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Hydraulic Fluid and Hydraulic System Compatibility with Bio-Ultimax™ Technology

STABILIZED™ by Renewable Lubricants

"Biobased Lubricants that Perform Like Synthetics"

Bio-Ultimax™ Hydraulic Fluids, (1000, 1200, 1500, and 2000 ISO Grade Series), including Bio-Fleet™, Bio-HVO™, Bio-HVO2™, Bio-Air Compressor Fluid, and Bio-AW turbine R&O Hydraulic Fluids (listed herein as Bio-Ultimax™ Technology Fluids) are compatible with the same system materials and components that are designed to operate on mineral oil based and most synthetic based fluids. In addition, they have been tested and have shown to be compatible with mineral oil based and most synthetic based fluids. Conversion procedures are much easier and No engineering design changes are necessary. They are compatible with the same filters, seals, hoses, accumulator bladders, cylinders and valves designed for petroleum, petroleum semi-synthetic, petroleum synthetic, and synthetic ester formulations. They can operate in static, mid-dynamic, and dynamic areas of hydraulic systems that contain plastic nylon composite (Nylatron GS, GSM, NSM), bearing composite (Iglide), fluorocarbon (Viton), polytetrafluoroethylene (Teflon), fluorosilicone, polyurethane, polysulfide, low Nitrile Buna-N, medium Nitrile Buna-N, high Nitrile Buna-N, Hydrogenated Nitrile Buna Rubber (HNBR), and include the following elastomers and description trade names:

Elastomer Compatibility

Including **ISO/DIN 1629**	DESCRIPTION (Trade Names)
• NBR	Low nitrile rubber NBR-L, NBR1 (Buna N, <30% acrylonitrile)
• NBR	Medium to high nitrile rubber (Buna N, >30% acrylonitrile)
• HNBR	Hydrogenated or Highly Saturated Nitrile Rubber
• FPM, FKM	Fluoroelastomer (Viton) Type 1 or A, Type 2 or B, (Dyneon, Flurel)
• FFKM	Perfluoroelastomer (Kalrez, Chemraz, Isolast, and Perlast)
• TFE/P, FEPM	Tetrafluoroethelene propylene (Aflas) non-conventional FKM Fluoroelastomer
• AU, EU	Polyurethane, (Adiprene, Millathane, Desmopan) Polysulfide, (Thiokol)
• PTFE, FEP	Polytetrafluoroethylene (Teflon, Armalon, Fiberglide)
• ECO, CO	ECH Epichlorhydrin,
• CR	Polychloroprene (Neoprene)
• FVMQ	Fluorosilicone, (FSE, Silastic, Sylon), generally used for static seals
• VMQ, Si	Vinyl-methyl-silicone, silicone, generally used for static seals

In addition to the elastomer compatibility list above, Bio-HVO2™ Hydraulic ISO 46 and 68 FR Fluids have also performed in hydraulic system containing EPDM elastomers and contain specific biodegradable, biobased oils that provide compatibility with EPDM. (See TDS on Bio-HVO2™ Hydraulic Fluids ISO 46, and 68 FR Fluids, ISO 32 Grade is not compatible with EPDM).

Petroleum-Mineral Oil Based Fluid Compatibility

Bio-Ultimax™ Technology Fluids have been designed to directly replace mineral oil based hydraulic fluids and improves the performance of the overall hydraulic system operation. To convert a system, simply drain and recharge. For biodegradability, at least 90% of the mineral oil based fluid should be removed from the system. Most of the fluid can be removed by draining the reservoir and lines. Flushing is not necessary for compatibility, but if you choose to flush, only use Bio-Ultimax™ Technology Fluids as a flushing fluid. Bio-Ultimax™ Technology Fluids may also be used as a top fill (with compatible fluids) until the existing fluid is converted in the maintenance schedule. One of the most widely used elastomer in the industry for mineral oil based hydraulic systems is NBR. HNBR and FKM elastomers are gaining market in newer equipment and are listed above with other elastomers that are used.

Synthetic Based Fluid Compatibility

PAOs

Bio-Ultimax™ Technology Fluids are compatible with synthetic Polyalphaolefins (PAOs) and semi-synthetic PAO and mineral oil blends. PAOs are widely used in the synthetic lubricant market and generally formulated to meet the same hydraulic systems compatibility requirements as mineral oil fluids. Converting a system would require the same procedure as mineral oil based above.

