

October 17, 2014

The Board of Commissioners of Public Utilities
Prince Charles Building
120 Torbay Road, P.O. Box 21040
St. John's, Newfoundland & Labrador
A1A 5B2

Attention: Ms. Cheryl Blundon
Director Corporate Services & Board Secretary

Dear Ms. Blundon:

**Re: The Board's Investigation and Hearing into Supply Issues and Power Outages
on the Island Interconnection System – Sunnyside Equipment Replacement Project and
Western Avalon Terminal Station T5 Tap Changer Replacement**

In reference to the Board's letter of October 15, 2014 relating to the above-noted matter, and further to Hydro's letter of the same date related thereto, please find enclosed the following in response to the requests outlined in paragraphs 1 and 2 of the Board's letter:

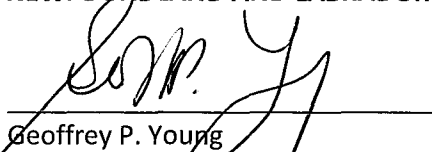
Attachment 1 - A technical report of the results of the factory acceptance tests performed by ABB on October 11, 2014 on the replacement T1 transformer for the Sunnyside terminal station; and

Attachment 2 - Copies of three field acceptance test reports performed on the Western Avalon T5 transformer: (i) Oil Diagnostics Report; (ii) results of DOBLE tests performed by Hydro; (iii) results of DOBLE and other tests performed by Pennecon Energy Technical Services; and (iv) email from Doble Engineering as to the test results – October 15, 2014.

If you have any questions or comments, please contact the undersigned.

Yours truly,

NEWFOUNDLAND AND LABRADOR HYDRO



Geoffrey P. Young
Senior Legal Counsel

GPY/jc

cc: Gerard Hayes – Newfoundland Power
Paul Coxworthy – Stewart McKelvey Stirling Scales
Sheryl Nisenbaum – Praxair Canada Inc.
ecc: Roberta Frampton Benefiel – Grand Riverkeeper Labrador

Thomas Johnson – Consumer Advocate
Thomas O' Reilly – Cox & Palmer
Danny Dumaresque

REPORT 2

Client	N&L Hydro
Equipment	75/100/125 MVA AUTO-TRANSFORMER
Manufacturer	ABB, South Boston
Transformer Number	CN 00053
Date Inspected	October 11, 2014
Date Submitted	October 14, 2014
Inspected By	I. Dmitriev
Submitted By	R. Rowe

FINAL TEST SUMMARY

All power tests done at 60 Hz

CORE LOSS

KW & Iex A%	90%	95%	100%	105%	110%	115%
Before insulation	20.25/.04	0	27.58	0	45.45/.75	0
After insulation		0		0	0	0
Guaranty			28			

LOAD LOSS

MVA	TAP/RA	% IZ	Loss (KW)	@ 85C	Guaranty
	1	0.00	0.00		
75	4	0.00	0.00		
	5	5.53	79.86		84.50
	1	0.00	0.00		
125	4	0.00	0.00	0.00	0.00
	5	0.00	0.00		

TEMPERATURE RISE

75 MVA ONAN RA 17 Total Losses 110.16 KW

	H1-H0	H2-H0	H3-H0	X1-X2	X2-X3	X3-X1
Gradient	0	6.4	0	0	0	0
Avg Oil Rise	0	36.7	0	0	0	0
Avg Wdg Rise	0	43.1	0	0	0	0

100 MVA ONAF RA 5 Total Losses 0 KW

Gradient	0.0					
Avg Oil Rise	0.0					
Avg Wdg Rise	0.0					

125 MAV RA 17 236.15 KW

Gradient		10.7	0.0			0.0
Avg Oil Rise		33.3	0.0			0.0
Avg Wdg Rise		44.0	0.0			0

Infrared Scan: Hottest Temp - NA around the LV Bushings

INSULATION TESTS**IMPULSE TEST**

	LIL		WAVE SHAPE	APPLIED	TAP/RA
	FW	CHOP	microseconds		
HV	950	0	1.2 x 51.4	RFW, FW, CW, CW, FW	5
LV	550	0	1.4 x 52	RFW, FW, CW, CW, FW	1
TV	110	na			
X0	na	na			
H0	110	na	1.7 x 41	RFW, FW, FW	5

SWITCHING SURGE

	LIL	WAVE SHAPE microseconds			APPLIED	TAP/RA
		FRONT	90%-90%	TAIL		
HV	0					

HIPOT

	KV
HV-LV&Grd for 1 minute	34
LV-HV&Grd for 1 minute	34

INDUCE

Three Phase, Feed LV, 200 Hz, RA 1		
1.7 x Normal for: seconds	36	0
1.5 x Normal for: hour	1	0

Time: min	H1		H2		H3	
	pc	uv	pc	uv	pc	uv
1.7 x N	25000	6800	145000	23000	34400	7100
1.5 x N	25000	6800	145000	23000	34400	7100
5	25000	6800	145000	23000	34400	7100
10	25000	6800	145000	23000	34400	7100
15	25000	6800	145000	23000	34400	7100
20	25000	6800	145000	23000	34400	7100
25	25000	6800	145000	23000	34400	7100
30						
35						
40						
45						
50						
55						
60						

ADDITIONAL ITEMS

ONAF heat run was checked to insure the gradients were the same as original.
All phase were acceptable.

Unit passed impulse.

The transformer failed induce test in a similar manner as the first failure.

At 70% voltage the readings of uV and pC were extremely high.

At 70% voltage the readings of 269000 pC were measured on the core clamps.

ABB is investigating.

Oil Diagnostics Report



Jason Brown
CG Power Services
101 Rockman Street
Winnipeg, MB R3T 0L7

STARK International Inc.
 113 Archimedes Street
 New Glasgow, Nova Scotia
 B2H 2T3

10-Oct-14

Toll Free: 1-877-875-2775 Fax: (902) 755-2949

Unit ID	T5	Power Rating (MVA)	125.0
Serial Number	63002244	Voltage	230 kV
Location	Chapel Arm	Fluid Volume	55043 L
Manufacturer	Federal Pioneer	Fluid Type	Mineral Oil
Year of Manufacture	1989	Preservation	Conservator
Sample Date	3-Oct-14		
Laboratory No.	M269797A		
Container No.			
Temperature (°C)	50		
H ₂ Hydrogen (ppm)	<10		
CH ₄ Methane (ppm)	<5		
C ₂ H ₆ Ethane (ppm)	<2		
C ₂ H ₄ Ethylene (ppm)	<2		
C ₂ H ₂ Acetylene (ppm)	<2		
CO Carbon monoxide (ppm)	<5		
CO ₂ Carbon dioxide (ppm)	26		
N ₂ Nitrogen (ppm)	5320		
O ₂ Oxygen (ppm)	2470		
Total Gas (ppm)	7816		
Total Combustible Gas (ppm)	0		
D1533 Moisture (ppm)	2		
D971 Interfacial Tension (dynes/cm)	33.8		
D974 Acid Number (mg KOH/g)	0.01		
D1500 Color Number	1.5		
D1524 Visual Examination	Clear		
D877 Dielectric BV (kV)			
D1816 Dielectric BV (kV)	54 (2 mm)		
D924 Power Factor (% at 25 °C)	0.187		
D924 Power Factor (% at 100 °C)	3.71		
D2668 Oxidation Inhibitor (%)			
D1298 Specific Gravity	0.8651		
D88 Viscosity (SUS)			
D97 Pour Point (°C)			
D92 Flash Point (°C)			
D92 Fire Point (°C)			
D1807 Refractive Index			
D1275 Corrosive Sulfur			
PCB Content (ppm)			
Degree of Polymerization			
Estimated % Life Remaining			
Interpretation:	<i>Power factor (0.187% at 25 °C and 3.71 at 100 °C) are questionable. All other oil quality properties and dissolved gas levels are within acceptable limits.</i>		
Recommendation:	<i>Continue sampling on an annual basis.</i>		

