

Fire Resistant Transformer Oils – A Primer

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Fire Resistant Transformer Oils

Fire Resistant transformer oils add a significant margin of safety to any liquid filled electrical equipment. These insulating oils are used instead of conventional mineral oil in transformers and switchgear that are located in hazardous or sensitive areas.

When is Fire Resistance Needed?

Fire resistant insulating oils are used any time the safety of electrical equipment needs to be increased. Fire Resistant fluids can be used in all equipment that would normally use conventional transformer oil. These fluids have been widely used in transformers, switchgear, and voltage regulators located:

- Inside buildings
- in government buildings or installations
- in areas of high pedestrian traffic (i.e., in crowded areas of cities)
- inside or near petrochemical or industrial sites
- in areas of frequent natural disasters (earthquakes)
- in urban electrical substations
- in mines or tunnels

Fire regulations often require extra fire protection in these locations. Using fire-resistant insulating fluids in transformers and switchgear is an excellent means of preventing fires and explosions in electrical equipment.

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Fire Resistant Insulating Oils and Fire Safety:

Fire Resistant Hydrocarbon oils combine fire safety with low environmental and health risk. Since their introduction, fire-resistant hydrocarbons have been used to lower the risk of fire and explosion in hundreds of thousands of transformers and switchgear installations.

The principal advantage of the fire resistant oils is their resistance to ignition. These fluids require a tremendous amount of energy input to raise the temperature to one that will sustain a flame. This is easily shown with the fire point test.

Compare the relative flammability of fire resistant oils with conventional transformer oil:

<u>Fluid</u>	<u>Fire Point (ASTM D92), °C.</u>
Conventional Mineral Oil	145
Fire Resistant Insulating Oil	>300

You can see the added safety margin that is provided by the fire resistant oil. This is proven in the fact that fire resistant hydrocarbon oils have a flawless safety record.

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Choosing Fire Resistant Insulating Materials:

There are several considerations that should be used in choosing a fire resistant dielectric fluid. Among the most important are:

- The fluid must have excellent electrical characteristics
- The fluid must be a good cooling medium
- The fluid must be easy to handle and friendly to the environment
- Fire resistant fluids should be compatible with materials that are used with conventional transformer oil.

Fire Resistant Petroleum fluids

Fire resistant petroleum oils are very popular for use in new equipment. They are the least expensive fire resistant oils available. Beta Fluid is a good example of this type of oil. Beta Fluid is highly refined petroleum oil with special additives. It has the same electrical characteristics as conventional transformer oil, with additional fire safety. It has good environmental qualities. Beta Fluid is compatible with conventional transformer oil and with all equipment construction materials.

Beta Fluid can be used in switches, circuit breakers, and other equipment. Maintenance practices are the same as for conventional transformer oil.

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Synthetic hydrocarbon fluid

Synthetic paraffin hydrocarbon fluids are widely used in new and in used equipment transformers. This process is called retrofilling. The most popular synthetic paraffinic hydrocarbon in use today is called Alpha-1 fluid. Alpha-1 Fluid is a hydrocarbon, just as petroleum oils are, but instead of being refined from crude oil, it is manufactured in a chemical process.

Alpha-1 Fluid also has excellent electrical characteristics. Because it is synthetic, it has better cooling performance, and better flow at low temperatures. These characteristics make Alpha-1 Fluid perfect for changing the existing oil in PCB or mineral oil transformers.

The maintenance and disposal procedures for Alpha-1 Fluid are similar to those of conventional transformer oil. Alpha-1 is compatible with standard materials used to make transformers.

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Use in New Equipment:

In new transformers and switchgear, fire resistant fluids can be used instead of conventional transformer oil. They are a direct replacement for conventional transformer oil. The electrical characteristics of fire resistant fluids are excellent. Because of their higher viscosity, transformers may operate at slightly higher temperatures. Extra cooling (radiators) or larger internal cooling ducts can be used to minimize this effect.

Changing Oil in Existing Equipment:

Transformer operators sometimes want to upgrade the fire safety of existing electrical equipment. Changing the oil with a fire resistant fluid is often an easy and inexpensive way to increase the fire safety margin of the existing unit.

This is a simple procedure. In many cases, this process (called retrofilling) is simply a matter of draining the original oil and filling the unit with the new fluid.

Alpah-1 Fluid is specially made for this application because of their excellent cooling characteristics, which minimize the operating temperature of the retrofilled transformer.

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Conclusions:

Fire Resistant fluids are used throughout the world in installations to minimize the risk of fire and explosion. These fluids will not ignite until they are at extremely high temperatures. They are an effective means of adding extra fire safety to electrical equipment installations and can be used in transformers and switchgear that were designed for conventional transformer oil. Fire Resistant Hydrocarbon Oils can be used in both new equipment, or to refill equipment that was originally filled with conventional transformer oil.

Typical Properties of Dielectric Fluids

	Fire Resistant Petroleum Fluid (Beta Fluid)	Synthetic Fire Resistant Hydrocarbon (Alpha-1 Fluid)
Fire Point, °C.	308	306
Pour Point, °C.	-21	-68
Dielectric Strength IEC Electrodes, 2mm, kV	56	56
Dissipation Factor @ 20 °C., %	0.10	0.06
Viscosity @ 100 °C., cSt.	12.0	8.5
Compatible with transformer oil	yes	yes