

GENERAL ELECTRICS

ASSORTED BATES #s  
SEE SHEET INSIDE FOR  
LIST OF #s

BATES #s

803510 - 803547

NOT CLOSED

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April 4, 1950

Mr. W.H. Cooney  
Secretary of Factory Committee on Pyranol

I am enclosing with this letter copies of the proposed text for instruction leaflet GEI-28006 concerning No. 1467 Pyranol. It is to be one of a group of instruction leaflets that are intended to replace instruction book GEH 58 when they are completed.

The material in this leaflet was obtained primarily from GEH-1093A with a few additions and changes made to emphasize the important points. The leaflet has received preliminary approval from the Engineering & Commercial sections.

I am sending these to you with the thought in mind that you may wish to submit them to the Pyranol Committee for any further comments or suggestions. If so, please return any suggestions to me as soon as possible.

T. McDade  
INSTRUCTION BOOK SECTION  
10-2A Phone 2555

TM:md

cc:  
L.P. Burgess



803510

GENP 014879

APPARATUS DEPARTMENT  
**GENERAL  ELECTRIC**

SUBJECT No. 1467 Pyranol  
Instruction Leaflet, GEI-28006  
LOCATION  
REFERENCE

May 11, 1950

Mr. L. Wetherill  
16.....340

Listed below are some suggested changes.

Page 2 - verb is "are".

Page 2 - bottom - insert -

Recognition should be taken of the fact that some of the D50P18 component may be removed by such filtration, particularly if activated earth is employed. Upon completion of the purification, a laboratory test will indicate the necessary amount of D50P18 compound which must be added to the Pyranol if any. *AK*

Page 5 - (3 KV per second rise).

Page 4 - #4 once.

Page 6 - insert - Under no conditions shall the test cup be colder than the Pyranol being tested. *OK*

Page 6 - Pyranol testing lower than 25 KV should be filtered. If the Pyranol should fail to respond to persistent filtration, the nearest District office should be contacted for instructions. *X*

Page 6 - Add a sixth item - moisture content.

With the above changes, the instruction appears to be satisfactory.

*E. A. Kern*  
Insulation Research Section  
Transformer and Allied Products Laboratory  
Bldg. 8-42 Tel. 2-275

EAK:S



GENP 014880

803511

For Use in Transformers, Regulators  
and Pyranol Immersed Current Limiting  
Reactors

### INTRODUCTION

No. 1467 Pyranol\* is a cooling and insulating liquid which is non-inflammable, chemically stable, and nonsludging.

As applied for use in transformers and regulators it is straw yellow in color and has a Saybolt viscosity of about 54 seconds at 37.8°C as compared to 57 seconds for No. 10-C oil.

Materials that are unaffected by Pyranol have been selected for use in constructing Pyranol apparatus. No materials should be used in contact with Pyranol except those approved by the General Electric Company.

Impurities in Pyranol tend to lower the dielectric strength and decrease its noninflammable properties. Subsequent instructions describe precautions that should be taken to exclude these impurities and obtain extended service from the Pyranol.

### HANDLING PYRANOL

Pyranol may be handled in the same manner as mineral oil. However continued exposure may produce local skin irritations. Cleanliness by workmen handling Pyranol constitutes an adequate safeguard against such effects. Ordinary medicinal washes will remove any irritation caused by Pyranol coming in contact with an open cut or skin abrasion. A drop of castor oil will neutralize any irritation caused by contact of liquid Pyranol with the eyes. As with most volatile materials, exposure to concentrated Pyranol vapors in an unventilated room should be avoided.

\*Registered trade-mark for G-E askarel

Pyranol must be handled in containers, pipes, all metal hose, etc. that are free from oil, grease, pitch, or other foreign materials. It is desirable that all such equipment used in storing or transporting Pyranol be maintained for exclusive use with Pyranol, as it is extremely difficult to remove all traces of oil or other Pyranol contaminants from equipment of this type. Also, mineral oil is completely miscible in Pyranol and it is practically impossible to separate the two liquids after they have been mixed.

All metal hose must be used in handling Pyranol since rubber and rubber-lined hoses are dissolved by Pyranol. This is also true of most synthetic rubber hoses.

Use naphtha or benzine to remove all traces of Pyranol that is spilled or dripped on the outside of the transformer tank during the filling procedure. This precaution must be taken since Pyranol has a tendency to soften the paint.

#### PERIODIC INSPECTION

After the first few days of operation of the apparatus, test the top and bottom Pyranol for dielectric strength. Sample every 6 months for the first year and yearly thereafter unless experience shows less frequent sampling is required. The recommended time between inspections and tests depends on local climatic conditions and also upon the importance of minimizing interruptions. ~~and~~

*Should be*  
LLHC ~~accurate records kept.~~ If, at any time, the Pyranol tests below 25 Kv at room temperature, use a filter press or Pyranol purifier to restore the dielectric strength to 30 kv or more.

Maintain the level of Pyranol up to, or above, the lower sampling valve or to the normal level mark on the liquid-level gage.

The condition of the transformer external surfaces should be examined at regular intervals. If it is found that weathering is taking place, thoroughly clean the surface and repaint with a good grade of durable paint recommended by the General Electric Company.

#### SAMPLING AND TESTING PYRANOL

Follow the procedure outlined herewith to obtain consistent results from samples taken for either field or laboratory tests.

##### SAMPLING FROM APPARATUS

1. Take samples preferably when the temperature of the apparatus is near 25 C. Take samples from outdoor apparatus on a clear day and guard against contamination by wind-blown dust, etc.

2. Use small-neck glass bottles as sample containers. A one-quart <sup>amber</sup> bottle will hold sufficient Pyranol for complete tests. Sample containers filled with new 1467 Pyranol are available from Pittsfield (See the section on "Pyranol Testing Service").

Empty the container into the apparatus, allow it to drain thoroughly and then immediately refill it with the liquid to be tested. Cleaning the containers, as described below may be disregarded when they are received filled with new 1467 Pyranol. However, the subsequent steps should be followed to insure obtaining a sample representative of the original Pyranol.

3. To clean the bottles, rinse with non-leaded, oil-free gasoline; then wash with strong soapsuds, rinse thoroughly with water and dry in an oven 105 C to 110 C for at least eight hours. After drying the bottles, seal tightly with a glass stopper or a clean

cork. Protect the cork by wrapping with clean metal foil.

