

TURBOFLUID EHC QUESTIONS AND ANSWERS

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Q1. What is the difference with Fyrquel EHC?

Answer: Very little. ICL (was Supresta) Fyrquel EHC is a blend of two triaryl phosphates, one a 'natural' fluid and one a 'synthetic'. The Chemtura Reolube Turbofluids are one type. Both companies offer various EHC (electrohydraulic control) quality triaryl phosphate ester fluids. Fyrquel EHC contains trixylenyl phosphate (TXP) and butylated phenyl phosphates. Various fluids from both the major suppliers can be approved by the different steam turbine suppliers.

Q2. What happened to Stauffer and Akzo Nobel?

Answer: They were acquired by other companies. Stauffer Chemical was acquired by Akzo Nobel in 1987. Then Supresta was formed in July 2004, when Akzo Nobel sold its phosphorus chemicals flame retardant business to a private equity fund managed by Ripplewood Holdings L.L.C. In August 2007 Supresta was acquired by Israel Chemicals Ltd. (ICL), a multinational fertilizer and specialty chemicals company.

Q3. Is Durad EHB still available?

Answer: Yes. This is now called Reolube Turbofluid 46B. It was supplied by a division of FMC which was acquired by Ciba-Geigy and then by Great Lakes Chemical Corporation which merged with the Crompton Corporation in 2005 to be called Chemtura Corporation. See www.chemtura.com. For the Reolube Turbofluid fluids select 'Our Businesses', then 'Petroleum Additives & Fluids', 'Products and Services' and finally 'Finished Lubricants'. They are listed after the greases.

Q4. Who supplies Turbofluid EHC fluids?

Answer: They can also be made available through a number of local suppliers including the The Slover Group in Texas (www.slovergroup.com) and for a minority and female owned company, Cole Chemicals (<http://www.colechem.com>).

Q5. Who is using them?

Answer: Worldwide. Chemtura Reolube Turbofluids are being used around the world. In the US the Turbofluids 46, 46B and 46XC are used by utilities such as Austin Energy, Exelon, Florida Power & Light, Georgia Power, LCRA, Progress Energy and TVA. They are also used in most of the nuclear stations in Canada. Chemtura have fluids approved by GE, Westinghouse, Siemens, Alstom and others. Chemtura are a global supplier of flame retardants and the largest component supplier to the lubricants industry. They are a billion \$ US based company.

Q6. Are there differences between fluids?

Answer: Yes. First approved fluids met the same steam turbine OEM performance requirements and can provide years of trouble free service. While all are triaryl phosphates (TAP), there are differences related to the specific characteristics of the type of TAP used. The so called 'natural' products have good overall characteristics and good hydrolytic (resistance to degradation caused by water) stability. The 'synthetics' have the best oxidation resistance. Forsythe can provide three fluids suitable for electrohydraulic control systems, one natural and two synthetics. A blend of natural and synthetic phosphate esters, which is a compromise of characteristics, is available from the other manufacturer. Which is the best depends on the control system design.

Q7. Can the various fluids be mixed?

Answer: Yes. Because all of the fire resistant fluids approved by the steam turbine manufacturers are triaryl phosphates they are chemically fully compatible with each other. The steam turbine OEM's have also stated that they can be mixed, and in fact, most of the fluid being used today is a mixture of two different types. Specifics can be discussed as required because the various types of fluids have pros and cons. Consequently, one type of fluid may not be best for all systems.

Q8: How often should the fluid be changed?

Answer: Never. With the required maintenance and prompt correction of any system deficiencies, these fluids should not require changing. This assumes a 'normal' makeup rate of 10-15% per year. As proof, after over twenty years the original charge of Turbofluid 46B is still being used in its first unit. This is in a General Electric turbine in Texas.

Q9. What materials can be used with Durad/Turbofluids?

