

Pumps are the heart of heat-transfer plants

Manufacturers in a variety of industries depend on heat-transfer plants to heat or cool their machines and apparatus. German firm *heat11 GmbH & Co. KG* specializes in heat-transfer plants of virtually all types. The chemical industry uses their installations for controlling the temperature of reactors and during the production of color pigments and liquid crystals. In the plastics industry, heat-transfer plants are essential for producing polyethylene terephthalate (PET) and in the production of CDs and DVDs. But recently, according to heat11's Managing Director Dietmar Hunold, heat recovery has become an increasingly important application.

Oil or water?

Operators considering the use of a heat-transfer plant must answer a fundamental question: water or oil as the heat-transfer liquid? If the answer is oil, then they must choose between petroleum-based and synthetic varieties. Since oil can be used up to 350 °C without pressurization, it is commonly used in applications over 200 °C in order to avoid the high pressures associated with water vapor. As a result, the entire system can be constructed with thinner walls. Oil also does not have the corrosive properties of water. By contrast, at 200 °C water exhibits a pressure of 16 bar; at 250 °C, the pressure reaches 40 bar.

For applications that require temperatures of between 350 and 400 °C (such as ground preparation or manufacturing of semiconductors and printed circuits), synthetic oil is the only choice.

Pump requirements

Pumps are of central importance in every heat-transfer system, since they convey the boiler-heated liquid to the places it is needed. However, the high temperature of the liquid places special requirements on the pumps' sealing systems. "I've been in this business a long time and it is my experience that pumps from Allweiler AG have proven their value in these applications," according to Mr. Hunold. So it should come as no surprise that most of his company's systems contain heat-transfer centrifugal pumps from Allweiler AG of southern Germany. Colfax Fluid Handling's Allweiler brand has provided heat

transfer pumps to global customers for more than 40 years. High-temperature pumps, designed specifically for synthetic heat-transfer oils, have been available for approximately 10 years.

Standard versions of these pumps are available in pressure ratings PN16 and PN25. Versions up to PN40 are available upon request for use with liquids that operate at high pressures. Special materials like nodular cast iron GGG 40.3 are used if the medium will be cooled to below -10 °C. If very high capacities are required (like in PET plants), the "Allheat 1000" is selected. This pump is capable of moving up to 1,450 m³/h with a delivery head of 100 m.

Similar to the choice between oil or water, operators must make a fundamental decision here as well: mechanical seal or magnetic coupling.

Due to their design characteristics, mechanical seals will always wear, necessitating regular maintenance. Pumps equipped with a magnetic coupling, on the other hand, are significantly more expensive to procure and exhibit lower overall efficiency than mechanical-seal pumps. For these two reasons, approximately 80% of pumps used by heat11 GmbH are equipped with mechanical seals, according to Mr. Hunold.

In any case, synthetic heat-carrier oils do place special demands on pumps. Compared to petroleum-based oils, their lubricity is lower.

Special design solutions

Residual low-boiling compounds place additional stress on the system and pumps. Low-boiling compounds reduce pump capacity, which increases stress on the burner's heating surface, accelerating decomposition of the heat transfer fluid, and ultimately forming more low boilers. Special design solutions are required to compensate for this situation. A large sealing area and the ability to collect gases within the pump (where they can be easily removed) are critical for extending the pump's service life and increasing its reliability. In addition, the bearing and the seal must be adapted precisely to each other, the low viscosity, and the overall application. Carbon bearings with non-balanced mechanical seals as well as silicon carbide bearings with balanced seals have proven to be effective combinations. Silicon carbide bearings and balanced seals also give the pumps a greater ability to resist sludge and other contamination in the oil. Finally, quench fluid buffers contribute to a longer service life of the gaskets and provide greater security against leaks. A quench further reduces temperature at the mechanical seals and eliminates the possibility that fluid leaking out of the seal will oxidize and cause damage to the seal.

Furthermore, this principle makes it possible to use non-hermetic pumps with critical liquids, since the use of a non-critical quench liquid greatly thins the pumped liquid in a way that is comparable to the effects of a corresponding double-action mechanical seal. From the standpoint of operations and efficiency, hermetic pumps have the advantage that they consume less power by avoiding excessive losses from friction and vortex stream during power transmission.

