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

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PYDRAUL® 312

FIRE-RESISTANT
HYDRAULIC FLUID

Pydraul® 312 Fire-Resistant Hydraulic Fluid . . . a synthetic fluid that gives you the performance of premium grade petroleum oils — plus safety — at the price of water/glycols.

TECHNICAL BULLETIN O/FF-7

Monsanto

0615053

TOWOLDMON0039131
WATER_PCB-00023600

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Introducing Pydraul® 312 Hydraulic Fluid

Pydraul 312 is the first of Monsanto's new high performance low cost fire-resistant hydraulic fluids. This synthetic is the latest innovation in Monsanto's internationally accepted and growing line of fire-resistant hydraulic fluids and lubricants.

In 1951 Pydraul hydraulic fluids first began working to protect hydraulic operations from fire. Now, well over a decade later, 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. And besides 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"

Where does new Pydraul 312 fit into this well established picture?

Pydraul 312 hydraulic fluid is a unique marriage of synthetic fluids with specially chosen petroleum fractions. The result is a fire-resistant hydraulic fluid that matches or excells the properties of existing hydraulic fluids — including synthetics premium grade petroleum oils, and water-containing fluids — but sells in the same price range as water/glycol fluids. *They offer up to 40% savings over other water-free, fire-resistant hydraulic fluids.*

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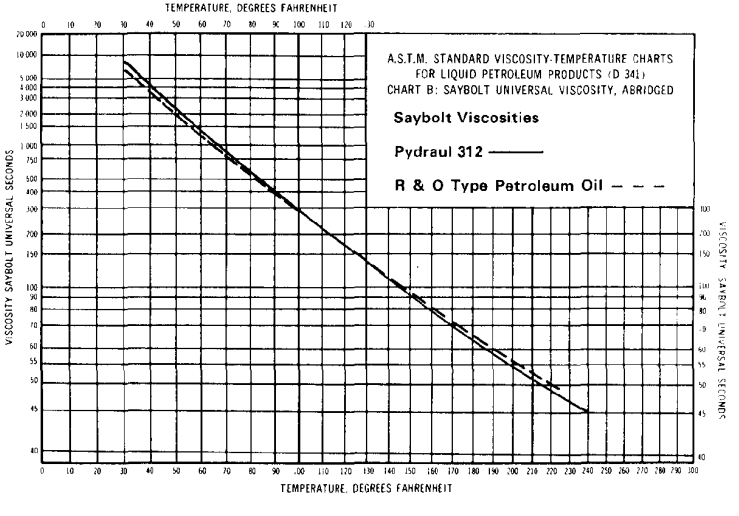
Inspection Properties . . .

Viscosity, SSU @ 40°F	4200
Viscosity, SSU @ 100°F	312.0
Viscosity, SSU @ 210°F	50.9
Viscosity Index	+77
Pour Point, °F	−10
Density 25/25°C	
Grams/cc	1.095
pounds/gal	9.26
ASTM D-892 Foam Test	
Sequence I	Pass
Sequence II	Pass
Sequence III	Pass

The viscosity and viscosity index of Pydraul 312 are very similar to those of a high quality R&O (rust and oxidation inhibited) type petroleum hydraulic oil as the following comparative viscosity curves indicate.



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Corrosion and Stability . . .

The corrosion and oxidation stability properties of Pydraul 312 are equal to those of the best petroleum hydraulic fluids. Pydraul 312 will not rust or corrode any metal in a hydraulic system even when over-heated to 250°F.

In the *ASTM D-665 Rust Test* Pydraul 312 showed no rust at all, and in use Pydraul 312 does not lose its anti-rust properties.

Good hydrolytic stability is a basic characteristic of Pydraul 312. If water somehow enters your hydraulic system, Pydraul 312 won't hydrolyze to foam acidic or corrosive products.

Beverage Bottle Test (Pydraul 312 plus water aged @ 200°F for 168 hours with a copper strip through both phases).

Neutral No. change, mg KOH/mg	0.04
Viscosity change, % @ 100°F	−0.6
% @ 210°F	−1.3
Insolubles	none
Weight loss, Cu strip, mg/cm²	none

Fire Resistance . . .

Pydraul 312 is an industrial fire-resistant hydraulic fluid listed by Underwriters' Laboratories.

Miscellaneous Fire-Resistance Tests

ASTM D-286, Auto. Ign. Temp °F	940
High Pressure Spray Test (AMS-3150C and Federal Test Method STD791). Test fluid sprayed at 1000 psi through orifice, passing through flame of oxyacetylene 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 (Federal Test Method STD791) Test fluid dripped on tube at 1300°F.	Intermittent flashing but does not propogate to pan below.
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.

Your Monsanto representatives will be glad to show you color motion pictures of the performance of Pydraul 312 in these tests.

To test fire-resistance under working conditions, Pydraul 312 was sprayed on actual ignition sources in operating plants. In no case was a fire carried from the immediate source of ignition. In one plant, a line rupture on a die-casting machine sprayed Pydraul 312 onto molten aluminum in a holding furnace and over the surrounding area. Flame was confined to the furnace, no plant personnel were injured, and there was no fire damage.

Performance Properties . . .

Pydraul 312 has good viscosity and viscosity-temperature (V I) properties. These properties are permanent. Pydraul 312 will not shear mechanically to degrade viscosity.

The following chart shows viscosity of Pydraul 312 *before* a Vickers Hydraulic Pump Test . . . and practically the same viscosity *after* the test.

