HyJet® IV-A^{plus}

ExxonMobil
Aviation Lubricants

Advanced fire-resistant Type IV phosphate ester aviation hydraulic fluid

Description

Exxon HyJet IV-A^{plus} is the latest in a series of fire-resistant Type IV phosphate ester aviation hydraulic fluids. Built on the strengths of its predecessors, HyJet IV-A^{plus} features:

- superior stability against degradation
- remarkable strength in rust protection
- low density

All of these fluid characteristics will contribute to lower maintenance and operating costs for airlines. HyJet IV-A^{plus} offers many of the performance capabilities of Type V fluids to a great extent, and is Boeing Type V, Grade B approved. Additionally, Exxon HyJet IV-A^{plus} is qualified by all major aircraft manufacturers and meets SAE AS1241.

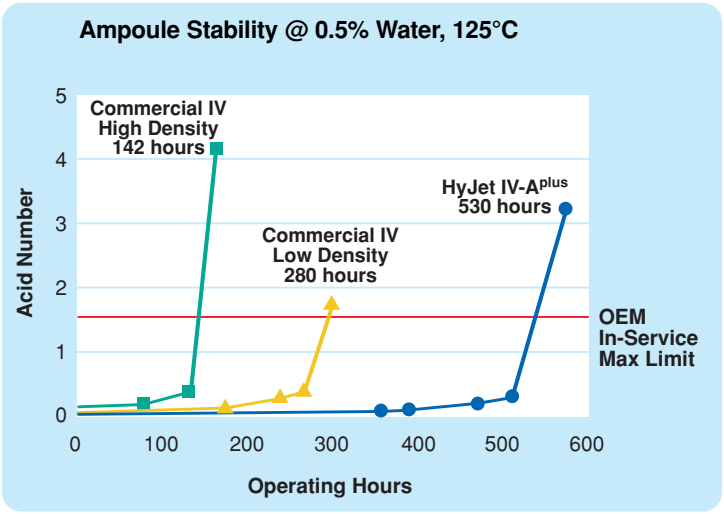
High Temperature Stability for Long Oil Life

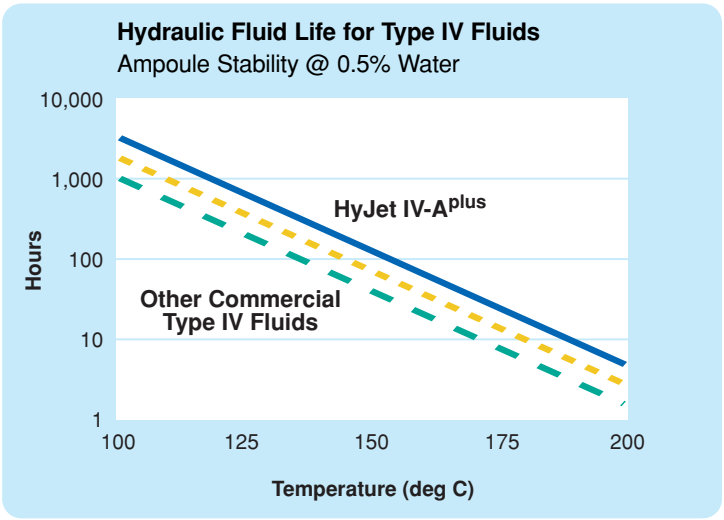
The dominant degradation mechanism for phosphate ester hydraulic fluids is reaction with water at elevated temperatures. Since all phosphate ester hydraulic fluids are highly hygroscopic (they tend to absorb water from the atmosphere very rapidly), aircraft systems typically contain water concentrations ranging from 0.2% to 0.8% water, sometimes even more. Reaction of phosphate esters with water produces acids, which if unchecked, can damage elastomers and etch metal surfaces within the hydraulic systems. All phosphate ester aviation hydraulic fluids contain acid control additives designed to immediately neutralize the acids formed. When the acid control additive is fully consumed, the acid formation rate increases very rapidly. Fluid acid number (which used to be called neutralization number) can then rapidly reach levels which may harm aircraft hydraulic system components.