4. Impurities tending to affect the dielectric strength of Pyranol will, in general, be at the top of the liquid. Therefore, take the sample from the top through the small valve or plug, and allow enough Pyranol to run out so that any moisture or foreign material which may have collected in the drainpipe, valve, or plug will be removed.

5. Draw a sample into the bottle, leaving sufficient air space to allow for possible expansion of the Pyranol. Carefully seal the container to prevent any exposure of the Pyranol to the atmosphere using the stopper removed from the bottle.

6. After taking the sample, reseal the apparatus; then establish the internal pressure of the apparatus at the proper value according to Table I, using dry air or nitrogen.

TABLE I

| Pyranol Temperature<br>Degrees C | Approximate Pressure<br>Lb per Sq. In. |
|----------------------------------|----------------------------------------|
| 25                               | 0.0                                    |
| 30                               | 0.5                                    |
| 35                               | 1.0                                    |
| 40                               | 1.5                                    |

If the sample is taken when the temperature is lower than 25 C, reseal the apparatus at atmospheric pressure. However, when the temperature reaches 25 C, vent the apparatus to atmospheric pressure to avoid excessive internal pressure at higher temperatures.

## SAMPLING FROM DRUMS

Take samples from drums after the Pyranol has remained undisturbed for at least eight hours, and when the Pyranol is at least as warm as the surrounding air. If the drums are outdoors, take samples on a clear day only and guard against wind-blown dust etc. Take a sample from the top of the drum by means of a chemically clean thief. Observe the sampling precautions previously outlined.

2. Clean the glass thieves used for taking the samples, in the same manner as the bottles, and dry, preferably at a temperature not less than 37.8 C (100 F).

## TESTING FOR DIELECTRIC STRENGTH

The technique as specified by the American Society for Testing Materials in the test method entitled "The Standard Method of Testing Electrical Insulating Oils" is recommended for the testing of Pyranol. The following precautions and modifications must be observed:

1. Set the spacing of the two 1-inch disk electrodes at 0.100 inch.

2. Wipe the test cup and electrodes clean with dry, calendared tissues or clean, dry chamois and rinse thoroughly with clean, non-leaded, oil-free gasoline.

3. Fill the cup with dry gasoline and make a breakdown test under standard conditions of voltage application (3 kv per second rise). If the dielectric strength is not less than 25 kv, the cup is considered suitable for testing purposes. The usual precautions in handling gasoline should be observed.

4. Immediately after the final rinsing with gasoline, rinse the test cup with the Pyranol under investigation and proceed with the test at once.

5. The temperature of the Pyranol, when tested, should be the same as that of the room, which should be between 20 C and 30 C (68 F and 86 F).

6. After filling the test cup, allow the Pyranol to stand for three minutes before testing, to allow entrained air bubbles to escape.

7. Make one test per filling, fill at least five times and average the results.

Pyranol testing lower than 25 kv should be filtered or replaced. Instructions (GEH-1031) for filtering are available upon request at the nearest apparatus sales office of the General Electric Company.

#### PYRANOL TESTING SERVICE

For convenience in sampling and testing Pyranol, the General Electric Company will, upon receipt of order at an Apparatus Sales Office, furnish one-quart sample containers filled with clean, dry Pyranol to replace the Pyranol which is removed for samples.

The samples may be sent to the Field Service Engineer, Power Transformer Engineering Div., General Electric Company, Pittsfield, Mass. for testing. Recommendations for continued use or treatment will be furnished, in addition to a complete report covering the following tests:

- |                        |               |
|------------------------|---------------|
| 1. Dielectric strength | 3. Acidity    |
| 2. Color               | 4. Condition; |
|                        | 5. SULFIDES   |

Reliable tests are dependent on the sample as it reaches the laboratory being exactly the same as Pyranol in the apparatus from which it was taken. Therefore, in obtaining and handling the sample follow the technique outlined under "Sampling from Apparatus".

To assist in furnishing the most useful comments on the results of the tests, requests for this information should:

1. State why the tests are considered desirable.
2. Give the serial number and rating of the apparatus.
3. State whether or not the sample represents the Pyranol originally furnished with the apparatus. If not, when was the Pyranol replaced.
4. State the date, temperature and weather conditions at the time the sample was taken and also whether the apparatus is located indoors or outdoor.
5. Give any other information that might have a bearing on the condition of Pyranol.
6. State to whom the report should be sent.

#### AVAILABLE TEST AND FILTERING DEVICES

The General Electric Company manufactures a 35,000-volt, 2-kva test set, Catalog No 79 X 336 for testing the dielectric strength of Pyranol. A Pyranol purifier, Catalog No. 79 X 789, is available for filtering and drying Pyranol. Information concerning these devices may be obtained from the nearest apparatus sales office of the General Electric Company.

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These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

GEI-28006 No. 1467 Pyranol  
No. 1467 Pyranol GEI-28006

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## Summary

Ferric chloride reagent is compared with cupric potassium chloride as a gravimetric reagent for sulfur. The advantages of ferric chloride are noted in the case of bronze and metallic copper. Possible use in the determination of the composition of non-ferrous furnace metals is mentioned.

X-ray diffraction patterns of the ferric chloride and the cupric potassium chloride residues show that sulfur remains as cuprous sulfide and elementary sulfur.

The procedure described has been in use for approximately one year and has given satisfactory results.

## LITERATURE CITED

- (1) American Society for Testing Materials, "X-Ray Diffraction Data for Chemical Analysis, Supplement."
- (2) Holler, A. C., and Yeager, J. P., *Ind. Eng. Chem., Anal. Ed.*, 16, 349 (1944).
- (3) Lundell, G. E. F., and Hoffman, J. I., "Outlines of Methods of Chemical Analysis," p. 218, John Wiley & Sons, Inc., New York, 1938.
- (4) Cumenge, E., and Wimmer, R., *Dinglers Polytech. J.*, 250, 35 (1855).
- (5) Silverman, Louis, *Ind. Eng. Chem., Anal. Ed.*, 10, 433 (1938).
- (6) Weiser, H. B., Milligan, W. O., and Marshall, J. M., *J. Phys. Chem.*, 47, 496 (1943).

