T E C H N I C A L D A T A S H E E T

PYROCLOR 5®

TRANSFORMER ASKAREL BY **Monsanto**

Pyroclor 5 is a fire resistant transformer coolant in the Askarel class. A new Monsanto transformer coolant Inerteen* 70/30, introduced in 1967, achieved remarkable success in the U.S.A. Because of this Monsanto in Europe has started manufacture of this product at the Newport U.K. plant. This new fluid is called : Pyroclor 5.

Pyroclor 5 is now the recommended fluid for all Pyroclor transformers and has the following important features :

- Better cost performance from lower weight per gallon.
- Same compatibility with materials of construction.
- Higher relative permittivity.
- Similar viscosity over the normal temperature range of transformer operation (—5° to +90 °C).

The Pyroclor synthetic transformer coolant at present on the European market is still available for cases where viscosity at unusually low temperatures is an important factor. This fluid will be known simply as Pyroclor.

Pyroclor 5 incorporates all the advantages of previous Pyroclor :

- Maximum fire protection
- No special fire equipment needed
- No maintenance
- No siting limitations
- Low noise level
- Low power loss
- High impulse level
- Gas scavenger to absorb any free hydrogen chloride should transient arcing occur

* Trade name of Westinghouse Corporation.

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Typical Properties

In terms of physical, chemical and electrical properties Pyroclor 5 and Pyroclor are very similar but detailed properties are listed for comparison in Table 1.

TABLE 1

A Comparison of Typical Physical, Chemical and Electrical Properties of Pyroclor 5 and Pyroclor (This table is not a specification)

Property	Test Method	Pyroclor	Pyroclor 5
Physical			
Description	ASTM D1702	Limpid, mobile liquid	Limpid, mobile liquid.
Colour (APHA)	ASTM D1702	40	40
Density at 20 °C (kg/m^3)	BS 733	1556	1520
Density at 100 °C (kg/m^3)	BS 733	1468	1436
Coefficient of expansion 20-100 °C (deg. C^{-1})	Calculated from density	0.000743	0.000732
Viscosity at 20 °C (cSt)	BS 188	21	26
Pour point (°C)	IP 15	—34	—32
Refractive index at 25 °C	ASTM D1807	1.6147	1.6158
Chemical			
Fire point	ASTM D92	None to boiling point	None to boiling point
Inorganic chlorides (ppm)	ASTM D1821	0.05	0.05
Neutralization number (mg KOH/g)	Monsanto	0.004	0.004
PPO content (%)	ASTM D1701	0.2	0.2
Stability test (Details follow)	Monsanto	Pass	Pass
Water content (ppm)	ASTM D1533	30	30
Electrical			
Dielectric strength at 25 °C	BS 148		
4 mm gap (kV) . . . withstand		40 for 1 min.	40 for 1 min.
. . . breakdown		> 70	> 70
Dissipation factor at 50 Hz,	ASTM D924		
1kV/mm (%) . . . at 25 °C		0.5	0.5
. . . at 100 °C		5	5
Resistivity at 500 V/mm,	ASTM D1169		
1 minute (TΩcm) . . . at 25 °C		10	10
. . . at 100 °C		2	2

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Stability (Corrosion) Test

Description

A sample of the Pyroclor is heated in darkness for 6 hours at a temperature of 210 °C with a prepared piece of aluminium foil. At the end of this period, the appearance, colour, inorganic chlorides and neutralization number of the sample of Pyroclor are determined. The piece of aluminium foil is examined for changes in appearance and its weight loss is determined.

Results

The values in the following table must not be exceeded for the sample of Pyroclor to pass this test.

TABLE 2

Property	Test method	Value
Aluminium foil		
Weight loss (g)	—	0.0
Change in appearance	Visual	None
Pyroclor sample		
Colour (APHA)	ASTM D1702	200 (max)
Inorganic chlorides (ppm)	ASTM D1821	5.0 (max)
Neutralization number (mg KOH/g)	Monsanto	0.01 (max)

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A Comparison of the Compatibility of Transformer Insulating Materials with Pyroclor

In past years we have accumulated a considerable amount of data on the compatibility of various types and brands of transformer constructional materials with Pyroclor. In order to test whether this information is also valid for Pyroclor 5 we have run side-by-side tests with 5 different materials. The details of these tests are as follows :

Ageing conditions : 7 days at 100 °C
Concentration : As given in the table 3
Testing conditions : Temperature 100 °C; dissipation factor measured at a frequency of 50 Hz and a stress of 1 kV/mm; resistivity measured at a stress of 500 V/mm after 1 minute.

TABLE 3

Material	Concentration	Pyroclor		Pyroclor 5	
		Dissipation factor (%)	Resistivity (TΩcm)	Dissipation factor (%)	Resistivity (TΩcm)
'Varnite' core insulation	64 cm^2 in 150 cm^3	5.4	2.9	5.5	2.8
ML enamel wire, 0.116" dia.	14.5 cm^2 in 150 cm^3	3.3	4.0	2.3	5.4
Grade K 'Elephantide' pressboard, 0.375" thick	3 % w/w	6.3	4.0	4.0	5.6
'Nebar PR', 0.125" thick, smooth grade	0.4 % w/w	35.4	0.20	36.2	0.27
SRBP tube, 0.7" dia.	1 % w/w	11.6	1.0	13.5	1.9

From these tests we conclude that compatibility data obtained for Pyroclor are equally valid for Pyroclor 5.

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Kinematic Viscosity

A comparison of the kinematic viscosity of Pyroclor 5 and Pyroclor is shown in table 4.

TABLE 4

Temperature (°C)	Kinematic viscosity (cSt)		
	Pyroclor	Pyroclor 5	Typical mineral oil
— 30	ca. 16 000	ca. 60 000	2 500
— 20	1 800	4 524	750
— 10	350	655	270
0	100	162	118
+ 10	42	57	62
20	21	26	33
30	12.3	15	21
40	7.8	9.4	14
50	5.4	6.4	9.7
60	3.9	4.6	7.2
70	3.0	3.4	5.5
80	2.4	2.7	4.3
90	1.98	2.2	3.4
100	1.70	1.86	2.8

Vapour Pressure

A comparison of the vapour pressure of Pyroclor 5 and Pyroclor is shown in Table 5.

TABLE 5

Temperature (°C)	Vapour Pressure (torr)	
	Pyroclor	Pyroclor 5
40	< 1	< 1
60	2	1
80	5	4
100	12	9
120	27	20
140	55	41
160	105	79
180	188	141
200	322	242
220	527	397

In the above table the values at the lower temperatures have been obtained by extrapolation. This procedure was adopted to overcome inherent difficulties in the measurement of low vapour pressures of mixtures of liquids.

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Density

A comparison of the density of Pyroclor 5 and Pyroclor is shown in Table 6.

TABLE 6

Temperature (°C)	Density (kg/m³)	
	Pyroclor	Pyroclor 5
0	1578	1541
10	1567	1530
20	1560	1520
30	1545	1510
40	1534	1499
50	1533	1488
60	1512	1478
70	1501	1468
80	1490	1457
90	1479	1446
100	1468	1436

Safe Handling of Pyroclor

Pyroclor 5 and Pyroclor are made from blends of chlorinated hydrocarbons and skin contact should be avoided. For detailed instructions on handling of Pyroclor 5 please see our leaflet « Safety with Pyroclor ».

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