T E C H N I C A L B U L L E T I N

PYDRAUL® 135

Fire-Resistant Hydraulic Fluid

Pydraul 135 Fire-Resistant Hydraulic Fluid . . . a low viscosity synthetic that gives you the performance of premium grade petroleum oils — plus safety — at the price of water/glycols.

O/FF-4

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FUNCTIONAL FLUIDS Monsanto®

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Introduction

Pydraul® 135 is another of Monsanto's growing line of internationally accepted, fire-resistant hydraulic fluids and lubricants.

Pydraul 135 is a lower viscosity sister product of recently introduced Pydraul 312. Both are permanent, stable formulations of carefully selected petroleum fractions in a synthetic base of chlorinated hydrocarbons and phosphate esters. These new fire-resistant hydraulic fluids match or excel properties of existing hydraulic fluids—including synthetics, premium grade petroleum oils and water-containing fluids — but sell in the same price range as water/glycol fluids. *They offer up to 40% savings over other water-free, fire-resistant hydraulic fluids.*

Pydraul hydraulic fluids first began working to protect hydraulic operations from fire in 1951. Today, the seven Pydraul fluids have performed millions of machine hours of service without contributing to a single fire . . . not even when sprayed from ruptured high-pressure hydraulic lines onto white-hot metal. In addition to fire-resistance, the Pydraul fluids have always offered . . .

. . . lubrication as good as premium grade oils
. . . freedom from corrosive action and foam
. . . ease of maintenance
. . . and permanence — they don't "wear out"

Properties of Pydraul 135

Physical Properties

Viscosity, SSU @ 40°F	1600
Viscosity, SSU @ 100°F	141
Viscosity, SSU @ 210°F	41
Viscosity Index	+49
Pour Point, °F	—10
Density 25°/25°C	
Grams/cc	1.19
pounds/gal.	9.92
ASTM D-892 Foam Test	
Sequence I	pass
Sequence II	pass
Sequence III	pass

The viscosity and viscosity index of Pydraul 135 are similar to those of a high quality R & O (rust and oxidation inhibited) type petroleum hydraulic oil as the comparative viscosity curves indicate on the following page.

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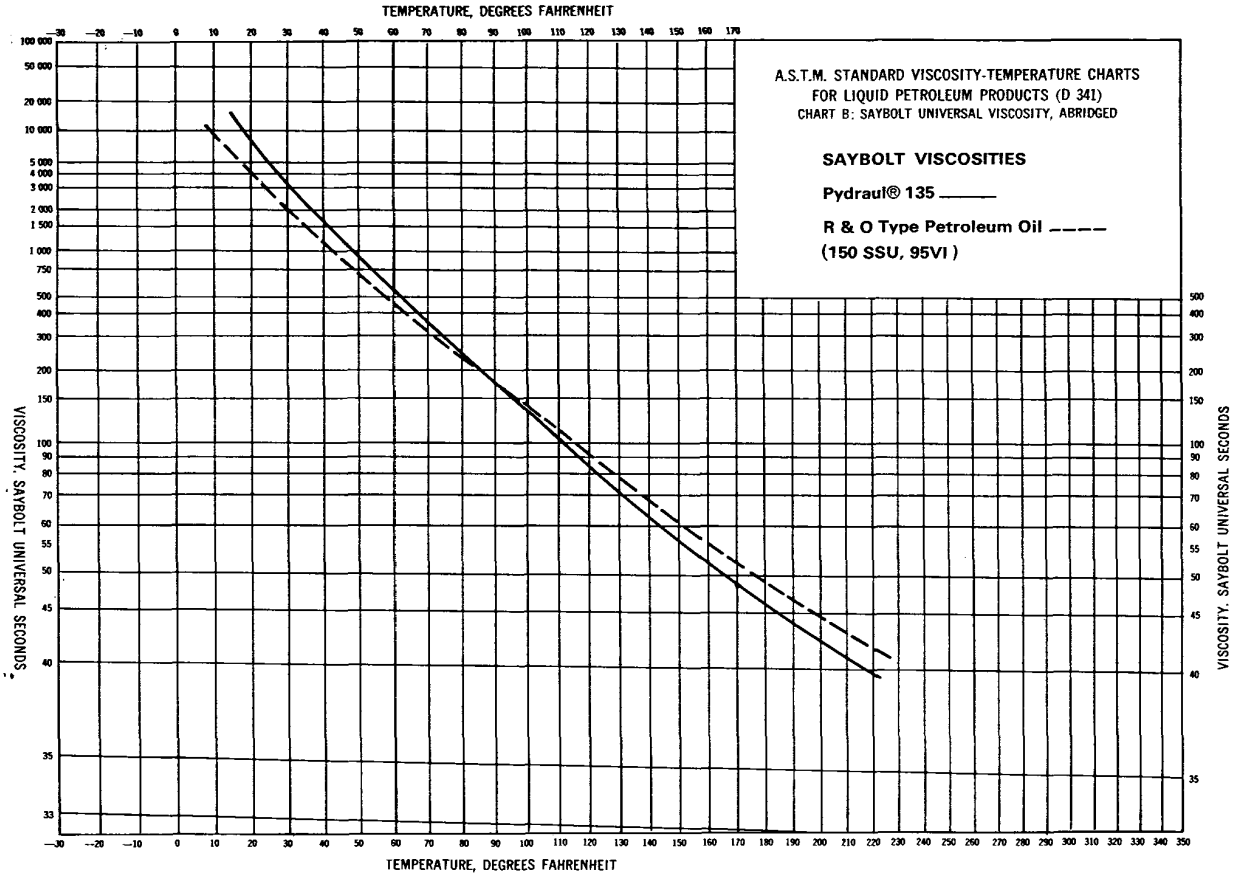

