

DIELECTRIC FLUIDS - ASKAREL

In 1929 it was discovered that polychlorinated biphenyls possessed the same good electrical insulating values as mineral oil dielectrics and that these PCBs are very unusual organic liquids because they do not burn. Moreover, it was discovered that their electric arc formed gases do not support combustion and that the electrical capacitance of PCBs is twice that of mineral oil.

This discovery was patented because the industry was in great need of fire safe dielectric fluids for special use in capacitors and transformers. ~~The World Almanac documented the advent of PCB dielectrics as being one of the world's greatest discoveries.~~

PCBs are manufactured at reasonably low cost. Possessing twice the capacitance of mineral oil allows making capacitors half the size of mineral oil units and yet able to do the same work. This has proved to be an impelling economic advancement as the saving of materials and space are great.

The unusual combination of safety from fire, good electrical insulating properties, and strong economic

advantages account for the fact that since their discovery over forty years ago these PCB fluids have been used exclusively for certain types of essential capacitors and transformers. Replacements are not at hand today and it is most unlikely that anything similar can be found without compromise.

ESSENTIAL APPLICATIONS

PCBs are used exclusively for the following type capacitors:

- 1) Utility line power factor correction, including balance of all the EHV lines on down to power conservation at industrial and commercial sites.
Absence of the PCB capacitors from these power and distribution lines would result in massive power failure and economic chaos.
- 2) By law, all air conditioning apparatus must be fitted with PCB motor-run capacitors to conserve power. Similar PCB capacitors are used for the efficient operation of most large motors used for industrial purposes and for large appliances. Elimination of this product from these applications would lead to major power failures.

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- 3) All fluorescent and mercury vapor lighting ballasts for indoor and outdoor lighting operate with PCB capacitors.
- 4) Other essential PCB capacitor applications include induction heating capacitors for steel production and metal working; voltage regulator capacitors for communication systems such as telephones, TV, radio and microwave, high energy storage capacitors for atomic fission, laser operation, impulse testing of large electrical apparatus, special metal forming operations and a variety of space age related functions.

Over the forty years of existence of PCB-type capacitors attempts at possible replacement have been made in various areas of application. None have been successful, with the exception of a case such as electronic circuits where it was possible to redesign the entire system to solid state.

PCBs are used in transformers:

Promptly following their discovery PCB fluids were employed to make fire-resistant type transformers for specialty applications in confined and populated areas to protect people and property from fire hazard.

The generic name askarel was assigned to PCB dielectrics and as manufacturer of these fluids Monsanto patented the trade name Aroclor. Transformer makers assigned their own names. Examples are Pyranol, Inerteen, Noflamol, and Chlorextol.

The askarel transformer is strictly a specialty type unit selected in place of mineral oil where need for safety from fire warrant paying the askarel transformer unit premium cost. These judgments are made by individual electrical architects and by organizations such as the utilities, and Government agencies including the Army and Navy. The judgments and requirement for fire safe transformer use are incorporated into various civic building codes and requirements by the fire underwriters.

The popular size of askarel transformers ranges from about 350 KVA to 3,000 KVA. Accordingly, they are quite small as compared against typical mineral oil filled power transformers which are usually located in remote areas.

In a number of instances the transformer selection is a matter of judgment of an askarel unit versus an

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open dry type transformer. Here advantages of askarel units are their ability to withstand greater overloads, greater line surges, greater impulse resistance, satisfactory operation at higher voltage levels, lower heat loss, lower cost operation and lower noise levels.

Also as the askarel unit is hermetically sealed it can be used in areas of high humidity, or where water flooding may be expected. A good example of this is the use of askarel transformers by utilities along our coastal areas, and the fact that our East Coast electric train systems operate with askarel units instead of dry type transformers which failed during the snow storms. Open dry units are also not well suited for many industrial sites where there is a dusty or corrosive environment. Maintenance of the open dry unit is excessive even when located in more favorable atmosphere.