Answer: All the standard ones for phosphate esters. Turbofluid 46B and rest of the family of Chemtura Turbofluids are all triaryl phosphates. These are the same as the other approved fluids so that the material requirements are no different. However, all of these fluids will soften certain plastics. Consequently, materials to avoid include PVC, nitrile rubber and Buna-N. Fluorocarbon based elastomers, such as Viton, or PTFE are commonly used as are ethylene propylene elastomers. Butyl rubber can also be acceptable but it has a much lower temperature limit. In addition, only compatible paints such as epoxy ones should be used.

Q10: How often should the fuller's earth be changed?

Answer: One time more often than 'necessary'. You do not want to exceed the limits so this depends on the rate of degradation, but for GE units is typically 3 times a year. GE also recommend 'either/or' change requirements. First, they say to change it every three months. Secondly, change the fuller's earth more often in case the chlorine content is >150 ppm, the water content is >2,000 ppm **or** the acid number is >0.20 mgKOH/g. Please note that it is our recommendation to work to at least half of the GE values. This is to avoid irreversible degradation. Work to maximums of 1,000 ppm water and acid numbers of 0.10 mgKOH/g.

Q11. Changing the fuller's earth does not seem to make any difference. What's wrong?

Answer: Usually flowrate. This can be for a number of reasons, all of which can be easily checked. First, are the changes really being done? A check of stores withdrawals might be required for verification. Secondly, are the fuller's earth cartridges wet and as a result are spent? This because one fullers earth supplier states that after only six months of storage they will not be effective and that the cartridges require drying.

Next, is the flow getting to the fullers earth? Ensure that the housings have been vented of air, that the back-up filter is not plugged and that none of the bypass pressure relief valves are passing. In addition, verify the flow. As an example on General Electric units, check that the selector valve is in position 3, and that the flow valve is in the right position for that sized reservoir. Some of the data is in error.

Q12. What fluid testing is required?

Answer: As recommend plus some. The OEM's all have recommendations for periodic fluid testing, such as for the acid number and the water content. Plus, it has been found that additional testing can also be beneficial. In particular, testing for metals to determine if the magnesium or calcium has been released from the fuller's earth or if sodium has been released by Selexsorb or activated alumina. Metals are of concern because they can lead to filter and screen plugging. The fluid color can also be very useful.

Testing every month is sufficient in most cases and the testing is provided by Forsythe at no charge. Additional testing, such as used filter element analysis and valve

examinations, can also be performed to assist with problem solving.

Q13. How often should the servo-valves be replaced?

Answer: As the turbine OEM recommends. This is typically every 5-6 years and will depend on what has been causing any problems. For a system that is clean and where the fluid has always been in good condition, the standard OEM recommendations are probably sufficient. For a General Electric turbine, see GEK-1135C, these are to stagger the replacements so that no servo-valve is in service longer than six years and to inspect the screens annually.

Q14. What is the cause of high particle counts?

Answer: Usually sampling. This can be quickly checked by testing samples taken one after the other. They should be the same. If not, check to ensure that the proper sampling procedure is being followed and that the samples are being taken from the right place. Other likely causes can be contamination from the fuller's earth, from makeup fluid, from maintenance or from passing breathers.

A simple upgrade on a GE unit is to install a 20" Forsythe back-up filter element rather than the current two 10" ones. The longer element is less likely to cock over and as an added plus it is more effective at catching smaller particles. As added benefits a better back-up filter can help extend the life of the fluid and reduce plugging of the much more expensive pump discharge filter elements.

Q15. If the acid number has been very high, what can be done to bring it back into specification?

Answer: An acid number above 0.3 or sometime even 0.2 mgKOH/g, generally means that the fluid cannot be recovered with traditional means. This is because repeated changes of the fuller's earth or Selexsorb media may bring the acid number down, but the metal content will likely then be too high. This can lead to worse problems with soaps and gels jamming servo-valves and solenoid valves. There are options including fluid bleed and feed, a total change or treatment with Forsythe ion exchange resin. The resin is available as a portable rig or as cartridges to be put in the fuller's earth housings.

Fyrquel is a trade mark of ICL Corp, Reolube Turbofluid a trademark of Chemtura Co. and EHC a trademark of FMC.

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