Attachment 2 (ii), Page 1 of 4

Nameplate - Autotransformer with Tertiary

Company	Newfoundland & Labrador Hydro	Serial Number	61-00-69167
Location	WAV	Special ID	
Division	P&C EAST	Circuit Designation	T5
Manufacturer	FP	Configuration	Y-Y-D
Yr. Manufactured	1989	Tank Type	OPEN-CONSER
Mfr. Location		Oil Volume	54716 L
Phases	3	BIL	95 kV
Weight	130780 kg	Coolant	OIL
kV	230, 138,	VA Rating	75, 100, 125, MVA
Note			

Test Date	10/14/2014	Test Time	2:11:31 PM	Weather	NIGHT
Air Temperature	9 °C	Tank Temp.	°C	RH.	100 %
Tested by		Work Order #		Last Test Date	8/20/1996
Checked by		Test Set Type	M4K	Retest Date	
Checked Date		Set Top S/N		Reason	
Last Sheet #	1	Set Bottom S/N			

Arrester Nameplate

Loc	Serial	Mfr	Overall Catalog	Unit Catalog	Type	Rated kV	Order
H1-T	D6418	COB	219652	215920-3008	VN	70	
H1-B	D6419	COB	219652	215920-3013	VN	82	
H2-T	D6420	COB	219652	215920-3008	VN	70	
H2-B	D6417	COB	219652	215920-3013	VN	82	
H3-T	D6424	COB	219652	215920-3008	VN	70	
H3-B	D6425	COB	219652	215920-3013	VN	82	
X1-T	D4666	COB	219598	215920-3001	VN	42	
X1-B	D4667	COB	219598	215920-3005	VN	56	
X2-T	D4668	COB	219598	215920-3001	VN	42	
X2-B	D4669	COB	219598	215920-3005	VN	56	
X3-T	D4670	COB	219598	215920-3001	VN	42	
X3-B	D4671	COB	219598	215920-3005	VN	56	

Bushing Nameplate

Dsg	Serial	Mfr	Type	C1 % PF	C1 Cap	C2 % PF	C2 Cap	kV	Amps	Year
H1	273414		OTHER	0.33	383	1	697	300	600	
H2	273415		OTHER	0.26	382	1	712	300	600	
H3	273416		OTHER	0.26	379	1	616	300	600	
N	272556			0.23	532	1	100	15	400	

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X1	272494		OTHER	0.26	350	1	623	138	600	
X2	272516			0.33	350	1	609	145	600	
X3	272495			0.23	356	1	576	145	600	

Overall Tests

Meas.	Test kV	mA	Watts	%PF corr	Corr Fctr	Cap(pF)	IR _{auto}	IR _{man}
CH + CHT	10.006	38.564	1.293		1.00	10229.5		
CH	10.004	21.876	0.6280	0.29	1.00	5802.7	G	
CHT(UST)	10.004	16.687	0.6580	0.39	1.00	4426.3	G	
CHT		16.688	0.665	0.40	1.00	4426.800	G	
CT + CHT	2.000	55.191	2.434		1.00	14639.7		
CT	2.000	38.494	1.678	0.44	1.00	10210.6	G	
CHT(UST)	2.000	16.698	0.6730	0.40	1.00	4429.3	G	
CHT		16.697	0.756	0.45	1.00	4429.100	I	
IWC:	mA: 38.564/38.564 , 1/1		watts: 1.293/1.293 , 1/1		pF: 10229.5/10229.45 , 1/1			
IWC:	mA: 21.876/21.876 , 1/1		watts: 0.6280/0.628 , 1/1		pF: 5802.7/5802.736 , 1/1			
IWC:	mA: 16.687/16.687 , 1/1		watts: 0.6580/0.658 , 1/1		pF: 4426.3/4426.291 , 1/1			
IWC:	mA: 55.191/55.191 , 1/1		watts: 2.434/2.434 , 1/1		pF: 14639.7/14639.67 , 1/1			
IWC:	mA: 38.494/38.494 , 1/1		watts: 1.678/1.678 , 1/1		pF: 10210.6/10210.62 , 1/1			
IWC:	mA: 16.698/16.698 , 1/1		watts: 0.6730/0.673 , 1/1		pF: 4429.3/4429.323 , 1/1			

Bushing C1

ID	Serial	NP %PF	NP Cap	Test kV	mA	Watts	%PF corr	Corr Fctr	Cap(pF)	IR _{auto}	IR _{man}
H1	273414	0.33	383	10.006	1.419	0.0400	0.28	1.00	376.38	G	
H2	273415	0.26	382	10.006	1.425	0.0320	0.22	1.00	378.00	G	
H3	273416	0.26	379	10.006	1.478	0.0350	0.24	1.00	391.96	G	
X1	272494	0.26	350	10.005	1.300	0.0290	0.22	1.00	344.71	G	
X2	272516	0.33	350	10.010	1.302	0.0410	0.31	1.00	345.42	G	
X3	272495	0.23	356	10.006	1.320	0.0350	0.27	1.00	350.21	G	
N	272556	0.23	532	10.007	1.975	0.0410	0.21	1.00	523.94	G	
IWC:	mA: 1.419/1.419 , 1/1			watts: 0.0400/0.04 , 1/1			pF: 376.38/376.379 , 1/1				
IWC:	mA: 1.425/1.425 , 1/1			watts: 0.0320/0.032 , 1/1			pF: 378.00/378.002 , 1/1				
IWC:	mA: 1.478/1.478 , 1/1			watts: 0.0350/0.035 , 1/1			pF: 391.96/391.963 , 1/1				
IWC:	mA: 1.300/1.3 , 1/1			watts: 0.0290/0.029 , 1/1			pF: 344.71/344.707 , 1/1				
IWC:	mA: 1.302/1.302 , 1/1			watts: 0.0410/0.041 , 1/1			pF: 345.42/345.416 , 1/1				
IWC:	mA: 1.320/1.32 , 1/1			watts: 0.0350/0.035 , 1/1			pF: 350.21/350.214 , 1/1				
IWC:	mA: 1.975/1.975 , 1/1			watts: 0.0410/0.041 , 1/1			pF: 523.94/523.94 , 1/1				

