

Thermal Oil – A Standard with Unknown Depth

Thermal oil is a general term for a multitude of products that require explanation. Even though the application of thermal oils has been state-of-the-art in heat transfer plants for more than 60 years, thermal oils are often not used optimally and are only given minimal and sometimes no maintenance. Special products, e.g. such as silicone oils for applications in open bath thermostats and HT1 oils for the foodstuff industry are often not known at all to the users in many cases.

FRAGOL is a manufacturer and supplier of thermal oils with a portfolio of more than 40 products, comprising all typical material groups, and expertise in all relevant analytical requirements. Thermal oil is in focus here on a daily basis.



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Oil analyses are always a topic for controversial discussions. From the point of view of a manufacturer and supplier of oils, what are the key steps in oil analysis?

There are three main steps in oil analysis:

1. The sample must be taken properly.
2. The measurement results according to the type of oil must be determined in a specialized laboratory according to DIN 51 529.
3. The measurement results must be assessed by a qualified person taking into account the considerations regarding the installation and operation.

For steps 1 and 2 at this point we refer to the expert contribution by the NESS company in the appendix regarding proper sampling (section 1) and in chapter 2 regarding the measurement values to be determined and the associated methods. Both steps are described in an excellent manner. In addition, however, we would also like to highlight step 3. What is the point of an optimum sample and perfectly measured results if the assessor does not have the necessary expertise? In reality incorrect assessments are often made for this reason. 2 examples below:

1. Individual values are considered and not the interaction of the values. For example, if only the dirt content is high and all other values are within a good range, then this is not a criteria for changing the oil, but in most cases only relates to a sample which has not been taken properly. In this case, the sampling point has not been flushed sufficiently, so that a new sample must be requested.
2. With thermal oils, which are used in heating processes (e.g. mineral oil), the flashpoint may well drop from more than 200 °C to only just around 100 °C. This is totally normal as a result of decomposition. This reduced flashpoint, however, is often used as a criteria for a change, even though changing the oil is generally not necessary. Simple actions can be taken to enhance it again (see NESS specialist contribution for degassing systems (section 3.1)). The system prerequisites for degassing must be at hand of course.

During the assessment expert knowledge is required, since only in this way can values be considered in context, inconsistencies detected (e.g. insufficient sampling) and solutions be defined. Exceeding one individual limit value rarely causes the need for an oil change, particularly because limit values are only guiding values and are not rigid limits. And only knowledge regarding the capabilities of the individual oil types allows an assessment as to whether the oil condition is corresponding to the information on the installation and operation.

As a thermal oil specialist, FRAGOL also offers special analytical checks that go beyond the standard per DIN 51 529. What do these look like?

Just like the selection of the optimum thermal oil for the intended application, this is also a very extensive field. So, for example, in the biomass power plant sector we analyze, in addition to the thermal oil, the silicone oil-based working fluid for the ORC turbines and whether cross-contamination has taken place.

Another exciting area for special analysis is the foodstuffs industry. Here we carry out extended analyses for thermal oils with HT1 approval, in order to detect or rule-out contamination.

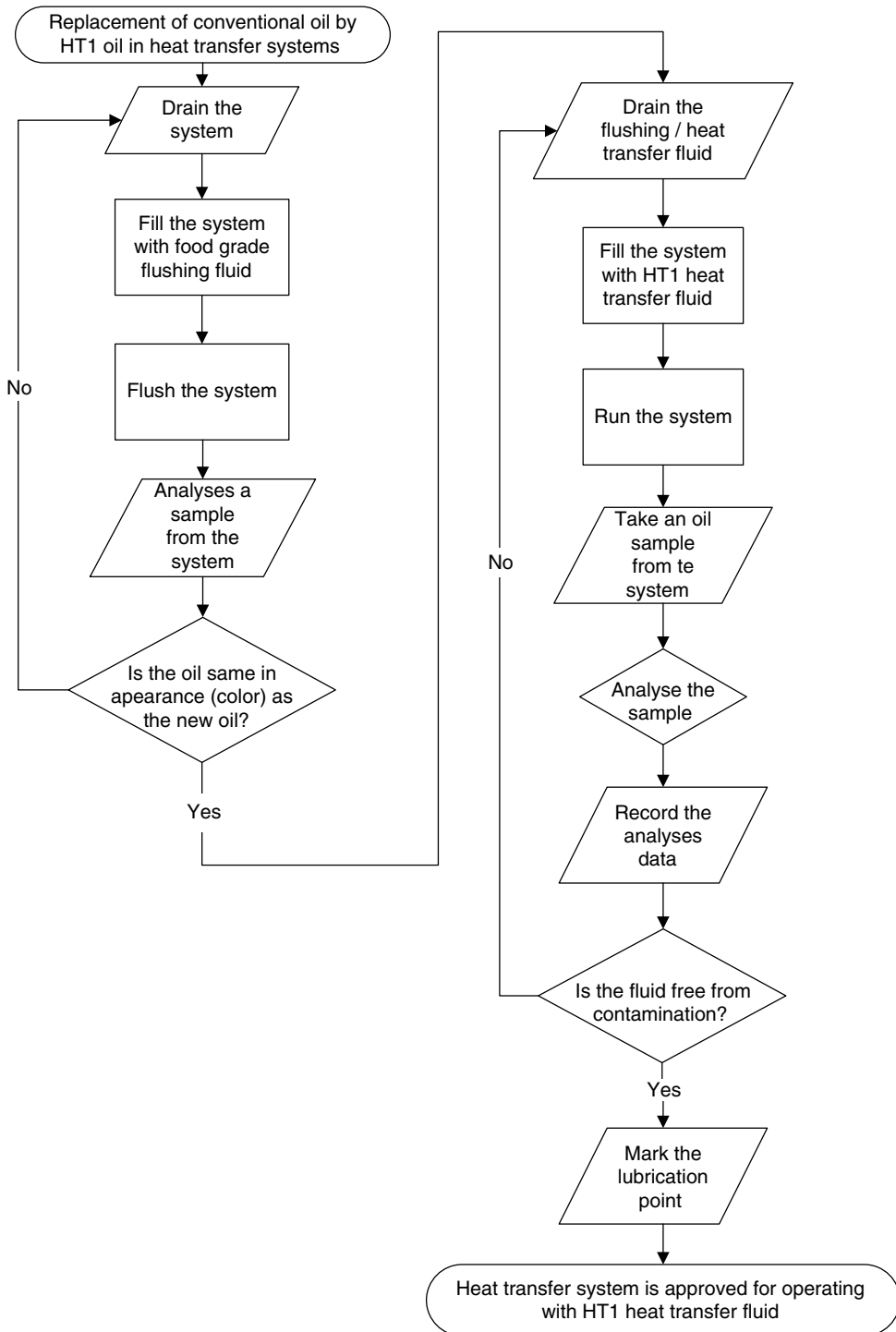
Foodstuffs industry – that sounds like demanding requirements. What are the challenges for thermal oils in this sector?

