Sealless Pumps—Best industry practice for Concentrated Solar Power (CSP)

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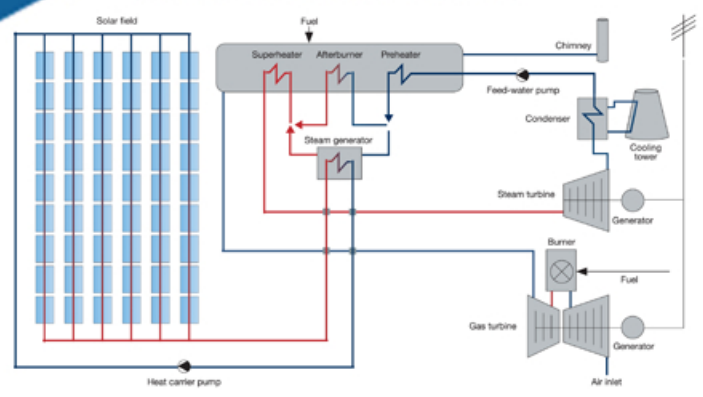
Schematic of a Parabolic Trough Solar Plant (ISCCS) Integrated Solar Combined Cycle System
(Image courtesy of Ferrostaal / Solar Millennium)



Synergy potential of hybrid power plants

In hybrid power plants, solar energy is used in addition to fossil or biogenic fuels. Through this combination, solar thermal power plants can also operate continuously at base load even when the radiation available is fluctuating, or conventional power plants can be made even more efficient. For example, the integration of a solar field into a combined cycle power plant raises profitability by improving the capacity utilisation of the turbines, by buffering absent solar energy and through the good combined costing of the power mix.

Pump use in CSP

Pumps are required to circulate the Heat Transfer Fluid (HTF) around the solar field and generate useable clean energy, see schematic.

Experience in Europe has shown mechanical seals have high failure rates due to the pressures and temperatures required for HTF circulation.

Mechanical seal failures cause

- **HSE Risk**
  - **Fires**
  - **Release of high temperature product**
- **Expense (Replace HTF, Replace mechanical seal)**
- **Downtime and loss of plant availability**

It has been seen by large scale CSP operators that the mechanical sealing system is the weakest link of the pump!

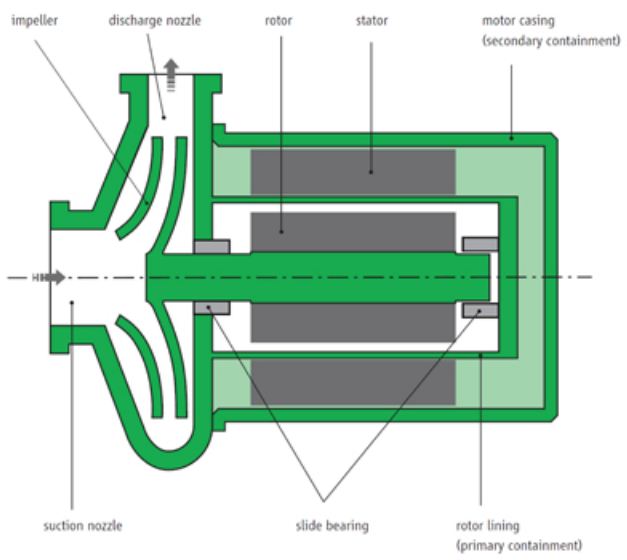
Canned Motor Pump

The Canned Motor Pump is a combination of a pump and electric motor. The motor rotor and pump hydraulics share a common shaft (see below). Drive is transmitted in the same manner as a standard electric motor.

