Double suction, dynamically balanced enclosed impeller
- Materials of construction per API 610 (other materials on request)

OPERATING LIMITS

Capacity	up to 30,000 gpm up to 6,814 m³/h
Head	up to 2,000 ft up to 610 m
Pressure	up to 1,813 psi up to 125 bar
Temperature	up to 850 °F up to 450 °C

OTHER APPLICATIONS

- Heavy-duty, high-temperature processes: charge, transfer, injection and utility booster

SCE

HTF auxiliary pump

Horizontal, centerline mounted, single stage process pump

CHARACTERISTICS AND DESIGN FEATURES

- Heavy-duty process design according to API 610 latest edition (OH2)
- Single or double volute depending on size
- Single suction, enclosed impeller
- Designed for continuous duty and over 130 hydraulic combinations available
- Back pull-out design for ease of maintenance
- SCE-L for low flow applications available
- Materials of construction per API 610 (other materials on request)

OPERATING LIMITS

Capacity	up to 14,000 gpm up to 3,200 m³/h
Head	up to 1,575 ft up to 480 m
Pressure	up to 1,300 psi up to 90 bar
Temperature	-110 °F to 850 °F -80 °C to 450 °C

OTHER APPLICATIONS

- Petroleum refining, production and distribution
- Hydrocarbon processing
- Heavy-duty chemical
- Industrial wastes

GP

Boiler feed water pump

Radially split, multi-stage, single case, ring-section type process pump

CHARACTERISTICS AND DESIGN FEATURES

- Non-API and API 610 latest edition (BB4) constructions available
- Modular design for various number of stages
- Available with balance drum or balance disk
- Low NPSH first stage design is available
- Single or double mechanical seals

OPERATING LIMITS

Capacity	up to 4,000 gpm up to 900 m³/hr
Head	up to 13,120 ft up to 4,000 m
Pressure	up to 6,000 psi up to 416 bar
Temperature	up to 400 °F up to 205 °C

OTHER APPLICATIONS

High-pressure and high-temperature applications across industries:

- Refining
- Hydraulic decoking
- Membrane feed pump in reverse osmosis

HSM

Boiler feed water pump

Horizontal, 2 or 4 stage, split case pumps for high pressure applications

CHARACTERISTICS AND DESIGN FEATURES

- HI design (BB3)
- Two or four stage pump with double volute casing and side-side nozzle arrangement
- Double suction, dynamically balanced enclosed impeller
- Cast iron as standard material (other materials on request)

OPERATING LIMITS

Capacity	up to 2,000 gpm up to 454 m³/h
Head	up to 2,200 ft up to 670 m
Pressure	up to 740 psi up to 51 bar
Temperature	up to 250 °F up to 121 °C

OTHER APPLICATIONS

- Circulating water service
- Cooling towers
- Pipelines
- HVAC
- Dewatering
- Municipal water systems
- Fire protection

VCT

Circulating water pump

Single or multi-stage, mixed and radial flow circulating pumps

CHARACTERISTICS AND DESIGN FEATURES

- HI design and API 610 latest edition (VS1) constructions available
- Open, semi-open and enclosed impellers available according to pump model
- It can handle large volumes of liquid with relatively low heads (mixed flow impeller)
- Packing as standard, mechanical seal is available
- Above or below ground discharge
- Optional pull-out design for ease of maintenance (for some large models)
- Cast iron as standard material (other materials on request)

OPERATING LIMITS

Capacity	up to 300,000 gpm up to 68,137 m³/h
Head	up to 330 ft up to 100 m
Pressure	up to 285 psi up to 20 bar
Temperature	-20 °F to 275 °F -30 °C to 135 °C

OTHER APPLICATIONS

Mainly used for water applications:

- Condensate extraction service
- Offshore facilities
- Pipelines
- Storm and flood water disposal
- Water transportation, distribution and treatment

