

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 16, 1999	
File Number	6621	Tested By	KH	
Location	361A Old Finch Ave., Scarborough, Ontario			
Equipment I.D.	African Pavilion Trans. T-6			
Substation	African Pavilion			

High Voltage Air/Load Break Switch

Nameplate Data					
Manufacturer	S&C	Voltage	27.6	kVolts	
Туре	SM Alduti Indoor	Current	600	Amps	
Style #		B.I.L.	150	kVolts	
Cat#	34563R4-T2	Serial #			

Mechanical Inspections

Description of Inspection	Status	Comments
Key Interlock	N/A	
Operating Mechanism	OK	
Operating Handle Grounding	N/A	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	φA	ϕB	φC	A/B	B/C	C/A
Insulation Resistance (M Ω)	780	540	755	3420	3280	4080
Contact Resistance (μΩ)	38	36	36			
Arc Interrupter Res.(Ω)	0.7	1.4	0.8			
Results Satisfactory	OK					

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T.S. HV_ABS



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 16, 1999	
File Number	6621	Tested By	KH/ AN	
Location	361A Old Finch Ave., Scarborough, Ontario			
Equipment I.D.	African Pavilion Transformer T-6			
Substation	African Pavilion			

High Voltage Power Fuse

Fuse Holder Nameplate Data				
Manufacturer	S&C	Voltage	27.6	kVolt
Туре	SM-5	Current	300	Amps
Style/Cat #	86641R1	Serial #		

Fuse Link Nameplate Data

Туре	SM-5	TCC	153-4
Style/Cat #	134060R4	Amps	40E

Mechanical Inspections Description of Inspection Status Comments Operating Mechanism OK **Contact Surfaces** OK **Contact Penetration OK** Contact Alignment OK. Fuse Barrel **OK Connector Condition** OK

 Insulator Condition
 OK

 Phase Barrier Condition
 OK

 Support Structure Condition
 OK

 Spare Fuses
 OK
 3 Spares in Cell

Electrical Tests Test Description B/C C/A ϕB φC A/BΦA >999 >999 Insulation Resistance (M Ω) >999 >999 >999 >999 1760 1733 Contact Resistance (μΩ) 1760

Results Satisfactory OK

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Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 16, 1999
File Number	6621	Tested By	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	T-6		
Substation	African Pavilion		

Power Transformer - Electrical

Manufacturer	Westinghou	se	Vector Group	Y-Y		
Туре	LNAN		Serial #.	795154		
Neutral	Solid		Liquid Type/Vol	Askarel	350	Gal
Rating	750/ 850	kVA	Total Weight	11,900		lbs.
Impedance	6.0	%	Primary Voltage	27.6/ 16		kVolt
Phase	3	ф	Secondary Voltage	208/ 120		Volt
Frequency	60	Hz	BIL	150/45		kVolt

Insulation Tests Prim. With Sec. With Prim. & Sec. Insulation Resistance Prim. Grounded @ 5k / 1k VDC Sec. Grounded To Ground 27.8 $M\Omega$ 27.2 Corrected to 20 °C. 76.2 77.8 The state of the s

	CH-L+G	CH-G	CH-L	CL-G	CL-H+G
Cap (pF)					
Corr. 20 °C					
				and the state of t	e market en
Dis. Fact.(%)					

Dis. Fact.(%)

Corr. 20 °C.

Turns Ratio Tests

Гар	Primary Volts	Calculated Ratio	<u>X0-X1</u> H0-H1	<u>X0-X2</u> H0-H2	<u>Х0-Х3</u> Н0-Н3
1					
2					
3	27,600	0.754	0.747	0.747	0.747
4					
5					

Tap Position Found & Left	3 (27,600V)	
Results Satisfactory	OK	

T.S. P_Trans_Elect



TECHNICAL FIELD SERVICE DEPARTMENT

Special Projects Group

Client Information

Customer	Toronto Zoo	Sample Date	June 17, 1999
File Number	6621	Sampled By	RPM
Location	361A Old Finch Ave., Scarbon	ough, Ontario	
Equipment I.D.	T-6		
Substation	Africa Pavilion		

Oil Analysis

Transformer Data						
Manufacturer	Westinghouse	Primary Volts	27.6/ 16	kVolts		
Type	LNAN	Rating	750/ 850	kVA		
Serial No.	795154	Liquid Volume	350	Gals.		