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Corrosion and Stability

The corrosion and oxidation stability properties of Pydraul 135 are comparable to those of the best petroleum hydraulic fluids. Pydraul 135 will not rust or corrode conventional metals of construction in a hydraulic system, even when over-heated to 250°F.

In the *ASTM D-665 Rust Test* Pydraul 135 showed no rust at all, and in use Pydraul 135 does not lose its anti-rust properties. In the *ASTM D-943 Turbine Oil Stability Test*, the life of Pydraul 135 was greater than 1000 hours before a 2.0 acid number was reached. Both iron and copper catalyst were like new.

Good hydrolytic stability is a basic characteristic of Pydraul 135. If water somehow enters your hydraulic system, Pydraul 135 won't hydrolyze to form acidic or corrosive products.

Beverage Bottle Test (Pydraul 135 plus water aged @ 200°F for 48 hours with a copper strip through both phases).

Neutral No. Change, mg KOH/mg	+0.2
Viscosity change, % @ 100°F	+1.0
% @ 210°F	+0.4
Insolubles	none
Copper strip	no corrosion

Fire Resistance

Pydraul 135 is an industrial fire-resistant hydraulic fluid and is listed by Underwriters' Laboratory.

Fire-Resistance Tests

High Pressure Spray Test (AMS-3150C). Test fluid sprayed at 1000 psi through orifice, passing through flame of oxy-acetylene torch, 6000°F.	Intermittent flashing, but self-extinguishing.
Low Pressure Spray Test (AMS-3150C). Test fluid sprayed at low pressure over ignited, oil-soaked rags to determine degree of increase in flame intensity.	Slight increase in flame intensity.
Hot manifold test (AMS-3150C). Test fluid dripped on tube at 1300°F.	Intermittent flashing, but does not propagate to pan below.
at 950°F.	Does not flash.
Molten Metal Ignition Test. Test fluid exposed to the surface of aluminum alloy at 1200°F to test for spontaneous ignition.	Does not ignite spontaneously. Flashes intermittently with ignition source.

*U.S. Bureau of Mines Schedule 30 Fire Tests:**	*Minimum Requirements*	*Pydraul® 135*
Pipe Cleaner Test, Number of Cycles:		
Fresh Fluid	24	28
Aged 2 hrs @ 150°F	18	—
Aged 4 hrs @ 150°F	12	24
Temperature/Pressure Spray Ignition Test:		
Propane Torch	See	pass
Electric Arc	Schedule	pass
Burning Kerosene-Soaked Cotton	30	pass
Autogenous Ignition Temperature: °F	600	760

Ask to see the color motion picture, *Before Hydraulic Fires Start.*

*Although Pydraul 135 fluid meets U. S. Bureau of Mines fire-test requirements, it is not approved since required field test in mining machinery have not been completed.

