POWER AND WATER AUTHORITY

STANDARDS BRANCH
– Power Division

DATE : 17/5/89

REVISION : 0

DISTRIBUTION : VOLUME 1 HOLDERS

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STANDARDS BULLETIN No. : S1-031

SUBJECT: TRANSFORMER OILS

Until recently, the Power & Water Authority (PAWA) has used only straight mineral oil in all transformers. The preferred oil is Shell 'Diala B'.

Shell 'Diala B' is a mineral oil with no additives.

Under period contract 210, Shell 'Diala BX' was offered as an alternative and has been accepted.

Shell 'Diala BX' is an inhibited mineral oil. It contains an additive to retard the oxidation of the oil and is commonly referred to as 'inhibited oil'.

There is a third type of oil available called 'passivated oil'. It contains an additive to stop the formation of copper solids. Shell does not now produce this product.

The effects and uses of these two additives to mineral oil can be summarised as follows:

Inhibitors Retard oxidation of oil, slows the formation of acids which attack the insulation and increase the 'wetness' of the oil (i.e., it's ability to absorb water). The main use for the inhibited oils is in high temperature applications. They also retard the formation of 'sludge' due to insulation breakdown.

Passivators Retard the formation of copper solids. This delays the production of sludge. The main use of this oil is where bare copper conductors are immersed in the oil.

Since most new distribution transformers have enamelled copper winding and/or Aluminium low voltage windings, the use of passivated oil is declining. To our knowledge the only Authority still using passivated oil is Sydney County Council and it appears they are phasing it out.

The Electricity Trust of South Australia's specification for transformer oil calls for inhibited oil only. ETSA claims that inhibited oil will prolong the insulation life of their transformers and, thereby, give them a cost saving on maintenance. This claim is questionable as most transformers will realise and far exceed their designed economic life using straight mineral oil.

It should be noted that inhibited oil can be mixed with straight mineral oil. Shell 'Diala B' and 'Diala BX' can be mixed without any special precautions or requirements. They are totally compatible. Mixing oils with different additives is not recommended as unknown reactions may take place that could cause failure of the oil.

The Australian Standard 1767, Insulating Oil for Transformers and Switchgear, sets out the requirements for insulating mineral oil. At present, no mention is made of either inhibited or passivated oil but the IEC publication, IEC 296 - Specification for New Insulating Oils for Transformers and Switchgear, on which the Australian Standard is based, indicates that the characteristics for inhibited oil is the same as those for mineral oil.

The characteristics listed by Shell for 'Diala B' and 'Diala BX' are the same.

It should be noted that these requirements apply to oils in bulk or delivered in drums not to oil delivered in transformers.

The Australian Standard 1883, Guide to Maintenance and Supervision of Insulating Oils in Service, makes recommendation as to when transformer oil should be tested during the life of the transformer and what results would indicate that maintenance is required.

Attached is the shell 'Diala B' and 'Diala BX' schedule of characteristics.

Due to the contaminants present in transformer when filled with oil, an acidity level of 0.05 mgKOH/g is considered acceptable.

BRIAN KENT
STANDARDS MANAGER POWER

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Date: 27th April, 1989

Power and Water Authority N.T.
P.O. Box 1921
DARWIN NT 0800

Attention: Mr. T. McKay-Lowndes

Dear Sir,

Re: Acidity of Shell Transformer Oils

Thank you for your recent enquiry regarding the acidity of Shell Transformer Oils.

Shell Diala B is a Straight Mineral Napthenic solvent refined oil containing no additives.

Shell Diala BX is the same oil treated with a small quantity of a hindered phenol type anti-oxidant. Both oils fully meet the relevant British, Australian and IEC specifications for Transformer oils, including the T.A.N. specification of 0.03 mgKOH/g.

The addition of the anti-oxidant has no effect on the acidity or alkalinity of the oil.

I trust that this is clear. If we can be of further assistance please contact us.

Yours faithfully,
for THE SHELL COMPANY OF AUSTRALIA LIMTIED

Michael Viset
Lubricants & Fuels Engineer

Shell Oils

Product Data Sheet PDS No.

SHELL DIALA OILS

These are specially manufactured for use in transformers and switchgear. All grades are highly refined oils of high chemical stability and give outstanding reliability during prolonged service.

Diala Oil B is a straight mineral napthenic solvent refined oil. Diala BX is Diala B treated with oxidation inhibitor.

We set out below some typical test data:-

	SHELL DIALA B	SHELL DIALA BX	SHELL DIALA AX
Density @ 15°C kg/l	0.876	0.876	0.886
Flash Point	153°C	153°C	152°C
Pour Point	<-40°C	<-40°C	-51°C
Viscosity @ 40°C	14 cSt	14 cSt	8.9 cSt
Viscosity @ 100°C	3cSt	3 cSt	2.3 cSt
Viscosity Index	45	45	50
T.A.N. mgKOH/g	<0.03	<0.03	<0.03
Dielectric Strength	70 KV	70 KV	34 KV
Loss Tangent	< 0.001	< 0.001	< 0.001
Water Content	< 25ppm	< 25ppm	< 25ppm
Additives	NIL	Oxidation Inhibitor	Oxidation Inhibitor
Specifications Met	BS 148-1972	BS 148-1972	ASTM D3487 Type II
	AS 1767-1975	AS 1767-1975	NEMA TR-P8-195 Type II

The Shell Company of Australia Limited

Incorporated in Victoria

7 September 1987

SHELL TRANSFORMER OILS

The duties of the oil in a transformer are to insulate the windings and to transfer heat generated when the transformer is in operation. The oil must have good dielectric properties, must be of low viscosity and have good oxidation stability.

SHELL DIALA OIL B

A straight mineral naphthenic solvent refined oil of high oxidation stability suitable for all classes of transformers up to the highest voltage in service.

Meets British standard 148-1972, IEC Publication 296 and Australian Standard 1767-1975 for Insulating Oils.

SHELL DIALA OIL BX (Oxidation Inhibited)

Diala B with added oxidation inhibitor. It complies fully with the same standards. Diala Oil BX may be used in place of Diala B or passivated oil in any transformer application.

Diala BX is intended for use in transformers operating under high temperature conditions or where extremely long service life is required.

PASSIVATED TRANSFORMER OIL (No Shell Product)

Transformer oil with added Metal Deactivator intended to discourage catalytic corrosion. The effectiveness of this additive is unknown and the demand for this product is diminishing. Passivated oil is still specified by some electrical authorities. (Sydney E.C.)