



CALFLO* AF HEAT TRANSFER FLUID

Introduction

Petro-Canada CALFLO* AF is a highly efficient heat transfer fluid formulated to lower operating costs in systems where fluid resistance to oxidative breakdown is critical.

CALFLO AF's unique chemistry starts with a blend of 99.9% pure base fluids, produced using a patented HT purity process. These crystal clear fluids are free of impurities that can hinder performance. Utilizing more than 25 years of formulating experience, Petro-Canada fortifies these thermally stable fluids with specially selected additives to provide stronger resistance to oxidative breakdown than leading competitive fluids.

The result is CALFLO AF, a heat transfer fluid that provides high thermal efficiency in systems operating up to 316°C (600°F). CALFLO AF's breakthrough chemistry can extend fluid life longer than leading competitive fluids, lowering operating costs by reducing the frequency of fluid change-outs.

Applications

Petro-Canada CALFLO AF is recommended for use in liquid phase heat transfer systems operating continuously at bulk temperatures up to 316°C (600°F). CALFLO AF's outstanding resistance to oxidative breakdown can result in longer fluid life and lower operating costs in systems where exposure to air can not be avoided, and oxidation is the most likely form of fluid degradation. Typical applications include temperature control units used in plastic extrusion, plastic moulding, and metal die-casting operations.

Features and Benefits

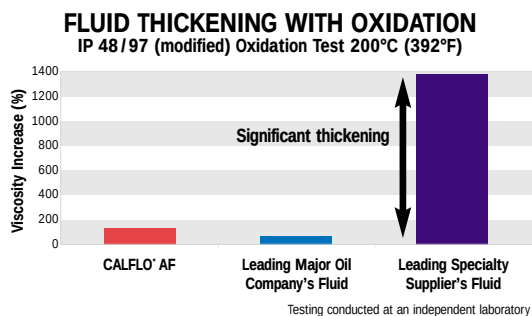
- **Better oxidative resistance than leading competitors can extend fluid life and lower operating costs.**

- Higher resistance to oxidative breakdown versus leading competitive fluids.

As a fluid oxidizes, it becomes more viscous. This increase in viscosity can:

- significantly reduce a fluid's thermal efficiency
- make the fluid more difficult to circulate through the heat transfer system
- result in overheating of the fluid
- necessitate a costly, premature fluid change-out

CALFLO AF demonstrates significantly better resistance to viscosity increase versus a leading specialty fluid in a severe oxidation test conducted at an independent industry laboratory:



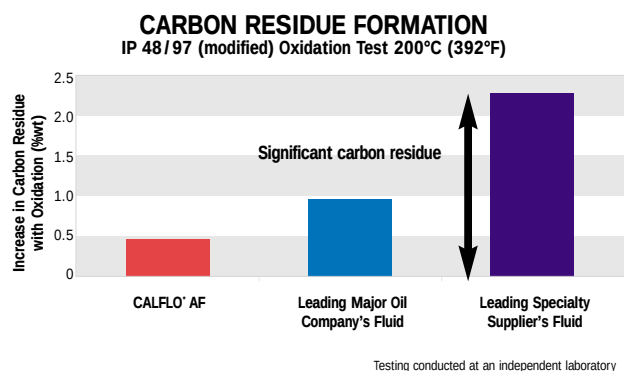
- Less prone to carbon residue and sludge formation versus leading competitive fluids.
CALFLO AF's resistance to oxidative breakdown also minimizes the formation of carbonaceous deposits and sludge within heat transfer systems. These deposits can dramatically reduce heat transfer efficiency and increase operating costs.

What is the HT difference?

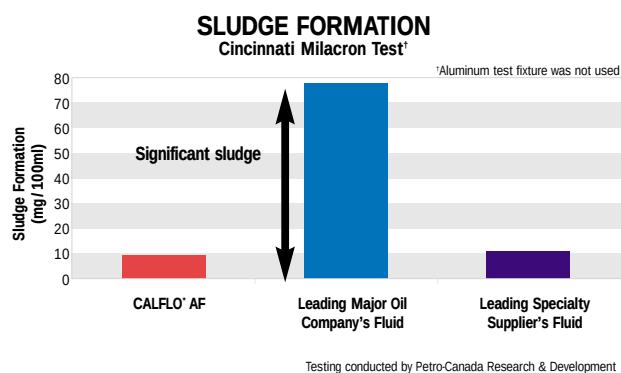
Petro-Canada starts with the patented HT purity process to produce water-white, 99.9% pure base oils. The result is a range of lubricants, specialty fluids and greases that deliver maximum performance for our customers.



