Oil & Gas

Technical Information

DOWTHERM™/SYLTHERM†

How to Select the Right Heat Transfer Fluid

Choosing between high-temperature and low-temperature fluids

The decision to choose a synthetic organic fluid, a silicone fluid or an inhibited glycol-based fluid is largely based on the application temperature requirements. If the heat transfer application has a maximum use temperature requirement above 175°C (350°F), a high-temperature, synthetic, organic fluid or a silicone fluid is recommended.

However, if the maximum use temperature is lower than 175°C (350°F), or if freeze protection is needed for a water-based system, a low-temperature, inhibited glycol-based fluid is recommended.

Synthetic organic and silicone fluids are engineered to be thermally stable at temperatures up to 400°C (750°F). While operating at these elevated temperatures, these fluids exhibit vapor pressures much lower than steam, making them much more practical and less expensive to use. Some high-temperature fluids, such as DOWTHERM™ J and SYLTHERM† fluids, have broad operating temperature ranges. These fluids also offer high-temperature stability, as well as low-temperature pumpability and excellent heat transfer characteristics.

Inhibited glycol-based fluids are solutions of water and inhibited glycols. The concentration of glycol in the fluid directly affects its performance properties and is specified by the user to meet specific application (typically minimum temperature) requirements.

What to consider when selecting a DOWTHERM™ or SYLTHERM† fluid

Maximum Recommended Use Temperature and Thermal Stability

For efficient performance and long fluid life, choose a fluid with a maximum recommended use temperature above the system's anticipated bulk-fluid temperature. A synthetic organic or silicone fluid's maximum recommended operating temperature is an indication of the high-temperature thermal stability properties of that fluid. Selection of a DOWTHERM™ or SYLTHERM† fluid, with a maximum recommended use temperature above the highest anticipated operating temperature, will provide optimal heat transfer efficiency, fluid life and operating economy. All DOWTHERM and SYLTHERM fluids exhibit excellent thermal stability within their recommended operating temperature ranges. Silicone fluids, in particular, exhibit low potential for fouling at elevated temperatures and, depending on service conditions, can last 10 years or longer when operating continuously at their recommended maximum operating temperatures.

Low-Temperature Pumpability

If the system is operating with exposure to cold, winter weather, a fluid offering low viscosity – and therefore low-temperature pumpability – will be required. Low-temperature pumpability is especially critical if the system is subject to a planned or unplanned shutdown. If the heat transfer fluid in the system is not pumpable, system start-up can be difficult, if not impossible, under these conditions.

SYLTHERM† silicone fluids offer excellent low-temperature pumpability characteristics, experiencing little viscosity change down to the lower end of their recommended operating ranges. Some DOWTHERM™ synthetic organic fluids have very low crystal points, causing the fluids to remain pumpable in extreme cold conditions and minimizing the potential for prolonged costly system shutdown.

Flammability and Fire Hazards

Heat transfer systems occasionally leak vapor into the atmosphere. Experience has shown that leaking vapors are usually cooled below the heat transfer fluid's fire point.

Vapor Pressure

Certain applications require the high operating range of a synthetic organic or silicone fluid – but they must also exhibit low vapor pressure. While all DOWTHERM™ and SYLTHERM† fluids have vapor pressures lower than steam, DOWTHERM G and DOWTHERM RP fluids are especially effective in systems with specific low vapor-pressure requirements. Another reason for selecting a fluid that offers low vapor pressure is the potentially lower initial investment in expansion tanks and other specialized equipment.

Operating Pressure Hazards

The vapor pressure of saturated steam at 350°C is 165 bara. Operating a DOWTHERM™ fluid at 1-10 bara, depending on the DOWTHERM fluid, is inherently safer than steam at high vapor pressures, thereby reducing the risk for a hazardous safety incident.

System Design Weight

In the design of an oil and gas processing facility, particularly for offshore platforms, the system design weight is a critical component, as the weight of the utility system will need to be supported. Alternative heat transfer utilities – such as steam and compressed water – require heavy steel components, including a steam boiler and condensate system, along with the associated thick wall piping rated to hold the high vapor pressures. Since all DOWTHERM™ and SYLTHERM† fluids operate at lower pressures than steam, the system weight can be reduced by eliminating the heavy thick-walled piping and steam boiler system. Further weight reduction can be achieved through the implementation of a waste heat recovery system, which utilizes existing waste heat streams as the heat source instead of adding a heater for the heat transfer fluid. These advantages typically make a heat transfer system using DOWTHERM™ fluids the most practical option in terms of initial capital cost and system design weight.

Project Economics and Fluid Recoverability

What to Consider When Selecting a DOWTHERM™ or SYLTHERM† Fluid

When evaluating potential long-term fluid cost, two factors should be considered:

1) What effect will degradation and normal operational leakage have on annual fluid make-up requirements?

2) How often will a complete fluid change-out be necessary?

In choosing a high-temperature fluid, the differences in the degradation and fouling potential of synthetic organic and silicone fluids should also be taken into account.

When choosing a heat transfer fluid, understanding the overall costs of a project requires facilities to look beyond just the initial cost. Some fluids, such as hot oils, are less expensive at the outset, but the savings diminish significantly in the face of high annual operating costs.

Long-term economics of synthetic, organic fluids – While synthetic, organic fluids are highly stable within their recommended operating ranges, some degradation should be expected over time. A fluid's tendency to degrade under a system's specific operating conditions has a direct impact on the fluid's long-term cost, due to fluid makeup and replacement expenses over time. To maximize fluid life, select a synthetic, organic fluid offering with sufficient thermal stability to both accommodate a maximum planned operating temperature and allow for unplanned excursions above that level – even if the initial cost of the fluid is higher than that of a less stable fluid.

Long-term economics of silicone fluids – In terms of initial purchase cost, silicone fluids are typically more expensive than synthetic organic fluids. However, in many cases, the use of silicone fluids can result in lower long-term expenses because they do not degrade in the same manner as other fluids or require top-off refills. Although silicone polymers exhibit some thermally induced changes over time, a balanced, steady state equilibrium composition is eventually attained. Depending on service conditions, this can reduce or eliminate the need for makeup fluid and extend fluid life to 10 years or longer.

Fluid analysis can also reduce long-term expense – Regardless of which type of high-temperature fluid is chosen, participating in a regular fluid testing program, such as Dow's fluid analysis service, can help maximize value in the long term. Dow provides a free, annual fluid analysis to qualifying customers to help periodically assess fluid condition and avoid system problems.

A Note About Product Safety

Dow encourages its customers and potential users to review their applications from the standpoint of human health and environmental aspects. To help ensure that Dow products are not used in ways for which they are not intended or tested, Dow personnel will assist customers in dealing with environmental and product safety considerations. Dow literature, including Material Safety Data Sheets, should be consulted by customers and potential users prior to use.

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