



Oil Analysis Report [OLXXXX]

Transformer Company

Power Station

Tag Number: TX3

Friday, 15 May 2020

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Report No.	OLXXX	Date:	15-May-20	Client:	Transformer Company
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Analysis Results

Transformer Description

Company	Transformer Company	Contact	Hayley Coulson	Email	hayley.coulson@txmonitor.com
Site	Power Station	Area	Plant	Asset Class	Power Transformer
Serial Number	123458	Manufacturer	Alstom		
Tag Number	TX3	Year of Manufacture	2014		
Power Ratings	50_MVA	Cooling Stages			
Voltage Ratings	33_kV	Total Liquid Volume	15377_l		

Sample Identification (Latest sample taken by Client.)

No	Date Sampled	Date Analysed	Temp. [°C]	Laboratory	Lab ID	Report No.	Report Date	Condition
1	13-Mar-16	15-Mar-16	26.00	Unknown	OLXXX1-01	OLXXX1	20-Mar-16	✓
2	03-Apr-17	09-May-17	30.00	TxMonitor	OLXXX2-01	OLXXX2	12-May-17	✓
3	18-May-20	21-May-20	28.00	TxMonitor	OLXXX3-01	OLXXX3	23-May-20	▲
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Gas Concentrations [PPM] as per ASTM-D3612

MU	±2	±2	±1	±2	±2	±30	±250	±55	±115	
Gas	Hydrogen	Methane	Ethylene	Ethane	Acetylene	Carbon Monoxide	Carbon Dioxide	Oxygen	Nitrogen	TDCG
No	H ₂	CH ₄	C ₂ H ₄	C ₂ H ₆	C ₂ H ₂	CO	CO ₂	O ₂	N ₂	
1	26	< 0.5	1	86	< 0.2	15	120	133	14701	128.7
2	18	3.5	5.5	481	< 0.2	27	690	3984	28766	535.2
3	26	5	7	557	< 0.2	39	750	2057	35468	634.2
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Laboratory Manager Signature: Hayley Coulson



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Analysis Results

Chemical Properties

No	Colour	Visual	Water	Acidity	Interfacial Tension	Breakdown Voltage	Power Factor [%]		Resistivity ASTM-D1169 [GΩ-cm]	
	ASTM D1500	ASTM D1524	ASTM D1533	ASTM D974	ASTM D971	AS1767-1999	ASTM D924		@25 °C	@100 °C
MU	N/A	N/A	± 2 (ppm)	± 0.01 (mgKOH/g)	± 2 (mN/m)	± 12 (Avg. [kV])	@25°C ± 0.01	@100°C ± 0.01	±5	±5
1	1.0	Clear & Bright	10	0.01	31	67	0.01	0.06	3.0	40.0
2	1.5	Clear & Bright	12	0.01	30	68	0.30	0.08	5.0	60.0
3	2.0	Clear & Bright	11	0.03	29	71	0.20	0.10	8.0	80.0
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Chemical Properties (cont.)

No	Paper DP(*^)	Furans [PPB]						Specific Gravity (*) [g/L]	DBPC(*^)	TIC (*^)	PCB
	ASTM-D4243	ASTM-D5837 (MU - 52HF <2; 2FAL<2, FOL<6, 2ACF<4, 5M2F<2)									
MU	N/A	52HF	2FAL	FOL	2ACF	5M2F	Total	N/A	%w/v ±0.01	%w/v ±0.01	PPM ±1
1	530	< 3	500	< 10	< 7	15	515	0.89	0.35	0.35	< 1
2	470	< 3	800	< 10	< 7	25	825	0.89	0.25	0.25	< 1
3	430	< 3	1092	< 10	< 7	30	1120	0.89	0.15	0.15	< 1
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Abbreviations:

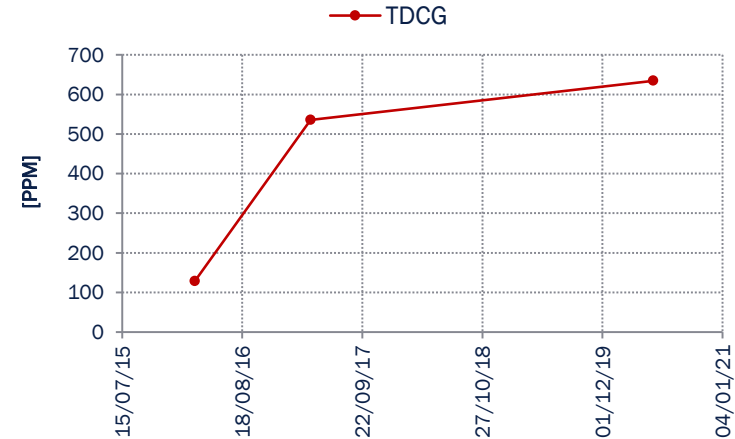
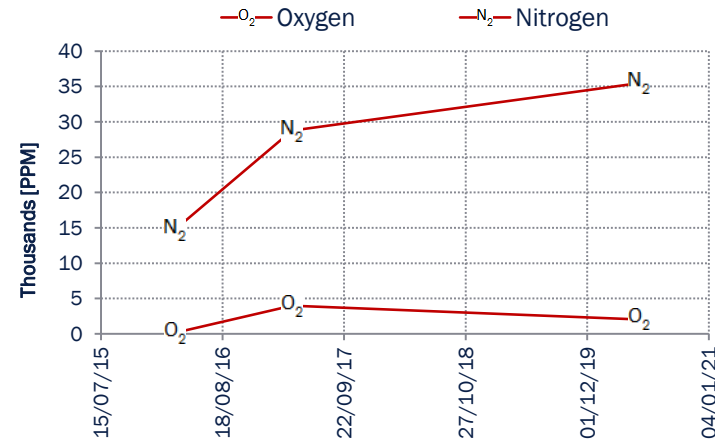
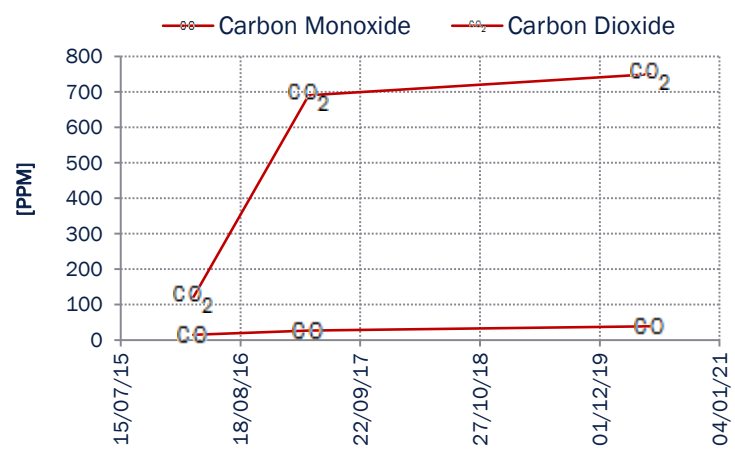
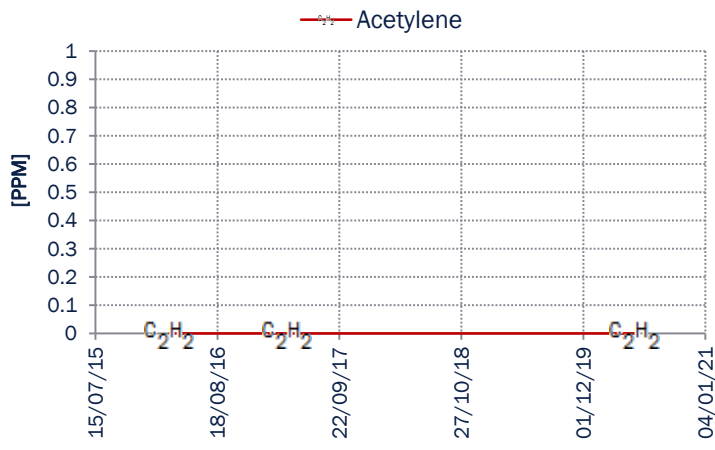
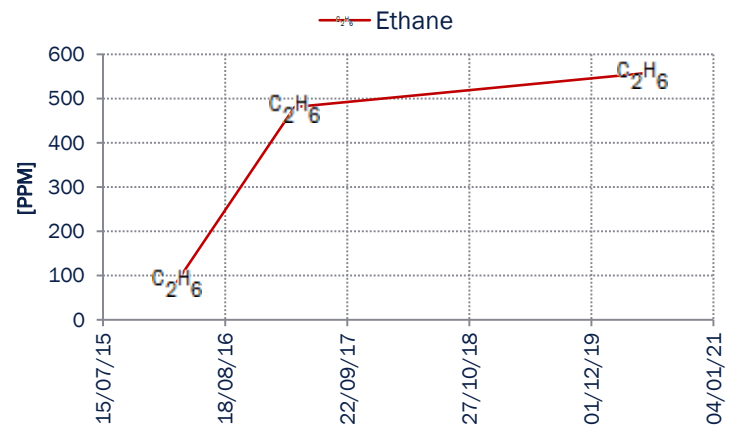
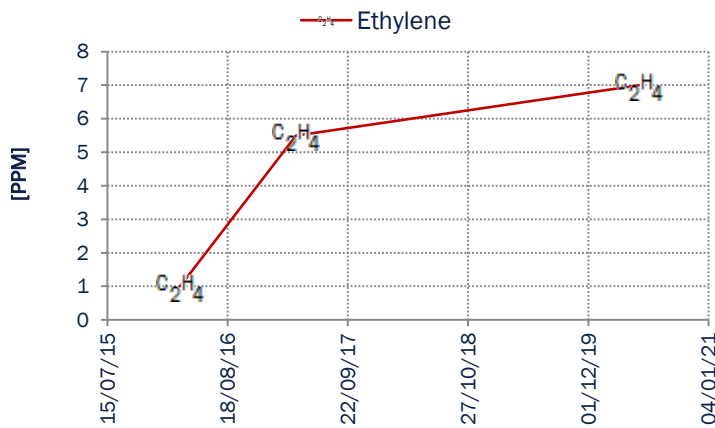