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	D877	30 kV	46.9
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.004
Interfacial Tension	D971	32 Dynes/ Cm Min.	N/A
Specific Gravity	D1298	0.84 - 0.91 (Oil)	1.520
Colour	D1500	≤3.5	0.5
Visual Condition	D1524	Clear	Clear
Water Content	D1533	30 ppm (<69kV)	
Power Factor	D924	1.0 % Max @ 25 °C	
PCB Content	D4059	50 ppm Max.	
Inhibitor	D2668	≥0.20%	
Furans	D5837	<100 ppb	
Hydrogen (H2)			
Oxygen & Argon			
Nitrogen (N2)			
Methane (CH4)			
Carbon Monoxide (CO)			
Carbon Dioxide (CO2)			
Ethylene (C2H4)			
Ethane (C2H6)	· · · · · · · · · · · · · · · · · · ·		
Acetylene (C2 H2)		nejednje indispirator i popializa i	<u> </u>
Total Gas Content			

Comments

Chemical Properties	OK
PCB Content	PCB fluid
Dissolved Gas Content	
TC	

T.S. Oil_Analysis



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 16, 1999
File Number	6621	Tested By	KH/ RPM/ TL
Location	361A Old Finch Ave., Scarborough, Ont	ario	
Equipment I.D.	T-6		
Substation	African Pavilion		

Power Transformer - Mechanical

Me Description of Inspection	Sta	itus	Comments
Breather & Silica Gel	N	/A	
Explosion Vent Gaskets	N	/A	
Pressure Relief Device	C	K	
Conservator Tank Gaskets	N	/A	
Inspection Cover Gaskets	C	K	
Main Cover Gaskets	N	/A	
Primary Bushing Gaskets	C	K	
Primary Bushing Porcelain	C	K	
Primary Bushing Connections	С	K	
Secondary Bushing Gaskets	C	K	
Secondary Bushing Porcelain	C	K	
Secondary Bushing Connections	C	K	
Secondary Throat Gaskets	C	K	
Radiator	C	K	
Pressure Gauge	C	K	-7 PSI Vacuum
Gas Relay	N	/A	
Oil Level	C	K	
Oil Leaks	C	K	None visible
Tank Valves	C)K	
Oil Temperature Gauge	C	K	
Oil Temperature Run/Max	35	45°C	
Winding Temperature Gauge	N	/A	
Winding Temperature Run/Max			
Tap Changer		•	Unit Locked: Inoperable
Paint Condition	C	K	
Pad	C	K	
Grounding	С	K	
Fan Operation	N	/A	
Control Wiring	N	/A	

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T.S. P_Trans_Mech



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 16, 1999			
File Number	6621	Tested By	KH/TL			
Location	361A Old Finch Ave., Scarborough, Ontario					
Equipment I.D.	T-6 Secondary					
Substation	African Pavilion					

Bus Duct

	Nameplate Data	10 May 10		:
Manufacturer	Square D	Voltage	120/ 208	Volts
Type	Power Clad	Current	3000	Amps
Style	3 Phase, 4 Wire	B.I.L.		kVolts
Cat#	AF-510-23-FES	Serial #		

Mechanical Inspections

Description of Inspection	Status	Comments
Bus Insulation	OK	
Type of Bus Insulation	OK	
Support Insulators	OK	
Interior Clean	OK	Visible Sections Only
Interior Dry	OK	Visible Sections Only
Bus Duct Enclosure	OK	
Bus Duct Enclosure Ventilated	N/A	
Bus Joints Clean & Dry	OK	
Bus Joints Torqued	OK	
Gaskets at Joints	OK	
Grounding	OK	
Enclosure Paint Condition	OK	
Support Structure	OK	

