

1 **Substations**

- 2
- 3 **Q. Reference: "2025 Capital Budget Application," Newfoundland Power Inc.,**
- 4 **June 28, 2024, sch. B, Gander Substation Power Transformer Replacement, p.**
- 5 **63, and Supporting Materials, Substations: 2.2, app. B, sec. 1.3, pp. 3–4.**
- 6 **a) Please provide a detailed breakdown of the scope of maintenance**
- 7 **completed on GAN-T2 in September 2022.**
- 8 **b) Please provide Dissolved Gas Analysis test results for each year from 2021**
- 9 **to 2023 for GAN-T2.**
- 10 **c) In its report titled "Substation Spare Transformer Inventory" filed with its**
- 11 **2023 Capital Budget Application, Newfoundland Power indicated that it**
- 12 **had opted to repair a total of nine power transformers over the period**
- 13 **2011–2022, seven of which required the use of a portable substation. Why**
- 14 **does Newfoundland Power not consider this a viable option in the case of**
- 15 **GAN-T2?**
- 16 **d) It is stated that "it is reasonable to expect multiple power transformer**
- 17 **failures could occur over the same period." Please confirm that**
- 18 **Newfoundland Power has a suitable spare transformer for GAN-T2, and if**
- 19 **so, how many?**
- 20 **e) Please confirm how many of Newfoundland Power's three portable**
- 21 **substations are suitable for deployment in place of GAN-T2 if GAN-T2 were**
- 22 **to be removed for repair.**
- 23 **f) Did Newfoundland Power receive quotes for the repair of GAN-T2? If so,**
- 24 **please provide the estimated cost to repair GAN-T2. If not, why not?**
- 25 **g) Please provide the quoted lead time for the repair of GAN-T2.**
- 26
- 27 **A. a) See Attachment A for a detailed breakdown of the scope of maintenance completed**
- 28 **on GAN-T2 in September 2022. Refer to Type of Maintenance IV for the standard**
- 29 **procedures conducted during this maintenance type.**
- 30
- 31 **b) See Attachment B for the dissolved gas analysis test results for each year from 2021**
- 32 **to 2023 for GAN-T2.**
- 33
- 34 **c) See Newfoundland Power's 2025 Capital Budget Application, report 2.2 Substation**
- 35 **Power Transformer Replacements, Appendix B, section 4.2 Alternative 2 – Repair**
- 36 **GAN-T2 for why Newfoundland Power does not consider the repair of GAN-T2 to be**
- 37 **a viable option.**
- 38
- 39 **d) See Newfoundland Power's 2025 Capital Budget Application, report 2.2 Substation**
- 40 **Power Transformer Replacements, Appendix B, section 4.1 Alternative 1 – Condition**
- 41 **Based Maintenance of GAN-T2. Newfoundland Power has one suitable spare**
- 42 **transformer for GAN-T2. The spare transformer that is capable of replacing GAN-T2**
- 43 **is presently installed in the Salt Pond ("SPO") Substation with the designation**
- 44 **SPO-T5, and is currently serving as an in-service backup to SPO-T4. This unit must**
- 45 **be reinstalled on the Burin Peninsula once it is no longer needed for emergency use.**
- 46
- 47 **e) See Newfoundland Power's 2025 Capital Budget Application, report 2.2 Substation**
- 48 **Power Transformer Replacements, Appendix B, section 4.1 Alternative 1 – Condition**

- 1                    *Based Maintenance of GAN-T2.* Two of Newfoundland Power’s four portable  
2                    substations are suitable for deployment in place of GAN-T2 if GAN-T2 were to be  
3                    removed for repair.  
4
- 5                    f) Newfoundland Power did not receive quotes on the repair of GAN-T2. See  
6                    Newfoundland Power’s *2025 Capital Budget Application*, report *2.2 Substation Power*  
7                    *Transformer Replacements, Appendix B*, section *4.2 Alternative 2 – Repair GAN-T2*  
8                    for the reasoning why repair of GAN-T2 was not a viable option.  
9
- 10                  g) Newfoundland Power did not receive quotes on the repair of GAN-T2. See  
11                  Newfoundland Power’s *2025 Capital Budget Application*, report *2.2 Substation Power*  
12                  *Transformer Replacements, Appendix B*, section *4.2 Alternative 2 – Repair GAN-T2*,  
13                  which states that a repair would require the unit to be removed from service for 18  
14                  to 24 months.

**ATTACHMENT A:**  
GAN-T2 Scope of Maintenance

## POWER TRANSFORMERS

Created by: M. Rideout  
Revised by: M. Greening

Reviewed by: M. Greening  
Approved by: G. Samms

The following steps are considered as standard procedures for maintenance on power transformers. Other scope may be completed as required on a case-by-case basis.

Form MSF009, “Power Transformer Maintenance Report”, is used in reporting Maintenance I, III, IV or V through paper form or PowerDB. Also, Maintenance Standard Form MSF001, “Nameplate and Description”, is completed during Maintenance I.

Type of Maintenance				Procedure
I	III	IV	V	
X				1. Assign and install an ID number.
X				2. Record the complete nameplate information on MSF001. This will include the main nameplate, the tapchanger (if it has a separate nameplate), bushings, lightning arresters, gas detector relays, fan motors, and any other accessories that would have a nameplate.
X				3. An internal inspection should be made on all new transformers and on transformers that have been in storage or have been moved from one location to another. For transformers that have been energized previously, this internal inspection may be omitted if the Substation Asset Management Group has determined that it is not practical or necessary. Refer to MSR017 for detailed guidelines to be followed in completing this internal inspection.
X				4. Perform a dew point test if moisture is suspected to have entered the tank.
X				5. Ensure continuity of all CT taps; check that the CT is not grounded; and check all ratios. Refer to MST005 for ratio checking procedures.
X				6. If not already installed, install a fall arrest bracket on the unit.
X	X	X		7. Ensure an appropriate PCB label is installed on the unit. Record the PCB level on MSF009. Place a label on the inside of the control cabinet indicating PCB level. If no lab oil test has been previously conducted on the unit, take an oil sample for lab testing.
X	X	X		8. Make a visual inspection, noting the general condition of the transformer. Check for such things as dents, oil leaks (particularly around gasketed joints), paint condition, damaged bushings, broken glass on gauges, abnormal readings on thermometers, oil level gauges, etc. Report issues to the electrical Maintenance Planner Group.
X	X	X	X	9. Ensure that the tank is properly grounded. A good, permanent, low-resistance ground is essential. All grounding and neutral connections to be upgraded to 19/#9 copper clad steel unless otherwise noted.
X	X	X		10. Check the oil level as indicated by the gauge on the conservator tank or on the main tank if there is no conservator tank. Top up as required.
X	X	X		11. Check bushings for oil leakage and oil level where possible. Report issues to the electrical Maintenance Planner Group

## POWER TRANSFORMERS

Type of Maintenance				Procedure
I	III	IV	V	
X	X	X		12. Check radiators for paint condition, oil leaks, and position of all valves. Ensure Radiators are well painted to prevent corrosion and rusting unless otherwise noted.
X	X	X		13. Check the condition of the silica gel. Replace as required. Breather piping and silica gel canister shall be replaced unless otherwise noted. Refer to MSR020 for silica gel breather requirements.
X		X*		14. Install or replace humidity absorbent packets in the gas detector relay as required if relay is not replaced.
X	X	X	X	15. If the unit is equipped with a spill pan, check that heat tracing and valve is operational. Ensure pan is free of oil and drained.
X		X*		16. Clean bushings and lightning arresters where they exist. The porcelain should be kept clean and free from atmospheric pollution. Inspect closely for chips and cracks. All chips and cracks are to be reported to the Electrical Maintenance Planner Group and painted with glyptol to prevent moisture ingress. In cases with excessive damage bushings may require replacement
X	X	X		17. Painting is done at intervals determined by visual inspection. Refer to MSR014 for painting guidelines. The entire transformer shall be painted unless otherwise noted.
X	X	X		18. Check that the upper diaphragm on the explosion vent is intact. PRD and piping shall be installed if identified in the scope of work by the Planner.
X		X		19. Check the operation of the gas detector relay. Refer to MST007.
	X			20. Record the reading of the maximum indicating pointer on the temperature gauges and check that the method of resetting the pointer is operational.
X		X		21. Check the operation of the temperature gauges including the settings of switches. Refer to MST010.
X	X	X		22. Check the cooling fans for proper operation. Ensure that drain plugs or adhesive tape is removed from fan motors. If the unit is equipped with a fan exerciser, ensure it is operational and that an appropriate time interval is established.
X	X	X		23. Check the dielectric value of the insulating oil. Refer to MSR013 for method of testing. Refer to MSR010 for oil dielectric requirements.
X	X	X	X	24. Obtain an oil sample with a syringe and bottle for gas analyses. Refer to MSR013 for sampling procedures. Record results on MSF020. Do this during Maintenance V if requested.
X		X*		25. Megger the windings. To do so, all bushings should be wiped clean and dry and all connections to live bus bars and lightning arresters should be disconnected. Give the measured resistance on MSF009 (do not make the temperature correction conversion). Refer to MSR012 for evaluation of megger readings and maximum meggering voltages. Refer to MST008 for transformer meggering procedure.

