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TITLE	SPECIFICATION FOR NEW CABLE OIL	REFERENCE	CP_TSSPEC_165	REV	1
		DATE:		AUGUST 2022	
		PAGE:	1	OF	14

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FOREWORD

Recommendations for corrections, additions or deletions should be addressed to the:

Research and Development Chief Engineer

City Power Johannesburg SOC Ltd

P O Box 38766

Booyens

2016

1 INTRODUCTION

The failure of any component of a high-voltage cable installation generally results in significant repair cost and disruption to the power system. In order to minimise the risk of this occurring and to ensure the optimum life of oil-filled cable systems, the Distribution Division has undertaken to acquire only cable oil in accordance with this specification.

2 SCOPE

The purpose of this specification is to standardise the quality of new cable oil that will be used to maintain City Power's existing oil-filled cables, and to maintain uniform, compatible and contamination-free oil that will ultimately ensure the optimum life of power equipment.

3 NORMATIVE REFERENCES

The following documents contain provisions that, through reference in the text, constitute requirements of this specification. At the time of publication, the editions indicated were valid. All standards and specifications are subject to revision, and parties to agreements based on this specification are encouraged to investigate the possibility of applying the most recent editions of the documents listed below.

ASTM D93	Standard test methods for flash-point by Pensky-Martens closed cup tester.
ASTM D97	Standard test method for pour point of petroleum products.
ASTM D445	Standard test method for kinematic viscosity of transparent and opaque liquids.
ASTM D611	Standard test methods for aniline point and mixed aniline point of petroleum products and hydrocarbon solvents.
ASTM D974	Standard test method for acid and base number by color-indicator titration
ASTM D4052	Standard test method for density and relative density of liquids by digital density meter.
ASTM D-5864	Standard test method for determining aerobic aquatic biodegradation of lubricants or their components
BS 5874	Method for determination of the electric strength of insulating oils.
CEC L-33-A-934 (previously CEC L-33-T-82)	Biodegradability of two-stroke cycle outboard engine oils in water.
IEC 60156	Insulating liquids - Determination of the breakdown voltage at power frequency - Test method.
IEC 60247	Insulating liquids – Measurement of relative permittivity, dielectric dissipation factor ($\tan \delta$) and d.c. resistivity.
IEC 60465	Specification for unused insulating mineral oils for cables with oil ducts
IEC 60475	Method of sampling insulating liquids
IEC 60628	Gassing of insulating liquids under electrical stress and ionization.

IEC 60814	Determination of water by automatic coulometric Karl Fischer titration.
ISO 2719	Petroleum products – Determination of flash-point – Pensky-Martens closed cup method.
ISO 2977	Petroleum Products and Hydrocarbon Solvents - Determination of Aniline Point and Mixed Aniline Point.
ISO 3016	Petroleum oils – Determination of pour-point.
ISO 3104	Petroleum products – Transparent and opaque liquids – Determination of kinematic viscosity and calculation of dynamic viscosity.
ISO 3675	Crude petroleum and liquid petroleum products – Laboratory determination of density or relative density – Hydrometer method.
ISO 5662	Petroleum products – Electrical insulating oils – Detection of corrosive sulphur.

4 DEFINITIONS

- 4.1. **Aniline point:** The temperature at which a mixture of aniline and oil separates. It provides a rough indication of the total aromatic content, and relates to the solvency of the oil for materials that are in contact with the oil. The lower the aniline point, the greater the solvency effects.
- 4.2. **Biodegradable:** Biodegradable means that a material has the proven capability to decompose in the most common environment where the material is disposed of within 3 years through natural biological processes into non-toxic carbonaceous soil, water, carbon dioxide or methane.
- 4.3. **Breakdown voltage:** The minimum voltage at which electrical flashover occurs in oil. It is the measure of the ability of oil to withstand electrical stress at power frequencies without failure. A low breakdown voltage indicates the presence of contamination such as water, dirt and other conducting particles in the oil.
- 4.4. **Flash point:** The minimum temperature at which heated oil gives off sufficient vapour to form a flammable mixture with air. It is an indicator of the volatility of the oil.
- 4.5. **Gassing tendency:** Two types of oils are available, namely, gas evolving and gas absorbing. The gassing tendency will depend on the structure of the oil and this property is a function of the capacity of the oil to absorb the hydrogen formed by electrical discharges.
- 4.6. **Low pressure oil-filled cable:** A self-contained (static), fluid-filled, paper-insulated, metal-sheathed cable which operates with a minimum static pressure of between 20 kPa (0,2 bar) and 300 kPa (3,0 bar) inclusive, a maximum static pressure of not more than 800 kPa (8,0 bar) and a minimum transient pressure of not less than 20 kPa (0,2 bar). (The quoted pressures are above atmospheric pressure.)
- 4.7. **Neutralisation value:** The neutralisation value of an oil is a measure of the amount of acidity or alkaline materials present. As oil age in service, the acidity and the neutralisation number increases. Used oil having a high neutralisation number indicates that the oil is oxidised or contaminated. The basic neutralisation number results from an alkaline contaminant in the oil.