## On the Toxicity of the "Arochlors" -

ROBERT M. BROWN, Chief,  
Industrial Hygiene Section, Division of Health, Department of Public Welfare,  
City of St. Louis, Missouri

A recently published article (1) has recommended the substitution of one of the "Arochlors" as the melting-point bath liquid in preference to the customary sulfuric acid. As stated in that article, the "Arochlors" are a group of chlorinated diphenyls produced by the Monsanto Chemical Company.

There is need, therefore, to give a warning. For the toxicity of these compounds has been repeatedly demonstrated, both from the standpoint of their absorption from the inspired air as well as from their effect in producing a serious and disfiguring dermatitis when allowed to remain in contact with the skin. Since these effects have been repeatedly observed, industrial hygienists have taken great pains to see that proper controls have been established wherever these products are used. For example, the maximum allowable concentration of chlorinated diphenyl for an 8-hour working day is 1 milligram per cubic meter of air.

It is probable that nothing like an uncontrolled industrial exposure will occur in the laboratory. However, whether an individual is subjected to a possible acute exposure to chlorinated diphenyl and its serious consequences will depend upon the size of the melting-point bath, the caution with which it is used and the temperature to which it may be heated. Likewise, with

Page Thirty-three

PLAINTIFF'S  
EXHIBIT  
2803

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CINP 014210

careless handling of the material and the resulting contamination of the skin, clothing, laboratory towels, work table surfaces, etc., the way if left open for the producing of dermatitis. Scrupulous cleanliness must be insisted upon wherever this material is handled.

The foregoing remarks have been prompted by the belief that, in recommending the use of a material with which is associated a potential hazard from the health standpoint, it is very important that the possible consequence be presented together with recommendations for correct handling.

## LITERATURE CITED

- (1) Maglio, M. Martin, *Chemist Analyst*, 35, 94 (1946).

## Short Cut in Routine Water Analysis

MAXEY BROOKE

Jefferson Lake Sulphur Company, Inc., Brazoria, Texas

The usual procedure in making routine water analyses, particularly of boiler salines, is to titrate a sample with sulfuric acid to the phenolphthalein end point. The titration is then continued to the methyl orange end point. These measurements of the phenolphthalein and methyl orange alkalinities are generally expressed in grains of  $\text{CaCO}_3$  per gallon.

To measure the salinity, a fresh sample of the water is first titrated with sulfuric acid to the phenolphthalein end point. Then a few drops of a 5% solution of potassium chromate are added and the sample is titrated with silver nitrate. The salinity is expressed as grains of NaCl per gallon.

When a large number of samples are to be analyzed, it would save time if all three determinations could be run on the same sample. Since the chromate acts as an indicator only through a narrow pH range, some means must be used to increase the pH of the sample which has been acidified to the methyl orange end point. To accomplish this, the potassium chromate is dissolved in a 0.1 N sodium bicarbonate solution instead of the usual distilled water. Five drops of this indicator solution are sufficient to bring the pH of the sample within the desired range.

Duplicate tests were run with the buffered and unbuffered indicator. The results, expressed in grains per gallon, were as follows:

| Sample               | Methyl Orange<br>Alkalinity<br>$\text{CaCO}_3$ | Salinity<br>NaCl<br>Unbuffered | Salinity<br>NaCl<br>Buffered |
|----------------------|------------------------------------------------|--------------------------------|------------------------------|
|                      |                                                |                                |                              |
| Neutral 0.390 N NaCl | 0.0                                            | 1336                           | 1336                         |
| Boiler saline        | 23.1                                           | 267                            | 267                          |
| Tap water            | 55.0                                           | 72                             | 72                           |

Thus it will be seen that the short cut is fully as accurate as the standard method of analysis.

Page Thirty-five

GENP 014211

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#34

# Handbook of Dangerous Materials

BY  
N<sup>uclear</sup> IRVING SAX  
Toxicologist, General Electric Co.  
Schenectady, N. Y.

Assisted by  
M. J. O'HERIN  
*Fungicide Laboratory*  
*General Electric Co., Schenectady, N. Y.*  
and  
W. W. SCHULTZ  
*General Engineering Laboratory*  
*General Electric Co., Schenectady, N. Y.*

BOOK DIVISION

REINHOLD PUBLISHING CORPORATION  
330 West Forty-Second St., New York 18, U.S.A.

1951

803521

PLAINTIFF'S  
EXHIBIT

2804

GENP 014178

**Shipping Regulations:**†

Oxidizing material 153, 163\* Yellow label 100 lbs. (max. lot)

**"Chlorcosane"**

A proprietary product composed of a chlorinated paraffin with a combined chlorine content of 27-30%. For information concerning the possible toxic or hazardous properties of this mixture, see components as listed.

**Chlordane**

**Hazardous Properties:** An insecticide (16) derived from indane and has somewhat greater toxicity than DDT.

**Formula:**  $C_{10}H_6Cl_4$  **B. P.:** 175°C

**M. Wt.:** 409.75

**Density:** 1.57-1.67 @ 60/60°F

**Description:** Colorless, odorless, viscous liquid

**Shipping Regulations:**† None.

**Chloroethyl Benzene**

**Hazardous Properties:** Can cause iritis and corneal necrosis (experimental) (6).

**Treatment and Antidotes:** Removal from exposure will generally clear up the symptoms.

**Storage and Handling:** Personnel who must be exposed to this material should wear personal protective equipment. Chemical safety goggles are recommended.

**Chloric Ether**

**Hazardous Properties:** A dangerous fire hazard.

**Storage and Handling:** Store in a cool place away from acute fire hazards. Should be plainly labelled.

**Description:** A solution of 60 cc chloroform and 940 cc alcohol

**Shipping Regulations:**† Red label (1).

**Chloride of Lime**

See Calcium Hypochlorite.

**Chlorinated Benzenes**

**Maximum Allowable Concentrations in Air:**\* 50 to 75 parts per million.

**Hazardous Properties:** These materials can cause extreme dilation of the pupil of the eyes, and dermatitis, and are generally toxic. Often injury is complicated by the fact that other chloro derivatives, such as ortho and paradichlorobenzol, are present. They are approximately as toxic as benzol. The lethal dose for cats for a 7 hour exposure is 3,700 ppm. The maximum tolerated for 1 hour was 220 to 660 ppm. Orthodichlorobenzene, which is used as a fumigant, degreaser, and to remove sulphur from illuminating gas, is similar in toxicity to monochlorobenzene. The lethal concentration is about 2.5 times that of carbon tetrachloride, while it is less toxic than tetrachloroethane.