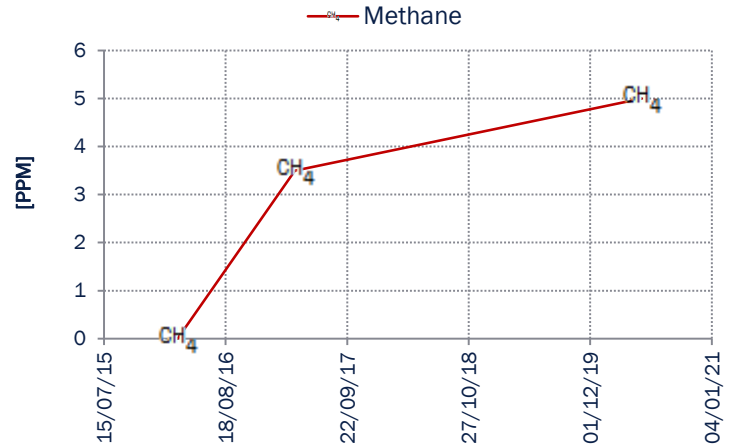
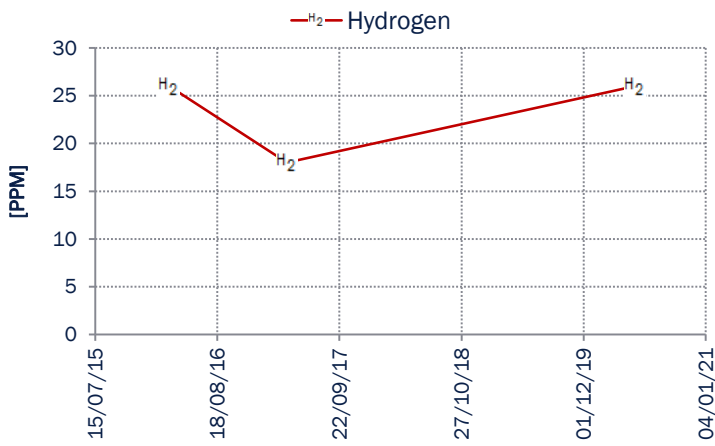
DP = Degree of Polymerization	TIC = Total Inhibitor Content	DBPC = 2,6-ditertiary-butyl paracresol
TDCG = Total Dissolved Combustible Gases		PCB = Polychlorinated Biphenyls

