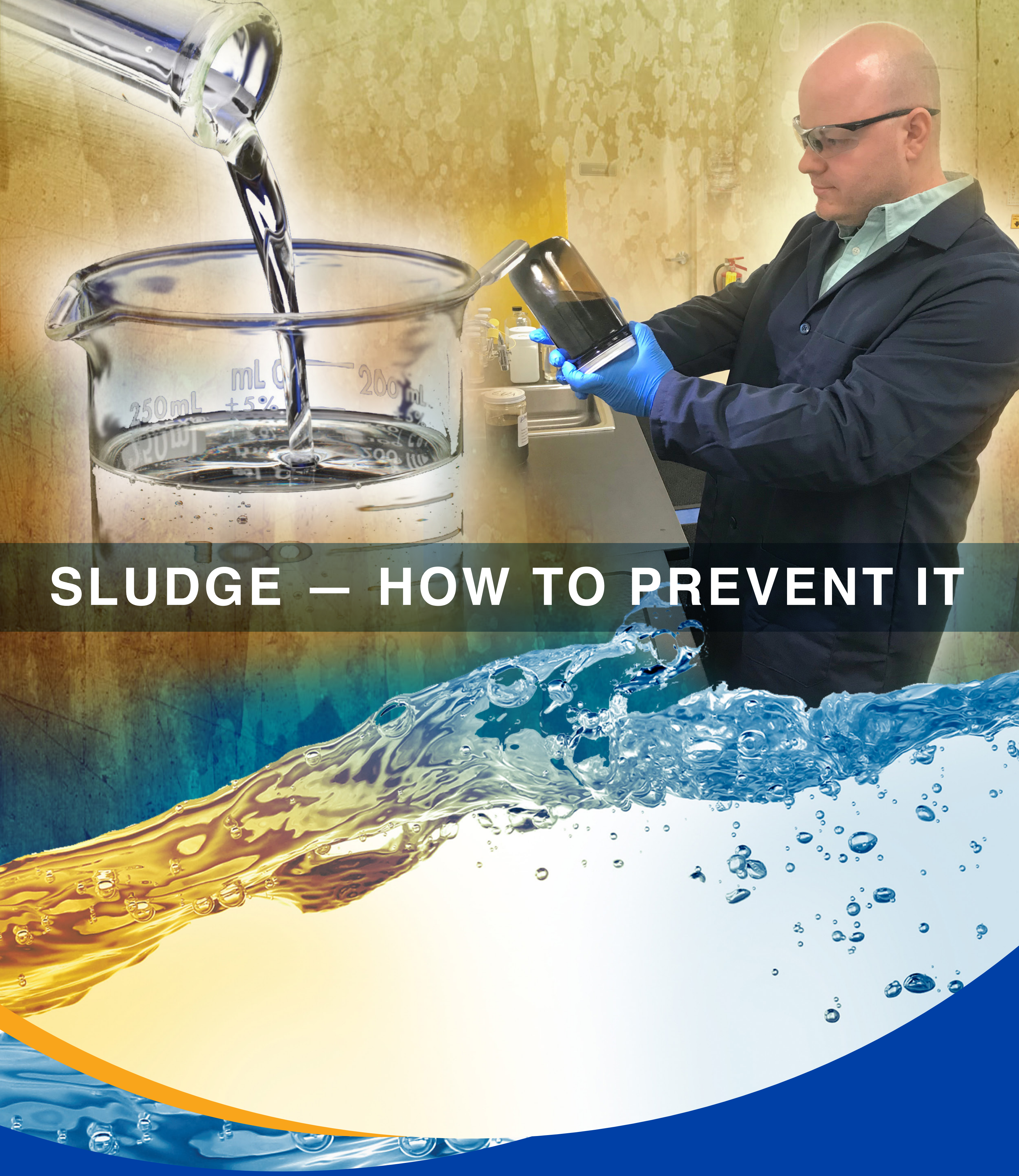

SLUDGE — HOW TO PREVENT IT

Paratherm™
HEAT TRANSFER FLUIDS

SLUDGE—HOW TO PREVENT IT

Oxidation is the leading cause (>95%) of all thermal fluid replacement recommendations. Chemically, oxidation is the reaction of hot thermal fluid with air (oxygen) that produces acids. These acids build up over time and eventually polymerize to form solid coke and sludge — and also are responsible for turning the fluid to "black yogurt" or worse when it's cold.

The reaction between the hot fluid and air occurs in a vented/open expansion tank (or reservoir in stand alone temperature control units) that continuously runs hot (>140°F) while the system is operating. Some indications of a hot expansion tank (reservoir) are:

1. Smoke/vapor from the tank vent
2. Surface rust on the lower half of the tank due to missing paint
3. Tank is hot to touch or there are visible heat waves coming from the surface
4. Sight glass is stained black
5. Fluid has a high acid number

Expansion tank corrosion is another problem that is aggravated by oxidation. Water in the expansion tank continually vaporizes and condenses in the vapor space during operation and will eventually cause rust. This in turn catalyzes the rate of acid formation and increases the acidity of the water which in turn accelerates the corrosion rate. Eventually a pinhole leak will develop.

GAS BLANKETING OF THE EXPANSION TANK—The Only Way to Prevent Oxidation

The only way to prevent oxidation is to install a gas blanketing system to eliminate oxygen from the vapor space. Nitrogen is the most commonly used gas because it's cheap and readily available. Natural gas and blends of lower weight hydrocarbons are often used in gas processing installations where they are readily available and can be vented safely. The system can be installed on non ASME code tanks as long as a maximum 15-psig pressure relief valve is used.