High acidity levels will promote the degradation of the paper and will induce corrosion in the cable. The presence of acids is normally an indication of oxidation of the oil.

4.8. **New cable oil:** Virgin or unused cable oil that complies with this specification.

4.9. **Pour point:** The lowest temperature at which the oil will just flow. A low pour point is important, particularly in cold climates, to ensure that the oil will circulate and serve its purpose as an insulating medium.

4.10. **Viscosity:** The resistance to flow under specified conditions.

5 REQUIREMENTS

5.1. Oil specifications

New (unused) cable oil shall comply with the requirements given in table 1.

Property	Unit	Requirements	Reference and/or test method
Physical			
Oil type		Virgin / unused	
Appearance		Clear, free of sediment and suspended matter	IEC 60296
Odour		Mild hydrocarbon odour	
Flammability		Non-flammable	
Explosive Properties		Not explosive	
Biodegradability		Readily Biodegradable	CEC L-33-A-934 / ASTM D5864
Density @ 20 °C	g/cm ³	□ 0,9	ISO 3675 / ASTM D4052
Kinematic viscosity @ 40 °C	mm ² /s	≤ 6,0 max.	ISO 3104 / ASTM D445
Flash point	°C	≥ 130 min.	ISO 2719 / ASTM D93
Pour point	°C	≤ -45 max.	ISO 3016 / ASTM D97
Chemical:			
Neutralisation value	mg KOH/g	≤0,03 max.	ASTM D974
Moisture Content	mg/kg	Bulk: < 30 Drum: < 40	IEC 60814
Corrosive sulphur		Non-corrosive	ISO 5662
Electrical:			
Breakdown Voltage	kV	Bulk 40 min. Drum 30 min.	IEC 60156 / BS 5874
Dissipation factor @ 90 °C, 50/60Hz		Bulk 0,002 max	IEC 60247
Gassing tendency, absorption	mm ³ /min	≥ 2	IEC 60628/78A
Aniline point	°C	63 to 84	ISO2977 / ASTM D611

Table 1: Properties of new cable oil

5.2. Quality management system

5.2.1 The supplier (deemed to be an organization that undertakes any manufacturing or assembly operation) shall have a formally documented and implemented quality management system (QMS), that as a minimum meets with the requirements of the international code of practice for quality systems ISO 9001.

City Power reserves the right to audit quality management systems for suitability and effectiveness, and to verify all goods for conformance prior to delivery.

5.2.2 Foreign and third party manufacturers shall, in addition, hold valid certification of their quality management system. Such certification shall be from a national quality systems certification body (Registrar), duly accredited by a QMS accreditation body, which is signatory to a mutual recognition agreement with South Africa.

5.2.3 Additional quality requirements may apply when City Power enters into a term contract. Specific requirements will be specified therein.

6 TESTS

- a) New cable oil complying with this specification shall meet the limiting values specified in column 3 of table 1 when tested in accordance with the corresponding test methods given in column 4 of table 1. These values apply only to unused oil, as delivered, prior to its introduction into cable.
- b) The oil supplier shall guarantee that the oil delivered complies with this specification. The guarantee shall be in the form of a certificate. Records shall be traceable and shall be kept for auditing purposes.
- c) Sampling shall be carried out in accordance with the procedure described in IEC 60475.

7 MARKING, LABELING AND PACKAGING

7.1 Marking and labelling

7.1.1. Each cable oil drum shall be indelibly labelled showing the following information:

- a) Manufacturers name;
- b) type of cable oil;
- c) volume of oil (l); and
- d) drum mass (kg);

7.1.2. Cable oil delivered to City Power shall be accompanied by a certificate guaranteeing that the oil complies with the requirements of this specification (see table 1 and annex A). Records shall be traceable and shall be kept for auditing purposes.

7.1.3. Cable oil delivered to City Power shall be supplied with a material safety data sheet.

7.2 Packaging

Cable oil shall be supplied in sealed drums of 210 liters.