That's right. More and more companies are working according to the HACCP-concept (**H**azard **A**nalysis and **C**ritical **C**ontrol **P**oints). The objective is to identify, analyze and minimize all hazards present in the enterprise relating to the safety of the foodstuffs and therefore the consumer. Critical control points must be identified, where interventional limits, monitoring and corrective measures must be defined.

Referring to the selection of thermal oils, this means that products with an HT1 certification (e.g. by NSF International) are preferred. Furthermore, additional certificates may be required for certain religions. The FRAGOL THERM thermal oils for the foodstuffs industry are therefore all certified as halal and kosher.

One question is always asked regarding HT1 products: "Can I distribute my foodstuffs, if I had a leak and the foodstuff has come into contact with HT1 product?" This question, which surprises many people, must be answered with a clear "NO". The definition for the HT1 category is as follows: "This product is acceptable for use as a heat transfer fluid where there is a possibility of incidental food contact (HT1). The amount used should be the minimum required to accomplish the desired technical effect." I.e. it is not a food ingredient, meaning that contaminated foodstuffs must be discarded. However, the lowest possible hazard exists for the consumer if an HT1 product is used and if an undetected and unintentional contamination arises after all.

Another repeating question is regarding the changeover from a conventional thermal oil to a thermal oil with HT1 certification. Because residues always remain in the system when changing oil, according to HACCP, flushing of the system is unavoidable. The individual steps for the changeover are shown very well in the following sequence schematic:



[Source: EHEDG European Hygienic Engineering and Design Group, DOC 23 – Part 1, Use of H1 & HT1 Registered Lubricants, Third Edition, October 2017]

To minimize the required flushing quantity, plant sections that can be isolated can also be flushed sequentially. Once the changeover is complete, an HT1 product should be treated just like any other thermal oil. Only the additional analysis mentioned above is recommended.

When selecting HT1 products, it is important to take a look at the chemistry. As high temperature stability aromatic chemistry cannot be certified in the foodstuff industry, due to the constituent substances and possible decomposition products, hydrogenated hydrocarbons or poly- α -olefins are used. To suggest higher quality to the user, the keyword "synthetic" has often been used in the marketing of poly- α -olefins, but in reality they have a shorter service life than hydrogenated hydrocarbons. "Synthetic" is only the description of the manufacturing process, and does not always mean better performance. With hydrogenated hydrocarbons, it is also worth looking at the viscosity. The lower it is, the lower the service life is as well.

The thermal oil sector also continues to develop. Which topics motivate you, where do you see the challenges?

As a medium-sized German company we are fortunately fast, innovative and flexible. We constantly develop our product range and our analytical activities, to be able to meet the market requirements in all areas. With FRAGOLTHERM X-76-A we have just designed a product with a maximum permissible bulk temperature of 430 °C, which is a significant extension of the previous upper limit of 400 °C.

Within the near future in the analytics area we will be able to complete the testing phase of our patented TEMPERBLOCK, which will enable us to investigate the thermal stability of thermal oils even more intensively according to the standards.

The challenge is and will continue to be global integration of the thermal oil business, both on the customer side as well as the supplier side. In addition to availability, regional differences in legal requirements also play a major part. In Europe in particular the REACh chemical directive must be taken into account. Here, the synthetic aromatic high-temperature products have drawn attention and a first product has already been taken into the candidate list of the SVHC substances (SVHC = **S**ubstances of **V**ery **H**igh **C**oncern). These candidates will be checked at a later point in time for limits of approval.

Nevertheless, challenges are there to be mastered, so that FRAGOL continues to apply all its efforts to thermal oils and will remain the contact partner for all questions in and around the topic of thermal oils.

COMPANY PROFILE

FRAGOL is the competent partner for all questions regarding heat transfer fluids, with the largest portfolio in Europe and its own engineers and chemists who are specialized in these products. Temperatures of -110 °C to 430 °C are covered with a portfolio of more than 40 heat transfer fluids. The main focus is on application technology and quality assessment areas. FRAGOL offers experience, innovation and competence for users, plant manufacturers, engineering companies and component manufacturers for all product classes or material groups used in current heat transfer fluid technology.

The FRAGOL product portfolio also includes industrial lubricants for select applications in the areas of hydraulics, gears, compressors and vacuum pumps. Here, "tailor-made products" are made for special applications, and for OEM customers and traders a full portfolio of private label solutions is offered.

FRAGOL is an active participant in specialist groups, holds presentations and seminars and carries out customer training on site. The FRAGOL service also includes regular or one-off sample analysis.