STAND ALONE TEMPERATURE CONTROL UNITS (TCU)

It's difficult to control oxidation in these units because all of the components including the reservoir/expansion tank are enclosed in a sheet metal box that typically has minimal ventilation

openings on top. Scheduled replacement of the thermal fluid is the only way to keep the acid number low and prevent carbon from forming. Using a fluid with an antioxidant can reduce the frequency of the change outs but will not eliminate them.

FIRED AND ELECTRIC SYSTEMS WITH SEPARATE EXPANSION TANKS

Because the oxidation rate doubles with every 18°F (10°C) increase in temperature, the goal is to keep the tank temperature as low as possible. Heating cannot be prevented during operation because a small volume of hot fluid is pushed up through the expansion line into the tank every time the burner or the electric elements cycles on. The actual volume is based on the fluid expansion coefficient, the total system volume and the temperature increase with each cycle. This cycling also pulls in fresh air as the fluid cools.

Keeping the expansion tank ¾ full can reduce the overall tank temperature by 30°F or more than by running with it ¼ full. The greater volume not only provides more of a heat sink as the heater cycles, it also increases the tank wall surface available to transfer heat from the fluid.

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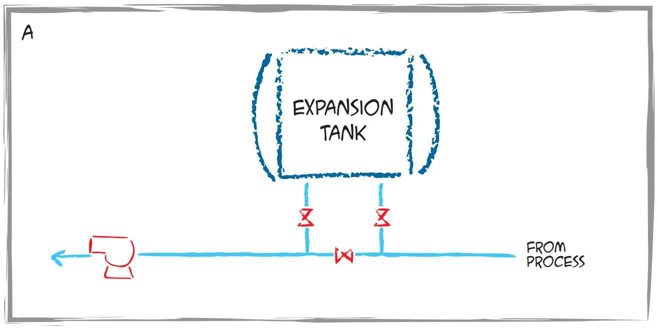
Insulation — An insulated expansion line will prevent cooling of the fluid as it flows into the tank during the heating cycle. Remove any insulation from this line.

The expansion tank should never be insulated unless the heater manufacturer specifies insulating certain parts of the tank.

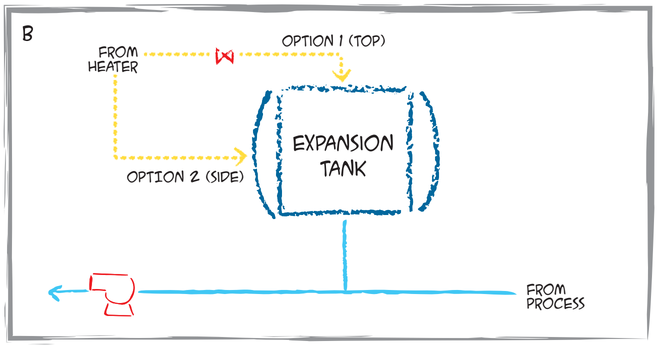
Valve Positions — Many heaters have 2 lines connected to the expansion tank — an expansion line (closest to the pump suction) and a warm-up/boilout line. Typically both lines are open during cold start-ups to facilitate removing entrained air and water.

If the expansion tank is equipped with 2 parallel lines (A) connected to the bottom of the tank,



make sure the 2nd line (farthest away from the pump) is closed off once the oil temperature is >275°F. If there is a valve on the expansion line, it should be 2/3 closed to minimize thermal currents into the tank. **This valve should never be completely closed during operation.**

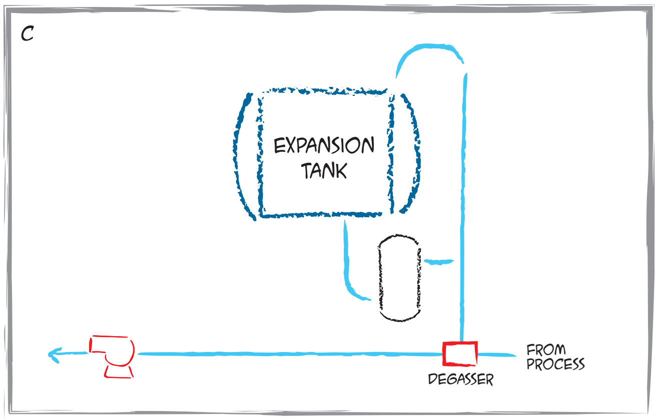
If the 2nd line runs from the heater outlet to the top or side of the tank (B), it is even more



important to make sure that the valve is closed before the heater outlet temperature exceeds 250°F. The tank may not appear to be hot because the flowrate through the usually small diameter (<2") line is not enough to heat up the entire tank. But oxidation will occur because the fluid flowing into the tank will be at the heater outlet temperature and will thoroughly mix with the air in the head space.

Tank location — Expansion tanks don't have to be located directly on top of the heater. Expansion lines that have long runs of bare pipe can be effective in cooling the fluid before it reaches the tank.

Thermal buffer tank — This is an uninsulated vertical tank that is part of the expansion line (C). The lower end of the buffer tank connects to the expansion tank and the upper end is piped to the main loop. Its purpose is to trap the hotter less dense fluid at the top. A well designed tank will have enough residence time to cool the fluid before it flows into the tank.



Exposed tanks — It's not a good idea to paint an expansion tank black if it is located outside in the sun. Light colors or silver should be used to reflect the sun light. Even better is to install a sun shield.

Founded in 1988, Paratherm—Heat Transfer Fluids has become a leading U.S. manufacturer of specialized heat transfer fluids and system cleaners. The firm offers a wide range of heat transfer fluids (currently 8 fluids and 3 cleaners) covering temperatures from -137°F to +650°F. The company has a network of distributors and warehousing locations throughout North America and globally to offer regional service and quick delivery.

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