

Parodi

# Electra 7426



*dielectric evolution*

PRODUCT  
GUIDE



*A.&A. Fratelli Parodi s.p.a.*

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# PARYOL ELECTRA 7426® - NATURAL HIGH PERFORMANCE

## Green Chemistry

Paryol ELECTRA 7426® is a patented dielectric fluid (pat. WO 2012110432) made of a peculiar mixture of vegetable oils. Our long-standing oleochemical experience allowed us to reduce the amount of additives necessary to obtain enhanced performance together with strong oxidation resistance. Thanks to its chemical nature, Paryol ELECTRA 7426® provides the real green solution in the dielectrics field. It is an ideal substitute to the commonly employed mineral-based fluids, also ensuring perfect chemical compatibility with all the parts of the transformer apparatus.

## Safety and performance

Paryol ELECTRA 7426® is an advanced insulating dielectric oil designed and developed with the aim of minimizing the environmental impact and of decreasing fire risk, as well as exhibiting excellent performances.

## Technical Overview - Advantages

### Flash and Fire points - Less fire risk

Paryol ELECTRA 7426® has Flash and Fire points above 300 °C, not reached by any of the alternatives on the market and as such is considered as a *Less Flammable* fluid.

The Factory Mutual approval for the product has already been requested.

### Better water solubility - Prolonged transformer's lifetime

The chemical nature of Paryol ELECTRA 7426® imparts higher water solubility compared to that of mineral oils (10 to 50 times lower). This property allows the product to retain water, reducing the migration into the insulating paper wrapped around the windings.

With Paryol ELECTRA 7426® the paper degrades at a considerably lower rate in comparison with mineral oil and the transformer lifetime is thus prolonged.

### Higher oxidation stability - Prolonged oil's lifetime

Paryol ELECTRA 7426® shows superior oxidation stability in comparison with other vegetable oils. Figure 1 shows the comparison between the behaviour of the product and of other vegetable oil based dielectric fluids on the market under oxidation test.

Although not required by the IEC 61125 c standard, the 168 h trial completes and clarifies the picture: after 48 h all the oils perform very well, but between 72 and 168 h substantial differences arise. Paryol ELECTRA 7426® fully satisfies the most aggressive conditions of the test, ensuring a prolonged dielectric lifetime.

This intrinsic behaviour is a plus for the employment of Paryol ELECTRA 7426® in transformers with conservator, where more contact with air occurs.

### Natural ester - No PHAs, no corrosive sulphur developed

Paryol ELECTRA 7426® is a natural ester. In the event of arcing phenomena, the product doesn't develop PHAs (Polycyclic Aromatic Hydrocarbons), and doesn't contain corrosive sulphur, unlike petroleum-based oils. This feature is fundamental to preserve environmental safety in case of spills, and to ensure workplace safety for operators.

### Better dielectric properties - Higher efficiency

Paryol ELECTRA 7426® has a Dielectric Dissipation Factor (DDF) similar to that of traditional mineral oil, but during service its value increases at a slower rate, meaning that the device retains higher efficiency during its lifetime. On the other hand, the product has a Breakdown Voltage (BV) higher than 60 kV.

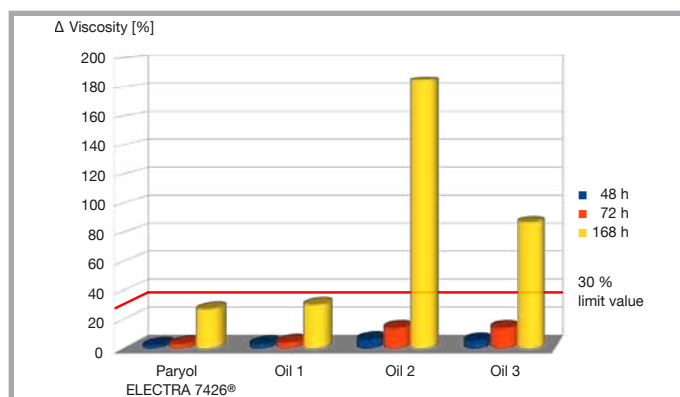


Figure 1: Viscosity comparison between different vegetable oils after oxidation tests

