Laboratory Results

DGA PLUS | BENCHSTOCKING Metal Cylinders - Glass Syringes http://www.nttworldwide.com | NORTHERN TECHNOLOGY & TESTING NTT

Northern Technology and Testing ◆ 8140 Industrial Parkway, Suite 8 ◆ Sacramento, CA 95824 ◆ Tel: (916) 383-6800 ◆ Fax (916) 383-7794

SITE & NAME PLATE DATA

Location	PLEASANT HILL ROAD
Address	
Serial No.	12345
Manufacturer	GE
Year Built	1979
Main\LTC	MAIN
Bank\Phase	BANK-#2 A-PHASE
KVA	2,000
Oil Temp	70C
Notes1	NITROGEN BLANKET
Notes2	
Project\P.O.	P.O.# H42-995050
Lab Notes:	

SAMPLE DATA

Lab ID 100157

Date:	
Sampled	01/01/1995
Received	01/10/1995
Lab Run	01/11/1995
Report	01/12/1995
TAT	1 hr
Status	RUSH
Carrier	UPS GROUND
Container	NTT-CYL-102
	1-QT BOTTLE
Oil Type	Mineral Oil

SAMPLE

CUSTOMER DATA

Account No.\Company Information

128301-00-00
ELECTRICAL UTILITY USA, INC.
386 INDUSTRIAL PARKWAY
SOMMERSVILLE, LA 82687

Contact Name: MR JOHN SMITH
Phone1: 216-555-1212
Phone2:
Fax: 216-555-1212

NTT Quality Control\Quality Assurance Measures

- ☐ Results faxed\discussed with: _____
- ☐ Memo attached
- ☐ Report QA\QC checked by: _____

Dissolved Gas Analysis Results - ASTM D3612A

Note: Interpretations and Diagnostics developed using Mineral Oil.
All detection limits are less than 1 ppm, however, all results are rounded off to the nearest 1 ppm.

		Present	1st Prior	2nd	3rd	4th	5th
	Sample Date	01/01/1995	01/01/1994	05/05/1993	02/05/1993	01/10/1992	01/15/1991
	NTT Lab ID No	100157	100156	100101	100090	100050	100009
	Foreign Lab				SDMYR38421	GELIL59022	OMTR342342
	Sampling Temperature(C)	70C	50C	45C	40C	42C	60C
	ASTM D1533B Moisture (ppm)	18	19	25	35	28	15
	Moisture Saturation (%)	3.4	9.1	15.1			
H2	Hydrogen	83 ppm	69	32	34	29	32
CH4	Methane	23	18	14	14	12	14
C2H6	Ethane	4	4	3	3	3	3
C2H4	Ethylene	22	22	12	13	12	12
C2H2	Acetylene	67◂◂	63«	24«	25«	23«	22«
CO	Carbon Monoxide	20	17	15	18	17	22
CO2	Carbon Dioxide	1867	2007	1612	1758	1695	1735
N2	Nitrogen	83215	83109	84177	80689	382805	90549
O2	Oxygen	3142	1414	1497	936	2945	2987
	TDCG	219	193	101	107	97	105
	Total Gas	88443	86723	87387	83490	87542	95376
	Equiv TCG(%)	0.1886	0.1633	0.0835	0.0935	0.0795	0.0812

Interpretive or Key Gas Method (present sample only) indicates:

Hydrogen within normal limits (<1500ppm).
Methane within normal limits (<80ppm).
Ethane within normal limits (<35ppm).
Ethylene within normal limits (<150ppm).
▸▸***Acetylene ≥ 7ppm. Possible arcing.***
Carbon Monoxide within normal limits (<1000ppm).
Carbon Dioxide within normal limits (<10000ppm).

Rogers' Ratios (present sample only) indicates:

CH4/H2	0.28	Code=0
C2H6/CH4	0.17	Code=0
C2H4/C2H6	5.50	Code=2
C2H2/C2H4	3.05	Code=2
CO/CO2	0.01	

Since total combustible gases are less than 500 ppm, the Rogers' Ratios result indicated below is considered less significant.
▸Arc, with power follow through.