Performance Properties

Pydraul 135 has good viscosity and viscosity-temperature (V.I.) properties. These properties are permanent. Pydraul 135 will not shear mechanically to change viscosity.

The following chart shows the viscosity of Pydraul 135 before a Vickers hydraulic pump test . . . and practically the same viscosity/temperature slope after the test.

Vickers Hydraulic Vane Pump Test
(V-105E pump, 1000 hours, 140°F, 1000 psi)

% Viscosity change @ 100°F	+11
@ 210°F	+ 5
Weight loss of pump parts, mg.	
bushings, 2015	21
bushings, 2016	11
Ring	22
Vane	2

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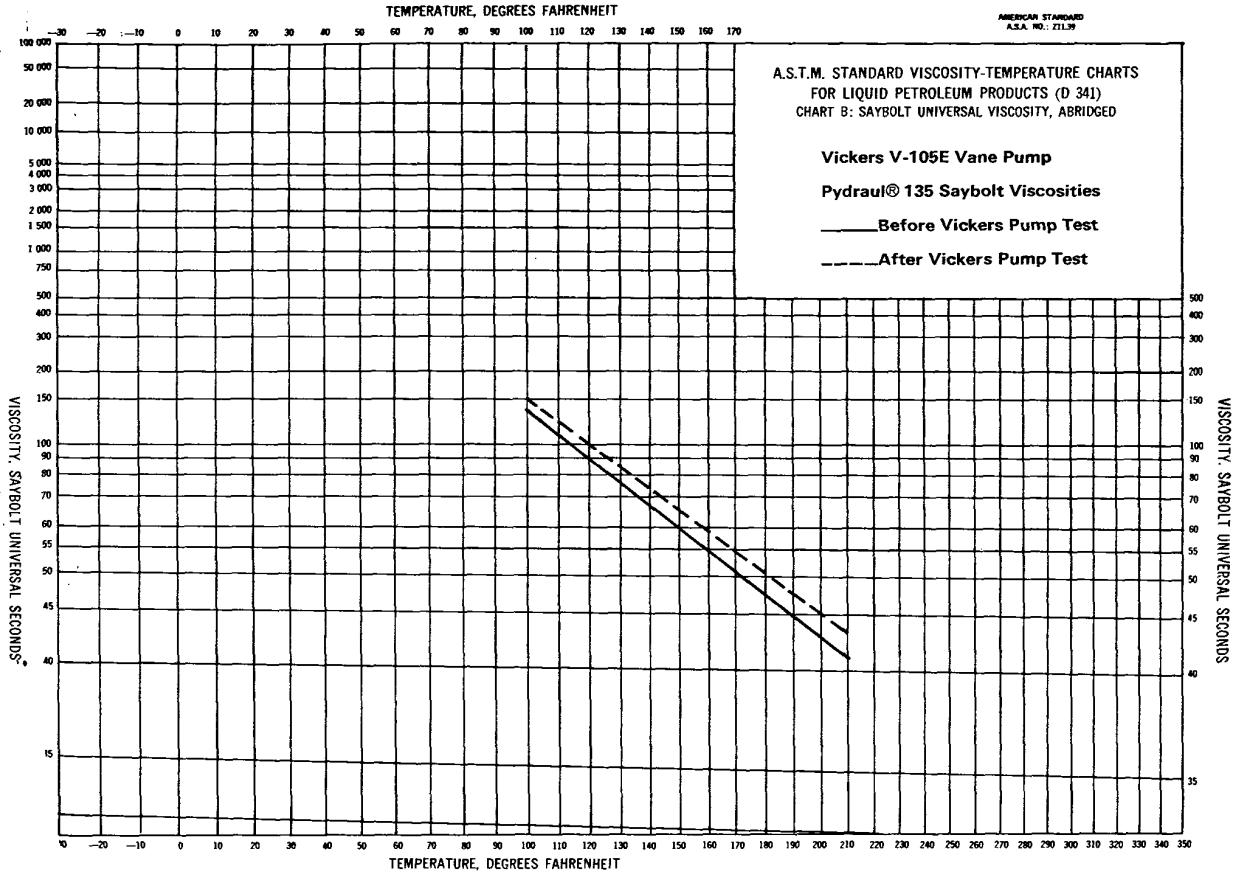