Property	Test method			Property requirements		Typical Value
	U.M.	ISO / IEC	ASTM	Unused natural esters for transformers IEC 62770	As received new fluid prior to any processing ASTM D6871	PARYOL ELECTRA 7426
<b>PHYSICAL</b>						
Appearance		visual	visual	bright and clear		clear
Color	[ASTM]		D1500		≤ 1.5	≤ 1.5
Density	[g/ml], at 20 °C	ISO 3675		≤ 1.000		0.910 – 0.925
Viscosity [cSt]	[cSt], at 100 °C	ISO 3104	D445	≤ 15	≤ 15	8.0 – 10.0
	[cSt], at 40 °C	ISO 3104	D445	≤ 50	≤ 50	37.0 – 43.0
Pour Point	[°C]	ISO 3016	D97	≤ -10	≤ -10	-15 – -27
Flash Point	[°C]	ISO 2719	D92	≥ 250	≥ 275	≥ 300
Fire Point	[°C]	ISO 2592	D92 (COC)	≥ 300	≥ 300	≥ 350
Thermal class	[°C]	IEC 60076-14		130		130
<b>ELECTRICAL</b>						
Dielectric Breakdown	[kV]	IEC 60156 (2.5 mm gap)	D1816 (2 mm gap)	≥ 35	≥ 35	≥ 60
Dissipation Factor	100 °C, 60 Hz [%]		D924		≤ 4.0	1.0 – 3.9
	90 °C, 50 Hz [tan δ]	IEC 60247		≤ 0.05		0.02 – 0.05
	25 °C, 60 Hz [%]		D924		≤ 0.20	≤ 0.20
<b>CHEMICAL</b>						
Water	[ppm]	IEC 60814	D1533	≤ 200	≤ 200	70 – 150
Acidity	[mgKOH/g]	IEC 62021-3	D974	≤ 0.06	≤ 0.06	0.015 – 0.060
Additives	[w/w %]	IEC 60666		5		≤ 2.7
Corrosive Sulfur		IEC 62535	D1275	Non corrosive	Non corrosive	Non corrosive
<b>PERFORMANCE, ACIDITY AND VISCOSITY AFTER IEC 61125 C MODIFIED TEST - OXIDATION STABILITY (48 h, 120 °C)</b>						
Acidity	[mgKOH/g]	IEC 62021-3		≤ 0.6		0.1 – 0.6
Viscosity @ 40°C		ISO 3104		30% increase over initial		1 – 2% increase
Dissipation Factor	90 °C, 50 Hz [tan δ]	IEC 60247		≤ 0.5		≤ 0.5
<b>ENVIRONMENTAL</b>						
Ecotoxicity		OECD 202		Non ecotoxic		Non ecotoxic
Biodegradability (ultimate type)		OECD 301B, C or F		Readily Biodegradable	Readily Biodegradable	Readily Biodegradable

Table 1: Physical, Electrical and Chemical properties of Paryol ELECTRA 7426®

# THE CHOICE FOR A SAFE, CLEAN AND SUSTAINABLE FUTURE

## Reduced fire risk

### An ideal substitute for mineral-based dielectrics

Table 2 shows that Paryol ELECTRA 7426® has Flash and Fire points above 300 °C, higher than all the other dielectric fluids. As such it is classified as K-type oil according to the IEC61039 standard. The combination of both Fire point and Thermal class shows that Paryol ELECTRA 7426® is the product with the highest safety margin at operating temperatures.

In order to reduce fire risk, it is advisable to replace more flammable insulating fluids (typically mineral-based) with Paryol ELECTRA 7426®. This is even more desirable when the transformer is placed indoor (underground places, mines, tunnels, ships, submarines).