Bushing C2

ID	Serial	NP %PF	NP Cap	Test kV	mA	Watts	%PF corr	Corr Fctr	Cap(pF)	IR _{auto}	IR _{man}

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H1	273414	1	697	2.000	2.838	0.1480	0.52	1.00	752.74	D	
H2	273415	1	712	2.001	2.853	0.1320	0.46	1.00	756.83	G	
H3	273416	1	616	2.001	2.514	0.1230	0.49	1.00	666.78	D	
X1	272494	1	623	2.000	2.500	0.1310	0.52	1.00	663.09	G	
X2	272516	1	609	2.000	2.517	0.0770	0.31	1.00	667.67	G	
X3	272495	1	576	2.000	2.278	0.0880	0.39	1.00	604.28	G	
IWC:	mA: 2.838/2.838 , 1/1			watts: 0.1480/0.148 , 1/1			pF: 752.74/752.744 , 1/1				
IWC:	mA: 2.853/2.853 , 1/1			watts: 0.1320/0.132 , 1/1			pF: 756.83/756.825 , 1/1				
IWC:	mA: 2.514/2.514 , 1/1			watts: 0.1230/0.123 , 1/1			pF: 666.78/666.779 , 1/1				
IWC:	mA: 2.500/2.5 , 1/1			watts: 0.1310/0.131 , 1/1			pF: 663.09/663.086 , 1/1				
IWC:	mA: 2.517/2.517 , 1/1			watts: 0.0770/0.077 , 1/1			pF: 667.67/667.671 , 1/1				
IWC:	mA: 2.278/2.278 , 1/1			watts: 0.0880/0.088 , 1/1			pF: 604.28/604.284 , 1/1				

Surge Arrester Tests

Location	Test Mode	Test kV	mA	Watts	IR _{auto}	IR _{man}					
H1-T	UST RB	10.022	0.1700	0.0900	G						
H1-B	GAR RB	10.016	0.2340	0.1260	G						
H2-T	UST RB	10.017	0.1700	0.0810	G						
H2-B	GAR RB	10.016	0.2230	0.1210	G						
H3-T	UST RB	10.008	0.1690	0.0690	G						
H3-B	GAR RB	10.024	0.2290	0.1170	G						
X1-T	UST RB	10.014	0.2720	0.1320	G						
X1-B	GAR RB	10.023	0.2920	0.1400	G						
X2-T	UST RB	10.007	0.2720	0.1220	G						
X2-B	GAR RB	10.027	0.2890	0.1480	G						
X3-T	UST RB	10.008	0.2710	0.1300	G						
X3-B	GAR RB	10.023	0.2890	0.1390	G						
IWC:	mA: 0.1700/0.17 , 1/1			watts: 0.0900/0.09 , 1/1			pF: 45.160/45.16 , 1/1				
IWC:	mA: 0.2340/0.234 , 1/1			watts: 0.1260/0.126 , 1/1			pF: 59.035/59.035 , 1/1				
IWC:	mA: 0.1700/0.17 , 1/1			watts: 0.0810/0.081 , 1/1			pF: 45.068/45.068 , 1/1				
IWC:	mA: 0.2230/0.223 , 1/1			watts: 0.1210/0.121 , 1/1			pF: 58.967/58.967 , 1/1				
IWC:	mA: 0.1690/0.169 , 1/1			watts: 0.0690/0.069 , 1/1			pF: 44.808/44.808 , 1/1				
IWC:	mA: 0.2290/0.229 , 1/1			watts: 0.1170/0.117 , 1/1			pF: 60.555/60.555 , 1/1				
IWC:	mA: 0.2720/0.272 , 1/1			watts: 0.1320/0.132 , 1/1			pF: 71.969/71.969 , 1/1				
IWC:	mA: 0.2920/0.292 , 1/1			watts: 0.1400/0.14 , 1/1			pF: 77.291/77.291 , 1/1				
IWC:	mA: 0.2720/0.272 , 1/1			watts: 0.1220/0.122 , 1/1			pF: 71.952/71.952 , 1/1				
IWC:	mA: 0.2890/0.289 , 1/1			watts: 0.1480/0.148 , 1/1			pF: 76.467/76.467 , 1/1				
IWC:	mA: 0.2710/0.271 , 1/1			watts: 0.1300/0.13 , 1/1			pF: 71.715/71.715 , 1/1				
IWC:	mA: 0.2890/0.289 , 1/1			watts: 0.1390/0.139 , 1/1			pF: 76.475/76.475 , 1/1				

Exciting Current Tests

	Mfr.	Type	Steps	Boost %	Buck %	Position Found	Position Left	Oil Volume

Attachment 2 (ii), Page 4 of 4

De-Energized Tap Changer													
On-Load Tap Changer	Rein		17										

			H1 - H0			H2 - H0			H3 - H0				
DETC	LTC	Test kV	mA	Watts	X	mA	Watts	X	mA	Watts	X	IR _{auto}	IR _{man}
	1	10.074	17.793	158.06	L	13.020	126.41	L	20.950	186.69	L	I	
	9	10.064	21.462	188.78	L	16.096	150.97	L	24.979	218.46	L	I	
	17	10.093	26.687	228.91	L	20.856	183.69	L	29.981	261.58	L	I	
IWC:	mA: 17.793/17.793 , 1/1			watts: 158.06/158.056 , 1/1			pF: -2167.54/-2167.539 , 1/1						
IWC:	mA: 13.020/13.02 , 1/1			watts: 126.41/126.405 , 1/1			pF: -828.45/-828.453 , 1/1						
IWC:	mA: 20.950/20.95 , 1/1			watts: 186.69/186.69 , 1/1			pF: -2519.91/-2519.911 , 1/1						
IWC:	mA: 21.462/21.462 , 1/1			watts: 188.78/188.78 , 1/1			pF: -2708.82/-2708.823 , 1/1						
IWC:	mA: 16.096/16.096 , 1/1			watts: 150.97/150.969 , 1/1			pF: -1480.89/-1480.892 , 1/1						
IWC:	mA: 24.979/24.979 , 1/1			watts: 218.46/218.461 , 1/1			pF: -3211.81/-3211.808 , 1/1						
IWC:	mA: 26.687/26.687 , 1/1			watts: 228.91/228.912 , 1/1			pF: -3643.20/-3643.202 , 1/1						
IWC:	mA: 20.856/20.856 , 1/1			watts: 183.69/183.694 , 1/1			pF: -2618.74/-2618.741 , 1/1						
IWC:	mA: 29.981/29.981 , 1/1			watts: 261.58/261.576 , 1/1			pF: -3882.45/-3882.453 , 1/1						



Service Report

Ted Hudson
CG Global

October 15, 2014

**Our Reference: Testing of Transformer T5
Newfoundland Hydro Western Avalon Substation
Work Order WTSA005592**

Dear Sir,

The following report is provided on completion of testing the above transformer on your behalf. The testing was carried out after completion of repairs and modifications by CG Global that included the installation of a new Online Tap Changer. Our tests included:

1. Doble Testing including Overall Test, Bushing C1 and C2 Tests, Oil PF Test, Surge Arrestor Tests and Exciting Current Tests. The Doble test results have been submitted to Doble Engineering by the end user for official analysis. Initial onsite analysis indicates all tests are good.
2. DC Insulation Resistance Testing including windings and core ground. These test results are normal.
3. Turns Ratio Test on all taps; these test results are normal.
4. Winding Resistance Tests on all taps; these test results are normal

The test sheets for the above tests are enclosed in the order listed above; in addition we have "signed off" the appropriate sections of the Newfoundland Hydro work scope and have included them in our report.