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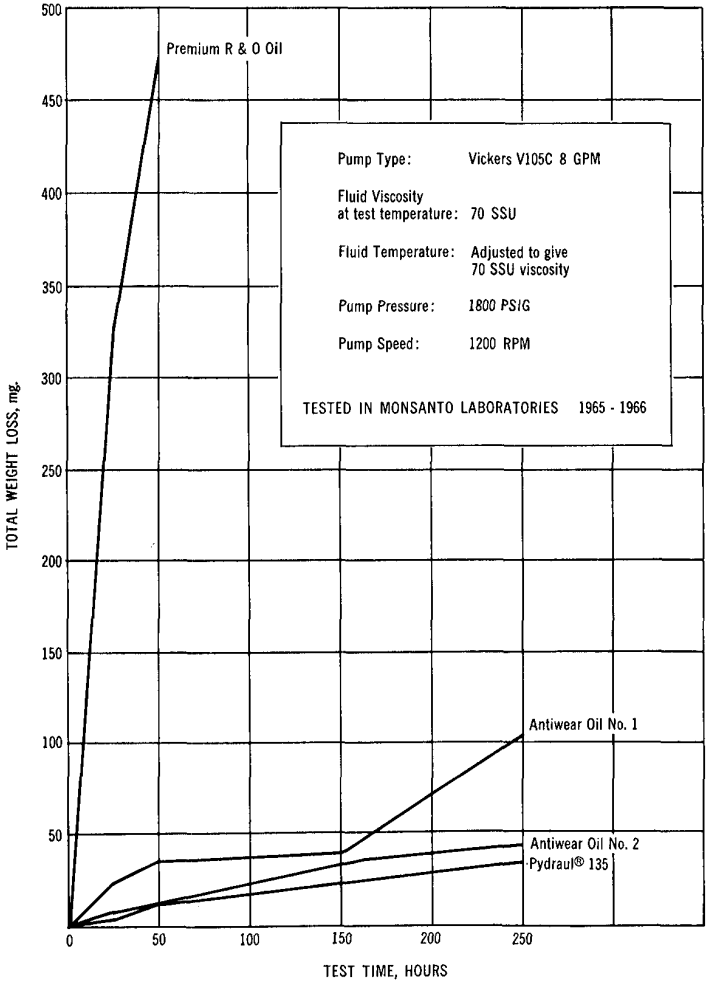
In a more severe Vickers hydraulic pump test (V-105C pump), Pydraul 135 lubricated as well as commercial antiwear oils and proved far superior to premium R & O oil.



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Pydraul 135 lubricates under extreme pressure as well as high-quality industrial gear lubricants of comparable viscosity.

Shell Four Ball Wear Test (630 rpm, 1 hour, 167°F)

Steel on steel, mm scar diameter	
4 kg load	0.18
10 kg load	0.24
40 kg load	0.43
Steel on bronze	
10 kg load	0.48

Timken Test

Timken OK load, lbs.	45

Field Tests

In addition to the laboratory tests, Pydraul 135 has been thoroughly evaluated for use in GPE (formerly Askania) type regulators. General approvals for its use have been given by major equipment manufacturers. Pydraul 135 will give years of trouble-free pump service . . . the same long pump life afforded by high-quality R&O type petroleum hydraulic oils.

And Pydraul 135 doesn't wear out. Except for normal "make-up",

. . . you don't add water
. . . you don't have "drain and change" periods
. . . you don't have to check it daily
. . . or perform most of the other-time-consuming maintenance necessary with water-containing fluids.

Compatibility

With other hydraulic fluids . . .

Type	*Pydraul® 135*
Other Pydraul Fluids (A-200, F-9, 150, 625, & 312)	Soluble in all proportions.
Other commercial Phosphate Esters (Houghto-Safe 1130[1], Cellulube 220[2], etc.)	5% phosphate ester is soluble in Pydraul 135 at room temperature; 10% is insoluble at room temperature.
Water/Glycol Phosphate Esters	Insoluble in water/glycol fluids and vice versa.
Petroleum oils	Soluble in all proportions, but oil contamination can reduce Pydraul 135 fire-resistant qualities.
With Elastomers . . .	
Viton[3] A	Preferred, especially for dynamic seals at high temperatures.
Teflon[3]	Preferred, especially for hose under high temperature, high pressure conditions.
Butyl	Appears acceptable for high pressure seals and hose up to 140°F.
EPR	Currently under study, shows promise.