8 STORAGE

Cable oil shall be stored in a cool place away from sources of heat and out of direct sunlight to avoid pressure build up. Cable oil should not be stored near oxidizing agents / materials such as liquid chlorine, concentrated oxygen, sodium hypochlorite, calcium hypochlorite, peroxides, etc. as this may present an explosion hazard.

9 DOCUMENTATION

The tenderer shall complete the technical schedule B (see annex A) for the cable oil offered. By doing this, the tenderer will be stating compliance with this specification and will provide the information the purchaser has requested.

10 QUALITY MANAGEMENT

A quality management system shall be set up in order to assure the quality during manufacture, installation, removal, transportation and disposal. Guidance on the requirements for a quality management system may be found in the following standards: ISO 9001:2015. The details shall be subject to agreement between the purchaser and supplier.

11 HEALTH AND SAFETY

A health and safety plan shall be set up in order to ensure proper management and compliance during manufacture, installation, removal, transportation and disposal. Guidance on the requirements of a health and safety plan shall be found in OHSAS 18001:2007/ ISO 45001:2018 standards. The details shall be subject to agreement between City Power and the Supplier.

12 ENVIRONMENTAL MANAGEMENT

An environmental management plan shall be set up in order to ensure the proper environmental management and compliance is adhered to during manufacture, installation, removal, transportation and disposal. Guidance on the requirements for an environmental management system shall be found in ISO 14001:2015 standards. The details shall be subject to agreement between City Power and the Supplier. This is to ensure that the asset created conforms to environmental standards and City Power SHERQ Policy.

ANNEX A - Bibliography

Eskom SPECIFICATION FOR NEW (UNUSED) INSULATING OIL FOR CABLES
Unique Identifier: 34-1495

ANNEX B - Revision information

DATE	REV. NO.	NOTES
June 2006	0	First issue
Aug 2022	1	New Work Group Update the oil requirements table Quality Health Environmental Normative reference General Editing

ANNEX C - Item 1 OIL CABLE INSULATING – SAP 5025

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Subclause of CP_TSSPEC_165	Description	Schedule A	Schedule B
1	5.1	Physical Oil type	Alkyl Benzene	
	5.1	Appearance	Clear no suspended matter or sediment	
	5.1	Odour	Mild hydrocarbon odour	
	5.1	Flammability	Non-flammable	
	5.	Explosive properties	Not explosive	
	5.1	Density @ 20 °C	g/cm ³ ≤ 0,9.	
	5.1	Kinematic viscosity @ 40 °C	mm ² /s ≤ 6,0 max.	
	5.1	Flash point	°C ≥ 130 min.	
	5.1	Pour point	°C ≤ -45 max.	

Note: Ticks, Cross [✓, X], Astrick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted

Tender Number: _____

Tenderer's Authorised Signatory: _____
Name in block letters
Signature

Full name of company: _____

Item 1: OIL CABLE INSULATING

Deviation schedule

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Subclause of CP_TSSPEC_165	Proposed deviation

Note: Ticks, Cross [✓, X], Astrick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted

Tender Number: _____

Tenderer's Authorised Signatory: _____
Name in block letters
Signature

Full name of company: _____

ANNEX C - Item 1 OIL CABLE INSULATING – SAP 5025

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Subclause of CP_TSSPEC_165	Description	Schedule A	Schedule B
		Chemical		
	5.1	Neutralisation value mg KOH/g	≤0,03 max.	
	5.1	Moisture Content mg/kg	Bulk 40 min. Barrel 30 min.	
	5.1	Corrosive sulphur	Non-corrosive	
		Electrical		
	5.1	Breakdown voltage kV	Bulk 40 min. Barrel 30 min.	
	5.1	Dissipation factor at 90 °C	≤ 0,002	
	5.1	Gassing tendency mm ³ /min	≤ 2	
	5.1	Aniline point °C	63 to 84	

Note: Ticks, Cross [✓, X], Astrick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted

Tender Number: _____

Tenderer's Authorised Signatory: _____
Name in block letters
Signature

Full name of company: _____

ANNEX D – Stock Items

Material Group : CAB OIL

Item	SAP No.	SAP Short Description	SAP Long Description
1	5025	OIL CAB INSULATING	CABLE OIL. INSULATING. ALKYL BENZENE. CLEAR. SUPPLIED IN SEALED 210 LITRE DRUMS. TO BE USED FOR OIL FILLED CABLES. ITEM SPECIFICATION NO: CP_TSSPEC_165.