## POWER TRANSFORMERS

Type of Maintenance				Procedure
I	III	IV	V	
X		X*		26. Megger core ground with a 500V megger. If this will require removing oil, which may not be practical, this step may be omitted. This must be done as part of the acceptance procedure for a new unit.
X		X*		27. Carry out ratio tests with ratiometer. Refer to MST011 for TTR procedure.
		X		28. Carry out power factor and winding resistance testing. See appropriate manufacture manual for the test equipment that is being used.
X		X		29. Carry out a Transformer Protection Devices Inspection as per maintenance standard MST017. Ensure to inspect all junction boxes, making special note of any wear/cracking or any point at which water could enter the box. Ensure all gaskets and seals are checked and replaced as necessary. Install humidisorb packs in all junction boxes.
X		X		30. Ensure that all accessories are tested. Examine all apparatus, electrical cables, conductors, signaling and operating devices. A megger test is recommended if applicable.
X	X	X		31. Observe drop leads for signs of strain on bushings or associated equipment. If transformer is de-energized, check line connections for tightness.
X	X	X		32. Ensure that the control cabinet is clean and dry. Ensure the cabinet heater is operating to prevent condensation build up.
X				33. If present, ensure that any bushing wrap is removed.
X*		X		34. If transformer is to be kept as spare, wrap bushings with plastic wrap.
			X	35. For unplanned maintenance as a result of breakdown or diagnostic tests, make the necessary repairs and note on MSF009.
X	X	X	X	36. Any changes made or abnormal conditions found should be noted on MSF009 and reported to the Substation Asset Management Group.
X	X	X	X	37. Send copies of form MSF009 to the Electrical Maintenance Planners' group along with any unresolved issues with the equipment or with the procedures. Any outstanding work shall be entered into an Avantis work request and submitted.
X	X	X	X	38. Update maintenance history and nameplate information in Avantis.

**\* Only if the transformer is de-energized and if it is deemed necessary to make these checks.**

**Caution:** For some transformer maintenance, control wiring may have to be disconnected to disable alarms and trip circuits. This normally applies to gas detector relays, temperature gauges, pressure relief devices, etc., that are connected to external trip schemes. An approved protection plan may be required for such cases.

**Note:** For transformers with an on-load tapchanger, refer to MSP012 for standard maintenance procedures.



## **ATTACHMENT B:**

GAN-T2 2021-2023 Dissolved Gas Analysis



H<sub>2</sub>b

ANALYTICAL SERVICES  
INCORPORATED

# Transformer Condition Assessment <sup>TM</sup>

Glenn Samms  
Newfoundland Power  
P.O. Box 8910  
55 Kenmount Road  
St. John's, NF A1B 3P6

Location : GANDER  
Bank & Phase : GAN-T2  
Serial Number : W 1010-1  
Manufacturer : FPE  
Date Mfgd : 1967  
Size (kVA) : 16000  
Rating kV: 138

Date : 05-20-2021  
Report Number : 5073502  
Fluid volume : 18184  
Fluid type : Mineral Oil  
Preservation : Conservator  
Cooling : ONAN  
Core & coil wt. : 42000  
Impedance :

	Sample Date :	4/27/2021	11/27/2020	4/27/2020	11/7/2019	7/24/2019
	Laboratory No. :	5073502	5072795	5070131	5069108	5067476
	Container No. :	47993	44672	38732	41907	41912
	Temperature :	34	20	26	18	40
H2	Hydrogen (ppm) :	33	28	30	26	31
CH4	Methane (ppm) :	4	3	2	6	7
C2H6	Ethane (ppm) :	1	1	1	0	0
C2H4	Ethylene (ppm) :	20	18	14	15	12
C2H2	Acetylene (ppm) :	51	59	57	56	53
CO	Carbon monoxide (ppm) :	209	303	197	227	193
CO2	Carbon dioxide (ppm) :	1498	1734	1412	1455	1364
N2	Nitrogen (ppm) :	83402	93946	84956	89819	90046
O2	Oxygen (ppm) :	36342	38665	34816	29733	26449
	Total (ppm) :	121560	134757	121485	121337	118155
	TDCG (ppm) :	318	412	301	330	296
	SHL (%) :	7.52	8.57	7.55	8.10	7.47
	ETCG (% in blanket) :	0.21	0.24	0.19	0.20	0.19
Particles	5 to 15 um :	515181	15528	59300	107800	87800
Particles	15 to 25 um :	2207	808	4800	7450	10050
Particles	25 to 50 um :	453	260	1000	1300	1950
Particles	50 to 100 um :	38	22	100	150	150
Particles	> 100 um :	3	1	0	0	0
D1533	Moisture (ppm) :	7	6	4	7	4
D1816	Dielectric BV (kV) :	36	33	36	35	30
D974	Acid Number (mg KOH/g) :	0.017	0.07	0.016	0.018	0.016
D971	Interfacial Tension (dynes/cm) :	35.7	26.2	36.7	34.6	36.6
D1500	Color Number :	<1.5	<2.5	<1.5	<1.5	<1.5
D924	Power Factor :	0.016	1.620	0.004	0.028	0.024
D2668	Oxidation Inhibitor (%) :	0.063	<0.010	0.069	0.067	<0.010
5 HMF	5 hydroxymethyl-2-furaldehyde (ppm) :	<0.010	<0.010	<0.010	<0.010	<0.010
2 FAL	2 furaldehyde (ppm) :	0.036	0.022	0.051	0.049	0.045
2 ACF	2 acetylfuran (ppm) :	<0.010	<0.010	<0.010	<0.010	<0.010
5 MEF	5 methyl-2-furaldehyde (ppm) :	<0.010	<0.010	<0.010	<0.010	<0.010
2 FOL	2 furfural (ppm) :	<0.010	<0.010	<0.010	<0.010	<0.010
	Estimated DP :	845	906	801	806	815

**Transformer Condition Assessment Diagnostic Evaluation**

TCA Assessment : 1 ID: 200175 1 ID:200175 1 ID: 200175 1 ID: 200175 1 ID: 200175  
 Sampler: Collin Cuff Sampler: Collin Cuff Sampler: Collin Cuff Sampler: Collin Cuff Sampler: Collin Cuff

Sampling Interval : Retest in six months.

Operating Procedure : Continue normal operation. Paper mechanical condition is normal.

Comments : Arcing is indicated.

Field Comments : Fluid condition is within acceptable in-service parameters.

Approved by: RWarmenhove

Rico Warmenhove  
Lab Manager





# Tapchanger Activity Signature Analysis TASA™

Glenn Samms  
Newfoundland Power  
P.O. Box 8910  
55 Kenmount Road  
St. John's, NF A1B 3P6

Location : GANDER  
Bank & Phase : GAN-T2  
Serial Number : W 1010-1-LTC  
Ventilation : Conservator  
Compartment : Transfer

Date : 10/20/2021  
Report Number : 5075466  
Purchase Order Number:  
Manufacturer : Reinhausen  
Model : D III 200