Symptoms of intoxication, according to what happened when a small amount was acci-

dentally ingested by a child are as follows: it is a central nervous poison, causing unconsciousness lasting for 3 hours, cyanosis, loss of reflexes, and twitching of the facial muscles, followed by gradual recovery. Paradichlorobenzene has a physiological response similar to that of monochlorobenzene and orthodichlorobenzene.

**Treatment and Antidotes:** For first aid, if breathing has stopped, give artificial respiration; if possible, give oxygen. If the indications are that exposure has been severe, call a physician. In case of ingestion, call a physician at once.

**Storage and Handling:** Personnel exposed to high or unknown concentrations of these materials should wear adequate safety equipment. Recommended are protective clothing to avoid skin contact, a respirator to avoid excessive inhalation of the material, and gas-tight chemical safety goggles for protection of the eyes. When these materials are in general use, good ventilation should be provided. Since their vapors are heavy, down-draft ventilation is needed too. At room temperature, these materials are fairly safe to use, but at elevated temperatures they must be handled with caution. Store in a cool, ventilated area, away from powerful oxidizing agents, and acute fire hazards. Store out of doors, if possible, in a separate building.

**Chlorinated Camphene**

**Hazardous Properties:** Believed to be somewhat more toxic than DDT.

**Formula:**  $C_{10}H_{10}Cl_4$

**M. Wt.:** 413.86

**Chlorinated Diphenyls**

**Maximum Allowable Concentration in Air:**\* 1 mg/cu. meter.

**Hazardous Properties:** These materials can give rise to dermatitis. Systemic poisoning usually follows the inhalation of fumes rather than the handling of the dry hydrocarbon waxes. This damage is severe and occasionally fatal. Acute yellow atrophy of the liver is generally associated with serious exposure to such material. However, this is not invariably a sign of intoxication. The toxicity of the chlorinated diphenyls increases with increasing degree of chlorination.

**Treatment and Antidotes:** If severe exposure is suspected, a physician should be consulted. Usually, first aid treatment is not required after exposure.

**Storage and Handling:** Personnel who must be exposed to these materials should wear protective equipment. If the concentration is high enough, protective clothing to avoid skin contact is important. Furthermore, chemical safety goggles are advised. An approved type of respirator is recommended to prevent inhalation. All personnel should work under medical supervision. Constant checks of atmospheric contamination are another safeguard.

**Chlorinated Hydro****Hazardous Properties:**

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\* See list of abbreviations and symbols, page vii. † Section 5 gives complete ICC Shipping Regulations. Numbers in parentheses refer to literature citations, page vi.

\* See list of abbre

id are as follows: it is causing unconsciousness, loss of reflexes, etc., followed by benzene has a

first aid, if breathing is respiration; if possible, call a physician. In

exposed to high or of these materials safety equipment. Rec- clothing to avoid skin void excessive inhala- d gas-tight chemical on of the eyes. When use, good ventila- Since their vapors are tion is needed too. At materials are fairly d temperatures they tion. Store in a cool, a powerful oxidizing azards. Store out of arate building.

to be somewhat more

Wt.: 413.86

Air: \*1 mg/cu.

materials can give rise poisoning usually fol- omes rather than the rocarbon waxes. This asionally fatal. Acute is generally associated such material. How- a sign of intoxication. Chlorinated diphenyls in- degree of chlorination, ever exposure is sus- be consulted. Usually, required after exposure. nel who must be ex- should wear protective ration is high enough, id skin contact is im- chemical safety goggles d type of respirator is t inhalation. All per- medical supervision. heric contamination

Shipping Regulations.

### Chlorinated Hydrocarbons

**Hazardous Properties:** Chlorinated hydrocarbons are dangerous to the eyes, and may cause dermatitis by their defatting action on the skin. They may also cause allergic dermatitis. Their action is primarily upon the central nervous system, the secondary effect being upon the liver and kidneys. They seem to have some action upon the heart as well and are likely to cause a change in the cardiac rhythm. The physiological effect is one of anesthesia and narcosis, with damage and injury chiefly to the visceral organs, especially the liver, and in the case of tetrachloroethane, the kidneys. These materials may also be blood poisons, as illustrated by the effect of ortho and parnitrochlorobenzene. As a class they have a marked effect on the nervous system because they are lipoid solvents. They act as heart depressants, and some cause heart fibrillation. The relative order of the toxicity of these materials has not been completely clarified, probably as a result of the different standards by which they were judged individually.

**Treatment and Antidotes:** If exposure to this material is suspected, call a physician.

**Storage and Handling:** Personnel who must be exposed to this material should protect their eyes, and the recommended method is ECE\*<sup>†</sup>K. If the concentration in the air is either high or unknown and likely to be high, personal protective equipment is recommended, although general ventilation should be provided. Frequent checks of the concentration in the air are important.

### Chlorinated Naphthalenes

**Maximum Allowable Concentration in Air:** \* 0.5 mg/cu. meter calculated as pentachloronaphthalene. 5 mg/cu. meter calculated as trichloronaphthalene.

**Hazardous Properties:** Characteristic dermatitis. It has been noted that workers develop an acne form skin eruption. There are also internal injuries caused by these compounds. They affect the liver, with the production of yellow atrophy. The toxicity of these compounds increases with increasing degree of chlorination. Lesions of the skin can be caused, and in rare instances organs other than the liver may be affected, but not to a fatal extent. At least one case is reported where acute yellow atrophy was superimposed upon cirrhosis of the liver.

Chlorinated naphthalenes are used as impregnants in the manufacture of cables. The symptoms of intoxication include lesions of the skin, dermatitis, yellow atrophy of the liver, cirrhosis of the liver, what is referred to as acne, cable rash, and blackhead itch. Some workers have noted edema as being a typical symptom. The time elapsed before the systemic evidence

of toxicity presents itself varies from a few weeks to many months.