IEEE\ANSI C57.104 Guidelines (present and 1st prior samples only) suggest:

TDCG Level: 219 ppm
Rate: 0.071 ppm/Day
TDCG rate is Increasing.

▸Sampling Interval: B-Quarterly
▸Operating Procedure: 1-Continue normal monitoring.

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KVA	2,000
Oil Temp	70C
Notes1	NITROGEN BLANKET
Notes2	
Project\P.O.	P.O.# H42-995050
Lab Notes:	

SAMPLE DATA

Lab ID 100157

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Container	NTT-CYL-102 1-QT BOTTLE
Oil Type	Mineral Oil

SAMPLE

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PCE (Physical/Chemical/Electrical) Results

			Present	1st Prior	2nd	3rd	4th	5th
		Sample Date	01/01/1995	01/01/1994	05/05/1993	02/05/1993	01/10/1992	01/15/1991
		Lab ID No	100157	100156	100101	100090	100050	100009
		Foreign Lab				SDMYR38421	GELIL59022	OMTR342342
		Sampling Temperature	70C	50C	45C	40C	42C	60C
ASTM D1533B	Moisture	(ppm):	18	19	25	35	28	15
ASTM D971	IFT	(dynes/cm):	29.6	26.0	28.4	20.0	26.0	28.0
ASTM D974	Neutralization No	(mg KOH/g):	0.0024	0.0024	0.0048	0.0089	0.0078	0.0065
ASTM D1500	Color	(ASTM Color Scale):	L1.5	L1.0	L0.5	L0.5	L0.5	L0.5
ASTM D1524	Visual	(Relative):	CL & SPK	PARTIC	CL & SPK	CL & SPK	CL & SPK	CL & SPK
ASTM D924	Power Factor @ 25°C	(%):						
ASTM D924	Power Factor @ 100°C	(%):						
ASTM D877	Dielectric D877	(kV):	25@24C	32@24C	30@25C	26@25C	35@24C	28@25C
ASTM D1816	Dielectric D1816 0.04in	(kV):						
ASTM D1816	Dielectric D1816 0.08in	(kV):						
ASTM D445	Viscosity	(cSt):	53.00@25C	54.20@25C				
ASTM D92	Fire Point	(°C):						
ASTM D92	Flash Point	(°C):						
ASTM D1298	Specific Gravity	(60/60°F):	0.8554	0.9020				
ASTM D97	Pour Point	(°C):						
ASTM D2668	Oxidation Inhibitor	(%):						
Metals (AA-Graphite Furnace) Results:								
Fe	Iron	(ppm):		<0.1				
Al	Aluminum	(ppm):		0.2				
Pb	Lead	(ppm):		0.4				
Cu	Copper	(ppm):		<0.1				
Sn	Tin	(ppm):		0.2				
Ag	Silver	(ppm):		<0.1				
Zn	Zinc	(ppm):		<0.1				
PCB (EPA 600/4-81-045) Results:								
PCB		(ppm):	ND,<1					
		Aroclor:						

Furfural Analysis - ASTM D5837-95

5-Hydroxymethyl-2-furfural	(ppm):							
2-Furfuryl alcohol	(ppm):							
2-Furfural	(ppm):							
2-Acetyl furan	(ppm):							
5-Methyl-2-furfural	(ppm):							

NTT DIAGNOSTIC REPORT for Conventional Petroleum (mineral) Dielectric Oils

DGA PLUS™ BENCHSTOCKING™ http://www.nttworldwide.com NORTHERN TECHNOLOGY & TESTING™ NTT

Lab ID No: 100157 **Location: PLEASANT HILL ROAD** **Serial No: 12345** **Main\LTC: MAIN**