Electrical Tests

Test Description	n	ϕA	φ <i>B</i>	φC	N	A/B	B/C	C/A
Insulation Resistance (MΩ)		1170 1570		1920		1080	1980	3180
								
Comments								
Results Satisfactory	OK	•						

T.S. Bus_Buct



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 16, 1999
File Number	6621	Tested By	RPM/ TL/ KH
Location	361A Old Finch Ave., Scar., Ontario		
Equipment I.D.	Main Secondary C.B.		
Substation	African Pavilion		

Low Voltage Air Circuit Breaker

Nameplate Data					
Manufacturer	FPE	Voltage	600	Volts	
Type	75H-2	Frame Rating	3000	Amps	
Serial #	TH-4126-72	Int. Rating	75	kAmps	
Relay Type	Carriere FB600E	Sensors Ratio	3000:1	Amps	
Rating Plug.		Limiter Rating	N/A	Amps	

Relay Calibration Results

	Setti	ings	φ	A	Ç	b B	q	C
	P/U	T.D	P/U	T.D.	P/U	T.D.	P/U	T.D.
Long Time	0.85x	7.5		6.021		5.896		
Short Time	7x	0.4		0.477		0.476	·	0.471
Instantaneous	10x			0.094		0.103		0.111
			P/U	T.D.				
Ground Fault	1200	0.066					· · · · · · · · · · · · · · · · · · ·	

Mechanical Inspections

Description of Inspection	Status	Comments
Main & Arcing Contacts	OK	
Arc Chutes	OK	
Phase Barriers	OK	
Bus & Grounding Stabs	OK	
Interlocks	OK	
Manual Operation	POOR	See Deficiencies
Electrical Operation		

Electrical Tests

Test Description	φA	φ Β	φC	A/B	B/C	C/A
Insulation Resistance (M Ω)	>999	>999	>999	>999	>999	>999
Contact Resistance (μΩ)	40/70	49/ 50	49/48			
Results Satisfactory	NO. See	Deficienc	ries.			

T.S. LV_ACB



Technical Field Service Department

31 Puliman Court, Scarborough, Ontario M1X 1E4. Phone: (416)-298-9977 Fax: (416)-298-2907

Entrance/ Administration Building



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 15, 1999	
File Number	6621	Tested By	AS, AN	
Location	361A Old Finch Ave., Scarborough, Ontario			
Equipment I.D.	Feeder to Eurasia Pavilion			
Substation	Entrance/ Administration Building			

High Voltage Air/Load Break Switch

	Nameplate l	Data		
Manufacturer	S&C	Voltage	27.6	kVolts
Туре	Alduti Indoor	Current	600	Amps
Style #		B.I.L.	150	kVolts
Cat#	CDT-2765378	Serial #		

Mechanical Inspections Description of Inspection Status Comments Key Interlock N/A Operating Mechanism OK Operating Handle Grounding OK. **Grounding Mat** N/A **Stationary Contact Surfaces** OK **Moving Contact Surfaces** OK Arcing Contact Surfaces OK OK Contact Alignment Arcing Interrupter OK **Connector Condition** OK **Insulator Condition** OK **Phase Barrier Condition** OK **Support Structure Condition** OK

Electrical Tests Test Description A/BB/C C/A ϕA ϕB φC Insulation Resistance (G Ω) >505 >505 >505 >505 >505 >505 Contact Resistance ($\mu\Omega$) 58 61 65 Arc Interrupter Res.(Ω) 2.0 0.4 1.9 Results Satisfactory OK

T.S. HV_ABS



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 15, 1999		
File Number	6621	Tested By	AS, AN		
Location	361A Old Finch Ave., Scarborough, Ontario				
Equipment I.D.	Feeder to Indo-Malaya Pavilion				
Substation	Entrance/ Administration Building				

High Voltage Air/Load Break Switch

	Nameplate	Data		
Manufacturer	S&C	Voltage	27.6	kVolts
Type	Alduti Indoor	Current	600	Amps
Style #		B.I.L.	150	kVolts
Cat#	34163	Serial #		