	Sample Date :	9/28/2021	9/22/2020	7/24/2019	6/21/2018	4/25/2018
	Laboratory No. :	5075466	5072077	5067477	5063249	5062490
	Container No. :	49249	43483	41911	39201	38646
	Temperature :	32	35	40	40	30
H2	Hydrogen (ppm) :	3859	5804	7424	5878	9144
CH4	Methane (ppm) :	162	279	246	270	323
C2H6	Ethane (ppm) :	11	21	16	19	25
C2H4	Ethylene (ppm) :	212	337	352	365	434
C2H2	Acetylene (ppm) :	942	1705	2075	2487	2987
CO	Carbon monoxide (ppm) :	228	325	257	243	230
CO2	Carbon dioxide (ppm) :	1892	2181	1569	1220	1319
N2	Nitrogen (ppm) :	89057	84175	76511	89553	87450
O2	Oxygen (ppm) :	28642	26799	23317	28676	27619
	Total (ppm) :	125005	121626	111767	128711	129531
	TDCG (ppm) :	5414	8471	10370	9262	13143
	SHL (%) :	4.04	4.03	4.01	4.00	4.00
	ETCG (% in blanket) :	6.26	9.62	12.98	9.20	13.77
Particles	5 to 15 um :	32254	401109	1658400	129500	167450
Particles	15 to 25 um :	324	1565	50200	6200	8050
Particles	25 to 50 um :	82	448	10400	850	850
Particles	50 to 100 um :	4	37	1250	50	50
Particles	> 100 um :	0	0	0	0	0
D1533	Moisture (ppm) :	15	14	12	11	9
D1816	Dielectric BV (kV) :	31	36	31	34	29
D974	Acid Number (mg KOH/g) :	0.012	0.02	0.019	0.017	0.018
D971	Interfacial Tension (dynes/cm) :	38.4	32.8	34.3	37.9	37.0
D1500	Color Number :	<2.0	<2.0	<1.5	<1.5	<1.5

### Tapchanger Activity Signature Analysis Diagnostic Evaluation

TASA Assessment :	1 ID: 200175	1 ID: 200175	1 ID: 200175	1 ID: 200175	1 ID: 200340
Sampler:	Collin	Joseph	Collin	Collin	Collin
Cuff Counter:	111207	Strickland Counter: 111209	Cuff Counter: 111205	Cuff Counter: 111204	Cuff Counter: 111207

Sampling Interval : Recommend retest in one year or after specified number of operations if sooner.  
Operating Procedure : LTC is operating satisfactorily. No special actions are recommended.  
Comments : No abnormal dissipation of energy is indicated.  
Follow guidelines for oils with high flammable gas content.

Approved by: RWarmenhove  
Rico Warmenhove  
Lab Manager



# Tapchanger Activity Signature Analysis TASA™

Glenn Samms  
Newfoundland Power  
P.O. Box 8910  
55 Kenmount Road  
St. John's, NF A1B 3P6

Location : GANDER  
Bank & Phase : GAN-T2  
Serial Number : W 1010-1-LTC  
Ventilation : Conservator  
Compartment : Transfer

Date : 1/6/2022  
Report Number : 5076467  
Purchase Order Number:  
Manufacturer : FPE  
Model : D III 200

	Sample Date :	9/29/2021	9/28/2021	9/22/2020	7/24/2019	6/21/2018
	Laboratory No. :	5076467	5075466	5072077	5067477	5063249
	Container No. :	49249	49249	43483	41911	39201
	Temperature :	32	32	35	40	40
H2	Hydrogen (ppm) :	588	3859	5804	7424	5878
CH4	Methane (ppm) :	110	162	279	246	270
C2H6	Ethane (ppm) :	47	11	21	16	19
C2H4	Ethylene (ppm) :	1125	212	337	352	365
C2H2	Acetylene (ppm) :	1305	942	1705	2075	2487
CO	Carbon monoxide (ppm) :	90	228	325	257	243
CO2	Carbon dioxide (ppm) :	844	1892	2181	1569	1220
N2	Nitrogen (ppm) :	92940	89057	84175	76511	89553
O2	Oxygen (ppm) :	39512	28642	26799	23317	28676
	Total (ppm) :	136561	125005	121626	111767	128711
	TDCG (ppm) :	3265	5414	8471	10370	9262
	SHL (%) :	3.91	4.04	4.03	4.01	4.00
	ETCG (% in blanket) :	1.10	6.26	9.62	12.98	9.20
Particles	5 to 15 um :	31140	32254	401109	1658400	129500
Particles	15 to 25 um :	139	324	1565	50200	6200
Particles	25 to 50 um :	23	82	448	10400	850
Particles	50 to 100 um :	2	4	37	1250	50
Particles	> 100 um :	0	0	0	0	0
D1533	Moisture (ppm) :	15	15	14	12	11
D1816	Dielectric BV (kV) :	32	31	36	31	34
D974	Acid Number (mg KOH/g) :	0.013	0.012	0.02	0.019	0.017
D971	Interfacial Tension (dynes/cm) :	38.2	38.4	32.8	34.3	37.9
D1500	Color Number :	<2.0	<2.0	<2.0	<1.5	<1.5

### Tapchanger Activity Signature Analysis Diagnostic Evaluation

TASA Assessment :	2 ID: 200175	1 ID: 200175	1 ID: 200175	1 ID: 200175	1 ID: 200175
Sampler:	Collin	Collin	Joseph	Collin	Collin
Cuff Counter:	111207	111207	Strickland Counter: 111209	Cuff Counter: 111205	Cuff Counter: 111204

Sampling Interval : Recommend retest within 150 days (5 months) for trending.  
 Operating Procedure : Monitor for increased heating. Evaluate range of LTC operation.  
 Comments : A slightly abnormal dissipation of energy is noted. This is an early indication of fault or wear activity. Heating is indicated.

Approved by: RWarmenhove  
 Rico Warmenhove  
 Lab Manager



H<sub>2</sub>b

ANALYTICAL SERVICES  
INCORPORATED

# Transformer Condition Assessment <sup>TM</sup>

Glenn Samms  
Newfoundland Power  
P.O. Box 8910  
55 Kenmount Road  
St. John's, NF A1B 3P6

Location : GANDER  
Bank & Phase : GAN-T2  
Serial Number : W 1010-1  
Manufacturer : FPE  
Date Mfgd : 1967  
Size (kVA) : 16000  
Rating kV: 138

Date : 01-06-2022  
Report Number : 5076455  
Fluid volume : 18184  
Fluid type : Mineral Oil  
Preservation : Conservator  
Cooling : ONAN  
Core & coil wt. : 42000  
Impedance :

	Sample Date :	12/14/2021	4/27/2021	11/27/2020	4/27/2020	11/7/2019
	Laboratory No. :	5076455	5073502	5072795	5070131	5069108
	Container No. :	49211	47993	44672	38732	41907
	Temperature :	22	34	20	26	18
H2	Hydrogen (ppm) :	21	33	28	30	26
CH4	Methane (ppm) :	9	4	3	2	6
C2H6	Ethane (ppm) :	0	1	1	1	0
C2H4	Ethylene (ppm) :	17	20	18	14	15
C2H2	Acetylene (ppm) :	43	51	59	57	56
CO	Carbon monoxide (ppm) :	220	209	303	197	227
CO2	Carbon dioxide (ppm) :	1527	1498	1734	1412	1455
N2	Nitrogen (ppm) :	87123	83402	93946	84956	89819
O2	Oxygen (ppm) :	35960	36342	38665	34816	29733
	Total (ppm) :	124920	121560	134757	121485	121337
	TDCG (ppm) :	310	318	412	301	330
	SHL (%) :	8.47	7.52	8.57	7.55	8.10
	ETCG (% in blanket) :	0.19	0.21	0.24	0.19	0.20
Particles	5 to 15 um :	2935	515181	15528	59300	107800
Particles	15 to 25 um :	86	2207	808	4800	7450
Particles	25 to 50 um :	13	453	260	1000	1300
Particles	50 to 100 um :	1	38	22	100	150
Particles	> 100 um :	0	3	1	0	0
D1533	Moisture (ppm) :	8	7	6	4	7
D1816	Dielectric BV (kV) :	33	36	33	36	35
D974	Acid Number (mg KOH/g) :	0.012	0.017	0.07	0.016	0.018
D971	Interfacial Tension (dynes/cm) :	38.7	35.7	26.2	36.7	34.6
D1500	Color Number :	1.5	<1.5	<2.5	<1.5	<1.5
D924	Power Factor :	0.020	0.016	1.620	0.004	0.028
D2668	Oxidation Inhibitor (%) :	0.060	0.063	<0.010	0.069	0.067
5 HMF	5 hydroxymethyl-2-furaldehyde (ppm) :	<0.010	<0.010	<0.010	<0.010	<0.010
2 FAL	2 furaldehyde (ppm) :	0.047	0.036	0.022	0.051	0.049
2 ACF	2 acetylfuran (ppm) :	<0.010	<0.010	<0.010	<0.010	<0.010
5 MEF	5 methyl-2-furaldehyde (ppm) :	<0.010	<0.010	<0.010	<0.010	<0.010
2 FOL	2 furfural (ppm) :	<0.010	<0.010	<0.010	<0.010	<0.010
	Estimated DP :	810	845	906	801	806

**Transformer Condition Assessment Diagnostic Evaluation**

TCA Assessment : 1 ID: 200175 1 ID: 200175 1 ID:200175 1 ID: 200175 1 ID: 200175  
 Sampler: Collin Cuff Sampler: Collin Cuff Sampler: Collin Cuff Sampler: Collin Cuff Sampler: Collin Cuff

Sampling Interval : Retest in six months.