DIELECTRIC FLUID	STANDARD	FLASH POINT [°C]	FIRE POINT [°C]	THERMAL CLASS [°C]
Mineral Oil	IEC60296	140	160	105
Silicone	IEC60836	275	310	155
Synthetic Ester	IEC61099	250	300	130
<b>Paryol ELECTRA 7426</b>	IEC62770	310	350	130

Table 2: Flash point, Fire point and Thermal class for different dielectric fluids

TRANSFORMER TYPE	FLUID VOLUME [liters]	distance from	
		Other transformers or non-flammable buiding surfaces [m]	Flammable building surfaces [m]
<b>O Class Oil</b> (IEC61039) insulated transformers	1.000 < ... < 2.000	3	7.5
	2.000 ≤ ... < 20.000	5	10
	20.000 ≤ ... < 45.000	10	20
	≥ 45.000	15	30
<b>K Class Oil</b> (IEC61039) insulated transformers	1.000 < ... < 3.800	1.5	7.5
	≥ 3.800	4.5	15

Table 3: Reference values for outdoor transformers safety areas, according to IEC 61936-1 (CEI 99/2)

### Smaller safety areas needed with Paryol ELECTRA 7426®

Table 3 shows that K-type oils like Paryol ELECTRA 7426® require smaller safety areas than O-type fluids (like mineral oil) for any filled volume.

It's worth remembering that a 50% lenght reduction corresponds to a 75% area shrink. This is a great advantage in terms of civil works for new installations.



## Environmental responsibility - Global sustainability

### Low additivation means ready Biodegradability

Thanks to the accurate studies carried out at A&A Fratelli Parodi Spa, Paryol ELECTRA 7426® has been selected as an inherently self-protecting product towards oxidation. Therefore, the amount of added antioxidants is considerably reduced, and the product classifies as readily biodegradable.

### Non-toxicity has many advantages

Paryol ELECTRA 7426® is non-toxic to humans and to the environment: even the reduced amount of specific additives mixed with the natural base oil to enhance the oxydation stability doesn't affect the product's non-toxicity and biodegradability.

Thank to this fundamental features, Paryol ELECTRA 7426® is not considered, even conservatively, a pollutant relevant for environmental contamination. Also from a regulatory perspective, in the event of spills and accidental release into the environment, no contamination is envisaged and the responsible users do not incur into negative consequences.



Figure 2: The UVEO concept

### Carbon footprint analysis- Less CO<sub>2</sub> emitted

A life cycle assessment on Paryol ELECTRA 7426® has been carried out, showing that the substitution of mineral-based dielectric oils implies a considerable reduction of the emitted carbon dioxide, of around 5 kg CO<sub>2</sub> per kg of product.

With the foreseen carbon trade, this feature will have considerable advantages and will gain unprecedented popularity.

### Taking care of the product from cradle to cradle

The logo depicted in Figure 2 synthesizes the **UVEO** (Used Vegetable Esters and Oils) concept developed at A&A Fratelli Parodi Spa, that will open for transformer users the new option to freely dispose of all used vegetable based products like Paryol ELECTRA 7426®.

In the UVEO vision, used vegetable-based oils constitute a new raw-material for the production of sustainable 3<sup>rd</sup> generation Biodiesel.

## Referenced Standards

- IEC 61125 c Unused hydrocarbon based insulating liquids - Test methods for evaluating the oxidation stability
- IEC 62770 Fluids for electrotechnical applications - Unused natural esters for transformers and similar electrical equipment
- ASTM D6871 Standard Specification for Natural (Vegetable Oil) Ester Fluids Used in Electrical Apparatus
- IEC 60296 Unused mineral insulating oils for transformers and swithgears
- IEC 60836 Specifications for unused silicone insulating liquids for electrotechnical purposes
- IEC 61039 Classification of insulating liquids
- IEC 61936-1 (CEI 99/2) Power installations exceeding 1 kV a.c. - Part 1: Common rules



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CERTIFICATE N.25334

**UNI EN ISO 9001:2008 and UNI EN ISO 14001:2004 certified**

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