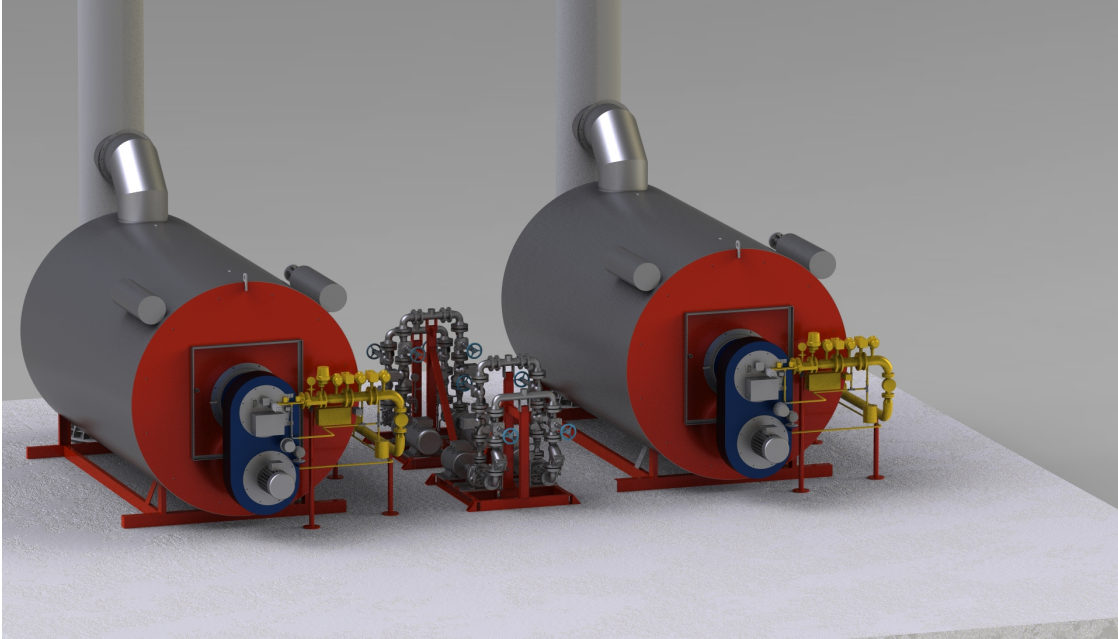
In addition, the bearings used in the “Allheat” pumps are specifically designed for the requirements of lower-lubricity synthetic oils, i.e. the special bearing geometry does not compress the bearings, but instead allows them to tilt. The special bearing geometry permits angular misalignment that is up to three times greater than with conventional bearings that are pressed into position. This avoids point strains and lengthens service life. Finally, a larger bearing surface ensures reliable formation and retention of the lubricating film at all times.

Double-cardanic couplings are used for all high-temperature applications and especially for systems that exhibit strong hot/cold differences. These couplings safely absorb even very high mechanical loads.

Other benefits

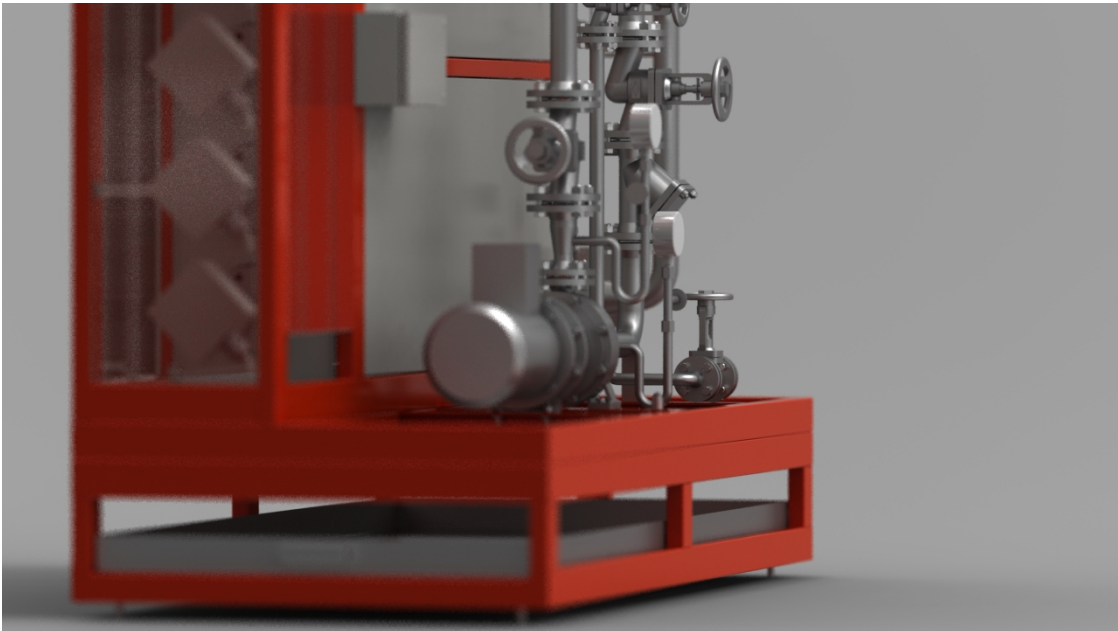
From the perspective of heat11, the design advantages of using Colfax Fluid Handling’s Allweiler pump/motor assemblies are complemented by three more important points: decades of experience, a global service network, and a broad product range. heat11 guarantees its customers 24/7 spare parts service and rapid availability of a service technician. “This makes it very important that we work with a suitable vendor,” according to Mr. Hunold. It is also important that each customer’s system contains pumps from only one manufacturer, since this is the only way to keep expenses associated with spare parts and maintenance low.

