



UCON Hydraulic Fluids FDC-300 and FDC-400

Product Description

UCON™ Hydraulic Fluid FDC-300 and FDC-400 are specially formulated products for use principally within the food, drug, cosmetic and tobacco industries. These products offer the unique combination of water solubility, good lubricating properties and formulation from FDA-sanctioned ingredients.

UCON Hydraulic Fluid FDC-300 and FDC-400 are clear, fluids that with the exception of some haze attributable to an additive component are completely soluble in water. They are readily biodegradable but also, under normal usage and in the absence of contaminants, are not expected to support the growth of any microorganisms. Sterilization of UCON Hydraulic Fluid FDC-300 and FDC-400 can be achieved at 121°C (250°F) by total exposure for 30 minutes.

FDA Status

All of the ingredients in these products are sanctioned for use as lubricants subject to incidental food contact under FDA Regulation 178.3570.

Typical Physical Properties

	FDC-300	FDC-400
Specific Gravity, 20/20°C (68/68°F)	1.126	1.147
Weight, lb/gal at 20°C	9.38	9.54
Pour Point, °C (°F)	< -8 (<18)	< -15 (<5)
Viscosity, cSt at 40°C (104°F)	29	46
cSt at 100°C (212°F)	5.3	6.8
SUS at 37.8°C (100°F)	150	233
SUS at 98.9°C (210°F)	44	48.6
Viscosity Index (VI)	114	100
Flash Point,		
Pensky-Martens Closed Cup, °F (°C)	350 (176)	361 (183)
Solubility in Water	Essentially complete; some turbidity may result	
Water Content, weight %, max.	0.5	0.5
Color, pt., max.	25	25

Performance Properties

UCON Hydraulic Fluid FDC-300 has been examined in full-scale pump tests using Vickers V-104A vane pumps. For comparison, tests were conducted also with glycerine/propylene glycol (1/1) and with two viscosity grades of USP white oil. It is expected that UCON Hydraulic Fluid FDC-400 would give similar results to those of the FDC-300.

Performance Properties (continued)

Test parameters included operation at 1150 rpm with a 5 gpm ring, a sump temperature of 130°F, and 2000 (or 1000) psi pressure, as dictated by performance of the fluids under test. Typical results follow:

Hydraulic Pump Evaluations

<u>Hydraulic Fluid</u>	<u>Weight Loss, mg.</u>	
	<u>Combined Rings & Vanes, 40 hours</u>	
	<u>at 1000 psi</u>	<u>at 2000 psi</u>
UCON Hydraulic Fluid FDC-300	3	25
Glycerine/Propylene Glycol (1/1)	428	Would not operate ¹
White Oil A (150 SUS at 100°F)	90	Would not operate ²
White Oil B (185 SUS at 100°F)	51	Would not operate ²

¹ Glycerine/propylene glycol would not permit development of 2000 psi pressure; also at 1000 psi, cooling to 110°F (rather than 130°F) was required to gain prescribed fluid flow.

² Neither white oil permitted the maintenance of 2000 psi pressure without erratic operation, excessive noise, and the generation of excessive heat.

As noted, operation of the vane pump test stand at 2000 psi was intended to provide accelerated differentiation among the hydraulic fluids being evaluated. Obviously, the glycerine/propylene glycol and both white oils failed to satisfy these requirements. On the other hand, UCON Hydraulic Fluid FDC-300 provided the low-wear levels commonly found with anti-wear hydraulic oils. Even at the lower, 1000 psi operational pressure, the glycerine/propylene glycol and the white oils gave problems and/or higher wear readings.

In independent pump tests using a Vickers PVB-10 axial piston pump, fully satisfactory results were reported over a period of 100 hours of operation at 2000 to 2500 psi. In other independent testing, UCON Hydraulic Fluid FDC-300 was described as giving fully satisfactory results in a Vickers V-3520 high-performance double pump.

Gear pump tests were conducted using a Commercial Shearing 15-H pump (with one-inch gears) operated at 1750 rpm and with a cycle of six seconds at 500 psi, six seconds at 1000 psi, and a fluid sump temperature of 120°F. After 1500 hours of operation, the pump exhibited minimal wear on the gear teeth; journals and bearings were in good condition. There was no change in output delivery from the pump over the full 1500-hour period.

Following Procedure A of ASTM Test D 655 (Rust-Preventing Characteristics of Steam-Turbine Oil in the Presence of Water), UCON Hydraulic Fluid FDC-300 gave passing results.

Compatibility with Coatings and Elastomers

UCON Hydraulic Fluid FDC-300 was examined thoroughly to establish compatibility with representative samples of the following six different types of coatings:

<u>Product Identification</u>	<u>Type of Coating</u>
"Plasite" 7122	Epoxy-Phenolic
"Phenoline" 368	Modified Phenolic
"Carboline" 1277	Alkyd
"Carboline" 936-1	Vinyl
"Carboline" 110	Epoxy-Ester
"Carboline" 190 HB	Epoxy

Performance Properties (continued)

Coated test panels (5" x 1") were exposed in contact with UCON Hydraulic Fluid FDC-300 for 111 days at 55°C (131°F). Similar tests were run for UCON Hydraulic Fluid FDC-400. Under these test conditions only one coating, the modified phenolic, showed no apparent change. All of the others exhibited some softening and some slight loss in adhesion. Thus, any component of the hydraulic circuit exposed to UCON Hydraulic Fluid FDC-300 or FDC-400 at elevated temperature should be coated with a resistant coating, or not coated at all.