Operating Procedure : Continue normal operation. Paper condition is normal.

Comments : Arcing is indicated.

Field Comments : Fluid condition is within acceptable in-service parameters.

Approved by: RWarmenhove

Rico Warmenhove  
Lab Manager



# Tapchanger Activity Signature Analysis TASA™

Glenn Samms  
Newfoundland Power  
P.O. Box 8910  
55 Kenmount Road  
St. John's, NF A1B 3P6

Location : GANDER  
Bank & Phase : GAN-T2  
Serial Number : W 1010-1-LTC  
Ventilation : Conservator  
Compartment : Transfer

Date : 03-31-2022  
Report Number : 5076823  
Purchase Order Number:  
Manufacturer : Reinhausen  
Model : D III 200

	Sample Date :	3/10/2022	9/29/2021	9/28/2021	9/22/2020	7/24/2019
	Laboratory No. :	5076823	5076467	5075466	5072077	5067477
	Container No. :	48014	49249	49249	43483	41911
	Temperature :	25	32	32	35	40
H2	Hydrogen (ppm) :	5673	588	3859	5804	7424
CH4	Methane (ppm) :	275	110	162	279	246
C2H6	Ethane (ppm) :	19	47	11	21	16
C2H4	Ethylene (ppm) :	435	1125	212	337	352
C2H2	Acetylene (ppm) :	2419	1305	942	1705	2075
CO	Carbon monoxide (ppm) :	371	90	228	325	257
CO2	Carbon dioxide (ppm) :	2055	844	1892	2181	1569
N2	Nitrogen (ppm) :	89116	92940	89057	84175	76511
O2	Oxygen (ppm) :	24828	39512	28642	26799	23317
	Total (ppm) :	125191	136561	125005	121626	111767
	TDCG (ppm) :	9192	3265	5414	8471	10370
	SHL (%) :	4.03	3.91	4.04	4.03	4.01
	ETCG (% in blanket) :	9.19	1.10	6.26	9.62	12.98
Particles	5 to 15 um :	26402	31140	32254	401109	1658400
Particles	15 to 25 um :	108	139	324	1565	50200
Particles	25 to 50 um :	10	23	82	448	10400
Particles	50 to 100 um :	3	2	4	37	1250
Particles	> 100 um :	0	0	0	0	0
D1533	Moisture (ppm) :	14	15	15	14	12
D1816	Dielectric BV (kV) :	29	32	31	36	31
D974	Acid Number (mg KOH/g) :	0.015	0.013	0.012	0.02	0.019
D971	Interfacial Tension (dynes/cm) :	38.1	38.2	38.4	32.8	34.3
D1500	Color Number :	<2.0	<2.0	<2.0	<2.0	<1.5

### Tapchanger Activity Signature Analysis Diagnostic Evaluation

TASA Assessment :	1 ID: 200175	2 ID: 200175	1 ID: 200175	1 ID: 200175	1 ID: 200175
	Sampler: Joseph	Sampler: Collin	Sampler: Collin	Sampler: Joseph	Sampler: Collin
	Strickland Counter:	Cuff Counter:	Cuff Counter:	Strickland Counter:	Cuff Counter:
	111203	111207	111207	111209	111205

Sampling Interval : Recommend retest in one year or after specified number of operations if sooner.  
 Operating Procedure : LTC is operating satisfactorily. No special actions are recommended.  
 Comments : No abnormal dissipation of energy is indicated.  
 Follow guidelines for oils with high flammable gas content.

Approved by: RWarmenhove  
 Rico Warmenhove  
 Lab Manager



H<sub>2</sub>b

ANALYTICAL SERVICES  
INCORPORATED

# Transformer Condition Assessment <sup>TM</sup>

Glenn Samms  
Newfoundland Power  
P.O. Box 8910  
55 Kenmount Road  
St. John's, NF A1B 3P6

Location : GANDER  
Bank & Phase : GAN-T2  
Serial Number : W 1010-1  
Manufacturer : FPE  
Date Mfgd : 1967  
Size (kVA) : 16000  
Rating kV : 138

Date : 07-05-2022  
Report Number : 5077348  
Fluid volume : 18184  
Fluid type : Mineral Oil  
Preservation : Conservator  
Cooling : ONAN  
Core & coil wt. : 42000  
Impedance :

	Sample Date :	6/6/2022	12/14/2021	4/27/2021	11/27/2020	4/27/2020
	Laboratory No. :	5077348	5076455	5073502	5072795	5070131
	Container No. :	51222	49211	47993	44672	38732
	Temperature :	30	22	34	20	26
H2	Hydrogen (ppm) :	43	21	33	28	30
CH4	Methane (ppm) :	7	9	4	3	2
C2H6	Ethane (ppm) :	1	0	1	1	1
C2H4	Ethylene (ppm) :	21	17	20	18	14
C2H2	Acetylene (ppm) :	66	43	51	59	57
CO	Carbon monoxide (ppm) :	327	220	209	303	197
CO2	Carbon dioxide (ppm) :	2174	1527	1498	1734	1412
N2	Nitrogen (ppm) :	90600	87123	83402	93946	84956
O2	Oxygen (ppm) :	10931	35960	36342	38665	34816
	Total (ppm) :	104170	124920	121560	134757	121485
	TDCG (ppm) :	465	310	318	412	301
	SHL (%) :	7.92	8.47	7.52	8.57	7.55
	ETCG (% in blanket) :	0.33	0.19	0.21	0.24	0.19
Particles	5 to 15 um :	4123	2935	515181	15528	59300
Particles	15 to 25 um :	804	86	2207	808	4800
Particles	25 to 50 um :	247	13	453	260	1000
Particles	50 to 100 um :	2	1	38	22	100
Particles	> 100 um :	0	0	3	1	0
D1533	Moisture (ppm) :	4	8	7	6	4
D1816	Dielectric BV (kV) :	36	33	36	33	36
D974	Acid Number (mg KOH/g) :	0.02	0.012	0.017	0.07	0.016
D971	Interfacial Tension (dynes/cm) :	34.5	38.7	35.7	26.2	36.7
D1500	Color Number :	<1.5	1.5	<1.5	<2.5	<1.5
D924	Power Factor :	0.011	0.020	0.016	1.620	0.004
D2668	Oxidation Inhibitor (%) :	0.066	0.060	0.063	<0.010	0.069
5 HMF	5 hydroxymethyl-2-furaldehyde (ppm) :	<0.010	<0.010	<0.010	<0.010	<0.010
2 FAL	2 furaldehyde (ppm) :	0.050	0.047	0.036	0.022	0.051
2 ACF	2 acetyl furan (ppm) :	<0.010	<0.010	<0.010	<0.010	<0.010
5 MEF	5 methyl-2-furaldehyde (ppm) :	<0.010	<0.010	<0.010	<0.010	<0.010
2 FOL	2 furfural (ppm) :	<0.010	<0.010	<0.010	<0.010	<0.010
	Estimated DP :	804	810	845	906	801

### Transformer Condition Assessment Diagnostic Evaluation

TCA Assessment : 3 ID: 200175 1 ID: 200175 1 ID: 200175 1 IID:200175 1 ID: 200175  
 Sampler: Collin Cuff Sampler: Collin Cuff Sampler: Collin Cuff Sampler: Collin Cuff Sampler: Collin Cuff

Sampling Interval : Retest in 30 days to confirm condition.

Operating Procedure : Monitor for increased arcing. Evaluate for worn or damaged components.

Comments : Arcing is indicated. Partial discharge is indicated. Paper condition is normal.

Field Comments : Fluid condition is within acceptable in-service parameters.