**Treatment and Antidotes:** Removal from exposure as soon as any of these symptoms is noted among workers who are exposed, and consequent consultation with a physician.

**Storage and Handling:** Personnel who must be exposed to these materials should take precautionary measures. Good general ventilation is the starting point. If the maximum concentration is above that noted, personal protective equipment should be used. Clothing should be worn to prevent skin contact with the dust of this material and respirators should be used to avoid inhalation.

### Chlorinated Triphenyls

**Hazardous Properties:** Chlorinated triphenyls are powerful liver poisons, even more toxic than hexachloronaphthalene, according to animal studies, although these materials have been used for similar purposes, and are known by the same trade name "Aroclors."

**Treatment and Antidotes:** Cessation of exposure upon the first symptoms and consultation with the medical department is recommended.

**Storage and Handling:** Personnel who must be exposed to these materials, in addition to good ventilation, should have good personal protective equipment, such as clothing to keep them from contact with the skin, and rubber gloves and respirators to prevent inhalation of the dust.

### Chlorine

**Maximum Allowable Concentration in Air:** \* 0.35 to 2 parts per million.

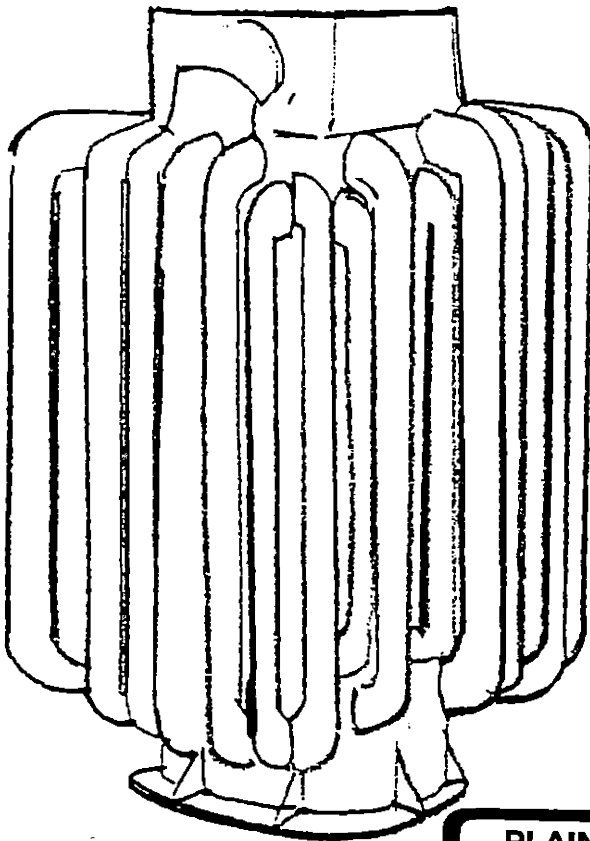
**Hazardous Properties:** Liquid chlorine is very dangerous to the eyes, as is chlorine gas. It can cause lachrymation, varying degrees of conjunctivitis, keratitis, blepharitis and palpebral eczema. High concentrations can cause pneumonitis and edema of the lungs. In concentrations of 1,000 ppm it is invariably and rapidly fatal. Therefore, lung irritation is one of the most serious effects of chlorine. The practice of using low concentrations of chlorine for the reduction of incidence of respiratory infection was very short-lived. It seems more probable now that low concentrations of this or other irritant gases will promote rather than prevent low-grade respiratory ailments. The least concentration with detectable odor is 3.5 ppm. The least concentration necessary to cause throat irritation is 15.1 ppm and to cause coughing is 30.2 ppm. Therefore, the strong odor of chlorine acts as a warning mechanism and there are fewer fatalities due to chlorine poisoning in industry, where it is widely used, than to nitrogen dioxide, which is more subtle. Further symptoms due to the inhalation of chlorine are respiratory reflexes, causing coughing, smarting of the eyes, and

\* See list of abbreviations and symbols, page vii. † Section 5 gives complete ICC Shipping Regulations. Numbers in parentheses refer to literature citations, page vi.

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*here's how to*  
**GET MORE PERFORMANCE**  
*and*  
**SAVE MONEY**  
*when specifying transformers*

---



**Monsanto**

803536



10-18-67

GENP 014817

# ASKAREL

*... the fire-resistant dielectric preferred*

## **askarel fire-resistant transformers offer**

### **LOWER OPERATING COSTS**

due to lower power losses

### **HIGH IMPULSE STRENGTH**

giving a margin of safety against transformer failure

### **LOW MAINTENANCE COSTS**

install them and leave 'em alone

### **LOW INSTALLATION COSTS**

place them where YOU want them placed

### **FIRE-RESISTANCE**

askarel provides safety from fire

### **QUIETNESS**

naturally designed to be quieter than open dry types

### **RELIABILITY**

more than 30 years of trouble-free operation

*specifiers who want to save money now and for years to come...*

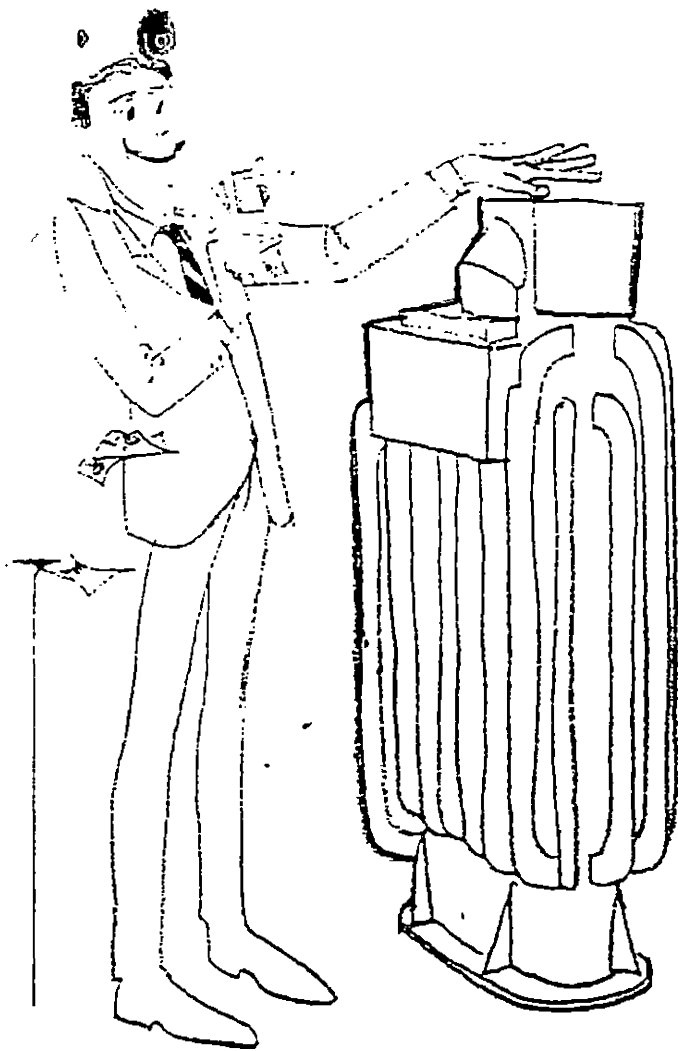
For over 37 years askarel transformers have served the commercial, industrial and utility fields faithfully with safety, economy and reliability. They are built to exact specifications by all major electrical equipment manufacturers.\*