To protect against such damage, aircraft manufacturers typically recommend a maximum acid number of 1.5, beyond which the oil should be replaced. The time it takes a fluid to reach an acid number of 1.5 can be considered as the in-service life of the fluid.

The Ampoule Stability test (see top graph) measures the thermal stability (resistance to molecular breakdown at high temperature) and the hydrolytic stability (resistance to reaction with water) of phosphate ester aviation hydraulic fluids.

Fluid life as a function of temperature at 0.5% water contamination (see bottom Hydraulic Fluid Life graph) is estimated from ampoule stability experiments.





Superior Stability

The comparison of HyJet IV-A^{plus} with competitive oils is based on side-by-side testing of samples. It demonstrates the superiority of HyJet IV-A^{plus} at a range of temperatures.

The fluid life for HyJet IV-A^{plus} as a function of temperature in these test conditions is about twice that of the next best commercial Type IV fluid. Experience with fluid samples from hydraulic system from severe aircraft collaborates the superior performance of HyJet IV-A^{plus} observed in these laboratory experiments.

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Rust Protection

Dissolved water in a phosphate ester hydraulic fluid does not cause rust, although the separated water phase can cause rapid corrosion of ferrous parts. Water in normal concentrations of up to about 1% is soluble in the fluid and not a cause for rust-related concerns. However, in absence of potent rust inhibitors in the fluid, if water concentration exceeds 3%, equipment damage can be rapid and severe.

As the photos to the right demonstrate, HyJet IV-A^{plus} offers superior rust protection relative to competitive Type IV products in the ASTM D665A rust test. This superior rust protection provides a measure of security against potentially damaging water contamination of an aircraft hydraulic system.

- HyJet IV-A^{plus} shows no rust on the test parts at 5% or 10% water mixed with fluid. The standard ASTM D665A test measures rust at 10% water.
- Competitive Type IV fluids show severe rust even at 5% water. At 10% water the rust damage observed becomes extremely severe.

5% Water

10% Water

Low Density Means Lower Operating Costs

Aircraft hydraulic systems are filled to a specific volume level. The weight of the fluid to achieve this volume is directly proportional to its density. A lower density fluid results in less weight carried by the aircraft.

Airlines can save money from lower fuel burn by using lower density fluids. The amount of money saved depends on the type and number of aircraft, number of flights, and the cost of fuel. Exxon HyJet IV-A^{plus} is the lowest density Type IV fluid commercially available.

Using HyJet IV-A^{plus} Results in Jet Fuel Savings Over Competitive Low and High Density Type IV Fluids

		Competitive Low Density		Competitive High Density	
Aircraft Type	Hydraulic System (gal/l)	Weight Savings (lb/kg)	Yearly Fuel Savings (gal/l)	Weight Savings (lb/kg)	Yearly Fuel Savings (gal/l)
A300, A310	105/400	11.4/5.2	170/640	53.4/24.2	790/3000
A319, A320, A321	62/235	6.7/3.0	120/460	31.5/14.3	570/2100
A330, A340	124/470	13.4/6.1	170/640	63.1/28.6	790/3000
A380	290/1100	31.4/14.3	310/1170	Not Approved for Use	
B727	33/125	3.6/1.6	90/320	16.8/7.6	400/1500
B737-100/200	23/90	2.5/1.1	60/220	11.7/5.3	270/1000
B737-300/500, NG	35/130	3.8/1.7	60/230	17.8/8.1	290/1100
B747, B777	178/670	19.3/8.8	240/920	90.6/41.1	1140/4300
B757	78/300	8.5/3.8	130/470	39.7/18.0	590/2200
B767	81/310	8.8/4.0	105/420	41.2/18.7	520/2000
DC-9, MD-80/90, B717	25/95	2.7/1.2	60/230	12.7/5.8	280/1100
DC-10, MD-11	125/470	13.6/6.1	240/920	63.6/28.8	1140/4300
L-1011	137/520	14.9/6.7	270/1000	69.7/31.6	1250/4700

Estimated on 3000 Flight Hrs./Year.
Values are intended for comparison only. Typical fuel burn factors reflecting typical flight cycles for each model were used. Actual results may vary.

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