

EP™ 2000

For Heavy Crude Oil

Background

EP™ 2000 Flow Improver is a part of the LiquidPower Specialty Products Inc. (LSPI) range of innovative and technologically superior Flow Improver solutions. This pioneering product provides the answer for flow improvement in heavy crude petroleum pipeline applications.

Historically, heavy crude oil has been a challenge for existing commercially available drag reducing agents (DRA). As crude oil gravities fall below ~23° API, traditional DRA becomes ineffective. LSPI developed a new class of advanced DRA technology to address this need. EP™ 2000 Flow Improver is proven to increase deliveries of produced heavy crude oil to market.

Characteristics

EP™ 2000 Flow Improver is an aqueous dispersion. Its robust characteristics make it a high-performing drag reducer for many heavy crude oil pipeline applications. EP™ 2000 provides the same drag reduction

performance as EP™ 1000, but is also formulated for high injection reliability.

This innovative product can provide greater than 50% drag reduction, allowing companies to strategically reduce pipeline operating costs, increase throughput, decrease pressure or shut down intermediate pump stations.

The successful application of EP™ 2000 Flow Improver requires transition or turbulent flow regime in a portion of the pipeline system, heavy crude oil/DRA polymer affinity, and a suitable pipeline system configuration.

The polymer technology developed by LSPI allows greater amounts of active polymer to be deployed in a fixed amount of product. The polymer of choice shows excellent heavy oil hydrocarbon affinity and is able to attain elevated levels of drag reduction under varied operating scenarios. It also has the strength to effectively endure shear forces. EP™ 2000 Flow Improver dissolves into flowing product without coating pipeline walls.

Handling

EP™ 2000 Flow Improver is easy to handle, store and clean up. It is nonflammable, flows easily, and does not require nitrogen pressurized storage tanks.

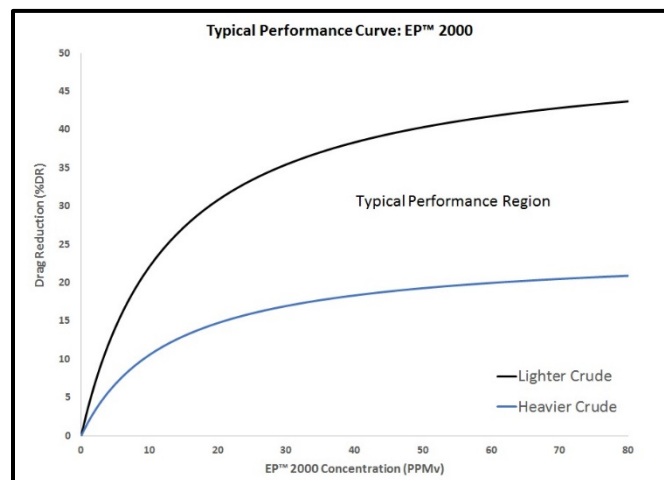
Benefits

Great Performance:

- Greater than 50% drag reduction
- Increases flow rates while maintaining current pipeline pressures
- Maintains flow while reducing pipeline pressures
- Allows shutting down of intermediate pump stations

Superior Technology:

- Improves pipeline capacity without capital investment
- Reduces crude heat loss



This performance curve demonstrates the range in which EP™ 2000 flow improver can operate, depending on pipeline and fluid conditions.

GENERAL

Application	Heavy petroleum crude oil
Flow Improver type	Dispersion
Carrier	Water and glycol mixture

PERFORMANCE

Maximum drag reduction	Greater than 50%
Typical concentration	5 to 100 ppm

TYPICAL PROPERTIES

Color	White
Density	8.4 lbs/gal (1.01 g/cm ³)
Flash Point	> 200°F (> 93.3°C)
Viscosity	85 cP @ 511s ⁻¹ (Non-Newtonian) @ 77°F/25°C
Freezing Point	-9°F (-23°C)
Boiling Point	222°F (106°C)
Vapor Pressure	0.46 psia (24 mm Hg) @ 77°F/25°C

HANDLING

Operating range	-9°F to 140°F (-23°C to 60°C)
Product stability	Stable dispersion No agitation required
Pressure	No nitrogen or pressurized vessels required
Heating	Climate control environment available

INJECTION EQUIPMENT

Pumps	Various designs available for different injection range and environments
Range	5 to 2,500 gal/day (20 to 9,500 L/day)
Flow meter	Mass (Coriolis)
Automation	Available

SAFETY AND ENVIRONMENTAL

Reference country specific Safety Data Sheet for local requirements.

Safety & Health (per U.S. OSHA)	Nonflammable. Expected to be a low hazard for usual industrial handling by trained personnel.
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Environmental (per U.S. EPA)	Not classified as hazardous waste
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