Another important factor is that the size of an askarel unit for a given rating is usually significantly smaller than a comparable dry type transformer. As transformers like most everything else are usually fitted into the minimum space area, it would be very difficult in many instances to replace existing askarel units with dry type units.

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Due to all of these considerations representatives of the electrical industry advise that if askarel type units and PCB fluids were not available the result would be a blackout of the entire North East section of our country and some other areas.

Again, as in the case of capacitors, there are no known satisfactory fire-resistant fluids available as replacement for transformer (PCB) askarels.

There are several types of askarel transformers:

- 1) Industrial load - small to medium power center transformers: These power centers are used by the steel mills, textile mills, paper mills, automotive manufacturing, aircraft manufacturers, chemical manufacturers, petroleum refiners, copper mines and in general by overall industry.

The Government is a large user of askarel transformer load centers at all the space centers and atomic energy centers, such as Cape Kennedy, Houston, Los Alamos, Oak Ridge, Hanover, etc.

The Army and Navy use askarel unit power supplies, not only domestically but around the world.

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Examples are at shipdocks and communication power supplies as for example the DEW-line early warning system.

Askarel power supplies are used by all of the Government's mints.

- 2) Distribution Type Transformers: Many utilities use askarel distribution type transformers, especially for underground networks.
- 3) Other important uses include: rectifier transformers; metering transformers; instrument transformers; electric railroad transformers; subway transformers such as the new Metro System being built in Washington, D.C.

Around the world, starting about 33 years ago, the same essential uses for PCBs in capacitors and transformers developed rapidly in Canada, Germany, France, Belgium, Switzerland, Britain, Spain, Italy and Scandinavian countries. This was followed by strong use in Mexico and South America, in Japan, Australia, India, Russia, and in other Iron Curtain Countries. Today these fluids

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are employed world-wide including remote areas where some of the applications involve critical defense uses.

In addition to their manufacture in the USA, PCBs are now produced in England, Germany, France, Russia, Japan, Italy, Spain, and Czechoslovakia. Production is contemplated in Rumania.

PRESENT STATUS OF PCBs FOR
CAPACITORS AND TRANSFORMERS

- A) Because of essential use and lack of replacements, and because PCB capacitors and transformers are hermetically sealed metal apparatus, the electrical use of PCBs is continued.
- B) Obvious initial steps taken were improvement of Monsanto's plants and those of the capacitor and transformer makers to ^{reduce escape of} ~~virtually prevent~~ any PCB from entering the environment.
- C) Since it has been the more highly chlorinated (more refractory) PCBs that have been found, in general, in the environment, Monsanto developed Aroclor 1016 which has these materials removed. This is now supplied as total replacement for Aroclor 1242 used by the capacitor makers.

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- D) Monsanto's Environmental Group has in operation a pilot machine capable of incinerating small PCB capacitors such as ballast and motor-run units.
- E) Arrangements have been made for users to return spent dielectric fluids for regeneration or incineration at our St. Louis plant.

FUTURE STEPS UNDERWAY

- A) Judgments and guidelines will be formulated about the proper disposal of solid scrap impregnated with PCBs and generated by the electrical industry. Examples are failed capacitors from ballast, motor run and power correction applications, and scrap core and coils from askarel transformers. The guidelines for disposal of both liquid and solid scrap must reach many end users, beyond the reach of Monsanto and the electrical manufacturers.
- B) To proceed with this and all aspects of PCB pollution as related to the electrical industry Committee C107 has been formed at ANSI. Working subcommittees will be formed at a meeting to be held in Washington, D.C., on September 14 at the National Bureau of Standards.

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The scope of this committee involves procedures and guides for safe use, maintenance and disposal of askarel and askarel-soaked materials used in electrical equipment.

The proposed objectives of the ANSI Committee are to:

- 1) Serve as a source for technical information and advice for Federal, State and local authorities and for the information of all others concerned.
- 2) Encourage the development of suitable disposal facilities and maintain a list of their capabilities and locations, for the information of all concerned.
- 3) Serve as the advisory group for U.S. participation in CEE, IEC, COPANT, SEGRA, and other international organizations.

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