We thank you for the opportunity to be of service and look forward to serving you in the future. Please do not hesitate to contact us should you have any questions regarding this or any other subject.

J. Clement Chisholm

Pennecon Energy Technical Services.
902 476 8467

61-00-69167_AT


Report Source AutotransformerWithTertiary

Session Test Date 10/14/2014 2:11:31 PM

Nameplate - Autotransformer with Tertiary

Company	Newfoundland & Labrador Hydro	Serial Number	61-00-69167
Location	WAV	Special ID	
Division	P&C EAST	Circuit Designation	T5
Manufacturer	Federal Pioneer	Configuration	Y_Y_D
Year Manufactured	1989	Tank Type	Open Conservation
Mfr Location		Coolant	Oil
Phases	Three	Class	ONAF
Oil Volume	54716.000 L	BIL	95 kV
Weight	130780.000 KG		
kV	230, 138	VA Rating	75, 100, 125, *, MVA

Test Date	10/14/2014	Test Time:	2:11 PM	Weather	Night
Air Temperature	9°C	Apparatus Temperature	*	Humidity	100 %
Tester	D.J. Wall / Jamie Sheppard	Work Order	WTSA005592	Date Last Tested	8/20/1996
Verified		Test Set Type	M4000	Date Retested	10/14/2014
Verification Date		Set Top Serial #		Reason	RETEST
Last Sheet #	1	Set Bottom Serial #		Travel Time	
Purchase Order		Ins. Book #		Duration	
Copies		Sheet #		Crew Size	2

[Header]

Arrester Nameplate

Location	Serial #	Manufacturer	Overall Catalog	Unit Catalog	Type	Rated kV	Order
H1-T	D6418	Canadian Ohio Brass	219652	215920-3008	VN	70	
H1-B	D6419	Canadian Ohio Brass	219652	215920-3013	VN	82	
H2-T	D6420	Canadian Ohio Brass	219652	215920-3008	VN	70	
H2-B	D6417	Canadian Ohio Brass	219652	215920-3013	VN	82	
H3-T	D6424	Canadian Ohio Brass	219652	215920-3008	VN	70	
H3-B	D6425	Canadian Ohio Brass	219652	215920-3013	VN	82	
X1-T	D4666	Canadian Ohio Brass	219598	215920-3001	VN	42	
X1-B	D4667	Canadian Ohio Brass	219598	215920-3005	VN	56	
X2-T	D4668	Canadian Ohio Brass	219598	215920-3001	VN	42	
X2-B	D4669	Canadian Ohio Brass	219598	215920-3005	VN	56	
X3-T	D4670	Canadian Ohio Brass	219598	215920-3001	VN	42	
X3-B	D4671	Canadian Ohio Brass	219598	215920-3005	VN	56	

Bushing Nameplate

Designation	Serial #	Manufacturer	Type	C1 %PF	C1 Cap	C2 %PF	C2 Cap	Rated kV	Amps
H1	273414		OTHER	0.33	383	1	697	300	600
H2	273415		OTHER	0.26	382	1	712	300	600
H3	273416		OTHER	0.26	379	1	616	300	600
N	272556			0.23	532	1	100	15	400
X1	272494		OTHER	0.26	350	1	623	138	600
X2	272516			0.33	350	1	609	145	600
X3	272495			0.23	356	1	576	145	600

[Header]

Bushing Additional Details - - H1

Designation	H1	Voltage	High	Serial #	273414
Catalog #		Amps	600 A	BIL *	Tap N
Class		Year		Drawing	
Style		Other		S.O. Number	
Physical Dimensions					
Creep Distance *		Overall Length *		Inner Seal Dia. *	Eff. Gnd Sleeve *
Total Weight *		Recess Depth *		Outer Seal Dia. *	Slot Size *
Units					
Flange Dimensions					
To Bottom *		# Bolts *		Max. Diameters	Draw Lead
To Top *		Bolt Size *		Below Flange *	Tube ID *
		Circle Diameter *		Above Flange *	To Pin *

Bushing Additional Details - - H2

Designation	H2	Voltage	High	Serial #	273415
Catalog #		Amps	600 A	BIL *	Tap N
Class		Year		Drawing	
Style		Other		S.O. Number	
Physical Dimensions					
Creep Distance *		Overall Length *		Inner Seal Dia. *	Eff. Gnd Sleeve *
Total Weight *		Recess Depth *		Outer Seal Dia. *	Slot Size *
Units					
Flange Dimensions					
To Bottom *		# Bolts *		Max. Diameters	Draw Lead
To Top *		Bolt Size *		Below Flange *	Tube ID *
		Circle Diameter *		Above Flange *	To Pin *

[Header]

Bushing Additional Details - - H3

Designation H3	Voltage High	Serial # 273416	
Catalog #	Amps 600 A	BIL *	Tap N
Class	Year	Drawing	
Style	Other	S.O. Number	
Physical Dimensions			
Creep Distance *	Overall Length *	Inner Seal Dia. *	Eff. Gnd Sleeve *
Total Weight *	Recess Depth *	Outer Seal Dia. *	Slot Size *
Units			
Flange Dimensions			
To Bottom *	# Bolts *	Max. Diameters	Draw Lead
To Top *	Bolt Size *	Below Flange *	Tube ID *
	Circle Diameter *	Above Flange *	To Pin *

Bushing Additional Details - - N

Designation N	Voltage	Serial # 272556	
Catalog #	Amps 400 A	BIL *	Tap N
Class	Year	Drawing	
Style	Other	S.O. Number	
Physical Dimensions			
Creep Distance *	Overall Length *	Inner Seal Dia. *	Eff. Gnd Sleeve *
Total Weight *	Recess Depth *	Outer Seal Dia. *	Slot Size *
Units			
Flange Dimensions			
To Bottom *	# Bolts *	Max. Diameters	Draw Lead
To Top *	Bolt Size *	Below Flange *	Tube ID *
	Circle Diameter *	Above Flange *	To Pin *

[Header]