Notes:

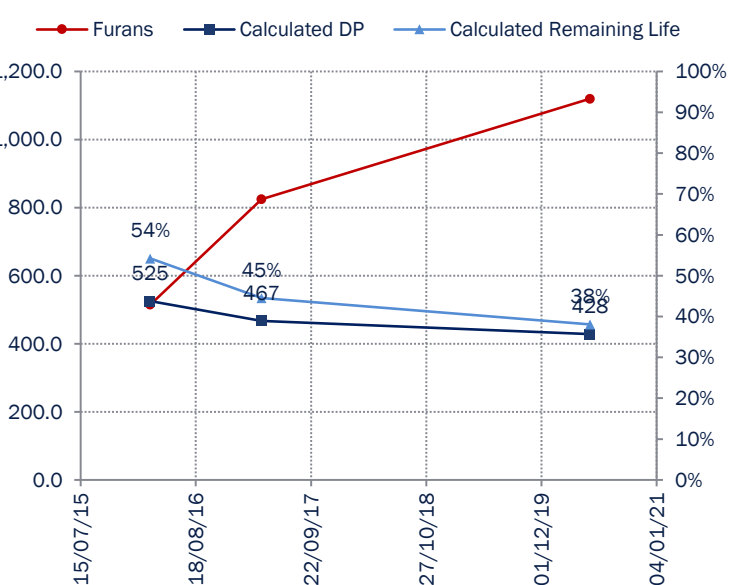
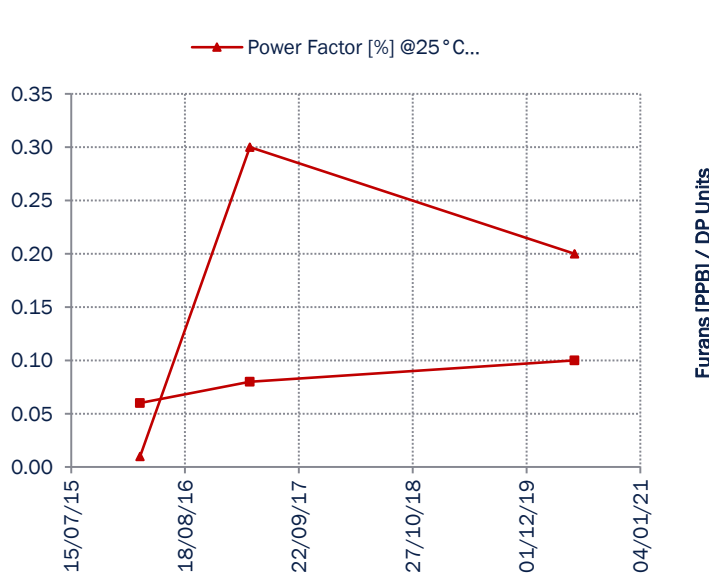
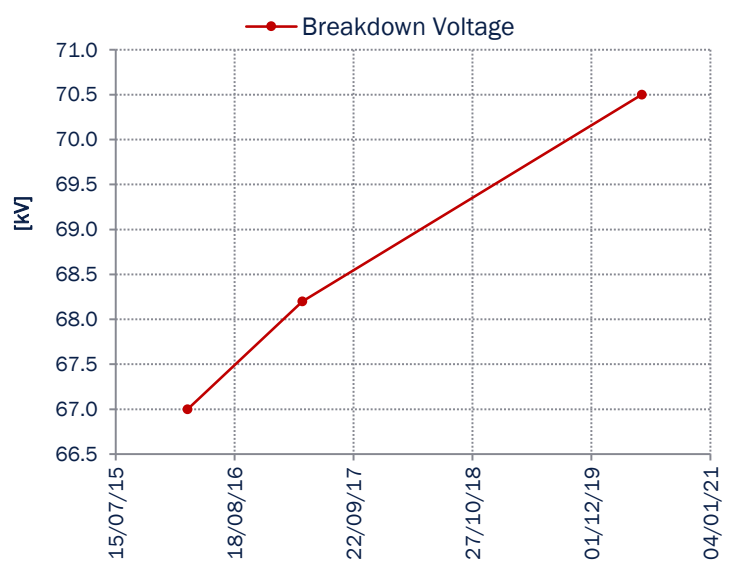
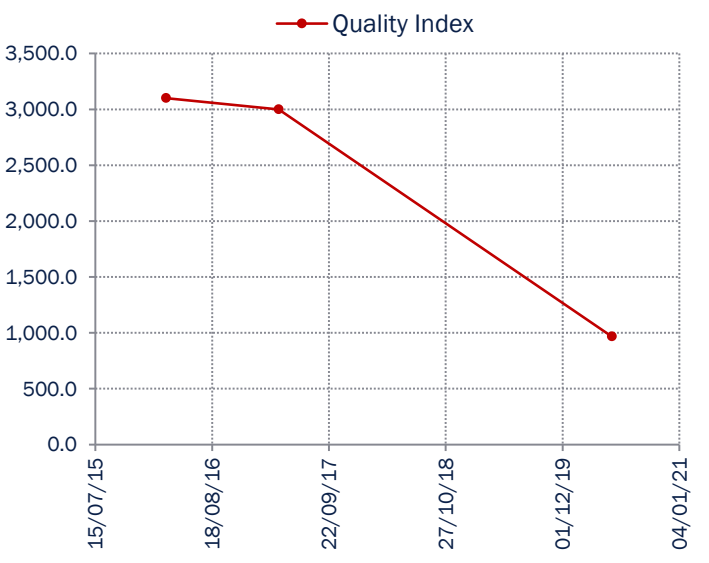
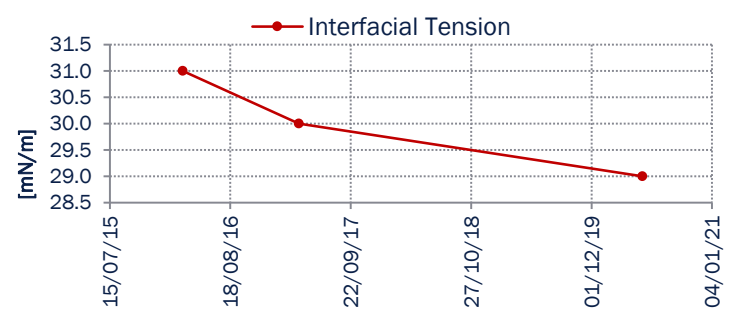
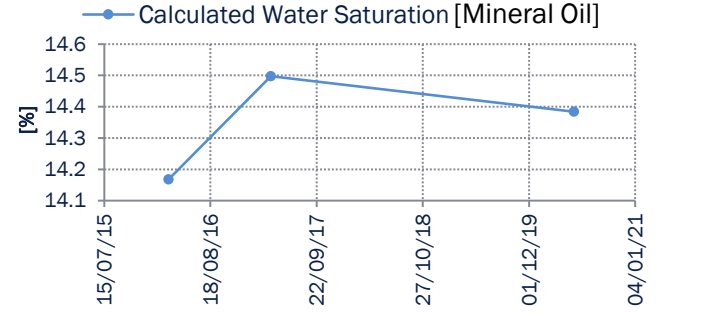