# Transformer Condition Assessment <sup>TM</sup>

Glenn Samms  
Newfoundland Power  
P.O. Box 8910  
55 Kenmount Road  
St. John's, NF A1B 3P6

Location : GANDER  
Bank & Phase : GAN-T2  
Serial Number : W 1010-1  
Manufacturer : FPE  
Date Mfgd : 1967  
Size (kVA) : 16000  
Rating kV : 138

Date : 07-05-2022  
Report Number : 5077348  
Fluid volume : 18184  
Fluid type : Mineral Oil  
Preservation : Conservator  
Cooling : ONAN  
Core & coil wt. : 42000  
Impedance :

TJ|H2b Analytical Services issues reports in a simplified manner; not all ASTM and ISO/IEC 17025 requirements are addressed in this report; however, all required information is retained and available upon request. TJ|H2b does not perform sampling services and provides results for tests performed on samples as received; it is recommended that samples are collected according to ASTM D923 or equivalent. TJ|H2b assumes no responsibility for the quality or condition of the samples it receives or for the accuracy of any information provided with those samples. Test reports shall not be reproduced, except in full, without prior written consent of TJ|H2b.

Approved by: RWarmenhove  
Rico Warmenhove  
Lab Manager



# Transformer Condition Assessment <sup>TM</sup>

Glenn Samms  
Newfoundland Power  
P.O. Box 8910  
55 Kenmount Road  
St. John's, NF A1B 3P6

Location : GANDER  
Bank & Phase : GAN-T2  
Serial Number : W 1010-1  
Manufacturer : FPE  
Date Mfgd : 1967  
Size (kVA) : 16000  
Rating kV : 138

Date : 08-12-2022  
Report Number : 5078054  
Fluid volume : 18184  
Fluid type : Mineral Oil  
Preservation : Conservator  
Cooling : ONAN  
Core & coil wt. : 42000  
Impedance :

	Sample Date :	7/6/2022	6/6/2022	12/14/2021	4/27/2021	11/27/2020
Laboratory No. :		5078054	5077348	5076455	5073502	5072795
Container No. :		51247	51222	49211	47993	44672
Temperature :		30	30	22	34	20
H2	Hydrogen (ppm) :	40	43	21	33	28
CH4	Methane (ppm) :	7	7	9	4	3
C2H6	Ethane (ppm) :	1	1	0	1	1
C2H4	Ethylene (ppm) :	21	21	17	20	18
C2H2	Acetylene (ppm) :	63	66	43	51	59
CO	Carbon monoxide (ppm) :	356	327	220	209	303
CO2	Carbon dioxide (ppm) :	2276	2174	1527	1498	1734
N2	Nitrogen (ppm) :	99001	90600	87123	83402	93946
O2	Oxygen (ppm) :	7986	10931	35960	36342	38665
	Total (ppm) :	109751	104170	124920	121560	134757
	TDCG (ppm) :	488	465	310	318	412
	SHL (%) :	8.25	7.92	8.47	7.52	8.57
	ETCG (% in blanket) :	0.32	0.33	0.19	0.21	0.24
Particles	5 to 15 um :	4183	4123	2935	515181	15528
Particles	15 to 25 um :	95	804	86	2207	808
Particles	25 to 50 um :	16	247	13	453	260
Particles	50 to 100 um :	2	2	1	38	22
Particles	> 100 um :	0	0	0	3	1
D1533	Moisture (ppm) :	21	4	8	7	6
D1816	Dielectric BV (kV) :	32	36	33	36	33
D974	Acid Number (mg KOH/g) :	<0.02	0.02	0.012	0.017	0.07
D971	Interfacial Tension (dynes/cm) :	37.1	34.5	38.7	35.7	26.2
D1500	Color Number :	1.5	<1.5	1.5	<1.5	<2.5
D924	Power Factor :	0.010	0.011	0.020	0.016	1.620
D2668	Oxidation Inhibitor (%) :	0.068	0.066	0.060	0.063	<0.010
5 HMF	5 hydroxymethyl-2-furaldehyde (ppm) :	<0.010	<0.010	<0.010	<0.010	<0.010
2 FAL	2 furaldehyde (ppm) :	0.051	0.050	0.047	0.036	0.022
2 ACF	2 acetylfuran (ppm) :	<0.010	<0.010	<0.010	<0.010	<0.010
5 MEF	5 methyl-2-furaldehyde (ppm) :	<0.010	<0.010	<0.010	<0.010	<0.010
2 FOL	2 furfural (ppm) :	<0.010	<0.010	<0.010	<0.010	<0.010
	Estimated DP :	801	804	810	845	906

### Transformer Condition Assessment Diagnostic Evaluation

TCA Assessment :      3 ID: 200175      3 ID: 200175      1 ID: 200175      1 ID: 200175      1 ID: 200175  
 Sampler: Collin Cuff      Sampler: Collin Cuff      Sampler: Collin Cuff      Sampler: Collin Cuff      Sampler: Collin Cuff

Sampling Interval : Retest in three months.

Operating Procedure : Monitor for increased arcing. Evaluate for worn or damaged components.

Comments : Arcing is indicated. Partial discharge is indicated. Paper condition is normal.

Field Comments : Fluid condition is within acceptable in-service parameters.



# Transformer Condition Assessment <sup>TM</sup>

Glenn Samms  
Newfoundland Power  
P.O. Box 8910  
55 Kenmount Road  
St. John's, NF A1B 3P6

Location : GANDER  
Bank & Phase : GAN-T2  
Serial Number : W 1010-1  
Manufacturer : FPE  
Date Mfgd : 1967  
Size (kVA) : 16000  
Rating kV : 138

Date : 08-12-2022  
Report Number : 5078054  
Fluid volume : 18184  
Fluid type : Mineral Oil  
Preservation : Conservator  
Cooling : ONAN  
Core & coil wt. : 42000  
Impedance :

TJ|H2b Analytical Services issues reports in a simplified manner; not all ASTM and ISO/IEC 17025 requirements are addressed in this report; however, all required information is retained and available upon request. TJ|H2b does not perform sampling services and provides results for tests performed on samples as received; it is recommended that samples are collected according to ASTM D923 or equivalent. TJ|H2b assumes no responsibility for the quality or condition of the samples it receives or for the accuracy of any information provided with those samples. Test reports shall not be reproduced, except in full, without prior written consent of TJ|H2b.

Approved by:

A handwritten signature in black ink that reads 'RWarmenhove'. The signature is written in a cursive style and is positioned above a horizontal line.

Rico Warmenhove  
Lab Manager





# Transformer Condition Assessment <sup>TM</sup>

Glenn Samms  
Newfoundland Power  
P.O. Box 8910  
55 Kenmount Road  
St. John's, NF A1B 3P6

Location : GANDER  
Bank & Phase : GAN-T2  
Serial Number : W 1010-1  
Manufacturer : FPE  
Date Mfgd : 1967  
Size (kVA) : 16000  
Rating kV : 138

Date : 09-23-2022  
Report Number : 5078632  
Fluid volume : 18184  
Fluid type : Mineral Oil  
Preservation : Conservator  
Cooling : ONAN  
Core & coil wt. : 42000  
Impedance :

			8/18/2022	7/6/2022	6/6/2022	12/14/2021	4/27/2021
	Sample Date :		8/18/2022	7/6/2022	6/6/2022	12/14/2021	4/27/2021
	Laboratory No. :		5078632	5078054	5077348	5076455	5073502
	Container No. :		52282	51247	51222	49211	47993
	Temperature :		40	30	30	22	34
H2	Hydrogen (ppm) :		55	40	43	21	33
CH4	Methane (ppm) :		5	7	7	9	4
C2H6	Ethane (ppm) :		1	1	1	0	1
C2H4	Ethylene (ppm) :		17	21	21	17	20
C2H2	Acetylene (ppm) :		56	63	66	43	51
CO	Carbon monoxide (ppm) :		257	356	327	220	209
CO2	Carbon dioxide (ppm) :		2006	2276	2174	1527	1498
N2	Nitrogen (ppm) :		72857	99001	90600	87123	83402
O2	Oxygen (ppm) :		31213	7986	10931	35960	36342
	Total (ppm) :		106467	109751	104170	124920	121560
	TDCG (ppm) :		391	488	465	310	318
	SHL (%) :		7.03	8.25	7.92	8.47	7.52
	ETCG (% in blanket) :		0.32	0.32	0.33	0.19	0.21
Particles	5 to 15 um :		2077	4183	4123	2935	515181
Particles	15 to 25 um :		62	95	804	86	2207
Particles	25 to 50 um :		46	16	247	13	453
Particles	50 to 100 um :		9	2	2	1	38
Particles	> 100 um :		0	0	0	0	3
D1533	Moisture (ppm) :		10	21	4	8	7
D1816	Dielectric BV (kV) :		19	32	36	33	36
D974	Acid Number (mg KOH/g) :		<0.02	<0.02	0.02	0.012	0.017
D971	Interfacial Tension (dynes/cm) :		35.0	37.1	34.5	38.7	35.7
D1500	Color Number :		1.5	1.5	<1.5	1.5	<1.5
D924	Power Factor :		0.016	0.010	0.011	0.020	0.016
D2668	Oxidation Inhibitor (%) :		0.052	0.068	0.066	0.060	0.063
5 HMF	5 hydroxymethyl-2-furaldehyde (ppm) :		<0.010	<0.010	<0.010	<0.010	<0.010
2 FAL	2 furaldehyde (ppm) :		0.051	0.051	0.050	0.047	0.036
2 ACF	2 acetylfuran (ppm) :		<0.010	<0.010	<0.010	<0.010	<0.010
5 MEF	5 methyl-2-furaldehyde (ppm) :		<0.010	<0.010	<0.010	<0.010	<0.010
2 FOL	2 furfural (ppm) :		<0.010	<0.010	<0.010	<0.010	<0.010
	Estimated DP :		800	801	804	810	845