Bushing Additional Details - - X1

Designation X1	Voltage Low	Serial # 272494	
Catalog #	Amps 600 A	BIL *	Tap N
Class	Year	Drawing	
Style	Other	S.O. Number	
Physical Dimensions			
Creep Distance *	Overall Length *	Inner Seal Dia. *	Eff. Gnd Sleeve *
Total Weight *	Recess Depth *	Outer Seal Dia. *	Slot Size *
Units			
Flange Dimensions			
To Bottom *	# Bolts *	Max. Diameters	Draw Lead
To Top *	Bolt Size *	Below Flange *	Tube ID *
	Circle Diameter *	Above Flange *	To Pin *

Bushing Additional Details - - X2

Designation X2	Voltage Low	Serial # 272516	
Catalog #	Amps 600 A	BIL *	Tap N
Class	Year	Drawing	
Style	Other	S.O. Number	
Physical Dimensions			
Creep Distance *	Overall Length *	Inner Seal Dia. *	Eff. Gnd Sleeve *
Total Weight *	Recess Depth *	Outer Seal Dia. *	Slot Size *
Units			
Flange Dimensions			
To Bottom *	# Bolts *	Max. Diameters	Draw Lead
To Top *	Bolt Size *	Below Flange *	Tube ID *
	Circle Diameter *	Above Flange *	To Pin *

[Header]

Bushing Additional Details -- X3

Designation X3	Voltage Low	Serial # 272495	
Catalog #	Amps 600 A	BIL *	Tap N
Class	Year	Drawing	
Style	Other	S.O. Number	
Physical Dimensions			
Creep Distance *	Overall Length *	Inner Seal Dia. *	Eff. Gnd Sleeve *
Total Weight *	Recess Depth *	Outer Seal Dia. *	Slot Size *
Units			
Flange Dimensions			
To Bottom *	# Bolts *	Max. Diameters	Draw Lead
To Top *	Bolt Size *	Below Flange *	Tube ID *
	Circle Diameter *	Above Flange *	To Pin *

[Header]

Overall Tests

	Insulation	Test kV	mA	Watts	% PF corr	Corr Fctr	Cap(pF)	FRANK™	Manual
1	CH+CHT	10.006	38.564	1.293	0.335	1	10229.5		
2	CH	10.004	21.876	0.628	0.287	1	5802.7	Deteriorated	
3	CHT(UST)	10.004	16.687	0.658	0.394	1	4426.3	Good	
4	CHT	0	16.688	0.665	0.398	1	4426.8	Good	
5	CT+CHT	2	55.191	2.434	0.441	1	14639.7		
6	CT	2	38.494	1.678	0.436	1	10210.6	Deteriorated	
7	CHT(UST)	2	16.698	0.673	0.403	1	4429.3	Good	
8	CHT	0	16.697	0.756	0.453	*	4429.1	Deteriorated	

LSR	mA: 38.564/38.564, 1/1	Watts: 1.293/1.293, 1/1	Cap (pF): 10229.5/10229.5, 1/1
LSR	mA: 21.876/21.876, 1/1	Watts: 0.628/0.628, 1/1	Cap (pF): 5802.7/5802.7, 1/1
LSR	mA: 16.687/16.687, 1/1	Watts: 0.658/0.658, 1/1	Cap (pF): 4426.3/4426.3, 1/1
LSR	mA: 16.688/16.688, 1/1	Watts: 0.665/0.665, 1/1	Cap (pF): 4426.8/4426.8, 1/1
LSR	mA: 55.191/55.191, 1/1	Watts: 2.434/2.434, 1/1	Cap (pF): 14639.7/14639.7, 1/1
LSR	mA: 38.494/38.494, 1/1	Watts: 1.678/1.678, 1/1	Cap (pF): 10210.6/10210.6, 1/1
LSR	mA: 16.698/16.698, 1/1	Watts: 0.673/0.673, 1/1	Cap (pF): 4429.3/4429.3, 1/1
LSR	mA: 16.697/16.697, 1/1	Watts: 0.756/0.756, 1/1	Cap (pF): 4429.1/4429.1, 1/1

FRANK™ Message 2 (Deteriorated) - The measured power factor is abnormally high for this type of apparatus, but compares to Initial tests, indicating the condition may be temporarily stable. However, a plan for correction of the problem should be made.

The power factor is good, but doesn't compare to the initial test. Test again in six months to determine the trend.

For this transformer, the upper % power factor limit for a "G" rating is 0.4 and the upper % power factor limit before an "I" rating is 0.6

The humidity is high, equal to or more than 70%. This may cause the watts and power factor to be higher than usual on your tests. If you compare sets of duplicate apparatus (arresters, bushings, live tank breakers) and one alone shows a high power factor, consider it suspect. but if all three duplicates all have high power factors, it may be due to the factor common to them all, the high humidity. Clean and dry, using heat if necessary, for better results.

3 (Good) - All values are acceptable.

6 (Deteriorated) - The power factor is higher than is normally expected for this type of transformer, however it compares with the initial test results.

8 (Deteriorated) - The power factor is higher than is normally expected for this type of transformer, however it compares with the initial test results.

[Header]

Bushing C1

ID	Serial #	NP %PF	NP Cap	Test kV	mA	Watts	% PF corr	Corr Fctr	Cap(pF)	FRANK™	Manual
H1	273414	0.33	383	10.006	1.419	0.04	0.28	1	376.38	Good	
H2	273415	0.26	382	10.006	1.425	0.032	0.22	1	378	Good	
H3	273416	0.26	379	10.006	1.478	0.035	0.24	1	391.96	Good	
N	272556	0.23	532	10.007	1.975	0.041	0.21	1	523.94	Good	
X1	272494	0.26	350	10.005	1.3	0.029	0.22	1	344.71	Good	
X2	272516	0.33	350	10.01	1.302	0.041	0.31	1	345.42	Good	
X3	272495	0.23	356	10.006	1.32	0.035	0.27	1	350.21	Good	

LSR											
LSR											
LSR											
LSR											
LSR											
LSR											
LSR											
LSR											

Bushing C2

ID	Serial #	NP %PF	NP Cap	Test kV	mA	Watts	% PF corr	Corr Fctr	Cap(pF)	FRANK™	Manual
H1	273414	1	697	2	2.838	0.148	0.52	1	752.74	Deteriorated	
H2	273415	1	712	2.001	2.853	0.132	0.46	1	756.83	Good	
H3	273416	1	616	2.001	2.514	0.123	0.49	1	666.78	Deteriorated	
X1	272494	1	623	2	2.5	0.131	0.52	1	663.09	Good	
X2	272516	1	609	2	2.517	0.077	0.31	1	667.67	Good	
X3	272495	1	576	2	2.278	0.088	0.39	1	604.28	Good	

LSR											
LSR											
LSR											
LSR											
LSR											
LSR											

[Header]

Insulation Resistance

		Core Ground Test		
Manufacturer				*
Serial #				*
Connections	Volts	T1 (Mohms)	T2 (Mohms)	PI
Hi to Tert/Earth	*	*	*	*
Hi to Earth Guard Tert	*	*	*	*
Lo to Hi/Earth	*	*	*	*
Tert to Hi/Earth	*	*	*	*
Tert to Earth Guard Hi	*	*	*	*
Hi to Tert Guard Earth	*	*	*	*
Core to Earth	*	*	*	*