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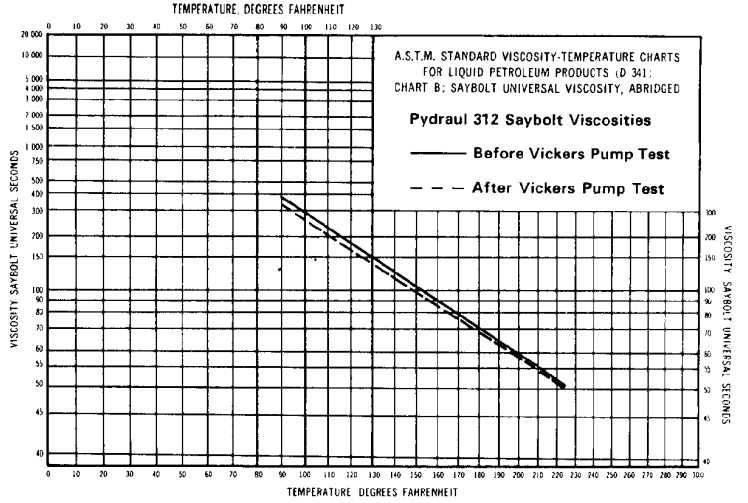
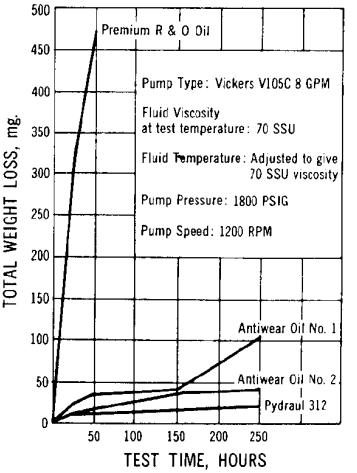


Pydraul 312 lubricates as well or better than High Quality R&O and antiwear type petroleum hydraulic oils.

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

% Viscosity change @ 100°F	−4.3
@ 210°F	−1.0
Weight loss of pump parts, mgs	
bushings, 2015	nil
bushings, 2016	−5.7
ring	−1.3
vane	−2.1



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Four Ball Wear Test (620 rpm, 1 hour, 167°F)

Steel on steel, mm scar diameter	
4 kg load	0.24
10 kg load	0.25
40 kg load	0.44
Steel on bronze	
10 kg load	0.87

Oilgear Radial Piston Pump Test (DS 425 pump, 1000 hours, 130°F, 3000 PSIG, pump speed 1200 RPM).

Pydraul 312 Fluid

% Viscosity change @ 100°F	12.3
@ 210°F	4.9
Acid No. increase mg KOH/g	0.9

Premium HVI Oil

% Viscosity change @ 100°F	−4.2
@ 210°F	−1.0
Acid No. increase mg KOH/g	0.7

Timken Test

Timken OK load, lbs.	55

Pydraul 312 lubricates under extreme pressure as well as high-quality industrial gear lubricants.

Field Tests

In addition to the laboratory tests, field tests in varied equipment such as automatic multi-welders, die casting machines and mobile steel mill equipment indicate Pydraul 312 will give years of trouble-free pump service . . . the same or longer pump life afforded by petroleum hydraulic oils.

And Pydraul 312 doesn't wear out. Except for normal "make-up",

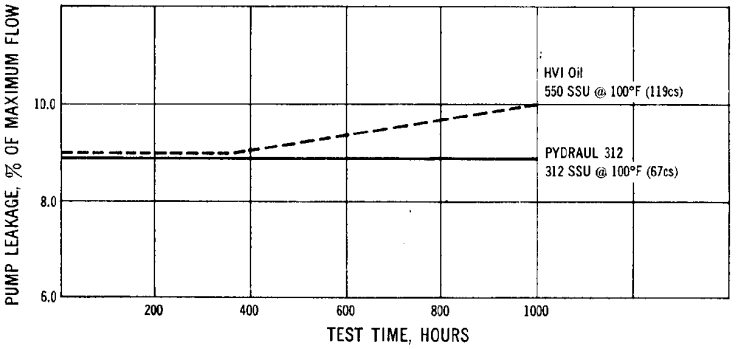
. . . you don't add water

. . . 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.

See results below:



CONDITION OF PUMP AFTER TEST: Generally good in all cases.
CONDITION OF OIL AND FLUID AFTER TEST: Properties not substantially changed.

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Change-Over Procedures

Converting to Pydraul 312 hydraulic fluid is easy. Virtually every type of equipment that 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® and silicone seals are best for Pydraul 312.

To replace other Pydraul fluids with Pydraul 312 where compatible seals are in the system, it is only necessary to add Pydraul 312 as make-up fluid. It is not necessary to drain or clean. When you convert from petroleum oils, non-Pydraul 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 Phosphate Esters (other than Pydraul)

(1) Drain the system completely.

(2) Cleaning is unnecessary.

(3) Generally, seal changes are unnecessary.

Changing from Petroleum Oil

1. Completely drain and clean the system. Small amounts of oil will not interfere with the performance of Pydraul 312, 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 312. 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 312.
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 312.

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 312 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.

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Handling and Storage

As with all specialized industrial fluids, certain precautions are advisable when handling Pydraul 312. No problems will arise when Pydraul 312 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 312; 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 312 at full strength indicate Pydraul 312 is a mild irritant, there is no evidence to show Pydraul 312 causes permanent damage to eye tissue. If Pydraul 312 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 312 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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