(1) Trademark of E. F. Houghton & Company
(2) Trademark of Stauffer Chemical Company
(3) Trademark of E. I. du Pont de Nemours & Co., Inc.

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Change-Over Procedures

Converting to Pydraul 135 hydraulic fluid is easy. Virtually every type of equipment which uses fire-resistant hydraulic fluid has been converted to Pydraul fluids. Equipment manufacturers are, therefore, experienced in Pydraul fluid conversions and should be consulted.

If changing seals is necessary, equipment manufacturers can tell you what seals to change, and most even carry a supply of correct seals. Laboratory tests show that Viton A is the preferred elastomer for compatible seals. For moderate temperatures, (below 140°F) butyl seals, hose, etc. appear acceptable. Teflon lined hose is satisfactory for higher temperatures.

To replace other Pydraul fluids with Pydraul 135, where compatible seals are in the system, it is only necessary to add Pydraul 135 as make-up fluid. It is not necessary to drain or clean. When you convert from petroleum oils, other synthetic fluids, water/glycol fluids, or water-in-oil emulsions, we recommend the following steps. These steps conform to National Fluid Power Association Standards.

Your Monsanto representative will assist you any way he can, or you can telephone our technical specialists in St. Louis directly.

Changing from Petroleum Oil

1. Completely drain and clean the system. Small amounts of oil will not interfere with the performance of Pydraul 135, but resistance to fire is reduced by the amount of oil left in the system.
2. Drain and blow out pipelines. Manually clean valves and reservoirs.
3. Open or remove and drain valves. Replace gaskets, packings, and seals with those compatible with Pydraul 135. It is particularly important to change dynamic seals. Static seals do not necessarily have to be changed if there is no objection to replacing them each time hydraulic components are serviced.
4. Remove pumps, accumulators, and cylinders, if necessary, for draining. Replace packings, seals, gaskets, and bladders with those compatible with Pydraul 135.
5. Check component functions before the system is closed and fluid is added.
6. If your system cannot be completely drained, you may have to flush it with a small amount of Pydraul 135.

Changing from Water/Glycol or Water-in-Oil Emulsion

1. Drain and clean system thoroughly. Remove all traces of water. Empty all lines and low points or dead pockets in components.
2. Clean with steam or warm water. Follow by blowing with dry air.
3. Check sealing materials, hoses, and accumulator bags. Replace if necessary with compatible materials.
4. Install a minimum charge of Pydraul 135 and operate the system from 16 to 24 hours. During this period, inspect the reservoir. If water or other contaminants float to the top, skim them off.
5. Drain the flushing charge immediately after shut-down while the fluid is warm. Drain all isolated points or parts which do not drain back to the reservoir. If water is apparent in fluid clinging to walls, wipe down all accessible parts.

Changing from Phosphate Esters (Other than Pydraul)

1. Drain the system completely.
2. Cleaning is unnecessary.
3. Generally, seal changes are unnecessary.

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Handling and Storage

As with all specialized industrial fluids, certain precautions are advisable when handling Pydraul 135. No problems will arise when Pydraul 135 is used as recommended.

Avoid repeated or continuous skin contact. Repeated or prolonged contact can lead to drying and skin "chapping". Where prolonged skin contact cannot be avoided, gloves should be worn.

At room temperature there is no significant vapor inhalation hazard from Pydraul 135; however, inhalation of vapors produced when the fluid is at high temperatures should be prevented. Single 6-hour exposures to an atmosphere saturated with vapors at ambient temperatures produced only mild discomfort in experimental animals and they survived the 10-day subsequent observation period without ill effect.

Although eye irritation studies using Pydraul 135 at full strength indicate Pydraul 135 is a mild irritant, there is no evidence to show Pydraul 135 causes permanent damage to eye tissue. If Pydraul 135 is splashed or sprayed into the eyes, eyes should be thoroughly flushed with water and the workman referred to a physician. To relieve irritation, physicians have used 1% tetracaine solutions, as well as ophthalmic cortisone acetate solution.

Pydraul 135 hydraulic fluid can be stored at subzero temperatures without fluid damage. Before using, simply allow the fluid to warm to 20 - 30°F. Drums stored outside should be sealed tightly and placed in a horizontal position to keep out moisture.

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