Mineral oil transformers can catch fire. When used in confined or populated areas, they require fire walls, vaults, and sprinkling systems; or they must be located at a more remote point requiring long expensive low-voltage lines.

Open dry type transformers are limited in flexibility of location. Supplemental installation costs usually run much higher than with askarel units, especially if sound-deadening or enclosing from atmospheric contamination and moisture is required. They are less dependable than askarel units because they are affected by corrosive atmospheric conditions. Due to the nature of open dry type units, they can require a great deal of maintenance; have a high noise level, are expensive to operate, and have lower impulse strength and overload capacities.



*Monsanto has manufactured and supplied askarel fluids since the askarel type transformer was first introduced. The askarel fluid insulation is supplied under various trademarks such as "PYRANOL" (General Electric); "INERTEEN" (Westinghouse); "CHLORENTOL" (Allis-Chalmers); "NOFLAMOL" (Wagner Electric). Many other manufacturers such as I-T-E use the generic name, askarel. In all cases, Monsanto makes the askarel fluid for these transformers.*



*askarel fire-resistant transformers operate  
less expensively than other types  
due to lower core and coil losses*

### TYPICAL EXAMPLE

1,000 KVA, 3 phase, 60 cycle, 13,800 to 480 Y volts. Transformer  
first cost assumed about \$8,500.

| UNIT          | CORE LOSS<br>(Watts) | COIL LOSS<br>(at 100% Load)<br>(Watts) |
|---------------|----------------------|----------------------------------------|
| Open Dry Type | 4,200                | 18,500                                 |
| Askarel Unit  | 2,900                | 12,500                                 |

(A) Based on a 75% load factor, coil losses are approximately as follows:

Open Dry Type.....  $18,500 \times (.75)^2 = 10,400$  watts

Askarel Type.....  $12,500 \times (.75)^2 = 7,000$  watts

Coil Loss Difference..... 3,400 watts

Total Core and Coil Loss Difference  
in favor of Askarel..... 4,700 watts

Based on an 8,700 hour year operation:  
 $4,700 \times 8,700 = 41,000$  KWHR (Approx.)

Assuming power cost is \$0.15 per KWHR:  
the savings each year is \$615.00 . . . or  
the Askarel Transformer first cost is paid  
for in about 10 years.\*

\*This annual savings compounded at 6% per year.

Askarel units deliver a steady power flow year after year, offering lower operating and maintenance costs, quietness and dependability. They are fire-resistant and allow you to place them where YOU want them placed, right at the point of use if you choose. Think of the savings in installation alone!

Askarel will not oxidize or sludge; remains chemically stable when subjected to elevated temperatures and will not corrode metals.

IT'S JUST LIKE GETTING A FREE  
TRANSFORMER IN ABOUT 10 YEARS!

Incorporate your own figures in the following example and prove this point to yourself. The figures shown assume the same first cost of an askarel transformer and an open dry type unit. (Askarel transformers are now quoted at the same price as 150°C. open dry types.)

GENP 014820

*askarel  
fire-resistant  
transformers offer  
easy maintenance*

And this is just one of the many advantages Askarel Transformers offer over open dry types.

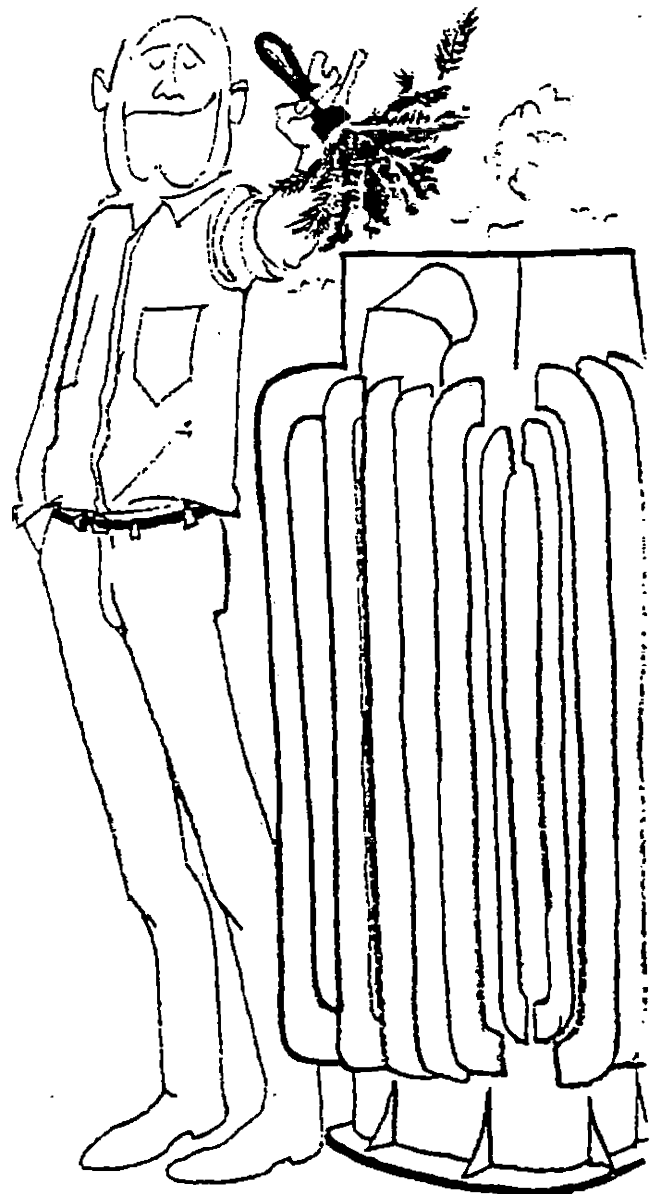
*askarel fire-resistant transformers  
offer higher impulse levels and greater  
overload capacities than open dry types*