Synthetic Esters

Bio-Ultimax™ Technology Fluids are compatible with most synthetic esters based fluids and depending on selection of esters they may be considered biodegradable. RLI's compatibility studies show polyolesters and diesters to be very compatible however there can be compatibility problems when blending some complex ester fluids. Most synthetic ester based fluids have excessive seal swell on butyl and low nitrile rubber and more chemically resistant seals and components (NBR medium to high nitrile, HNBR, FPM, FKM and PTFE) are recommended. Bio-Ultimax™ Technology Fluids are highly compatible with systems designed to use synthetic esters.

Polyalkalene Glycol (PAG), and Polyethylene Glycol (PEG), Water glycol (HFC) and invert emulsions (HFB)

Bio-Ultimax™ Technology Fluids are **NOT** compatible with most PAG, PEG, and water based fluids. These fluids must be removed from the system by draining the reservoir and lines. Refill with Bio-Ultimax Fluid as a flush. Remove residual fluid by circulating and draining. Flush and repeat flushing until the residual is removed from the system. Standard practice for flush and purification of hydraulic systems may be found in ASTM D 4174-89. Seal compatibility should also be considered before changing the system over, because EPDM seals may be used in systems designed with water glycol, PAG and PEG fluids.

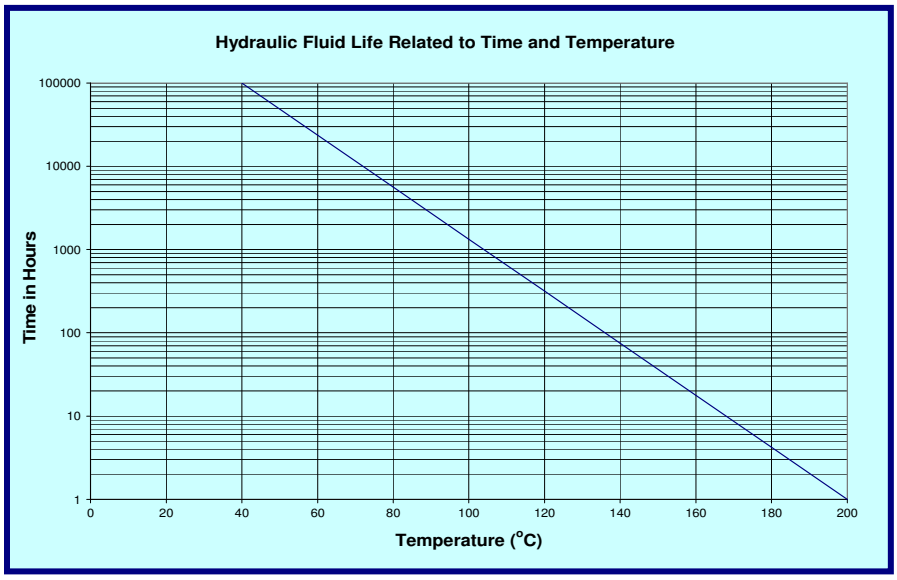
Phosphate Esters

Bio-Ultimax™ Technology Fluids are compatible with some, but not all phosphate ester fluids. Testing is recommended before conversion. Seal compatibility should also be considered because Butyl rubber and EPDM are the most compatible elastomer with phosphate esters. Conventional Butyl rubber and EPDM has poor compatibility with mineral/petroleum hydraulic oils.

It is recommended by RLI that if there is any question about material and fluid compatibility to contact RLI's technical service. If professional high velocity oil flushing, cleaning, and filtration are required, RLI can provide compatible flushing fluids for high velocity systems. For additional information on high velocity flushing services contact PWS Motion Control, Inc. www.pwsdirect.com or contact RLI.

Life Expectancy of Hydraulic Fluids

The logarithmic chart to the right shows the life expectancy of hydraulic fluids related to time and temperature. Bio-Ultimax Technology Fluids are designed to meet OEM oil change requirements that recommend mineral oil based fluids. Although this chart is a good reference, it does not take into consideration other variables that can affect the life of the fluid as in moisture, dusty conditions, system design, etc. With the proper maintenance and analysis program, equipment and/or fluid life can be extended.



Professional Technical Services

RLI's technical services include hydraulic fluid system analysis and conversion recommendations. RLI recommends a program of regular hydraulic fluid analysis every 6 months or less depending on the application and system. Contact RLI for these services. RLI's goal is to provide a high performance hydraulic fluid that is safe, cost effective, and extends the life of your equipment.

STABILIZED by Renewable Lubricants* is RLI's trademark on their proprietary and patented anti-oxidant, anti-wear, and cold flow technology. High Oleic Base Stock (HOBS) are agricultural vegetable oils. This Stabilized technology allows the HOBS to perform as a high performance formula in high and low temperature applications, reducing oil thickening and deposits.