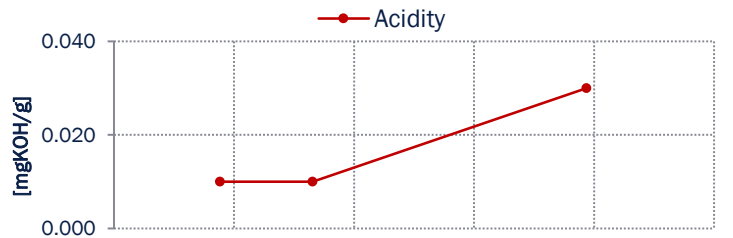
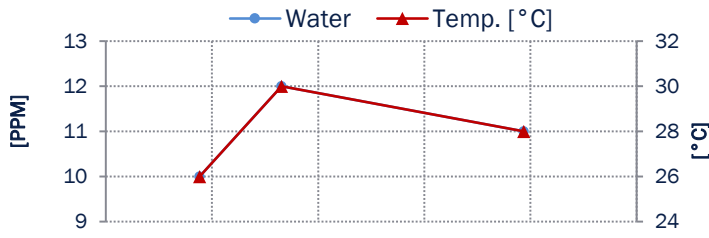
(*) Tests marked with this asterisk are not part of the scope of NATA accreditation.
 (^) Tests marked with this symbol are performed by a NATA accredited third-party.
 N/A Not Applicable