A leak free seal is provided the stator lining in between the rotor and stator. Full secondary containment is provided by the stator housing giving the **highest level of safety.**

Canned motor pumps are not hampered in the same way as mechanical seals meaning;

- **Suitable for fluids 400°C at 100bar pressure and above**



Schematic of a Canned Motor Pump (Image courtesy of Hermetic Pumpen GmbH)

Hermetic Canned Motor Pump in operation in Spain at the Plataforma Solar de Almeria (PSA), pumping water 300°C with 100bar system pressure
(Image courtesy of Auquime SA)

Canned Motor Pump Use in CSP

Hermetic Canned Motor Pumps have been used for pumping **Hot Oil** as a HTF on;

- **50MW solar plant in Spain**
- **150MW Integrated Solar Combined Cycle System (ISCCS) in Egypt**

Pumps have also been supplied for pumping water on Direct Integrated Solar Steam (DISS) plant pumping water as the HTF;

- **Plataforma Solar de Almeria (PSA) test field in Spain**
- **Kanchanaburi Province in Thailand (Asia's first parabolic trough plant)**

Aside from these parabolic trough installations the pumps have been proposed for Linear Fresnel and Dish collector systems.

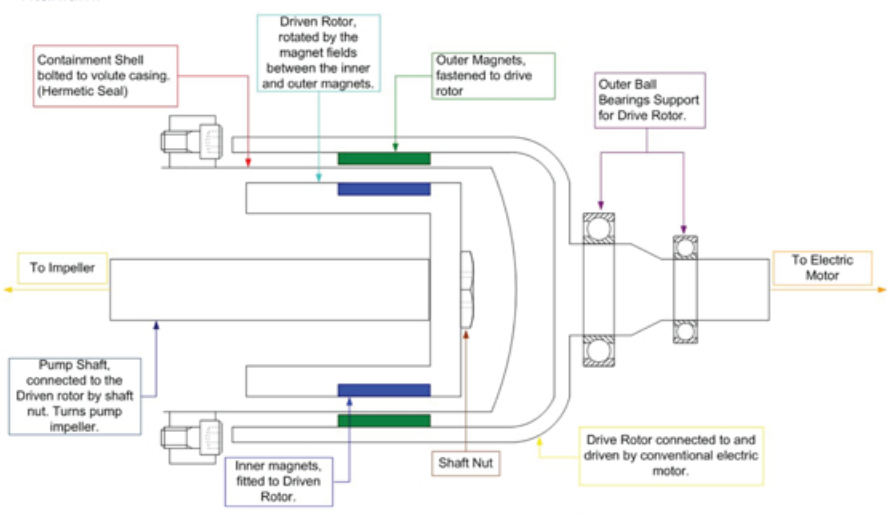
Magnetic Drive Pumps

The magnetic drive pump uses permanent magnets to transmit drive. An outer drive rotor is connected to a conventional electric motor, drive is transmitted to a driven rotor using permanent magnets (see below).

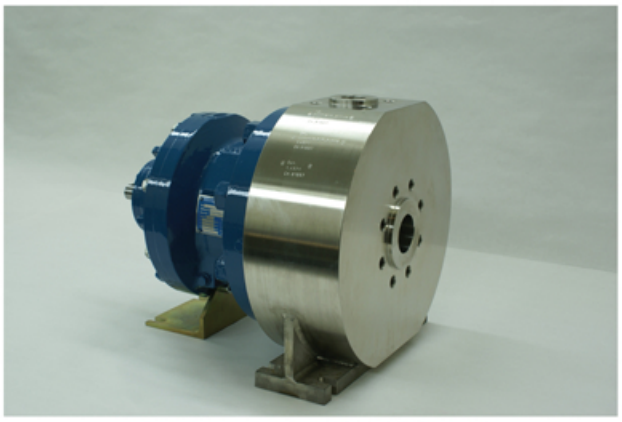
A leak free seal is provided by the isolation shell placed in between the 2 rotors.

Using high temperature magnets this technology can circulate fluids up to **450°C with no external cooling.**

Designs are also capable of handling pressures of **120 bar and above** through the use of Titanium.



Magnetic coupling working principle



High pressure design magnetic drive pump
(Image courtesy of Klaus Union)

Magnetic Drive Pump Use in CSP

Due to the ability of magnetic drive pumps being able to handle very high temperature fluids they have been used in the solar field specifically;

- **Pumping hot oil on parabolic trough solar plants in Spain**

The use of magnetic drive has also been proposed on steam systems and Dish Collector systems.

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