HSC / HSD / HSR / ZW

Cooling water pump

Horizontal, single stage, split case pumps

CHARACTERISTICS AND DESIGN FEATURES

- HI design (BB1)
- High efficiency, foot mounted design
- Double suction, dynamically balanced enclosed impeller
- Mechanical or packing seal
- All HS/ZW pumps can be mounted vertically or horizontally
- Cast iron as standard material (other materials on request)

**See ZM line for API build*

OPERATING LIMITS

Capacity	up to 140,000 gpm up to 31,800 m³/h
Head	up to 2,210 ft up to 480 m
Pressure	up to 298 psi up to 20 bar
Temperature	50 °F to 300 °F 10 °C to 150 °C

OTHER APPLICATIONS

- Circulating water service
- Pipelines
- HVAC
- Dewatering
- Municipal water systems
- Fire protection

Reference project

Molten salt pumps for Solar Two Project

Solar Two Project, developed by Bechtel, was a 10 MW Concentrated Thermal Solar Power Plant, with a molten salt system, in California's Mojave Desert.

The plant had a solar power tower sorrounded by heliostats that reflect the sunlight to the top of the tower. Molten salt was chosen as the thermal storage medium, allowing energy to be stored in large tanks for use during nighttime.

Ruhrpumpen provided its 700VLT pumps for the molten salt applications required for this innovative project. Solar Two was one of the first large scale demonstrations of CSP with molten salt storage and validated the potential for modern day utility scale CSP technology.

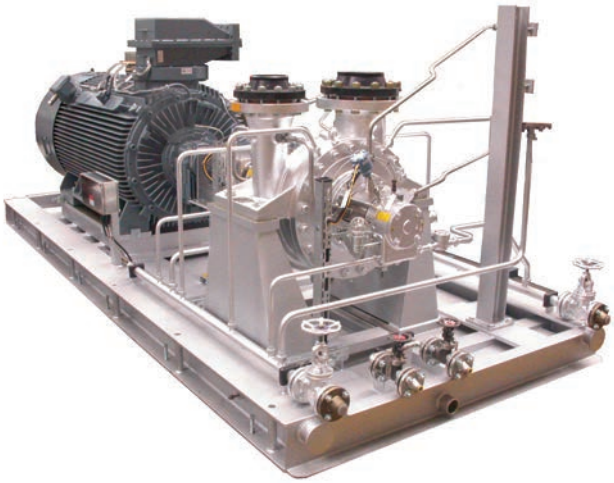
PUMP DETAILS

Capacity	443 gpm (100 m³/h)
Head	44 mcl (453 mca) 186 kW, 288 °C
Speed	3550 RPM

Reference project

HTF pumps for ANDASOL III

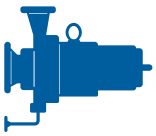
ANDASOL III, developed by Solar Milennium Group, is a CSP plant in Spain with the capacity of delivering electricity to 200,000 homes. It relies on our HVN 12x17 pump as the heat transfer fluid pumps of synthetic oil through the parabolic troughs. Due to the variable operation and daily starts and stops, along with temperatures as high as 750°F (400°C) that needed to be met, Ruhrpumpen selected these HVN pumps with casing and impeller fabricated in chrome steel. Moreover, the pumps are equipped with cooling systems, seals, gauges, lubrication systems, and are driven by electric motors and variable frequency drives.