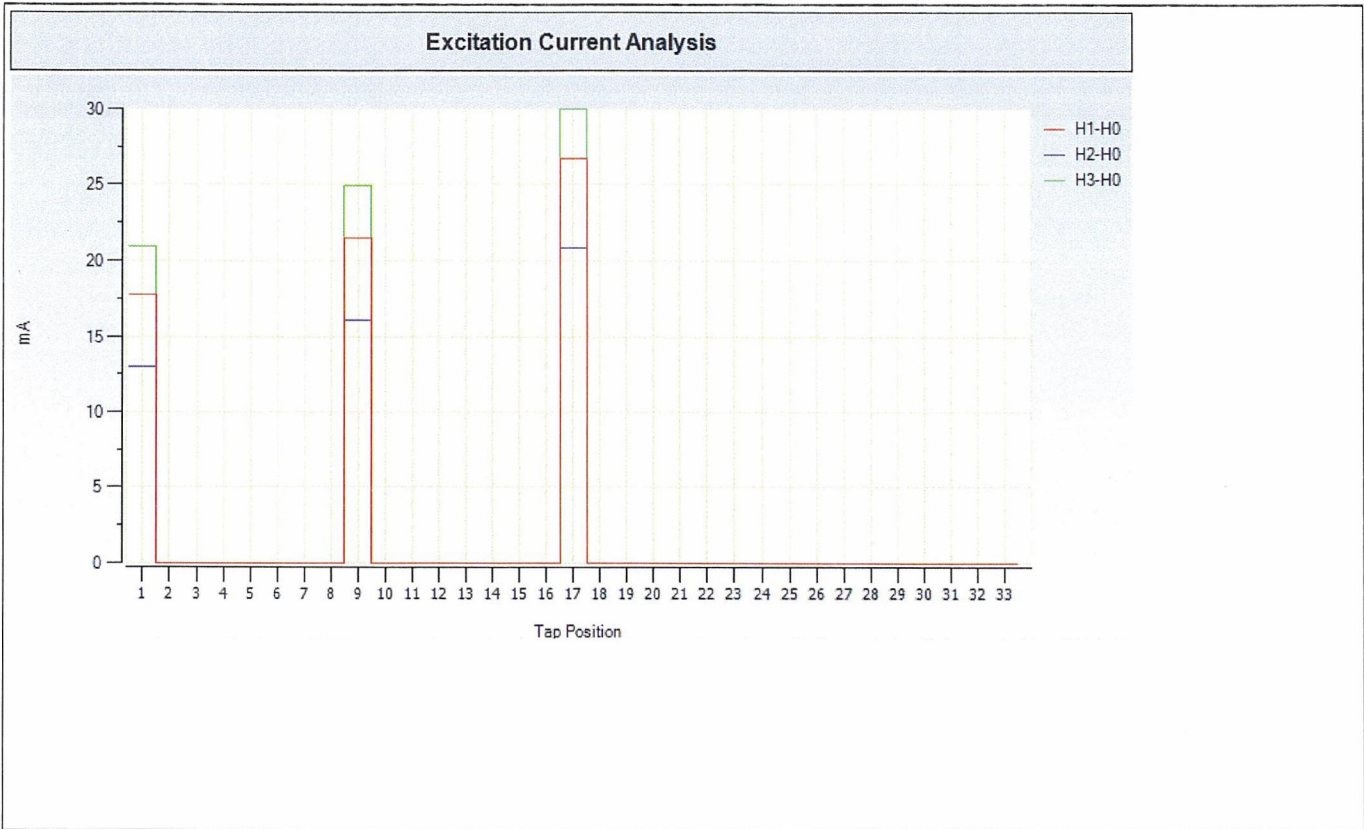
Surge Arrester Tests

Location	Test Mode	Test kV	mA	Watts	FRANK™	Manual
H1-T	UST RB	10.022	0.17	0.09	Good	
H1-B	GAR RB	10.016	0.234	0.126	Good	
H2-T	UST RB	10.017	0.17	0.081	Good	
H2-B	GAR RB	10.016	0.223	0.121	Good	
H3-T	UST RB	10.008	0.169	0.069	Good	
H3-B	GAR RB	10.024	0.229	0.117	Good	
X1-T	UST RB	10.014	0.272	0.132	Good	
X1-B	GAR RB	10.023	0.292	0.14	Good	
X2-T	UST RB	10.007	0.272	0.122	Good	
X2-B	GAR RB	10.027	0.289	0.148	Good	
X3-T	UST RB	10.008	0.271	0.13	Good	
X3-B	GAR RB	10.023	0.289	0.139	Good	

LSR	mA: 0.17/0.17, 1/1	Watts: 0.09/0.09, 1/1	Cap (pF): 45.16/45.16, 1/1
LSR	mA: 0.234/0.234, 1/1	Watts: 0.126/0.126, 1/1	Cap (pF): 59.035/59.035, 1/1
LSR	mA: 0.17/0.17, 1/1	Watts: 0.081/0.081, 1/1	Cap (pF): 45.068/45.068, 1/1
LSR	mA: 0.223/0.223, 1/1	Watts: 0.121/0.121, 1/1	Cap (pF): 58.967/58.967, 1/1
LSR	mA: 0.169/0.169, 1/1	Watts: 0.069/0.069, 1/1	Cap (pF): 44.808/44.808, 1/1
LSR	mA: 0.229/0.229, 1/1	Watts: 0.117/0.117, 1/1	Cap (pF): 60.555/60.555, 1/1
LSR	mA: 0.272/0.272, 1/1	Watts: 0.132/0.132, 1/1	Cap (pF): 71.969/71.969, 1/1
LSR	mA: 0.292/0.292, 1/1	Watts: 0.14/0.14, 1/1	Cap (pF): 77.291/77.291, 1/1
LSR	mA: 0.272/0.272, 1/1	Watts: 0.122/0.122, 1/1	Cap (pF): 71.952/71.952, 1/1
LSR	mA: 0.289/0.289, 1/1	Watts: 0.148/0.148, 1/1	Cap (pF): 76.467/76.467, 1/1
LSR	mA: 0.271/0.271, 1/1	Watts: 0.13/0.13, 1/1	Cap (pF): 71.715/71.715, 1/1
LSR	mA: 0.289/0.289, 1/1	Watts: 0.139/0.139, 1/1	Cap (pF): 76.475/76.475, 1/1

[Header]

Exciting Current Plot



Exciting Current											
USTR											
		Test Results H1-H0			Test Results H2-H0			Test Results H3-H0			
	LTC	Test KV	mA	Watts	KV.	mA	Watts	KV.	mA	Watts	KV.
	1	10	14.77	147.701	10.013	9.548	88.906	10.009	14.866	148.66	10.013
	9	10	17.263	171.548	10.013	10.989	106.777	10.011	17.283	171.86	10.013
	17	10	20.968	206.167	10.012	13.105	130.916	10.012	20.952	206.31	10.013