Source of Information: IEEE Guide for Acceptance and Maintenance of Insulating Oil in Equipment IEEE C57.106-1991			Table 1	Table 2		Table 3	Table 4	Table 5			Table 6		Table 7	Table 8	Table 9
IEEE Suggested Applications			Shipments of New Mineral Insulating Oil as Received from the Refinery	New Oil Received in New Equipment		New Oil Processed for Equipment, Prior to Filling	New Oil in Equipment, After Filling and Standing, Immediately Prior to Energizing	Suggested Limits for Continued Use of Service-Aged Insulating Oil (Grouped by Voltage Class)			Suggested Limits for Oil to be Reconditioned or Reclaimed		Shipments of New Mineral Insulating Oil for Circuit Breakers	New Circuit Breaker Oil, After Processing and Filling, Immediately Prior to Energizing	Suggested Limits for Continued Use of Service-Aged Circuit Breaker Insulating Oil
								Group I							
Apparatus Voltage Class or Group			Not Specified by IEEE	<69kV	69-230kV	345kV Class and Above	Not Specified by IEEE	≤69kV	69-288kV	>345kV	Group II	Group III	Not Specified by IEEE	Not Specified by IEEE	Not Specified by IEEE
Analysis	ASTM Method	*Current NTT Result*	**IEEE Limit Values**												
Moisture Content (ppm)	D-1533	18	maximum 35	maximum 25	maximum 20	maximum 10 ▲	maximum 20	maximum 35	maximum 25	maximum 20	Not Specified by IEEE		maximum 35	maximum 20	Not Specified by IEEE
Interfacial Tension (Dynes/cm)	D-971	29.6	minimum 40 ▼	minimum 35 ▼	minimum 35 ▼	minimum 40 ▼	minimum 35 ▼	minimum 24	minimum 26	minimum 30 ▼	minimum 24	minimum 16	minimum 40 ▼	minimum 35 ▼	minimum 25
Neutralization Number (mg KOH/gm oil)	D-974	0.0024	maximum 0.03	Not Specified by IEEE		maximum 0.03	Not Specified by IEEE	maximum 0.2	maximum 0.2	maximum 0.1	maximum 0.2	maximum 0.5	maximum 0.03	maximum 0.03	Not Specified by IEEE
Color	D-1500	L1.5	maximum 0.5	maximum 1.0	maximum 1.0	maximum 0.5	maximum 1.0	Not Specified by IEEE			Not Specified by IEEE		maximum 0.5	maximum 0.5	maximum 2.0
Visual Examination	D-1524	CL & SPK	Bright and Clear	Bright and Clear	Bright and Clear	Not Specified by IEEE	Bright and Clear	Not Specified by IEEE			Not Specified by IEEE		Bright and Clear	Bright and Clear	No Excessive Carbon in Oil
Power Factor @ 25°C (%)	D-924		maximum 0.05	maximum 0.15	maximum 0.10	maximum 0.05	maximum 0.10	Not Specified by IEEE			Not Specified by IEEE		maximum 0.05	maximum 0.10	maximum 1.0
Power Factor @ 100°C (%)	D-924		maximum 0.3	maximum 1.50	maximum 1.00	maximum 0.30	Not Specified by IEEE	Not Specified by IEEE			Not Specified by IEEE		maximum 0.30	Not Specified by IEEE	Not Specified by IEEE
Dielectric Breakdown Voltage (kV)	D-877	25	minimum 30 ▼	minimum 30 ▼	minimum 30 ▼	minimum 30 ▼	minimum 30 ▼	minimum 26 ▼	minimum 26 ▼	minimum 26 ▼	Not Specified by IEEE		minimum 30 ▼	minimum 30 ▼	minimum 25
Dielectric Breakdown Voltage 0.04 in. gap (kV)	D-1816		Not Specified by IEEE	minimum 20	minimum 30	minimum 30	minimum 30	minimum 23	minimum 26	minimum 26	Not Specified by IEEE		Not Specified by IEEE	minimum 30	Not Specified by IEEE
Dielectric Breakdown Voltage 0.08 in. gap (kV)	D-1816		Not Specified by IEEE	minimum 40	minimum 48	minimum 60	minimum 48	minimum 34	minimum 45	minimum 45	Not Specified by IEEE		Not Specified by IEEE	minimum 60	Not Specified by IEEE
Gas Content (%)	D-3612	8.84	Not Specified by IEEE	Not Specified by IEEE		maximum 0.5*	Not Specified by IEEE	Not Specified by IEEE			Not Specified by IEEE		Not Specified by IEEE	Not Specified by IEEE	Not Specified by IEEE

* Unless a lower value is specified by the manufacturer.