

# Canned motor pumps in solar thermal power stations

There are numerous technical and industrial processes which generally absorb or emit energy. Water and steam are often used to transmit heat within a temperature range of 0 °C to 200 °C, because of their high specific heat value. Machines and plant manufacturers and end users predominately make use of heat transfer oils for heating or cooling in temperature ranges from 200 °C to 450 °C. The following information describes the design and mode of operation for sealless canned motor pumps, including specifics for high-temperature applications.

Canned motor pumps are completely sealed centrifugal pumps in monobloc design, which

are driven by the so-called canned motor via a common shaft. There are two design principles available for high-temperature applications:

→ Canned motor pump with externally cooled motors (Fig 1)

→ Canned motor pumps with internally cooled motors (Fig 2)

In this design with externally cooled motors, the pump is spatially separated from the canned motor by an intermediate piece, which acts as a thermal barrier. This prevents heat

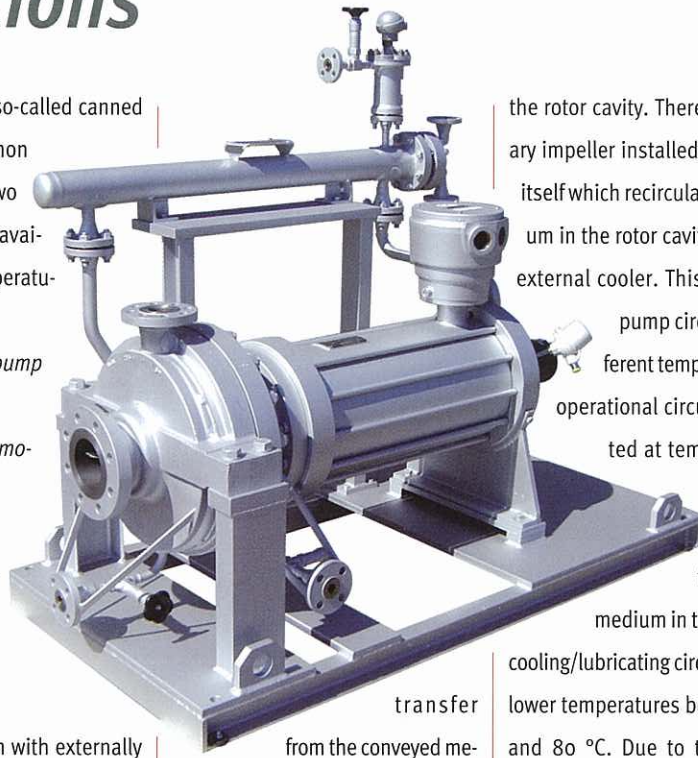


Fig 1 Single Stage Canned Motor Pump Type CNPK 100x50x400

the rotor cavity. There is an auxiliary impeller installed in the motor itself which recirculates the medium in the rotor cavity through an external cooler. This creates two pump circuits with different temperatures. The operational circuit can be rated at temperatures of up to 450 °C, while the conveyed medium in the secondary cooling/lubricating circuit has much lower temperatures between 60 °C and 80 °C. Due to the pressure equalization in the thermal barrier's circumferential gap, there is hardly any fluid exchange between the two temperature levels.

If there is not enough quality

coolant, or no coolant at all, available for cooling the motor, it is necessary to turn to different design principles. In addition, no matter what conveyed medium is used, the medium will always need to be heated before initial operation; in the pump as well as in the canned motor. The temperatures required for this are generally in a range which exceeds the allowed maximum temperature of the aforementioned Insulation Class H. That is where the canned motors furnished with special Insulation Class C windings come into play. Windings of this type are able to withstand constant temperatures of 450 °C at the winding ends. They are rated for economical motor loads of up to 400 °C (temperature of the conveyed medium). Fins at the centre of the motor's casing improve heat dissipation through natural convection.

### New Solar Energy Applications

Solar thermal power stations, particularly those placed on the Earth's 'sunbelt', are regarded as suitable industrial scale technology for creating inexpensive electricity from solar power. These concentrated systems come under the heading CSP

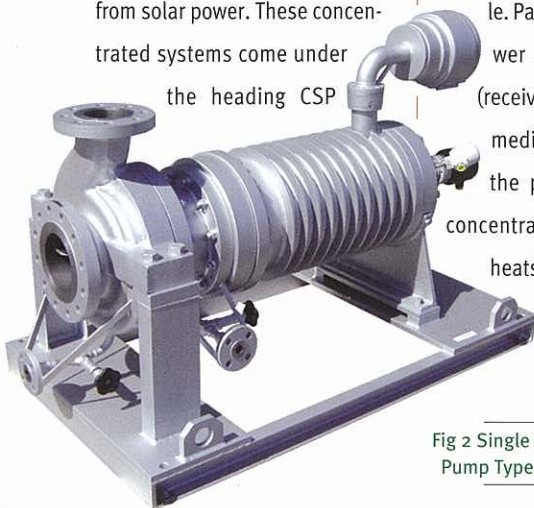


Fig 2 Single Stage Canned Motor Pump Type CNPF 150x100x290



Fig 3 Single Stage Canned Motor Pump Type CNPK 250-630

(Concentrating Solar Power) Technology. There are four different types of solar thermal power plants on the market, categorized by the type of mirror system used:

- *parabolic trough solar power-stations,*
- *solar power towers,*
- *Dish-Stirling systems, and*
- *fresnel reflectors.*

Parabolic Trough Solar Power Station with Heat Transfer Oil Intermediate Circuit

Parabolic trough solar power stations are considered a proven technology and are currently already constructed on an industrial scale. Parabolic trough solar power stations use a pipe (receiver) with a heat transfer medium in the focal line of the parabolic trough. The concentrated solar radiation heats the heat transfer medium, generally a synthetic heat transfer

oil, to approximately 400 °C. Individual troughs are connected to one another by distribution lines. The distribution lines carry the heat transfer oil to a heat exchanger, which vaporizes water. The steam, just like in a regular power plant, drives a steam turbine.

Hermetic pumps of the type CNPK (Fig 1) are used to recirculate the 400 °C synthetic thermal oil. All pumps are operated using a frequency converter, to achieve maximum efficiency during the day depending on the flow rate.

### Parabolic Trough Solar Power Station with direct vaporization

Water is the heat transfer medium used for direct steam creati-

on in parabolic trough solar power stations. Without going into the many advantages of direct vaporization, let it be said that the technical challenges raised by the world's largest direct vaporization plant, the Parabolic Trough Test Station DISS (Direct Solar System) on the Plataforma Solar de Almeria (PSA) in Spain.

A hermetic pump of the type CAMKT 30/6 (PN 100) is used to recirculate the water (100 bar system pressure at 400 °C). The pump is a multistage canned motor pump in can construction. The construction needs only one single seal instead of 6 static seals. A hermetic pump of the type CAMKT 44/3 (PN 100) was also used for Asia's first parabolic trough solar power station with direct vaporization (Thailand –Kanchanaburi Province).

Canned motor pumps for high-temperature applications are used for many technical and industrial processes where process heat must be supplied. Solar thermal energy has opened a new field of application in which canned motor pumps are used by preference due to their special characteristics.

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