Most of the processes in industrial process engineering take place where energy is absorbed or released simultaneously. Only a defined temperature level enables the required reactions or working processes in plants to take place. For precise control of the process the indirect heat input using heat carrier liquids is advantageous. In this case a heat transfer medium is circulated between the heater and heat consumer. The working temperatures in these heat carrier circuits are mainly between 100 °C and 400 °C. Different heat carrier liquids can be used for the transfer of energy to the heat consumer.

In the temperature range up to approximately 200 °C, water is the preferred medium as it is non-polluting and has a high specific thermal capacity. In the temperature range from 200 °C to 400 °C, organic heat transfer liquids are preferable because the vapour pressure also rises considerably when the temperature increases. For handling these heat transfer media, volute casing pumps have been specially developed. Because of the different physical properties of the heat transfer liquids the hot water pumps are different in design to the heat transfer oil pump.

**Technical data:**
- Output: 200 m³/h
- Delivery head: 60 m
- Temperature: max. 160 °C uncooled
- Casing pressure: PN 16
- Material: GGG 40.3 (Ductile iron)

**ZLN**
Standard hot water pump

Up to temperatures of 160 °C, the ZLN, a standard water pump in accordance with EN 733/ DIN 24255, can be used with an uncooled, balanced mechanical seal. Product circulation ensures that the mechanical seal is permanently surrounded by the medium thus preventing dry running. In plants where the necessary vapour pressure cannot be maintained, the ZLN with a throttling device is used. The throttling device maintains a sufficient pressure level in the mechanical seal chamber to prevent evaporation.

**ZLI**
Inline hot water pump

The economical inline design is becoming more acceptable where hot water is used, as it can be directly mounted into any pipework system. The ZLI uses a stub shaft connection which makes it possible to use a standard motor, giving the pump a compact design. The max. pumping temperature for the uncooled ZLI in the hot water design is limited to 150 °C. The back pull out design allows the disassembly of the complete pump unit without removing the pump casing from the pipework.
The design of conventional single-stage hot water pumps is based mainly on standard pumps to EN 733/DIN 24255 and EN 22858/DIN 24256. Modification to the seals makes these pumps suitable for specific requirements.

The pumping of hot water makes high demands on the pump design. Safe operation is influenced, to a high degree, by the mechanical seal. Therefore the parameters of pressure, temperature and sliding speed at the mechanical seal are optimised so that the service life is considerably increased.

Many other manufacturers of pumps and mechanical seals allow standard pumps with uncooled shaft seals to be operated at temperatures up to 180 °C. However, high thermal stresses, friction, insufficient margin from the vapour pressure as well as deformation of the seal surfaces may lead to a short service life and an unfavourable cost/benefit ratio. Therefore, operation at temperatures of more than 180 °C is only feasible using expensive cooling measures. Although these measures will reduce the operating temperature at the mechanical seal, they will, at the same time, increase the installation and operating costs.

This is not the case with the ZEN, a volute casing pump to EN 22858, where the mechanical seal has been placed at the "cold end"/drive end, of the pump. By means of a double heat barrier, a favourable drop in temperature at the drive end of the shaft is obtained. Even at inlet temperatures up to 230 °C, the use of an uncooled mechanical seal does not cause any problems as the temperature will not exceed 100 °C in the seal area.
When pumping hot water it is not merely sufficient to place the seal at the cold end, because this particular medium tends to vaporise during heating. Due to centrifugal forces, gas bubbles will be deposited on the smallest rotating parts, these being generally the sliding surfaces of the mechanical seal. The ZEN counters these physical effects by using patented gas separator in the mechanical seal chamber. At the highest point is a collecting chamber for the resulting gases, which can be ventilated by a valve both during standstill and start up of the plant. Vaporisation in the mechanical seal chamber can also be avoided as the chamber is connected through the flushing bore of the sleeve bearing so that the consequential low temperature maintains the liquid above its vapour pressure.

Shaft deflection also contributes to excessive wear of the shaft seal and to overcome this, deflection has been minimized in the ZEN by maintaining a short distance from the ball bearing to the mechanical seal. The sleeve bearing at pump end is hydrodynamically balanced and is lubricated by the medium; it has a special geometry in order to promote the proper flow of lubricant. The internal bearing is of wear-resistant tungsten carbide. This combination has optimum properties for the handling of hot water. The slotted pump feet compensate for thermal expansion and thus prevent additional tension in the pipe system.

This programme includes a multistage centrifugal pump to cover the range up to 12 m³/h.

The hydraulic parts of the ZEN 31 are enclosed by a barrel. Dimensions of the pipe connection remain unchanged, even when the duty parameters are altered, because of the adaptibility of the hydraulic parts. Apart from the hydraulics, this pump is identical with the volute casing design and consequently can be operated uncooled up to 230 °C.

The series ZDN is based on the same technology as the ZEN; the maximum operating temperature is 185 °C.

Technical data:
Output: 600 m³/h
Delivery head: 90 m
Temperature: max. 230 °C uncooled
Casing pressure: PN 40
Material: GGG 40.3 (Ductile iron)
Organic or synthetic heat transfer liquids offer the possibility to heat or cool without high system pressures.

In the course of the development of heat transfer installations and their liquids, the standard DIN 4754 has been compiled. This standard determines, among other things, safety requirements for the operation of pumps in hot oil circuits. Volute pumps in accordance with EN 733/DIN 24255 are also generally accepted for this specification.

**ZTK/ZTI**

Compact design thermal oil pumps

The ZTK and ZTI have been specially developed for installation in compact machinery. The series only differ from each other in the shape of the pump casing.