PUMP DETAILS

Capacity	7,032 gpm (1,600 m³/h)
Head	951 ft (290 m)
Temperature	up to 750 °F (400 °C)
Speed	3356 RPM

Additional Ruhrpumpen pumps for power generation services

	RP MODEL	DESCRIPTION	SERVICE	OPERATING LIMITS
	**CRP-M**	Sealless process pump with magnetic drive acc. to DIN EN ISO 2858 & 15783	Heating and cooling circuits Thermal oils	Capacity up to 9,690 gpm (2,200 m³/h) Head up to 1,080 ft (330 m)
	SCE-M	Heavy-duty process pump with magnetic drive acc. to API 685	Heating and cooling circuits Thermal oils	Capacity up to 2,200 gpm (500 m³/h) Head up to 705 ft (215 m)
	**CPP / CPO CRP**	Single stage, end suction ANSI & ISO process pumps sign (OH1)	Auxiliary services Fire protection	Capacity up to 12,340 gpm (2,800 m³/h) Head up to 770 ft (235 m)
	**GSD**	Single stage, end suction general service pump (OH0)	Auxiliary services	Capacity up to 4,500 gpm (1,022 m³/h) Head up to 400 ft (122 m)
	**SD / SDV**	Single stage, end suction pump in horizontal and vertical installations (OH3A)	Water auxiliary services	Capacity up to 61,700 gpm (14,000 m³/h) Head up to 147 ft (45 m)
	**SM / SM-I**	Axially split, multi-stage, double volute casing process pump (BB3)	Boiler feed	Capacity up to 8,806 gpm (2,000 m³/h) Head up to 5,249 ft (1,600 m)
	JTN	Axially split, multi-stage, diffuser casing process pump (BB3)	Boiler feed	Capacity up to 1,321 gpm (300 m³/h) Head up to 2,625 ft (800 m)
	**A-LINE**	Radially split, multi-stage, double case, barrel type process pump (BB5)	Boiler feed	Capacity up to 6,160 gpm (1,400 m³/h) Head up to 13,776 ft (4,200 m)
	**DSV**	Heavy-duty, double suction, single or multi-stage, vertical centrifugal pump (VS2)	Cooling water	Capacity up to 80,000 gpm (18,170 m³/h) Head up to 800 ft (244 m)
	**VSP**	Single casing, vertical sump pumps for wet pit applications (VS4)	Cooling water Utility pump	Capacity up to 8,500 gpm (1,931 m³/h) Head up to 425 ft (130 m)
	**COMBITUBE**	Single stage, pitot tube pump for low flow, high head applications (HI design)	Boiler feed Reactor feed	Capacity up to 352 gpm (80 m³/h) Head up to 4,856 ft (1,480 m)
	**RDP**	Reciprocating plunger pumps in triplex and quintuplex formats acc. to API 674 & ISO 13710	Dosing pump Auxiliary services	Capacity up to 1,611 gpm (366.5 m³/h) Discharge pressure up to 14,500 psi (1,000 bar)
	**VTG**	Multi-stage, vertical turbine generators (reverse running pumps) (VS6)	Small hydroelectric needs Water distribution	Capacity up to 29,174 gpm (6,626 m³/h) Head up to 3,500 ft (1,067 m)
Pre-Packaged Fire Pump Systems		Fire systems incorporate pumps, drivers, control systems and pipework in a single container. They can be skid mounted, with or without enclosure and supplied with electric motor or diesel engine. NFPA 20-850 with UL and FM approved components.	Fire protection	Capacity up to 5,500 gpm (1,250 m³/h) Head up to 670 ft (204 m) Pressure up to 355 psi (24 bar)

+65 years creating the pumping technology that moves our world

Ruhrpumpen is an innovative and efficient pump technology company that offers highly-engineered and standard pumping solutions for the oil & gas, power generation, industrial, water and chemical markets. We offer a broad range of centrifugal and reciprocating pumps that meet and exceed the requirements of the most demanding quality specifications and industry standards such as API, ANSI, UL, FM, ISO and Hydraulic Institute.

Ruhrpumpen Plants

- ARGENTINA, Buenos Aires
- BRAZIL, Rio de Janeiro
- CHINA, Changzhou
- EGYPT, Suez
- GERMANY, Witten
- INDIA, Chennai
- MEXICO, Monterrey
- RUSSIA, Moscow
- UK, Lancing
- USA, Tulsa

Manufacturing plant & service center

Service center