TRANSFORMER TURNS RATIO TEST



PAGE 1

AMBIENT TEMP. 15 °C DATE 10/8/2014

SUBSTATION West Avalon

HUMIDITY 70 % JOB # _____

POSITION T5

ASSET ID _____

EQUIPMENT LOCATION Main Sub

NAMEPLATE DATA

MFR Federal Pioneer CLASS ONAF PHASES 3
 SER NO 61-00-69167 COOLANT OIL REASON LTC Maint.
 YEAR 1989 BIL 950/650 kV WEIGHT 130780 kg
 H₂ YNyn0 X₂ WINDING MATERIAL Cu
 OIL VOLUME 54,716 l
 OIL TEMP 19 °C
 IMPEDANCE 5.63 %
 WEATHER Cloudy
 TANK TYPE OPEN-CONSER
 ALLOWED ERROR 0.5 %
 HAS TERTIARY

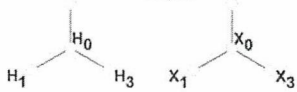


Diagram # 7 (ANSI)

Detect Transformer Type

	VOLTAGE (kV)	kVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING
PRIMARY:	230 / 132.791	125	0.31	17	5	LTC	
SECOND:	138 / 79.674	125	0.52	1			

COMMENTS: _____

HIGH SIDE TAPS TO LOW SIDE NOMINAL TURNS RATIO TESTS

#	H TAP	Voltage H/L	Test V	TVR	H ₁ - H ₀ / X ₁ - X ₀				H ₂ - H ₀ / X ₂ - X ₀				H ₃ - H ₀ / X ₃ - X ₀			
					Actual TVR	% error	I exc mA	Phase (Deg)	Actual TVR	% error	I exc mA	Phase (Deg)	Actual TVR	% error	I exc mA	Phase (Deg)
1	R4 Nomina	241,500 / 138,000	80	1.750	1.749	-0.08	0.8	-0.13°	1.750	-0.03	0.5	-0.13°	1.750	0.02	0.8	-0.13°
2	R3 Nomina	238,625 / 138,000	80	1.729	1.728	-0.07	0.8	-0.13°	1.728	-0.05	0.6	-0.13°	1.729	0.01	0.9	-0.13°
3	R2 Nomina	235,750 / 138,000	80	1.708	1.707	-0.10	0.8	-0.13°	1.708	-0.02	0.6	-0.13°	1.709	0.02	0.9	-0.13°
4	R1 Nomina	232,875 / 138,000	80	1.688	1.686	-0.08	0.8	-0.13°	1.687	-0.02	0.6	-0.13°	1.688	0.01	0.9	-0.13°
5	Nomina	230,000 / 138,000	80	1.667	1.665	-0.09	0.9	-0.13°	1.666	-0.03	0.6	-0.13°	1.667	0.01	0.9	-0.13°
6	L1 Nomina	227,125 / 138,000	80	1.646	1.644	-0.09	0.9	-0.13°	1.645	-0.03	0.6	-0.14°	1.646	0.02	0.9	-0.13°
7	L2 Nomina	224,250 / 138,000	80	1.625	1.624	-0.09	0.9	-0.13°	1.625	-0.03	0.6	-0.13°	1.625	0.02	0.9	-0.13°
8	L3 Nomina	221,375 / 138,000	80	1.604	1.603	-0.09	0.9	-0.13°	1.604	-0.03	0.7	-0.13°	1.604	0.01	1.0	-0.13°
9	L4 Nomina	218,500 / 138,000	80	1.583	1.582	-0.08	0.9	-0.13°	1.583	-0.02	0.7	-0.13°	1.583	0.00	1.0	-0.13°
10	L5 Nomina	215,625 / 138,000	80	1.563	1.561	-0.10	1.0	-0.13°	1.562	-0.03	0.7	-0.13°	1.563	0.02	1.0	-0.13°
11	L6 Nomina	212,750 / 138,000	80	1.542	1.541	-0.08	1.0	-0.13°	1.541	-0.02	0.7	-0.13°	1.542	0.02	1.0	-0.13°
12	L7 Nomina	209,875 / 138,000	80	1.521	1.519	-0.10	1.0	-0.13°	1.520	-0.03	0.7	-0.13°	1.521	0.02	1.1	-0.13°
13	L8 Nomina	207,000 / 138,000	80	1.500	1.499	-0.07	1.1	-0.13°	1.500	-0.03	0.8	-0.13°	1.500	0.03	1.1	-0.13°
14	L9 Nomina	204,125 / 138,000	80	1.479	1.478	-0.10	1.1	-0.13°	1.479	-0.02	0.8	-0.13°	1.479	0.02	1.1	-0.13°
15	L10 Nomina	201,250 / 138,000	80	1.458	1.457	-0.08	1.1	-0.14°	1.458	-0.03	0.8	-0.13°	1.459	0.03	1.2	-0.13°
16	L11 Nomina	198,375 / 138,000	80	1.438	1.436	-0.08	1.2	-0.14°	1.437	-0.02	0.8	-0.14°	1.438	0.02	1.2	-0.13°
17	L12 Nomina	195,500 / 138,000	80	1.417	1.416	-0.07	1.1	-0.13°	1.417	0.00	0.8	-0.13°	1.417	0.04	1.1	-0.13°

TEST EQUIPMENT USED: TTR 310 SN 60284-0512 Cal Due 09/ 15

TESTED BY: C Chisholm

Serial Number: _____

Firmware Information: _____

Calibration Date: _____

TRANSFORMER TURNS RATIO TEST



COMMENTS:	Transformer is 3 phase Y Auto with Delta Tertiary
DEFICIENCIES:	

TRANSFORMER WINDING RESISTANCE TEST

MFR <u>Federal Pioneer</u>	WEIGHT <u>130780</u> kg	OIL VOLUME <u>154715</u> GAL
SER NO <u>61-00-69167</u>	WEATHER <u>Cloudy</u>	OIL TEMP <u>19</u> °C
YEAR <u>1998</u>	BIL <u>950/650</u> kV	WINDING TEMP <u>19</u> °C
TYPE <u>OPEN-CONSER</u>	IMPEDANCE <u>5.63</u> %	CORRECT TO <input checked="" type="checkbox"/> <u>20</u> °C
CLASS <u>ONAN/ONAF</u>	REASON <u>LTC Maint.</u>	COOLANT <u>OIL</u>
PHASES <u>3</u>	Max Wdg Diff (%): <u>1</u>	

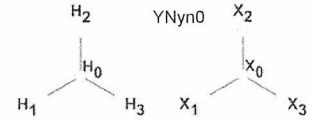


Diagram # 7 (ANSI)

	VOLTAGE (kV)	MVA	RATED I	# TAPS	NOMINAL	CHANGER	TAP SETTING	WINDING MATERIAL	SHOW RESULTS
PRIMARY:	230 / 132.791	125	313.78	17	5	LTC		Cu	<input checked="" type="checkbox"/>
SECOND:	138 / 79.674	125	522.96	1				Cu	<input checked="" type="checkbox"/>