CALFLO AF demonstrates significantly better resistance to carbon residue formation versus a leading major oil company's fluid and a leading specialty supplier's fluid in a severe oxidation test conducted at an independent industry laboratory:



Even at mild 135°C (275°F) temperature conditions, a second laboratory study conducted by Petro-Canada Research and Development demonstrates CALFLO AF's stronger resistance to sludge formation versus a leading major oil company's fluid:



- **Low vapour pressure can save on top-up costs while improving workplace safety.**
 - CALFLO AF's low vapour pressure can reduce or eliminate fluid leakage from control valves and pipe flanges.
 - Reduction or elimination of leaks provides a cleaner and safer operating environment, and results in operational savings by reducing the need for cleaning, maintenance and fluid top-up.
- **Natural lubricity extends operational savings.**
 - CALFLO AF's natural lubricating properties can also reduce maintenance costs by extending the service life of circulating pumps and other rotating parts.

- **No compromise to environmental and workplace health and safety.**
 - Unlike some alternative fluid chemistries, CALFLO AF is non-hazardous, virtually odourless and is not considered a toxic substance according to OSHA (United States) and WHMIS (Canadian) criteria.
 - Because CALFLO AF produces no objectionable odours and is not a respiratory or skin irritant, workplace conditions remain pleasant and safe for continuous operations.
 - CALFLO AF does NOT require special handling and is NOT considered a 'hazardous substance' under OSHA (United States) or a "controlled product" under WHMIS (Canadian) regulations.
 - Shipments and storage of CALFLO AF do not normally require special safety permits.
 - Further, drums used to transport CALFLO AF are readily accepted by drum re-conditioners.

Operational Considerations

CALFLO AF's high thermal stability provides long service life under normal operating conditions up to its maximum recommended temperature. However, actual fluid life is dependent upon system design and operating practice.

Special precautions should be taken to avoid operating conditions that can shorten fluid life. These include:

- thermal shocking resulting from accelerated system temperature increases
- thermal shocking from hot spots on a system's heating coils
- continuously running above the maximum recommended operating temperature

Although CALFLO AF is highly resistant to oxidative breakdown, excessive air and water contamination can reduce thermal efficiency and shorten fluid life. Where practical, Petro-Canada recommends inert gas blanketing of a system's expansion tank to guard against exposure to air and water and the need to change-out the fluid prematurely.

While CALFLO AF has been formulated to resist breakdown when exposed to air and water, contamination with process chemicals or deteriorated residual fluids can shorten fluid life. To maximize system efficiency and fluid life, Petro-Canada highly recommends system cleaning and flushing to remove all contaminants, sludge and varnish prior to recharging a system with CALFLO AF.

Thermal Data

PROPERTY	TEMPERATURE			
	15°C (60°F)	38°C (100°F)	260°C (500°F)	316°C (600°F)
Density, kg/m ³ (lb./ft ³)	855 (53.4)	840 (52.4)	690 (43.1)	653 (40.8)
Thermal Conductivity, W/m K (BTU/hr. °F·Ft)	0.142 (0.082)	0.142 (0.082)	0.130 (0.075)	0.127 (0.073)
Heat Capacity, kJ/kg K (BTU/lb. °F)	1.89 (0.45)	1.96 (0.47)	2.69 (0.64)	2.88 (0.69)
Vapour Pressure, kPa (psia)	0.00 (0.00)	0.00 (0.00)	3.77 (0.55)	15.3 (2.22)

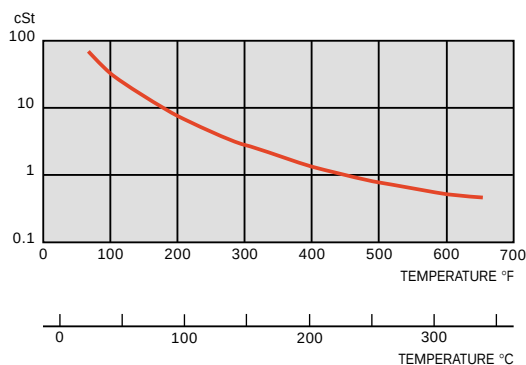
For detailed heat transfer calculations please refer to our CALFLO software which is available at no cost from your Petro-Canada representative.