Pumps of the Allheat series pump both low-viscosity, synthetic heat-transfer oils up to 400 °C as well as hot water up to 207 °C with the identical material configuration. These pump units employ a flexible modular system. Depending on the specific application, they are available in base-plate, block, and inline versions.



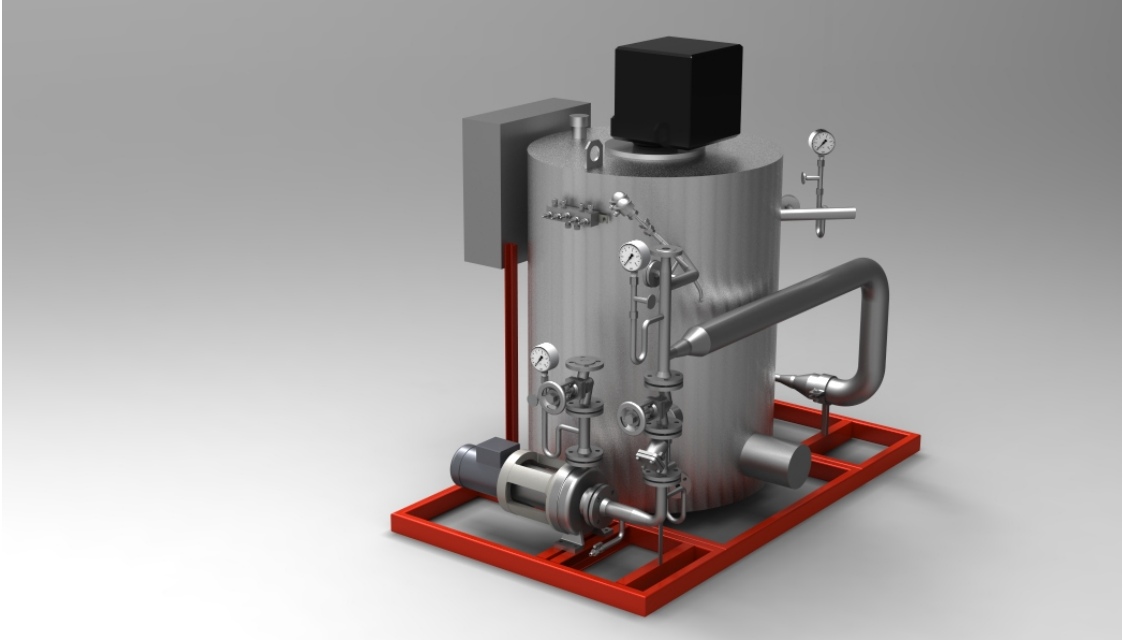
Tabasco.45

Two gas-fired boilers using heat-transfer oil. Each boiler generates 4500 kW of power and has two double-pump groups, each with one operational and one standby pump.



Rauch 320kW.38

Compact pump group using heat-transfer oil, with an electrically-heated, heat-transfer system.



Single.65

Close-coupled pump attached to a fired boiler (for heat-transfer oil).

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ABOUT ALLWEILER – Allweiler GmbH is the oldest German pump manufacturer and the European market and technology leader for macerators and centrifugal, propeller, screw, progressing cavity, gear, rotary lobe and peristaltic pumps. Headquartered in Radolfzell and with locations in Bottrop and Gottmadingen, Allweiler owns a foundry and produces its own stators. Main industries are commercial marine, oil & gas, chemical processing, specialty chemical, and waste and wastewater installations.

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