HIGH VOLTAGE WINDING RESISTANCE

Show Graph

Corrected Resistance to 20°C

Disable Recording of Make/Break Transition

Units: mOhms

#	TAP	Current (amp)	Nameplate Voltage	H ₁ - H ₀	H ₂ - H ₀	H ₃ - H ₀	Reading Stability %	Winding Difference %	Make/Break
1	R4	1.063	241,500	786.2	786.6	787.9	99.99	0.224	
2	R3	1.064	238,625	780.4	781.1	783.7	99.77	0.424	
3	R2	1.063	235,750	775.1	774.8	776.1	99.95	0.168	
4	R1	1.063	232,875	768.9	769.3	770.6	99.83	0.222	
5	Nominal	1.063	230,000	764.1	763.9	764.8	99.74	0.118	
6	L1	1.063	227,125	757.1	758.7	756.5	99.42	0.294	
7	L2	1.063	224,250	751.3	752.1	753.5	99.75	0.296	
8	L3	1.062	221,375	746.8	746.2	747.4	99.81	0.161	
9	L4	1.062	218,500	740.3	738.5	741.2	99.53	0.361	
10	L5	1.062	215,625	748.2	747.7	747.3	99.80	0.126	
11	L6	1.062	212,750	750.7	754.9	753.4	99.67	0.560	
12	L7	1.063	209,875	763.2	758.0	758.7	99.66	0.678	
13	L8	1.062	207,000	767.5	766.4	764.6	98.55	0.380	
14	L9	10.05	204,125	768.4	769.8	771.3	99.98	0.373	
15	L10	1.061	201,250	773.1	774.8	776.3	99.72	0.423	
16	L11	1.062	198,375	779.5	780.3	781.1	99.64	0.203	
17	L12	1.061	195,500	784.3	785.4	787.4	99.65	0.398	

LOW VOLTAGE WINDING RESISTANCE

Show Graph

Corrected Resistance to 20°C

Units: mOhms

#	TAP	Current (amp)	Nameplate Voltage	X ₁ - X ₀	X ₂ - X ₀	X ₃ - X ₀	Reading Stability %	Winding Difference %	
1	Nominal	1.062	138,000	472.8	474.6	471.9	99.55	0.573	

COMMENTS: MTO300 SN1600 0112 Cal Due September 19 2015 Demag at Completion Tested By C Chisholm

DEFICIENCIES: Transformer is Y Auto with Delta Tertiary

TEST EQUIPMENT USED: _____ TESTED BY: _____

Serial Number: _____ Firmware Information: _____ Calibration Date: _____

SECTION 2.0 TRANSFORMER COMMISSIONING

SECTION 2.1 POWER TRANSFORMER T5

SIGN-OFF SHEET

<u>SECTION</u>	<u>DESCRIPTION</u>	<u>COMPLETED BY</u>	<u>DATE (DD/MM/YY)</u>
SECTION 2.1.2	Nameplate Data/ Inspection	_____	___/___/___
SECTION 2.1.3	Insulation Resistance	<u>J.C. Chelala</u>	<u>09/10/2014</u>
SECTION 2.1.4	Winding Resistance	<u>J.C. Chelala</u>	<u>08/10/2014</u>
SECTION 2.1.5	Power Factor (Doble)	<u>J.C. Chelala</u>	<u>08/10/2014</u>
SECTION 2.1.6	Oil (Dielectric Test)	<u>J.C. Chelala</u>	<u>08/10/2014</u>
SECTION 2.1.7	Turns Ratio Test	<u>J.C. Chelala</u>	<u>08/10/2014</u>
SECTION 2.1.8	Protective Devices and Gauges	_____	___/___/___
SECTION 2.1.9	Fans, Pumps & Heaters	_____	___/___/___
SECTION 2.1.10	Tap Changer/Paralleling	_____	___/___/___
SECTION 2.1.11	Core Test	<u>J.C. Chelala</u>	<u>08/10/2014</u>
SECTION 2.1.12	Dissolved Gas In Oil Analysis	_____	___/___/___
SECTION 2.1.13	Heater Operation	_____	___/___/___
SECTION 2.1.14	TRO PM Check-sheet	_____	___/___/___
SECTION 2.1.15	Initial Energizing	_____	___/___/___

REVIEWED BY: _____

DATE: ___/___/___

From: "Gilbert, Norbert" <ngilbert@doble.com>
 To: "DerrickKing@nlh.nl.ca" <DerrickKing@nlh.nl.ca>
 Cc: "GaryBroderick@nlh.nl.ca" <GaryBroderick@nlh.nl.ca>, "PerryTaylor@nalcorenergy.com" <PerryTaylor@nalcorenergy.com>, "Hireland@nlh.nl.ca" <Hireland@nlh.nl.ca>
 Date: 10/15/2014 10:42 AM
 Subject: FW: WAV TS T5 Doble Results

Derrick,

Thank you for sending Doble the attached test results for this transformer that was tested on October 14, 2014. This transformer was tested earlier this year on October 7, 2014 so this is a retest. There was a report issued on October 12, 2014 for the previous tests results.

Here is the analysis of the transformer considering the new test results.

Overall Tests

The main insulation systems of this transformer Ch, Cl and Chl each measure $\leq 0.4\%$ which is considered to be very good for this size and vintage of transformer.

It appears that surface leakage across the insulation of the bushings may have been causing the higher losses. The cleaning of the bushing insulators has improved the power factor considerably.

Bushings

The bushings all have measured power factors $< 0.32\%$ for the history of these bushings which is very good. The measured capacitances for like bushings compare well. No problems are indicated by these results.

Surge Arresters

The Canadian Ohio Brass surge arresters are all acceptable for service considering the most recent test results as summarized in this table.

Surge Arrester	Overall Catalog	Unit Catalog	Rated kV	Limits (Watts)	Test Range (Watts) 2014	Comments
High Voltage Top	219652	215920-3008	70	0.05-0.15	0.069-0.090	Acceptable
High Voltage Bottom	219652	215920-3013	82	0.05-0.15	0.117-0.126	Acceptable
Low Voltage Top	219598	215920-3001	42	0.06-0.15	0.122-0.132	Acceptable
Low Voltage Bottom	219598	215920-3005	56	0.05-0.15	0.139-0.148	Acceptable

Exciting Currents

The exciting currents follow the expected HLH phase pattern.

Recommendations

This unit appears to be acceptable for service. Test again at your next routine maintenance for this transformer.

*** Remember to perform the overall tests with the OLTC off position 9. The nonlinear resistors that are across the tap winding could cause additional losses when tested on position 9. See that attached nameplate drawing.

Contact me if there are questions.

To submit a **Topic for Discussion** at the September Conference Meetings go to:
<http://www.doble.com/topics/>

To submit a **Trouble and Failure Report** go to: http://www.doble.com/forms/trouble_failure_report.php

Norbert E. Gilbert

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Conference Technical Coordinator
Transformers Committee Secretary

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