Inasmuch as 55°C (131°F) is not an unrealistic fluid temperature to encounter in hydraulic service, the interior surfaces of any hydraulic-system components that have been coated (e.g. reservoirs) may be subject to coating deterioration.

Careful monitoring of surfaces should be made for softening, lifting or peeling. If coating removal does occur, frequent maintenance of in-line filters may be all that is required to avoid equipment malfunctioning. UCON Hydraulic Fluid FDC-300 or FDC-400 should provide adequate corrosion protection to all ferrous surfaces wet with the oil.

Because external coated surfaces may not be exposed to these products at elevated temperatures, significant coating deterioration may not be a problem.

Resistance of Elastomers in Contact with UCON Hydraulic Fluid FDC-300

	Durometer Shore A Hardness Start / End	Wt. Change Mg/cm	Gross Thickness Change Inches
Butyl K-53	68 / 71	- 3.30	Nil
Buna N	78 / 85	- 7.20	- 0.002
Buna S	53 / 52	- 0.81	- 0.001
EPR	53 / 61	- 15.30	- 0.006
"Hypalon"	73 / 73	- 5.80	- 0.002
Neoprene 7797	79 / 79	- 0.90	- 0.001
Silicone #65	57 / 53	- 0.67	Nil
"Viton A"	87 / 84	+ 4.00	+ 0.001

Test Conditions: Test specimen (5" x 0.5" x 0.125") of each elastomer was exposed in contact with 500 mL of UCON Hydraulic Fluids FDC-300 at 55°C (131°F) for 111 days.

Resistance of Elastomers in Contact with UCON Hydraulic Fluid FDC-400

	Durometer Shore A Hardness Start / End	Wt. Change Mg/cm	Gross Thickness Change Inches
Butyl K-53	67 / 68	- 0.20	Nil
Buna N	84 / 88	- 1.30	+ 0.002
Buna S	48 / 47	- 1.70	+ 0.005
EPR	77 / 69	+ 1.70	+ 0.004
"Hypalon"	69 / 68	- 5.70	- 0.001
Neoprene 7797	77 / 84	- 2.30	+ 0.001
Silicone #65	53 / 53	+ 0.10	Nil
"Viton A"	81 / 84	- 0.80	+ 0.001

Test Conditions: Test Specimen (2.5" x 0.5") of each elastomer was exposed in contact with 250 mL of UCON Hydraulic Fluid FDC-400 at 55°C (131°F) for 95 days.

Because of the high ratio of surface area to volume of hydraulic fluid, and because of the extended time period, these data reflect severe examination of fluid/elastomer compatibility. While certain elastomers showed outstanding stability, others would probably provide acceptable performance under service conditions.

Conversion of Existing Systems

The introduction of UCON Hydraulic Fluid FDC-300 and FDC-400 to new equipment should not present any problems that are not normal to new service. Obviously, appropriate steps should be taken to remove all foreign matter that could damage equipment components or contribute to equipment malfunctioning.

Because these fluids are not compatible or miscible with hydrocarbon (petroleum based) hydraulic oils, used systems should be drained thoroughly to remove as much as possible of the used oil and residues. Particularly where white oil has been used as the hydraulic oil to provide FDA acceptability, the use of solvents for flushing may be precluded. Under these conditions, tests indicate the UCON Hydraulic Fluids FDC-300 or FDC-400 may be used for flushing. A minimum volume requirement of these fluids can be circulated and then drained rapidly from the system. Presumably, a major portion of the residual oil and/or sludges will be removed.

Because residual petroleum oil or oil-oxidation products will detract from the performance characteristics of the fluid, re-use of any UCON Hydraulic Fluid FDC-300 or FDC-400 used as a flushing oil is not recommended. The less dense petroleum oil may be separated as an upper layer.

Storage and Handling

UCON Hydraulic Fluid FDC-300 and FDC-400 have high flash points, so drums can be safely stored indoors. Room temperature storage is preferred, as fluid viscosity increases with decreasing temperature, and solidification occurs at less than 10°F. Drums should be kept sealed tightly to minimize moisture pickup during storage.

Tests indicate UCON Hydraulic Fluid FDC-300 and FDC-400 to be compatible with steel, stainless steel, aluminum, nickel, zinc, copper and tin.

Product Stewardship

Dow encourages its customers and potential users to review their applications from the standpoint of human health and environmental aspects. To help ensure that Dow products are not used in ways for which they are not intended or tested, Dow personnel will assist customers in dealing with environmental and product safety considerations. Dow literature, including Material Safety Data Sheets, should be consulted prior to the use.

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