The ZTK has a volute casing with axial inlet and radial discharge branches, whereas the ZTI has an inline casing which can be installed directly in the pipe system. Both pumps are designed as monobloc units and are fitted with a stub shaft which makes it possible to use standard motors. Furthermore the stub shaft principle is able to compensate for heat stresses between the pump and motor. The back pull out design allows the disassembly of the complete pump unit without removing the pump casing from the pipe work system.

By means of the double acting heat barrier and a ventilation fan, a favourable drop in temperature is obtained at the drive end. Heat losses at the product end are effectively prevented and the use of an uncooled standard mechanical seal becomes possible. In order to prevent the medium leaking from the pump in the case of sudden failure of the mechanical seal, a radial shaft seal ring has been installed as additional protection.

**Technical data:**
- Output: 200 m³/h
- Delivery head: 60 m
- Temperature: max. 350 °C ungekühlt
- Casing pressure: PN 16
- Material: GGG 40.3
The new series **ZTN** has been developed for handling thermal oil up to 350 °C in the heating processes. The increased demands on operational safety, environmental protection and the reduction in running expenses have consequently been considered in this design. This also applies to the standards DIN 4754 and EN 733.

All pressure loaded components are of ductile materials, e.g. GGG 40.3 (ductile iron). The complete field chart for the new heat transfer pump is covered by 29 sizes making it an economical selection for your application. The heat losses of the ZTN were able to be reduced considerably by installing a heat barrier arranged behind the hydraulics. Furthermore the pump is fitted with a thermally isolated bearing carrier. A sliding sealing cartridge compensates for possible thermal expansion and thus prevents distortion between the pump and coupling. By additional throttling a favourable drop in temperature in the shaft seal area is achieved. This allows the use of single, uncooled shaft seals.

**Technical data:**
- **Output:** 1000 m³/h
- **Delivery head:** 90 m
- **Temperature:** max. 350 °C uncooled
- **Casing pressure:** PN 16
- **Material:** GGG 40.3

**Technical data – ZTK magnetic drive:**
- **Output:** max. 600 m³/h
- **Delivery head:** 90 m
- **Temperature:** max. 300 °C uncooled
- **Gehäusedruck:** PN 16
- **Materials:** GGG 40.3 (ductile iron), stainless steel

Because of increasing environmental consideration, more stringent regulations are being applied by various Health & Safety authorities and the legal demands on greater safety, glandless pumps are increasingly being used, in particular when handling synthetic heat transfer liquids which are considered as damaging to a operators health. For these applications, pumps with magnetic couplings are becoming more and more acceptable. A leakproof magnetic coupling is the optimum solution in such cases where leakage to atmosphere of the heat transfer medium must be totally prevented, especially where oxygen is present. After careful examination a plants requirements and the required operating conditions not only can permanent trouble free operation be expected but also an active contribution to environmental protection be made. By moving the magnetic coupling to the cold end of the pump and keeping to the standard dimensions (DIN 24255/56) we have succeeded in operating thermal oil pumps safely, without cooling, at inlet temperatures up to 400 °C.

**ZTK magnetic drive**

**Compact magnetic pump – up to 300 °C uncooled**

The **ZTK magnetic drive** in monobloc design has proved successful when operating at temperatures up to 300 °C. This magnetic coupling design is not only completely leakproof but also practically maintenance-free. New higher wear-resistant sleeve bearings of silicon carbide/tungsten carbide give a long service life and the deep drawn isolating shroud, with a wall thickness of 1.6 mm, offers additional safety. The magnets are of high quality samarium/cobalt (SmCo); their outstanding
features are: high density magnetic energy, magnetic size and a high temperature load limit. Unlike the bearing bracket design, the alignment of pump and motor is not necessary. The modular design of the pump range ensures it is suitable for a comprehensive range of applications. This can be combined optionally with volute casings as per DIN 24255/24256 or inline casings. The robust construction and the possibility to mount an external filter for partial flow also makes these pumps suitable for difficult applications.

**ZTK magnetic drive**

*With a heat barrier – up to 400 °C – uncooled*

For temperatures up to 400 °C, a design with a heat barrier where a “dead ended” magnetic chamber is used. The heat barrier separates the pump thermally from the magnetic coupling and prevents heat flow into the magnetic chamber. In order to prevent the generation of additional heat by eddy current losses in the metallic isolation shroud, a shroud of industrial ceramics (zirconium oxide) is used. This material is not conductive and therefore it does not generate additional heat in the magnetic chamber. It is possible therefore to start the pump without venting the magnetic chamber.

**Technical data – ZTK magnetic drive with a heat barrier:**
- Output: 600 m³/h
- Delivery head: 90 m
- Temperature: max. 400 °C
- Casing pressure: PN 25
- Material: GGG 40.3 (Ductile iron), stainless steel GS-C25

The application of ceramic isolation shrouds is also recommended if the medium tends to polymerize, crystallize or solidify in case of heat input. A throttle bush near the internal magnet additionally prevents heat entering during operation. The sleeve bearing at the pump side is hydrodynamically balanced and lubricated by the medium; it has a special geometry in order to secure proper flow of the lubricant. The internal bearing is of wear-resistant tungsten carbide, the external bearing of solid silicon carbide. This combination has optimum properties for the handling of thermal oils. The casings or the pressure loaded components, are of GGG 40.3 or stainless steel respectively. Above 350 °C, according to DIN 4754 high-temperature steels are required which means that cast steel GS-C25 must be used for casings. Otherwise the 400 °C design corresponds to the previously mentioned version. At present the max. temperature limit is 400 °C.