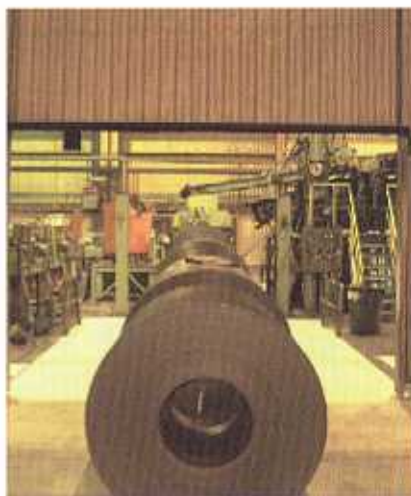


Affordable, Biodegradable, Fire-Resistant Hydraulic Oil? Two Steelmakers Say Yes



AK-ISG Steel is an electrolytic galvanizing operation in Cleveland. A devastating fire two years ago set off a quest for a fire-resistant alternative to keep pumps and pistons in one of its three hydraulic systems.

It's called Cosmolubric B-230, but for two steelmakers that have adopted this vegetable-based product is more easily identified as the affordable, biodegradable fluid technology that's proving effective in daily, heavy-duty use for their hydraulic systems.

Houghton International formulated it in 2000 and introduced it in 2001 as the "first and only fire-resistant vegetable oil hydraulic fluid."

Safety first

AK-ISG Steel Coating Co., a joint-venture of AK Steel and International Steel Group in Cleveland, is an electrolytic galvanizing line capable of producing 480,000 tons of automotive quality flat-rolled electro-galvanized steel per year. It has three major hydraulic systems, and two of these use water-dilutable hydraulic fluid. But, its 1,000-gallon Nireco Edge mask hydraulic system requires straight oil. Its pumps and pistons need to be continually lubricated, and water-based fluids will not suffice. After a devastating fire in 2001 (caused by a spark that ignited hydraulic fluid), AK-ISG evaluated its products and determined to find a fire-resistant fluid that met its performance requirements.

Houghton has been the hydraulic fluid supplier to the plant for 15 years, so after consultation AK-ISG accepted the recommendation to switch to its new product.

Cosmolubric B-230 is a blend of natural esters rather than a synthetic oil. Since it is made from a canola oil-base along with a blend of additives, Cosmolubric B-230 is fire resistant. Managers became convinced of the fluid's effectiveness after seeing a controlled experiment in which B-230 was sprayed directly into a flame — with no sustained flare-up.

It is more expensive than conventional hydraulic oil, but it provides excellent lubricity and equal pump life. Most important for AK-ISG, B-230 yields the same performance characteristics as its former fluid, making it an easy swap. "Although it is not an extreme-temperature application, the Nireco system is sensitive to fluctuations in temperature and the oil quality," said Chris Pace, AK-ISG maintenance engineer. "Changes in viscosity can change the performance of the servo-valves, so we had to have a product with physical characteristics as close to mineral oil as possible."

The hydraulic fluid is extremely sta-

ble, and since the introduction of B-230 operators at AK-ISG have never had to change-out the system. The mill uses approximately 1,000 gallons per year, which is kept in a tote to top off the reservoir as needed.

"We're very pleased with Cosmolubric B-230," Pace relates. "There has been no evidence of oxidation and Houghton's quarterly oil samplings have shown that our TAN numbers have remained stable. Houghton also conducts flashpoint tests periodically to make sure that the fluid has not been contaminated and maintains a high flashpoint," according to Pace.

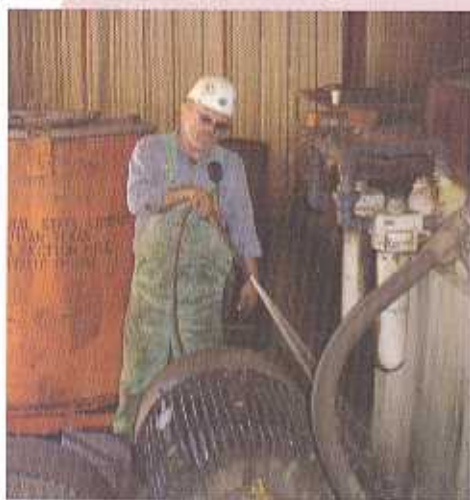
Canola tackles oxidation

Chaparral Steel is a mini-mill producing bars, rods, and structural products, and its 1.5-million tons/year melt shop in Midlothian, TX, uses four different hydraulic systems to move red-hot billets out of a reheat furnace and onto the cooling bed, then on to the rolling mills. Each system has a 600-gal fluid tank that is just topped-off on an as-needed basis.

