# PYROCLOR

TRANSFORMER COOLANT BY Monsanto

Pyroclor is Monsanto's brand name for its fire resistant transformer askarel. The term "askarel", as defined by ASTM, generally describes a broad class of fire resistant synthetic chlorinated hydrocarbon liquids used as electrical insulation media in transformers.

Transformer askarels were first used in the United States in 1932 and incorporate chlorinated biphenyl – one of the best liquid insulation materials ever developed. This inert material is chemically stable, fire resistant, heat stable, non-corrosive and has high dielectric strength under the operating conditions encountered in transformers.

In Europe, askarel transformers form a large percentage of the distribution transformers installed today. In France, one third of the distribution transformers brought into service each year are of this type.

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## PYROCLOR 5

This is the recommended fluid for all Pyroclor-filled transformers operating at normal ambient temperature conditions. Should special operating conditions be envisaged, please consult with Monsanto – it may be possible to provide a modified product.



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# Advantages of Pyroclor

1. Pyroclor is very fire resistant. It resists ignition and tests have shown it does not burn continuously as a result of transformer arcing.
2. Pyroclor-filled transformers need no special fire precautions as part of the transformer installation.
3. Pyroclor-filled transformers offer greater siting flexibility, particularly where space is limited. They can be located indoors, close to working areas or at the load centre.
4. Properly sealed Pyroclor-filled transformers require little or no maintenance of the fluid over many years of service.
5. Its permittivity is such that the distribution of electrical stress in the transformer is more uniform.





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# Sales Specification for Pyroclor 5

| Property | Test Method | Unit | Value |
|---|---|---|---|
| Appearance | ASTM D1702 | — | Clear liquid free from suspended matter and sediment |
| Colour | ASTM D1702 | APHA | 150 max. |
| Density at 20°C | ASTM D1810 and ISO/R 649 | $kg/m^3$ | 1502 - 1524 |
| Refractive Index at 20°C | ASTM D1807 | — | 1.6173 to 1.6193 |
| Kinematic Viscosity at 20°C | ASTM D445 | cSt | 32 max. |
| Fire Point | ASTM D92 | °C | None to BP |
| Pour Point | ASTM | °C | -30 max. |
| Neutralisation Number | Monsanto | mg KOH/g | 0.01 max. |
| Inorganic Chlorides | ASTM D1821 | ppm Cl | 0.1 max. |
| Scavenger Content (PPO) | Monsanto | % | ca. 0.2 |
| Water Content | ISO/R760 | ppm | 30 max. |
| Electric Strength at 25°C, 50 Hz | IEC 156 | kV | 45 min. |
| Resistivity at 100°C, 500V after 1 minute | Monsanto | G ohm.m | 10 min. |
| Dissipation Factor (tan $\delta$) at 100°C, 50 Hz | Monsanto | % | 5 max. |
| Relative Permittivity at 100°C, 50 Hz | Monsanto | — | 4.2 to 4.5 |

Typical Properties (Not part of specification)

| | | |
|---|---|---|
| Coefficient of thermal expansion (20 - 100°C) | $°C^{-1}$ | 0.00073 |
| Specific Heat (20°C) | $J.Kg^{-1}$ $°C^{-1}$ | 1000 |
| Thermal Conductivity (20°C) | $J\,m^{-1}$ $sec^{-1}$ $°C^{-1}$ | 0.098 |



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# Storage, Handling and Disposal of Pyroclor

**CAUTION:**

Pyroclor contains POLYCHLORINATED BIPHENYLS (PCBs) which some studies have shown may be persistent, an environmental contaminant, and, possibly, injurious to certain forms of bird, aquatic and animal life.

**Storage**

Inside storage of drums is recommended to avoid moisture contamination. If drums have to be stored outside they should be stacked on their sides with bungs uppermost to prevent moisture being sucked in by breathing. Partially emptied drums should not be left open to the air.

The supply of Pyroclor in bulk offers many advantages to medium and large users. Unloading, storing and transferring to the production unit is safer, easier and cheaper. Material losses due to spillage and incomplete emptying of drums is minimised. The possibility of product contamination during handling is greatly reduced.

Even where storage and handling facilities are not at present available, the economics of bulk handling may quickly pay for the tanks and piping systems required. A booklet, indicating the type of system necessary, is available from Monsanto and experienced Monsanto personnel are available for site discussion regarding the most suitable bulk installation and off-loading procedure.

It is essential that both drum and bulk storage areas should be organised so that leakages and spillages can be collected for safe disposal.



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## Handling

Transformer askarel has been made, handled and used for over 40 years. It can be handled safely if a few simple precautions are observed.

1. Minimise contact with the skin by using gloves and other protective clothing.

   Remove accidental skin contamination as soon as practicable by thorough washing with soap and water. Short term exposure is unlikely to cause harm except to very sensitive skin, but long term exposure should be avoided. Remove saturated clothing and do not re-use until dry-cleaned.

2. Protect eyes with goggles.

   Accidental eye contact may result in painful irritation but no permanent damage to tissue. If Pyroclor gets in the eyes, flush with large amounts of water. As with all eye-first-aid, refer to a qualified physician. To relieve irritation, ophthalmic anaesthetic solution, ophthalmic cortisone acetate solution, or castor oil may be used under qualified supervision.

