

## Test report

**Protection Class: Restricted**

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<u>Distribution list</u> E T TR MPT STCL SCM		EM TS CS TR ML	

## Testing of the inhibited oil Petro 45X Plus , supplier KunLun Lubricant Oil Institute of PetroChina Company Ltd. for applicability for Transformers

### Summary

***The inhibited transformer oil Petro 45X Plus of PetroChina from Supplier KunLun fulfils the requirements in the delivery state and for the high grade for oxidation stability according to IEC 60296.***

***The inhibited oil Petro 45X Plus can be used for the application cases described in TUN 901293.***

### 1 Cause of Study

The inhibited oil Petro 45X Plus from Supplier KunLun Lubricant Oil Institute of PetroChina Company Ltd. has been delivered for testing and evaluation.

### 2 Tests

The inhibited oil Petro 45X Plus has been tested in the delivered state according to IEC 60296 and for ageing stability according to DIN EN 61125C. The results are listed in Table 1 in comparison to the requirements of IEC 60296.

### 3 Results

#### 3.1 Properties in the Delivery State

The tested properties of the inhibited oil Petro 45X Plus and the comparison with the limit values of IEC 60296 are represented on Table 1.

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**Table 1. Properties of the inhibited oil Petro 45X Plus in the delivered state and after ageing according to the IEC 60296 .**

Property	Test Method	Unit	Value ID- Nr. 1995-2018	Supplier values	Limit value (IEC 60296)
Colour	ISO 2049		0		≤ 1
Purity	VDE 0370		clear	clear	clear
Neutralisation value	IEC 62021-1	mg KOH/g Öl	<0,01	<0,01	≤ 0,01
Diel. loss factor at 90°C	IEC 60247		<0,001	<0,001	≤ 0,005
Water content	IEC 60814	mg H2O/kg Öl	11	11	≤ 30
Density at 20 °C	ISO 12185	kg/m³	875,0	875,7	≤ 895
Breakdown voltage	IEC 60156	kV	68	40-60	>30 untreated >70 after treatment
Interfacial tension	ISO 6295	mN/m	49	45	-
2-Furfural	IEC 61198	mg/kg oil	<0,05	<0,05	≤ 0,1
Aromatic content	IEC 60590	%	3,28		
Inhibitor content	IEC 60666	%	0,30	0,29	0,30 -0,05/+0,10 (TUN 901293)
Corrosive sulfur	IEC 62535		non-corrosive	non-corrosive	negative
Corrosive sulfur	DIN 51353		non-corrosive	non-corrosive	negative
Passivator contentt	IEC 60666	mg/kg	n.d.	n.d.	n.d. (<5mg/kg)
Viscosity at 100°C	ASTM D 7042	mm²/s	2,36	-	
Viscosity at 40°C	ASTM D 7042	mm²/s	9,32	9,215	max 12mm²/s
Viscosity at -30°C <sup>1</sup>	ISO 3104	mm²/s	1346	1232	max 1800mm²/s
Flash Point <sup>1</sup> (PM)	ISO 2719	°C	149	151	min.135°C
Oxidation stability <sup>1</sup>	IEC 61125C				
Total acidity	500h	mgKOH/g oil	0,01	0,10	≤ 1,2* ≤ 0,3**
Sludge		%	<0,01	0,002	≤ 0,8* ≤ 0,05**
Diel. loss factor at 90 °C			0,027	0,035	≤ 0,5* ≤ 0,05**
Pour point <sup>1</sup>	ISO 3016	°C	-63	-45	max.-40
Gassing tendency <sup>2</sup>	IEC 60628A	µl/min	+11,25		no general requirement
DBDS	IEC 62697	mg/kg oil	n.d.	n.d.	n.d.
PCB	IEC 61619	mg/kg oil	n.d.	n.d.	n.d.
PCA content	DIN16143	%	<3	<3	max.3%
Total sulphur content <sup>1</sup>	RFA	%	0,0032	0,0036	for high Grade <0,05

\* standard grade

\*\* high grade

<sup>1</sup> not in the accreditation scope

<sup>2</sup> subcontract tests

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#### 4 Evaluation

***The inhibited transformer oil Petro 45X Plus of PetroChina Company Ltd. fulfils the requirements in the delivery state and for the high grade for oxidation stability according to IEC 60296.***

***The inhibited oil Petro 45X Plus can be used for the application cases described in TUN 901293.***



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