Because Chaparral hydraulic systems operate under very high pressures, between 1,800 and 2,000 psi, acid started to accumulate.

THE QUEST FOR THE PERFECT HYDRAULIC FLUID

The pressure on manufacturers to choose biodegradable alternatives to traditional products includes hydraulic fluids: hauling gallons and gallons of mineral oil-based fluids as



Chaparral Steel needed a fluid that would not convert to acid when high operating temperatures instigated condensation on the equipment.

Houghton's formulation for an effective hydraulic fluid is based on vegetable oil. Because vegetable oil is a naturally occurring ester, it is inherently biodegradable. It also exhibits good lubricity, on par with synthetic polyol ester fluids. And, vegetable oil is a relatively inexpensive base stock.

One problem is that vegetable oils have traditionally exhibited low oxidative stability - a critical shortcoming that prevented widespread use. Houghton's research and testing involved additive packages and selected base stocks.

Cosmolubric B-230 is canola oil-based and uses additive technology, so it performs like polyol esters. It contains viscosity index modifiers, rust- and oxidation-inhibitors, extreme pressure (EP) additives, copper passivators, and defoamers. These additives greatly improve the oxidation stability of vegetable oils so that they can equal the desired characteristics of synthetic polyol esters.

In benchmark tests comparing Cosmolubric B-230 to premium

hazardous waste is not acceptable or cost-efficient.

Synthetic alternatives to mineral oil such as polyglycols, and polyol esters have been priced out of reach for most manufacturers. And, operations with high-pressure or other extreme applications that require a fire-resistant hydraulic fluid have had to paying up to six times more for synthetic hydraulic oils than they used to for petroleum-based products, according to Houghton Intl.

synthetic polyol ester fluids, Cosmolubric was found to provide overall comparable performance in lubrication, pump life, and oxidative stability (see Figure 1.)

FIGURE 1: COMPARING HYDRAULIC FLUID BASE STOCKS

	Canola Oil	Synthetic Polyol Ester	Mineral Oil
Appearance	Clear Amber	Clear Amber	Clear Amber
ISO Viscosity Grade	68	68	68
Viscosity at 210°F	75 SUS	68 SUS	53 SUS
Viscosity at 100°F	335 SUS	305 SUS	330 SUS
Viscosity index	214	214	90-100
Total Acid Number	0.9	3.0	0.8
Flash Point, °F	495	595	385
Fire Point, °F	610	600	450
Pour Point, °F	0	-10	5
Specific Gravity	0.92	0.92	0.88

Cosmolubric B-230 is Factory Mutual approved as a "less hazardous fluid." It also passes the ASTM D-665A corrosion test. Among its physical properties are Viscosity Index of 214, ASTM Flash Point of 495°F, and ASTM Fire Point of 610°F — all of these properties at a par with the leading synthetic polyol esters. But, Cosmolubric B-230 costs less, making it a practical replacement for synthetic polyol esters, especially in applications where fire resistance is critical. (See Figure 2.)

FIGURE 2: COST COMPARISON OF HYDRAULIC FLUIDS

Hydraulic Oil Type	Cost per unit
Mineral Oil	1.0
Invert Emulsion	0.9
Water Glycol	2.0
Canola Oil	4.0
Synthetic Polyol Ester	4.5
Phosphate Ester	7.0

"These systems run very hot, so condensation seeps in, said Bob Davis, Chaparral's manager of crane and hydraulic steel production. "In the past, we've had problems with the condensation turning the fluid to acid. We tried a lot of different hydraulic fluids, and they always had problems."

Improvement began after taking Houghton's recommendation for Cosmolubric B-230 as "a cost-effective,

highly stable, and biodegradable oil-based hydraulic fluid" to combat acid and offer fire-resistance. After switching over the fluid in 2001, Chaparral did on-going testing and analysis. Houghton sampled the fluid on a quarterly basis, as well, testing for acid and other physical characteristics. The fluid has never oxidized, and the TAN numbers have remained low.

"Cosmolubric B-230 has been in the

system now for two years, and we haven't had any acid issues. It costs less than other synthetic fluids, and performs as well or better to the fluid that was originally recommended by the manufacturer for use with the system. I love the product, and recommend it to our other mills every chance I get," said Davis.