3. Avoid breathing Pyroclor vapour, mist or fumes.

   Infrequent exposure to Pyroclor vapour is unlikely to cause ill effects, but prolonged exposure to high vapour concentrations must be avoided. At normal ambient temperature, in well ventilated areas, the concentration of Pyroclor will be below that likely to cause harm. For handling hot Pyroclor in a confined space, a respirator with an active carbon canister should be worn.

4. Do not eat, drink, or smoke when handling Pyroclor. Although Pyroclor is not particularly toxic when ingested orally, this simple precaution will minimise hazard.

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## Disposal of Pyroclor Waste

Where possible the destruction of Pyroclor waste should be accomplished through carefully controlled high temperature incineration. This requires a special incineration facility providing a suitable balance between temperature, dwell-time, oxygen and auxiliary fuel and provision for removal of hydrochloric acid gas from the gasseous emissions. This facility must also make provision for handling the waste which may range from mobile fluid to solid, impregnated with Pyroclor.*

If such a facility does not exist, subject to the provisions of local regulations, the waste should be consigned to a waste disposal site designated for toxic materials.

Do not use empty Pyroclor drums except for waste Pyroclor. Before disposal they should be thoroughly drained and then flushed twice with kerosene type solvent. The solvent should be incinerated and the washed drums consigned to a waste disposal site. Alternatively incinerate unwashed drums in a suitable incinerator.

During handling and disposal of waste Pyroclor take great care to avoid pollution, particularly of drains and waterways.

*Please ask Monsanto for up-to-date information on facilities available for incineration of Pyroclor.



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# Toxicity

I. Inhalation

At ordinary temperatures the chlorinated biphenyls in askarel have not presented industrial toxicological problems. The hazard of potential toxic exposure varies with their volatility; the lower chlorinated, more volatile ones present more of a potential problem from the standpoint of both inhalation and skin contact. When askarel fluids are used at elevated temperatures, engineering controls must be applied, either by the use of closed systems or by effective local exhaust ventilation together with general workroom exhaust.

Vapours of askarel at room temperature should not be breathed in a confined space and no vapour of any fluid evolved at elevated temperatures should be allowed to be dispersed into the general workroom.

Inhalation tests on animals indicate that the maximum safe concentration of vapour is in the range from 0.5 to 1.0 milligramme per cubic metre of air. The threshold limit value (maximum allowable concentration of an 8-hour working day) set by the American Conference of Governmental Hygienists is 1.0 milligramme of the lower-chlorinated biphenyl compounds per cubic metre of air and 0.5 milligramme of the more-highly-chlorinated compounds, per cubic metre of air.

II. Skin Contact

Prolonged or repeated skin contact with the askarel fluids must be avoided by the use of gloves and protective garments, because of the possible occurrence of a condition called chloracne. Although reports of this condition caused by askarel are rare, it can be produced by excessive skin contact. If the fluid is spilled on the skin, the skin should be washed in the usual manner with a soap solution.

A burn caused by contact with a hot askarel should be treated like any ordinary burn.



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# Labelling Precautions

Pyroclor drums and containers carry the following label which gives general instructions for handling:

**IMPORTANT CHLOROBIPHENYLS (42%-54%) (or 60%) (PCB)**

This product contains POLYCHLORINATED BIPHENYLS (PCBs) which some studies have shown may be persistent, an environmental contaminant and, possibly, injurious to certain forms of bird, aquatic and animal life.

PREVENT ANY ENTRY INTO THE ENVIRONMENT THROUGH SPILLS, LEAKAGE, DISPOSAL, VAPOURISATION, RE-USE OF CONTAINERS OR OTHERWISE.

SPILLS, LEAKAGES AND WASTE PRODUCT MUST BE COLLECTED.
Use of this product must be restricted to applications which can be controlled so that entry into the environment does not occur and to applications in which it cannot come into contact with food, animal feedstuffs or pharmaceuticals.

HARMFUL SUBSTANCE IF TAKEN INTERNALLY OR IF IN PROLONGED CONTACT WITH THE SKIN.

CAUSES IRRITATION OF SKIN AND EYES.

DURING SHIPMENT AVOID SPILLS AND LEAKAGE INTO INLAND WATERWAYS AND THE SEA.

Store away from food, animal feedstuffs and pharmaceuticals.
Keep container tightly closed.
Do not eat or smoke when using.
Avoid breathing vapours, mist or fumes.
Do not wear contaminated clothing.
Wash product from skin with soap and water.
Wash eyes by flushing with water.



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All new Pyroclor transformers should carry a label giving the following information:—

**CAUTION**

The Insulating Liquid In This Transformer Contains Polychlorinated Biphenyls (PCBs). Care Should Be Taken To Prevent Entry Into The Environment. In Case Of Malfunction Or Leaks, Consult The Instruction Manual Or The Manufacturer.

# References

Reference should be made to the following publications for information relevant to this bulletin.


1. Guide for Acceptance and Maintenance of Transformer Askarels in Equipment.
   [American Institute of Electrical and Electronic Engineers Guide No. 76, (December 1958), (Revised edition)
   (I.E.E.E. Inc., 345 East 47th Street, New York)]
2. Guidelines for Handling and Disposal of Capacitor and Transformer Grade Askarels Containing Polychlorinated Biphenyls.
   [American National Standards Institute, Committee C 107, 155 East 44th Street, New York.]
3. The Properties of Askarels and Recommendations for Their Use in Electrical Equipment.
   [C.I.G.R.E. Working Group 02, Study Committee 15, Electra *33* (1974) 11-31.]



Published by Monsanto Europe S.A. 16-2(E)ME-1(6/75) Printed in England.





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