Typical Performance Data

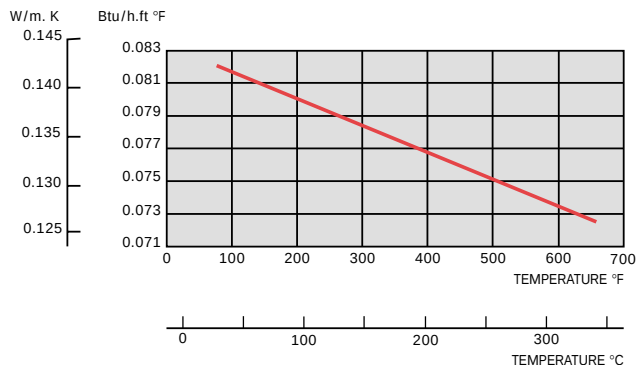
PROPERTY	TEST METHOD	RESULTS
Appearance		Pale Yellow
Pour Point, °C (°F)	ASTM D97	-42 (-44)
Flash Point, °C (°F)	ASTM D92	221 (430)
Fire Point, °C (°F)	ASTM D92	240 (446)
Autoignition Temperature, °C (°F)	ASTM E659-78	343 (650)
Sulphur Content, weight %	X-RAY	<0.001
Carbon Residue, weight %	ASTM D189A	<0.01
Average Molecular Weight		365
Viscosity, cSt at 40°C (104°F)	ASTM D445	32.1
cSt at 100°C (212°F)		5.4
cSt at 316°C (600°F)		0.73
Coefficient of Thermal Expansion, %/°C (%/°F)		0.1016 (0.0564)
Distillation Range, °C (°F)	ASTM D2887	
10%		367 (693)
90%		482 (900)

The values quoted above are typical of normal production. They do not constitute a specification.

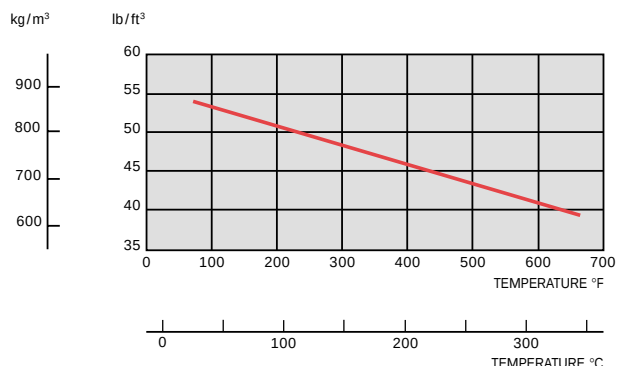
CALFLO AF VISCOSITY



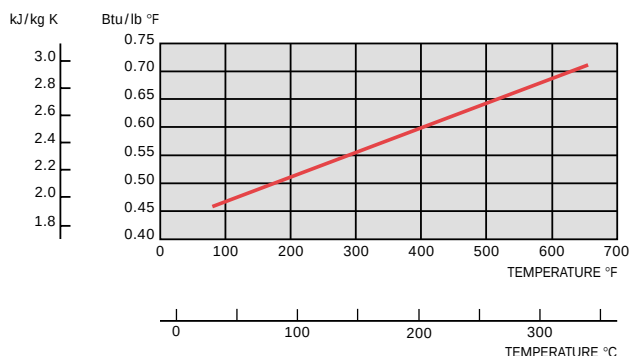
CALFLO AF THERMAL CONDUCTIVITY



CALFLO AF DENSITY



CALFLO AF HEAT CAPACITY



Health and Safety

Petro-Canada CALFLO AF has no adverse effects on health, provided it is used as directed. CALFLO AF is not controlled under OSHA or WHMIS with no worker exposure limits (PELs or TLVs). It is also not classified under the Dangerous Substance or Dangerous Preparation Directives (DSD/DSP) in Europe. To obtain Material Health and Safety Data Sheets, contact one of our TechData Info Lines.

TechData Info Lines

If you would like to know more about Petro-Canada CALFLO AF, or any other product in our complete line of quality lubricants, please contact us at:

**Petro-Canada
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385 Southdown Road
Mississauga, Ontario
L5J 2Y3



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