**ASKAREL GIVES YOU AN  
ADDED MARGIN OF SAFETY  
AGAINST POWER FAILURE!**

Don't settle for anything less than a transformer that will handle the full basic impulse level of the system. A liquid transformer gives you greater overvoltage protection and just naturally has more overload capacity because of a built-in heat sink. Askarel is your answer to the overload and power surge problem.

**LOW MAINTENANCE MEANS  
GREATER SAVINGS  
IN TIME AND MONEY!**

Askarel transformers are easiest to maintain. Proper sealing of modern askarel transformers has banished the threat of water contamination, the arch enemy of all transformers. No need to periodically shut down the system for cleaning . . . the askarel fluid is sealed against moisture and atmospheric contamination. Other than an occasional fluid test, you install them and leave 'em alone.



***askarel fire-resistant  
transformers  
can give you lower  
installation costs***

**PLACE THE ASKAREL  
TRANSFORMER WHERE AND  
WHEN YOU WANT IT PLACED!**

Because of the unique features of askarel transformers, you can place them where and when YOU want them placed . . . right at the point of power usage if you desire. You do not have to wait until other phases of construction are completed. No added expenses are necessary to protect it from contamination, subdue the sound level or run expensive lines from distant locations. You place it where your system dictates, not where the transformer dictates.

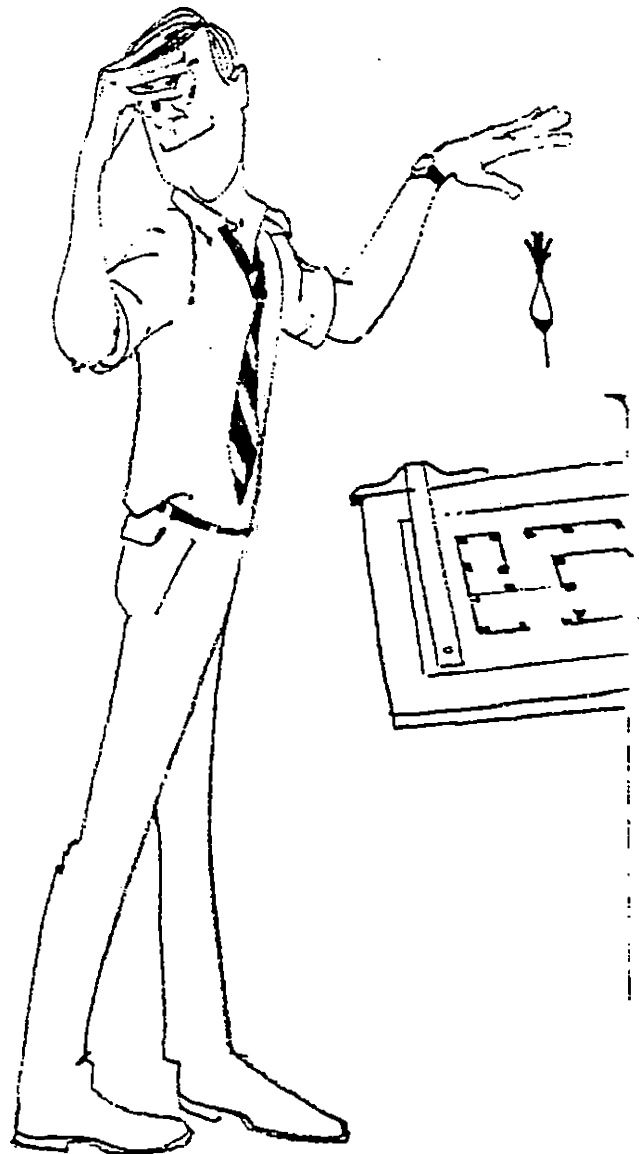
The start-up costs for askarel transformers are almost nil. Because they are sealed, there is no expensive clean-up and drying out required prior to starting. Just bring it in, hook it up and start operating. This alone offers a big savings.

***askarel transformers offer  
fire safety...***

**ASKAREL FLUIDS ARE  
FIRE-RESISTANT!**

The fluid is fire-resistant and does not support combustion. Just as important, the fluid will not

carry or add burning oil hazards to fires which may start from other causes. The liquid does not deteriorate when exposed to heat or hot metal; it does not decompose over long periods of time. The gases formed by arcing will not support combustion, eliminating the possibility of fire. Municipal codes also tend to favor askarel transformer installations over other types.



## CHECK THE STANDARDS

Open dry types produce a higher noise level, requiring expensive sound-suppressing additions or location far from the point of power usage. Wherever the sound level is a factor, askarel transformers rate quieter than comparable open dry type units . . . 3 to 6 decibels is a major reduction in discernible sound level.