### Transformer Condition Assessment Diagnostic Evaluation

TCA Assessment :      3 ID: 200175      3 ID: 200175      3 ID: 200175      1 ID: 200175      1 ID: 200175  
                                  Sampler: Collin Cuff      Sampler: Collin Cuff      Sampler: Collin Cuff      Sampler: Collin Cuff      Sampler: Collin Cuff

Sampling Interval : Retest in three months.

Operating Procedure : Monitor for increased arcing. Evaluate for worn or damaged components.

Comments : Arcing is indicated. Partial discharge is indicated. Paper condition is normal.

Field Comments : Fluid condition is within acceptable in-service parameters.



# Transformer Condition Assessment <sup>TM</sup>

Glenn Samms  
Newfoundland Power  
P.O. Box 8910  
55 Kenmount Road  
St. John's, NF A1B 3P6

Location : GANDER  
Bank & Phase : GAN-T2  
Serial Number : W 1010-1  
Manufacturer : FPE  
Date Mfgd : 1967  
Size (kVA) : 16000  
Rating kV : 138

Date : 09-23-2022  
Report Number : 5078632  
Fluid volume : 18184  
Fluid type : Mineral Oil  
Preservation : Conservator  
Cooling : ONAN  
Core & coil wt. : 42000  
Impedance :

TJ|H2b Analytical Services issues reports in a simplified manner; not all ASTM and ISO/IEC 17025 requirements are addressed in this report; however, all required information is retained and available upon request. TJ|H2b does not perform sampling services and provides results for tests performed on samples as received; it is recommended that samples are collected according to ASTM D923 or equivalent. TJ|H2b assumes no responsibility for the quality or condition of the samples it receives or for the accuracy of any information provided with those samples. Test reports shall not be reproduced, except in full, without prior written consent of TJ|H2b.

Approved by:

A handwritten signature in black ink that reads 'RWarmenhove'.

Rico Warmenhove  
Lab Manager



# Transformer Condition Assessment <sup>TM</sup>

Glenn Samms  
Newfoundland Power  
P.O. Box 8910  
55 Kenmount Road  
St. John's, NF A1B 3P6

Location : GANDER  
Bank & Phase : GAN-T2  
Serial Number : W 1010-1  
Manufacturer : FPE  
Date Mfgd : 1967  
Size (kVA) : 16000  
Rating kV : 138

Date : 10-31-2022  
Report Number : 5079080  
Fluid volume : 18184  
Fluid type : Mineral Oil  
Preservation : Conservator  
Cooling : ONAN  
Core & coil wt. : 42000  
Impedance :

	Sample Date :	9/15/2022	8/18/2022	7/6/2022	6/6/2022	12/14/2021
	Laboratory No. :	5079080	5078632	5078054	5077348	5076455
	Container No. :	52277	52282	51247	51222	49211
	Temperature :		40	30	30	22
H2	Hydrogen (ppm) :	58	55	40	43	21
CH4	Methane (ppm) :	8	5	7	7	9
C2H6	Ethane (ppm) :	2	1	1	1	0
C2H4	Ethylene (ppm) :	24	17	21	21	17
C2H2	Acetylene (ppm) :	52	56	63	66	43
CO	Carbon monoxide (ppm) :	453	257	356	327	220
CO2	Carbon dioxide (ppm) :	3074	2006	2276	2174	1527
N2	Nitrogen (ppm) :	83590	72857	99001	90600	87123
O2	Oxygen (ppm) :	11832	31213	7986	10931	35960
	Total (ppm) :	99093	106467	109751	104170	124920
	TDCG (ppm) :	597	391	488	465	310
	SHL (%) :	8.11	7.03	8.25	7.92	8.47
	ETCG (% in blanket) :	0.48	0.32	0.32	0.33	0.19
Particles	5 to 15 um :	26	2077	4183	4123	2935
Particles	15 to 25 um :	6	62	95	804	86
Particles	25 to 50 um :	18	46	16	247	13
Particles	50 to 100 um :	2	9	2	2	1
Particles	> 100 um :	0	0	0	0	0
D1533	Moisture (ppm) :	14	10	21	4	8
D1816	Dielectric BV (kV) :	19	19	32	36	33
D974	Acid Number (mg KOH/g) :	<0.02	<0.02	<0.02	0.02	0.012
D971	Interfacial Tension (dynes/cm) :	36.2	35.0	37.1	34.5	38.7
D1500	Color Number :	<1.5	1.5	1.5	<1.5	1.5
D924	Power Factor :	0.002	0.016	0.010	0.011	0.020
D2668	Oxidation Inhibitor (%) :	0.069	0.052	0.068	0.066	0.060
5 HMF	5 hydroxymethyl-2-furaldehyde (ppm) :	<0.010	<0.010	<0.010	<0.010	<0.010
2 FAL	2 furaldehyde (ppm) :	0.052	0.051	0.051	0.050	0.047
2 ACF	2 acetylfuran (ppm) :	<0.010	<0.010	<0.010	<0.010	<0.010
5 MEF	5 methyl-2-furaldehyde (ppm) :	<0.010	<0.010	<0.010	<0.010	<0.010
2 FOL	2 furfural (ppm) :	<0.010	<0.010	<0.010	<0.010	<0.010
	Estimated DP :	799	800	801	804	810

### Transformer Condition Assessment Diagnostic Evaluation

TCA Assessment :	3 ID: 200175	3 ID: 200175	3 ID: 200175	3 ID: 200175	1 ID: 200175
	Sampler: N/A	Sampler: Collin Cuff	Sampler: Collin Cuff	Sampler: Collin Cuff	Sampler: Collin Cuff

Sampling Interval : Retest in three months.

Operating Procedure : Monitor for increased arcing. Evaluate for worn or damaged components.

Comments : Arcing is indicated. Partial discharge is indicated. Paper condition is normal.

Field Comments : Fluid condition is within acceptable in-service parameters.



# Transformer Condition Assessment <sup>TM</sup>

Glenn Samms  
Newfoundland Power  
P.O. Box 8910  
55 Kenmount Road  
St. John's, NF A1B 3P6

Location : GANDER  
Bank & Phase : GAN-T2  
Serial Number : W 1010-1  
Manufacturer : FPE  
Date Mfgd : 1967  
Size (kVA) : 16000  
Rating kV : 138

Date : 10-31-2022  
Report Number : 5079080  
Fluid volume : 18184  
Fluid type : Mineral Oil  
Preservation : Conservator  
Cooling : ONAN  
Core & coil wt. : 42000  
Impedance :

TJ|H2b Analytical Services issues reports in a simplified manner; not all ASTM and ISO/IEC 17025 requirements are addressed in this report; however, all required information is retained and available upon request. TJ|H2b does not perform sampling services and provides results for tests performed on samples as received; it is recommended that samples are collected according to ASTM D923 or equivalent. TJ|H2b assumes no responsibility for the quality or condition of the samples it receives or for the accuracy of any information provided with those samples. Test reports shall not be reproduced, except in full, without prior written consent of TJ|H2b.

Approved by:

A handwritten signature in black ink that reads 'RWarmenhove'. The signature is written in a cursive style and is positioned above a horizontal line.

