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'Providing Tribological Solutions'

TECHNICAL NOTE

EHC FLUID AND ELASTOMER COMPATIBILITY

Lanxess Reolube Turbofluids are based on triaryl phosphate esters and while they can have the same viscosities as mineral oils, the material requirements can be quite different. This is the same for all OEM triaryl phosphate ester approved fire resistant fluids for use in steam turbine control systems.

For example, ethylene-propylene (EPR) and butyl rubbers are suitable for Reolube Turbofluids but not for mineral oil. Conversely, one of the most commonly used elastomers for mineral oils is nitrile rubber (Buna-N). This should not be used with any of the phosphate esters. Phosphate ester fluids are excellent plasticizers and are widely used in this application with polyvinyl chloride (PVC) materials. Consequently, PVC components and coated wires can be softened if left in contact with these fluids.

As to what is okay, compatibility is often determined by immersing a sample of the material in the fluid and soaking it at an elevated temperature. Acceptable changes might range from 5% shrinkage to 15% swell so that even with approved materials, there can be some effect. In addition, elastomer compounds in the same family or from different suppliers can vary widely. If there is any doubt, contact the component supplier for their specific recommendations and if still not sure do an accelerated immersion test.

In addition, the suitability of a particular compound depends on the material and the application. For example, in one application some swell may be acceptable, while in others it may not. It is generally okay with captured but not parts where there is motion.

Also silicone based rubber and/or sealants may be unsuitable in contact with EHC fluids but are reportedly acceptable as a coating for wires. This is not because of softening but if such material is exposed to the fluid there have been reports of adverse effects on the air release time of the fluid. In susceptible systems it can lead to more rapid fluid degradation because of excessive air being pulled into the pump suction. Similarly with some elastomers having chlorine there can be concerns about any lowering of the resistivity.

There can be considerable differences between the recommendations from components suppliers. So if in doubt contact the fluid supplier or do specific tests. A field test that can be used for an 'o' ring is to drop it into a container of the EHC fluid (SG of 1.13). If it sinks, the 'O' ring is likely Viton (SG of 1.85) and will be okay. On the other hand if it floats, it might be Buna 'N' (SG of 1.0) which is not okay. Unfortunately it may also be butyl rubber (SG of 0.92) which is acceptable for lower temperature applications.

The Reolube and Durad fluids are no different with respect to material compatibility than the other triaryl phosphate esters that have been used for 30 years. However, not all compounds are necessarily the same because seal suppliers can have different blends. There can also be various versions of the same family such as Viton A, B and GF. In addition, the temperature of the application is very important. The higher the temperature the greater the effects. Note also that elastomers with better chemical resistance might be more prone to taking a cold set. This is a permanent plastic deformation.

One problem in checking with component suppliers is that the fluids can be listed under a variety of names. If there is difficulty, try looking under some of the following;

1. **Trade Names:** Durad, Reolube Turbofluid, Fyrquel, Anvol PE, Hydran FR, Pyrogard 53 or 53T, Houghton Safe IP20 or Kronitex. All are phosphate esters but not all are EHC quality fluids.

2. **Chemical Names:** Phosphate ester (PE), Triaryl phosphate (TAP), Tricresyl phosphate, Trixylenyl phosphate, Tertiary-butylphenyl phosphate, Triphenyl phosphate, etc. Caution: trialkyl phosphate esters like Skydrol used in aircraft hydraulic systems are not the same.

3. **Standards:** MIL-H-1945D and SAE AS 1241A. While not exactly the same it might help with some suppliers.

4. **Tests:** One simple test suggested by GE is to immerse a piece for 168 hours in the fluid kept at 140°F (60°C). The limits are 15% swell and 5% shrinkage. Note: This might not be adequate for extended fluid contact, especially at elevated temperatures.

Please note that there can be variations in the performance of materials from different suppliers even if they are the same material type or have the same trade names. If it is a critical application or if there have been problems with swelling or disintegration, specific tests may be required.

If in doubt call your fluid supplier because not all the elastomer suppliers' data is necessarily appropriate for use with these fluids in control systems.

MATERIAL	Seals, hoses and bladders	Wire and cable insulation	Paints
acrylonitrile butadiene styrene (ABS)	U		
acrylic			U
alkyd paint (stoved)			S
butyl rubber	**R**		
ethylene propylene rubber (EPDM)	S		
epoxy paint (cured)			**R**
natural rubber (NR)	U		
chloroprene rubber (CR) 'Neoprene'	U		
nitrocellulose			U
nitrile butadiene rubber (NBR) 'Buna N'	U		
nylon (PA66)		**R**	**S**
phenolic resins			S
polyethylene (PE)		A	
polypropylene (PP)		A	
polyurethane paint			S
polyvinyl chloride (PVC)	U		
silicone rubber (MVQ)	U	A	
polytetrafluorethylene (PTFE) 'Teflon'	**R**	**R**	
fluorocarbon rubber (FPM) 'Viton'	**R**		

Key: R = recommended
A = Acceptable
S = Suitable under certain conditions
U = Unsuitable

Provided for information only. Specific recommendations should be obtained from the equipment manufacturers, the fluid suppliers and/or the component suppliers.