*askarel fire-resistant transformers  
are reliable...*

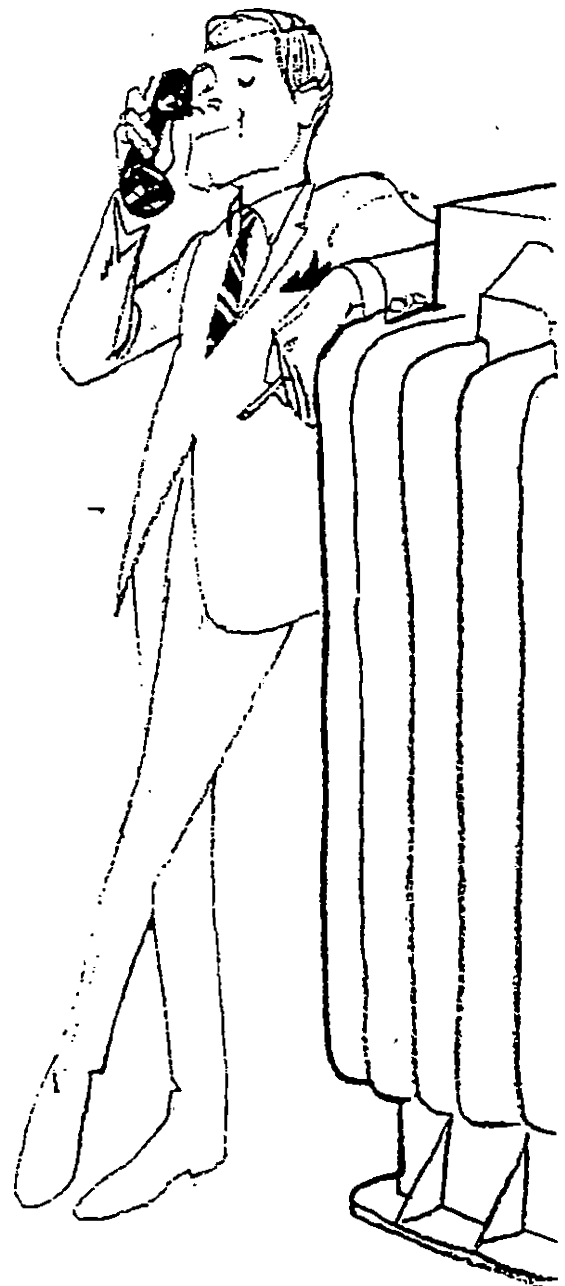
## THERE ARE MANY EXAMPLES OF OVER 30 YEARS OF TROUBLE-FREE OPERATION!

A properly designed and installed askarel transformer will give long years of trouble-free service . . . many in operation for over 30 years. This fact has been proven in installations throughout the world. Even longer life can now be expected due to more modern design practices in sealing out moisture and eliminating leaks.

## LET'S GET ALL THE FACTS ON THE TABLE

Askarel fluids have been manufactured, handled and used safely for 37 years. Transformer makers, utilities and specifiers handle askarel fluids under standard normal good housekeeping and personal precautions used with other industrial materials.

*askarel fire-resistant transformers  
are quieter!*



## ARCING IN ASKAREL DOES NOT PRODUC

Should you encounter this misconception, don't you believe it! Five independent series of research from three different countries, both theoretically and in practice, prove that it is impossible to derive Phosgene or Chlorine from the arcing of askarel. Under strong conditions of arcing, HCL gas can be evolved. Where appropriate or necessary, standard techniques or devices for venting are available from transformer makers.

The most significant and reliable measurement of transformer askarel electrical performance is its dielectric strength. Askarel will maintain its high dielectric strength unless there is a significant amount of moisture contamination or breakdown of the fluid from an unusually severe electrical discharge.

Askarel fluids are manufactured by Monsanto and shipped to transformer makers all over the world. They are manufactured and quality checked for consistency and properly packaged for shipment.

# PHOSGENE OR CHLORINE GASES!!

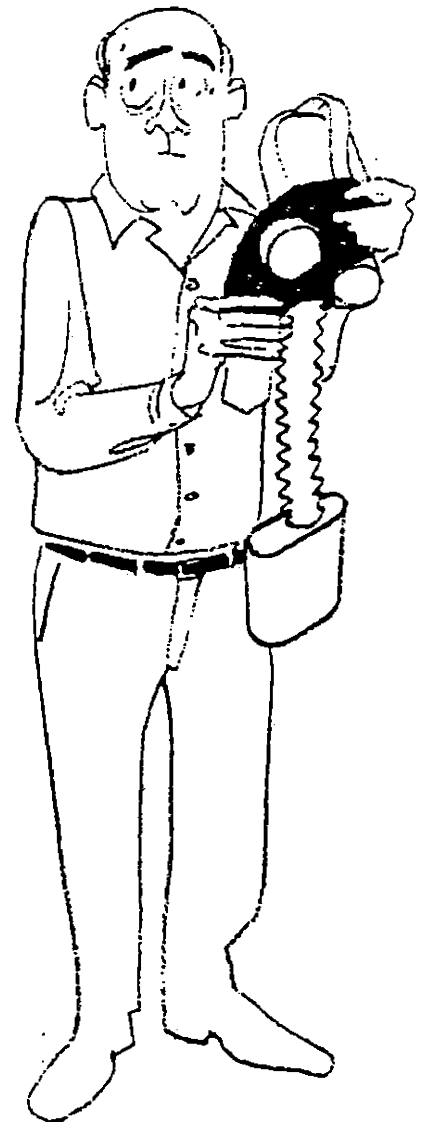
Operating with askarel fire-resistant transformers is the safest, easiest and often the least expensive way to distribute electrical power. Your transformer supplier can give you the complete story on his askarel transformers. Be sure to check with him soon . . . specifying askarel transformers is your best bet when your plans call for transformer equipment in . . .

**Industrial Unit Substations, Load Centers, Power Centers . . .** in factory areas where maximum safety from fire is required and where atmospheric contamination may exist.

**Utility Networks . . .** where safety and space is a consideration.

**Institutions and Office Buildings . . .** schools, hospitals, hotels, shopping centers, apartments, etc. where maximum safety, low noise levels and space is a prime factor.

**In any electrical system . . .** where you are charged with the responsibility of giving your client the best installation available at the lowest overall installation and operational cost.



## SPECIFY ASKAREL FOR YOUR NEXT JOB

Monsanto will be happy to supply you with a copy of "The Care and Grooming of Askarel Transformer Fluid" or "Monsanto Askarel Inspection and Maintenance Guide." Ask your supplier to get your copy for you, or simply return the coupon below.

Monsanto Company  
Functional Fluids Dept. 323  
800 North Lindbergh Blvd.  
St. Louis, Missouri 63166

Please send the literature checked

- ☐ The Care & Grooming of Askarel Transformer Fluid  
☐ Monsanto Askarel Inspection & Maintenance Guide

\_\_\_\_\_  
Name/Title

\_\_\_\_\_  
Company

\_\_\_\_\_  
Address

\_\_\_\_\_  
City/State/Zip



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