Laboratory Manager Signature: 
 Hayley Coulson

Trend Charts (This section is not part of the scope of NATA accreditation)



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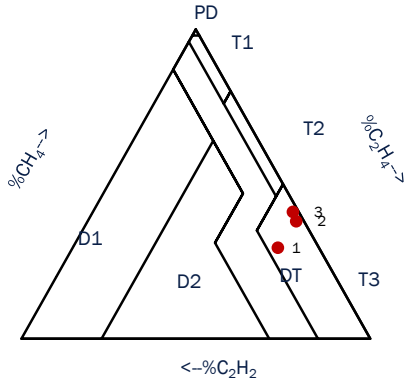


Results Interpretation (This section is not part of the scope of NATA accreditation)

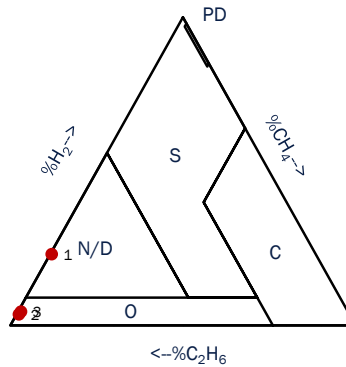
Sample being analysed:

No: 3, Date: 18/May/20

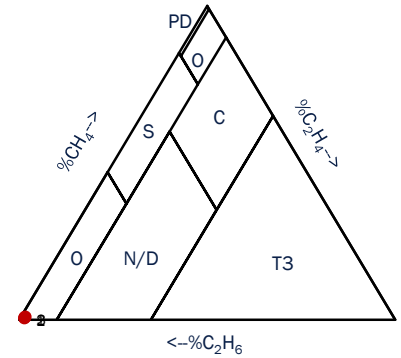
Duval's Triangles Dissolved Gas Analysis Interpretation



Triangle 1 - Classical Triangle for Mineral Oils



Triangle 4 - Low Temperature Faults in Mineral Oils
This triangle is used for a more precise diagnosis of faults identified as low temperature (PD, T1 or T2) by Triangle 1. Do not use for faults D1, D2 or T3.



Triangle 5 - Low Temperature Faults in Mineral Oils
This triangle is used for a more precise diagnosis of faults identified as low temperature (PD, T1 or T2) by Triangle 1. Do not use for faults D1 or D2.