Rico Warmenhove  
Lab Manager



# Tapchanger Activity Signature Analysis TASA <sup>TM</sup>

Glenn Samms  
Newfoundland Power  
P.O. Box 8910  
55 Kenmount Road  
St. John's, NF A1B 3P6

Location : GANDER  
Bank & Phase : GAN-T2  
Serial Number : W 1010-1-LTC  
Ventilation : Conservator  
Compartment : Transfer

Date : 1/4/2023  
Report Number : 5079655  
Purchase Order Number:  
Manufacturer : Reinhausen  
Model : D III 200

	Sample Date :	12/9/2022	3/10/2022	9/29/2021	9/28/2021	9/22/2020
	Laboratory No. :	5079655	5076823	5076467	5075466	5072077
	Container No. :	53137	48014	49249	49249	43483
	Temperature :	30	25	32	32	35
H2	Hydrogen (ppm) :	4039	5673	588	3859	5804
CH4	Methane (ppm) :	318	275	110	162	279
C2H6	Ethane (ppm) :	34	19	47	11	21
C2H4	Ethylene (ppm) :	514	435	1125	212	337
C2H2	Acetylene (ppm) :	1851	2419	1305	942	1705
CO	Carbon monoxide (ppm) :	446	371	90	228	325
CO2	Carbon dioxide (ppm) :	3519	2055	844	1892	2181
N2	Nitrogen (ppm) :	77654	89116	92940	89057	84175
O2	Oxygen (ppm) :	19578	24828	39512	28642	26799
	Total (ppm) :	107953	125191	136561	125005	121626
	TDCG (ppm) :	7202	9192	3265	5414	8471
	SHL (%) :	4.08	4.03	3.91	4.04	4.03
	ETCG (% in blanket) :	7.89	9.19	1.10	6.26	9.62
Particles	5 to 15 um :	98446	26402	31140	32254	401109
Particles	15 to 25 um :	544	108	139	324	1565
Particles	25 to 50 um :	117	10	23	82	448
Particles	50 to 100 um :	6	3	2	4	37
Particles	> 100 um :	0	0	0	0	0
D1533	Moisture (ppm) :	18	14	15	15	14
D1816	Dielectric BV (kV) :	32	29	32	31	36
D974	Acid Number (mg KOH/g) :	<0.02	0.015	0.013	0.012	0.02
D971	Interfacial Tension (dynes/cm) :	32.5	38.1	38.2	38.4	32.8
D1500	Color Number :	<1.5	<2.0	<2.0	<2.0	<2.0

### Tapchanger Activity Signature Analysis Diagnostic Evaluation

TASA Assessment :	2 ID: 200175	1 ID: 200175	2 ID: 200175	1 ID: 200175	1 ID: 200175
	Sampler: Collin	Sampler: Joseph	Sampler: Collin	Sampler: Collin	Sampler: Joseph
	Cuff Counter: 414	Strickland Counter: 111203	Cuff Counter: 111207	Cuff Counter: 111207	Strickland Counter: 111209

Sampling Interval : Recommend retest within 150 days (5 months) for trending.  
 Operating Procedure : Monitor for the development of heating.  
 Comments : A slightly abnormal dissipation of energy is noted. This is an early indication of fault or wear activity.  
 Partial discharge is indicated.  
 Follow guidelines for oils with high flammable gas content.



# Tapchanger Activity Signature Analysis TASA

TM

Glenn Samms  
Newfoundland Power  
P.O. Box 8910  
55 Kenmount Road  
St. John's, NF A1B 3P6

Location : GANDER  
Bank & Phase : GAN-T2  
Serial Number : W 1010-1-LTC  
Ventilation : Conservator  
Compartment : Transfer

Date : 1/4/2023  
Report Number : 5079655  
Purchase Order Number:  
Manufacturer : Reinhausen  
Model : D III 200

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Approved by:

A handwritten signature in black ink that reads 'RWarmenhove'. The signature is written in a cursive style and is positioned above a horizontal line.

Rico Warmenhove  
Lab Manager



# Transformer Condition Assessment <sup>TM</sup>

Glenn Samms  
Newfoundland Power  
P.O. Box 8910  
55 Kenmount Road  
St. John's, NF A1B 3P6

Location : GANDER  
Bank & Phase : GAN-T2  
Serial Number : W 1010-1  
Manufacturer : FPE  
Date Mfgd : 1967  
Size (kVA) : 16000  
Rating kV : 138

Date : 01-05-2023  
Report Number : 5079654  
Fluid volume : 18184  
Fluid type : Mineral Oil  
Preservation : Conservator  
Cooling : ONAN  
Core & coil wt. : 42000  
Impedance :

			12/9/2022	9/15/2022	8/18/2022	7/6/2022	6/6/2022
	Sample Date :		12/9/2022	9/15/2022	8/18/2022	7/6/2022	6/6/2022
	Laboratory No. :		5079654	5079080	5078632	5078054	5077348
	Container No. :		53136	52277	52282	51247	51222
	Temperature :		30		40	30	30
H2	Hydrogen (ppm) :		43	58	55	40	43
CH4	Methane (ppm) :		9	8	5	7	7
C2H6	Ethane (ppm) :		2	2	1	1	1
C2H4	Ethylene (ppm) :		23	24	17	21	21
C2H2	Acetylene (ppm) :		48	52	56	63	66
CO	Carbon monoxide (ppm) :		399	453	257	356	327
CO2	Carbon dioxide (ppm) :		2792	3074	2006	2276	2174
N2	Nitrogen (ppm) :		86370	83590	72857	99001	90600
O2	Oxygen (ppm) :		24815	11832	31213	7986	10931
	Total (ppm) :		114501	99093	106467	109751	104170
	TDCG (ppm) :		524	597	391	488	465
	SHL (%) :		8.41	8.11	7.03	8.25	7.92
	ETCG (% in blanket) :		0.37	0.48	0.32	0.32	0.33
Particles	5 to 15 um :		2392	26	2077	4183	4123
Particles	15 to 25 um :		86	6	62	95	804
Particles	25 to 50 um :		71	18	46	16	247
Particles	50 to 100 um :		5	2	9	2	2
Particles	> 100 um :		1	0	0	0	0
D1533	Moisture (ppm) :		11	14	10	21	4
D1816	Dielectric BV (kV) :		40	19	19	32	36
D974	Acid Number (mg KOH/g) :		<0.02	<0.02	<0.02	<0.02	0.02
D971	Interfacial Tension (dynes/cm) :		32.5	36.2	35.0	37.1	34.5
D1500	Color Number :		<1.5	<1.5	1.5	1.5	<1.5
D924	Power Factor :		0.016	0.002	0.016	0.010	0.011
D2668	Oxidation Inhibitor (%) :		0.069	0.069	0.052	0.068	0.066
5 HMF	5 hydroxymethyl-2-furaldehyde (ppm) :		<0.010	<0.010	<0.010	<0.010	<0.010
2 FAL	2 furaldehyde (ppm) :		<0.010	0.052	0.051	0.051	0.050
2 ACF	2 acetylfuran (ppm) :		<0.010	<0.010	<0.010	<0.010	<0.010
5 MEF	5 methyl-2-furaldehyde (ppm) :		<0.010	<0.010	<0.010	<0.010	<0.010
2 FOL	2 furfural (ppm) :		0.060	<0.010	<0.010	<0.010	<0.010
	Estimated DP :		781	799	800	801	804

### Transformer Condition Assessment Diagnostic Evaluation

TCA Assessment :	3 ID: 200175	3 ID: 200175	3 ID: 200175	3 ID: 200175	3 ID: 200175
	Sampler: Collin Cuff	Sampler: N/A	Sampler: Collin Cuff	Sampler: Collin Cuff	Sampler: Collin Cuff

Sampling Interval : Retest in three months.

Operating Procedure : Monitor for increased arcing. Evaluate for worn or damaged components.

Comments : Arcing is indicated. Cellulose may be involved. Partial discharge is indicated. Paper condition is normal.

Field Comments : Fluid condition is within acceptable in-service parameters.



# Transformer Condition Assessment <sup>TM</sup>

Glenn Samms  
Newfoundland Power  
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55 Kenmount Road  
St. John's, NF A1B 3P6

Location : GANDER  
Bank & Phase : GAN-T2  
Serial Number : W 1010-1  
Manufacturer : FPE  
Date Mfgd : 1967  
Size (kVA) : 16000  
Rating kV : 138

Date : 01-05-2023  
Report Number : 5079654  
Fluid volume : 18184  
Fluid type : Mineral Oil  
Preservation : Conservator  
Cooling : ONAN  
Core & coil wt. : 42000  
Impedance :

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Approved by:

A handwritten signature in black ink that reads 'RWarmenhove'. The signature is written in a cursive style and is positioned above a horizontal line.

