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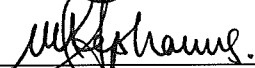
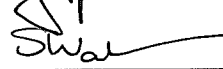
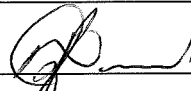
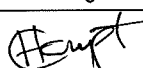
**ESKOM**

**KOEBERG NUCLEAR POWER STATION**

**SPECIFICATION ENGINEERING**

Specification Title

***FYRQUEL EHC ELECTRO-HYDRAULIC CONTROL FLUID***

PREPARED BY:		X Boo
REVIEWED BY:		A Stephanus
REVIEWED BY:		SR Warren (Chemistry)
AUTHORISED BY:		N Ryland
DATE:	2016-03-17	
DATA CAPTURED		C Tulley

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**KOEBERG NUCLEAR POWER STATION  
NUCLEAR ENGINEERING**

	APPROVED: B Dowds	DATE: 1989-07-28
REVISION	PREPARED BY	REVIEWED BY
1	N Lee	A Kotze

**RECORD OF REVISIONS**

Rev	Date	Description of Revision	Prep.	Rev.	Appr.
1	1989-07-28	Original	NL	AK	BD
2	2016-03-15	Full review	XB	AS/ SRW	NR

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**ESKOM**  
**KOEBERG NUCLEAR POWER STATION**  
**PROCUREMENT SPECIFICATION**

**PRODUCT:** FYRQUEL EHC ELECTRO-HYDRAULIC CONTROL FLUID

**TECHNICAL DESCRIPTION:**

- Fyrquel® EHC is a second generation trixylyl and t-butylated phenyl phosphate ester self-extinguishing (fire-resistant) electro-hydraulic control fluid product.
- FYRQUEL EHC ELECTRO-HYDRAULIC CONTROL FLUID as detailed on the Eskom Koeberg order shall conform to the following parameters:

**TYPICAL PROPERTIES:**

Appearance	:	clear, transparent liquid
Viscosity	:	at 37.8°C = 47 cST (220 SUS) at 98.9°C = 5 cST (43 SUS)
ISO Grade	:	46
Viscosity index	:	0
Specific gravity at 60/60°F	:	1.145
Pour point	:	-18°C
Water content	:	0.10 wt.% (max.)
Chlorine content (micro coulometry)	:	20 ppm
Acid number	:	0.04 mg KOH/g
Foaming (ASTM D-892-72)	:	10 ml
Colour (ASTM)	:	1.5
Particle distribution (SAE A-6D, tentative)	:	ISO 15/12 (Class 3)
Resistivity	:	$20 \times 10^9$ Ohm/cm (min.)
Air entrainment	:	< 7 minutes

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ENGINEERING DESIGN DATA:

Evaporation loss (22 hours @149°C) : 1.50 wt. %

Coefficient of thermal:

Expansion @ 100°F (MI/MI/°F) : 0.0003

Surface tension (@ 20°C) : 42 dynes/cm

Heat of combustion : 13,459 BTU/lb

Specification heat : @0°C = 0.3523 cal/g °C  
@38°C = 0.3762 cal/g °C  
@100°C = 0.4101 cal/g °C

Thermal conductivity (cal-cm/sec/cm<sup>3</sup>/°C) : @40°C = 3.04×10<sup>-4</sup>  
@94°C = 3.04×10<sup>-4</sup>  
@146°C = 2.95×10<sup>-4</sup>

Latent heat : 24.7 kcal/mole  
60.3 cal/g  
108.8 BTU/lb

Vapour pressure (mmHg abs) : @215.6°C = 0.08  
@221°C = 0.50  
@232°C = 1.20

LUBRICITY DATA:

<b>Shell 4-ball Test</b>	
<b>Load (kg)</b>	<b>Average scar diameter (mm)</b>
1	0.19
10	0.38
40	0.48
<b>V-104C Vickers vane pump test (ASTM D-2882)</b>	
<i>Ring wear (grs. Cumulative)</i>	
24 hours	0.0037
100 hours	0.0043
<i>Vane wear (grs. Cumulative)</i>	
24 hours	0.003
100 hours	0.0085
"FALEX" Lubrication Test	(ASTM D-2625)
Wear Test (ASTM-D-2670)	0.0105 scar width, inch
<b>Extreme Pressure Test (ASTM D-2625)</b>	
Transition Load	1,500 lbs
Transition Pressure	101,000 psi
"TIMKEN" Lubrication Test	(ASTM D-2714)
Wear Test	1.25 scar width, mm
<b>Extreme Pressure Test</b>	
O.K. Load	55 lbs
Pressure at O.K. Load	26,250 psi

SAFETY AND HANDLING:

Refer to the Material Safety Data Sheet (MSDS) of this product.

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## **MARKING AND IDENTIFICATION:**

Each container shall be clearly labelled with the following information:

- General description of package content;
- Manufacturer's name and product part/model number;
- ESKOM's SAP number (if applicable);
- ESKOM's order number.

Marking notices and signs shall be in accordance with OHSA, Act 85 of 1993, requirements.

Marking notices and signs shall be weatherproof.

## **QUALITY ASSURANCE:**

All conditions and requirements contained in this specification shall comply with the Eskom Quality Assurance standard provided with the tender enquiry or purchase order.

The safety classification of the chemical provided in accordance with this specification is:

- 0029/99Q (NSF/NC/Q3/NEV)

The Quality Assurance Data Package (QADP) shall consist of a guaranteed vendor's chemical analysis demonstrating compliance with this specification. This analysis shall identify the batch or lot number of the chemical.

## **DOCUMENTATION:**

The supplier/vendor shall provide the following documentation with each chemical delivery:

- Certificate of Compliance

The Certificate of Compliance shall state that the chemical supplied meets the requirements of this specification.

Eskom authorised personnel shall review the Certificate of Compliance prior to release and use of the chemical. All documentation must be completely legible.

- In addition, at the time of, or prior to, the first delivery to Eskom, the supplier / vendor shall furnish the following documentation:
  - Storage instructions to ensure chemical shelf life;
  - Technical literature on chemical handling (if available) which should be in the form of a Material Safety Data Sheet (MSDS).

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The supplier shall undertake to provide updates of the above as and when they become available.

Full details of all deviations from this Specification must be submitted to ESKOM (KOEBERG) in writing for clearance prior to manufacture/despatch of the product.

#### **PACKAGING AND SHIPMENT:**

The chemical materials shall be supplied in sealed containers to prevent loss, contamination or deterioration of contents during transport, handling and storage.

The sealed containers shall be of a robust nature to facilitate the prevention of personnel contact during transport, handling and storage.

#### **APPENDICES:**

Viscosity vs Temperature Graphs





APPENDIX 2: KINEMATIC VISCOSITY VS TEMPERATURE

Temperature, Degrees Fahrenheit