Sample		Triangle 1		Triangle 4		Triangle 5	
No.	Date	Zone	Diagnosis	Zone	Diagnosis	Zone	Diagnosis
1	13-Mar-16	T3	Thermal fault, T >700 °C		Not Applicable		Not Applicable
2	03-Apr-17	T3	Thermal fault, T >700 °C		Not Applicable		Not Applicable
3	18-May-20	T3	Thermal fault, T >700 °C		Not Applicable		Not Applicable
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Results Interpretation (This section is not part of the scope of NATA accreditation)

IEC Dissolved Gas Interpretation Guidelines (60599)

Alert condition. Institute more frequent sampling. Consider on-line monitoring.
 The following gases exceed the typical concentration values: Ethane > 90 PPM,
 O₂/N₂ ratio less than 0.3. Excessive oxygen consumption, investigate preservation system.
 The gas ratios R1 (C₂H₂/C₂H₄) =0.00, R2 (CH₄/H₂) =0.20 and R3 (C₂H₄/C₂H₆) =0.01 indicate the following condition:
 T1=>Thermal fault < 300 C.

IEEE Dissolved Gas Interpretation Guidelines (C57-104)

	Selected Sample	Previous Sample
Condition Classification Number	Condition: 4	Condition: 4
Condition Explanation	This sample falls under Condition 4 due to the following gases exceeding the recommended limits: Ethane > 150 PPM.	
Recommended Sampling Period	Weekly	
Recommended Action	Exercise extreme caution. Analyse each individual gas. Plan an outage. Get in touch with the manufacturer	

Gas Ratios

R1 CH ₄ /H ₂	0.196
R2 C ₂ H ₆ /CH ₄	111.400
R3 C ₂ H ₄ /C ₂ H ₆	0.013
R4 C ₂ H ₂ /C ₂ H ₄	0.000
R5 CO ₂ /CO	19.364

Diagnosis based on Gas Ratios

Roger's Ratios Diagnosis: Slight overheating 200 to 300 C.

IEEE Oil Quality Interpretation Guidelines (C57-106, Tables 2, 3, 5 and 7)

Oil Quality Tests	Guideline	Units	Result	Statement of Conformity
				For a transformer of this age and voltage class.
Acidity	<0.2	mgKOH/g	0.03	Complies
Colour	<3.5	N/A	2	Complies
Water	<27	PPM	11	Complies
Interfacial Tension	>25	mN/m	29	Complies
Breakdown Voltage	>40	kV	71	Complies
Power Factor @ 25°C	<0.5	%	0.2	Complies
Power Factor @ 100 °C	<5	%	0.1	Complies
PCB	<2	PPM	< 1	Complies
Specific Gravity	0.88-0.92	g/mL	0.89	Complies



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Results Interpretation (This section is not part of the scope of NATA accreditation)

Expert Peer Review

[IEEE C57-104 (DGA): Alert] [IEEE C57-106 (Oil Quality): Good]

Title: Interpretation of Dissolved Gas Analysis as per IEEE C57-104.

Dissolved Gas Analysis (DGA) is not indicative of an active failure mode. Gas concentrations are below the values considered typical by the IEEE interpretation guidelines.

Title: Interpretation of Oil Quality Properties as per IEEE C57-106.

Oil Quality properties are within recommended guidelines.

Furanic Compounds level is moderate. Based on the classification provided by the FIST standard the Estimated life remaining in the paper is 38%.

Calculated DP is 428 which is considered to be an excessive rate of aging.

Corrosive sulphur analysis was performed with the following results: ASTM1275B: Non-Corrosive: 3a - Dark Tarnish - Magenta overcast on brassy strip.

Continue with normal operation.

Recommended Sampling Period


6 Months

Note: Compliance Statement/Statement of Conformity - when the measurement results are within the appropriate standard guidelines, the standard guideline defines the compliance decision rule to be used and the measurement results meet the specified criteria (Complies). If the measurement result complies with appropriate standard guideline (ie: Complies), but falls outside the standard guideline when the uncertainty of measurement is applied, the client shall decide whether the result Complies or Fails based on the result being within the maximum permissible uncertainty prescribed in the specified criteria of the referenced standard guidelines.

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End of Report

Reviewed by:


Hayley Coulson
Laboratory Manager