Rico Warmenhove  
Lab Manager





# Tapchanger Activity Signature Analysis TASA <sup>TM</sup>

Glenn Samms  
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P.O. Box 8910  
55 Kenmount Road  
St. John's, NF A1B 3P6

Location : GANDER  
Bank & Phase : GAN-T2  
Serial Number : W 1010-1-LTC  
Ventilation : Conservator  
Compartment : Transfer

Date : 06-19-2023  
Report Number : 5080149  
Purchase Order Number:  
Manufacturer : Reinhausen  
Model : D III 200

	Sample Date :	6/5/2023	12/9/2022	3/10/2022	9/29/2021	9/28/2021
Laboratory No. :	5080149	5079655	5076823	5076467	5075466	
Container No. :	53162	53137	48014	49249	49249	
Temperature :	32	30	25	32	32	
H2	Hydrogen (ppm) :	5870	4039	5673	588	3859
CH4	Methane (ppm) :	367	318	275	110	162
C2H6	Ethane (ppm) :	41	34	19	47	11
C2H4	Ethylene (ppm) :	717	514	435	1125	212
C2H2	Acetylene (ppm) :	2774	1851	2419	1305	942
CO	Carbon monoxide (ppm) :	346	446	371	90	228
CO2	Carbon dioxide (ppm) :	2905	3519	2055	844	1892
N2	Nitrogen (ppm) :	71190	77654	89116	92940	89057
O2	Oxygen (ppm) :	29823	19578	24828	39512	28642
	Total (ppm) :	114033	107953	125191	136561	125005
	TDCG (ppm) :	10115	7202	9192	3265	5414
	SHL (%) :	4.02	4.08	4.03	3.91	4.04
	ETCG (% in blanket) :	10.96	7.89	9.19	1.10	6.26
Particles	5 to 15 um :	194650	98446	26402	31140	32254
Particles	15 to 25 um :	1843	544	108	139	324
Particles	25 to 50 um :	206	117	10	23	82
Particles	50 to 100 um :	4	6	3	2	4
Particles	> 100 um :	0	0	0	0	0
D1533	Moisture (ppm) :	11	18	14	15	15
D1816	Dielectric BV (kV) :	29	32	29	32	31
D974	Acid Number (mg KOH/g) :	<0.02	<0.02	0.015	0.013	0.012
D971	Interfacial Tension (dynes/cm) :	29.4	32.5	38.1	38.2	38.4
D1500	Color Number :	1.5	<1.5	<2.0	<2.0	<2.0

### Tapchanger Activity Signature Analysis Diagnostic Evaluation

TASA Assessment :	1 ID: 200175	2 ID: 200175	1 ID: 200175	2 ID: 200175	1 ID: 200175
	Sampler: Collin	Sampler: Collin	Sampler: Joseph	Sampler: Collin	Sampler: Collin
	Cuff Counter: 643	Cuff Counter: 414	Strickland Counter: 111203	Cuff Counter: 111207	Cuff Counter: 111207

Sampling Interval : Recommend retest in one year or after specified number of operations if sooner.  
 Operating Procedure : LTC is operating satisfactorily. No special actions are recommended.  
 Comments : No abnormal dissipation of energy is indicated.  
 Follow guidelines for oils with high flammable gas content.



# Tapchanger Activity Signature Analysis TASA <sup>TM</sup>

Glenn Samms  
Newfoundland Power  
P.O. Box 8910  
55 Kenmount Road  
St. John's, NF A1B 3P6

Location : GANDER  
Bank & Phase : GAN-T2  
Serial Number : W 1010-1-LTC  
Ventilation : Conservator  
Compartment : Transfer

Date : 06-19-2023  
Report Number : 5080149  
Purchase Order Number:  
Manufacturer : Reinhausen  
Model : D III 200

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Approved by:

A handwritten signature in black ink, appearing to read 'MKutzleb', written over a horizontal line.

Michelle Kutzleb, PhD  
Director of Operations



# Transformer Condition Assessment <sup>TM</sup>

Glenn Samms  
Newfoundland Power  
P.O. Box 8910  
55 Kenmount Road  
St. John's, NF A1B 3P6

Location : GANDER  
Bank & Phase : GAN-T2  
Serial Number : W 1010-1  
Manufacturer : FPE  
Date Mfgd : 1967  
Size (kVA) : 16000  
Rating kV : 138

Date : 06-27-2023  
Report Number : 5080148  
Fluid volume : 18184  
Fluid type : Mineral Oil  
Preservation : Conservator  
Cooling : ONAN  
Core & coil wt. : 42000  
Impedance :

	Sample Date :	6/5/2023	12/9/2022	9/15/2022	8/18/2022	7/6/2022
Laboratory No. :		5080148	5079654	5079080	5078632	5078054
Container No. :		53161	53136	52277	52282	51247
Temperature :		30	30		40	30
H2	Hydrogen (ppm) :	56	43	58	55	40
CH4	Methane (ppm) :	6	9	8	5	7
C2H6	Ethane (ppm) :	1	2	2	1	1
C2H4	Ethylene (ppm) :	24	23	24	17	21
C2H2	Acetylene (ppm) :	53	48	52	56	63
CO	Carbon monoxide (ppm) :	302	399	453	257	356
CO2	Carbon dioxide (ppm) :	2439	2792	3074	2006	2276
N2	Nitrogen (ppm) :	76461	86370	83590	72857	99001
O2	Oxygen (ppm) :	31745	24815	11832	31213	7986
	Total (ppm) :	111087	114501	99093	106467	109751
	TDCG (ppm) :	442	524	597	391	488
	SHL (%) :	7.32	8.41	8.11	7.03	8.25
	ETCG (% in blanket) :	0.34	0.37	0.48	0.32	0.32
Particles	5 to 15 um :	2401	2392	26	2077	4183
Particles	15 to 25 um :	40	86	6	62	95
Particles	25 to 50 um :	3	71	18	46	16
Particles	50 to 100 um :	3	5	2	9	2
Particles	> 100 um :	0	1	0	0	0
D1533	Moisture (ppm) :	3	11	14	10	21
D1816	Dielectric BV (kV) :	39	40	19	19	32
D974	Acid Number (mg KOH/g) :	<0.02	<0.02	<0.02	<0.02	<0.02
D971	Interfacial Tension (dynes/cm) :	35.3	32.5	36.2	35.0	37.1
D1500	Color Number :	1.5	<1.5	<1.5	1.5	1.5
D924	Power Factor :	0.003	0.016	0.002	0.016	0.010
D2668	Oxidation Inhibitor (%) :	0.060	0.069	0.069	0.052	0.068
5 HMF	5 hydroxymethyl-2-furaldehyde (ppm) :	<0.010	<0.010	<0.010	<0.010	<0.010
2 FAL	2 furaldehyde (ppm) :	0.050	<0.010	0.052	0.051	0.051
2 ACF	2 acetylfuran (ppm) :	<0.010	<0.010	<0.010	<0.010	<0.010
5 MEF	5 methyl-2-furaldehyde (ppm) :	<0.010	<0.010	<0.010	<0.010	<0.010
2 FOL	2 furfural (ppm) :	<0.010	0.060	<0.010	<0.010	<0.010
	Estimated DP :	803	781	799	800	801

### Transformer Condition Assessment Diagnostic Evaluation

TCA Assessment :	3 ID: 200175	3 ID: 200175	3 ID: 200175	3 ID: 200175	3 ID: 200175
	Sampler: Collin Cuff	Sampler: Collin Cuff	Sampler: N/A	Sampler: Collin Cuff	Sampler: Collin Cuff

Sampling Interval : Retest in three months.

Operating Procedure : Monitor for increased arcing. Evaluate for worn or damaged components.

Comments : Arcing is indicated. Cellulose may be involved. Partial discharge is indicated. Paper condition is normal.

Field Comments : Fluid condition is within acceptable in-service parameters.



# Transformer Condition Assessment <sup>TM</sup>

Glenn Samms  
Newfoundland Power  
P.O. Box 8910  
55 Kenmount Road  
St. John's, NF A1B 3P6

Location : GANDER  
Bank & Phase : GAN-T2  
Serial Number : W 1010-1  
Manufacturer : FPE  
Date Mfgd : 1967  
Size (kVA) : 16000  
Rating kV : 138

Date : 06-27-2023  
Report Number : 5080148  
Fluid volume : 18184  
Fluid type : Mineral Oil  
Preservation : Conservator  
Cooling : ONAN  
Core & coil wt. : 42000  
Impedance :

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Michelle Kutzleb, PhD  
Director of Operations