Mechanical Inspections

Description of Inspection	Status	Comments
Key Interlock		
Operating Mechanism	OK	
Operating Handle Grounding	OK	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK_	

Electrical Tests

Test Description	ϕA	ϕB	φC	A/B	B/C	C/A
Insulation Resistance (GΩ)	>505	>505	>505	>505	>505	>505
Contact Resistance (μΩ)	77	83	86			
Arc Interrupter Res.(Ω)	0.43	0.40	0.40	100 100 100 100		

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Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 15, 1999		
File Number	6621	Tested By	AS, AN		
Location	361A Old Finch Ave., Scarborough, Ontario				
Equipment I.D.	Feeder to Village Edge South	Feeder to Village Edge South			
Substation	Entrance/ Administration Building				

High Voltage Air/Load Break Switch

	Nameplate	Data		
Manufacturer	S&C	Voltage	27.6	kVolts
Туре	SM Alduti	Current	600	Amps
Style #		B.I.L.	150	kVoits
Cat #	34563-R4-T2	Serial #		

Mechanical Inspections

Description of Inspection	Status	Comments
Key Interlock		
Operating Mechanism	OK	
Operating Handle Grounding	OK	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

1	2021	Decilent L	~~~			
Test Description	φA	ϕB	φC	A/B	B/C	C/A
Insulation Resistance (GΩ)	>505	>505	>505	>505	>505	>505
Contact Resistance (μΩ)	28	28	35	and the		
Arc Interrupter Res.(Ω)	0.3	0.3	0.5			18.00
Arc interrupter Res.(12)	1 0.5	0.5	1 0.5			
Results Satisfactory	OK					

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T.S. HV_ABS



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 16, 1999			
File Number	6621	Tested By	AS, AN			
Location	361A Old Finch Ave., Scarborough, Ontario					
Equipment I.D.	Feeder to Village Edge South					
Substation	Entrance/ Administration Building					

High Voltage Power Fuse

Fuse Holder Nameplate Data						
Manufacturer	S&C	Voltage	34.5	kVolt		
Type	SM-5S	Current	300E	Amps		
Style/Cat #	86644R1	Serial #				
e i de la	Fuse Link Nar	neplate Data				

SM-5 TCC 153-4

Type Style/Cat # 80E 134125R4 Amps

Mechanical Inspections Description of Inspection Status Comments Operating Mechanism OK Contact Surfaces OK **Contact Penetration** OK **Contact Alignment OK** Fuse Barrel **OK Connector Condition** OK **Insulator Condition** OK **Phase Barrier Condition** OK **Support Structure Condition** OK Spare Fuses Fair One only in cell door

Electrical Tests Test Description ϕB ϕC A/B B/C C/A φ4 >505 Insulation Resistance (G Ω) >505 >505 >505 >505 >505 Contact Resistance (μΩ) 780 802 802 OK. Spare Links Required. Results Satisfactory

T.S. HV_Fuse



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 15, 1999			
File Number	6621	Tested By	AS, AN			
Location	361A Old Finch Ave., Scarborough, Ontario					
Equipment I.D.	Entrance Facilities Transformer T-7					
Substation	Entrance/ Administration Building					

High Voltage Air/Load Break Switch

Nameplate Data							
Manufacturer	S&C	Voltage	27.6	kVolts			
Туре	SM Alduti Indoor	Current	600	Amps			
Style #		B.I.L.	150	kVolts			
Cat#	34563R4-T2	Serial #					

Mechanical Inspections Description of Inspection Status Comments N/A **Key Interlock** OK Operating Mechanism Operating Handle Grounding OK N/A **Grounding Mat Stationary Contact Surfaces** OK OK **Moving Contact Surfaces Arcing Contact Surfaces** OK OK **Contact Alignment** OK **Arcing Interrupter** OK **Connector Condition Insulator Condition** OK **Phase Barrier Condition** OK

Support Structure Condition Electrical Tests B/C C/A Test Description φC A/B ϕB ϕA >505 >505 >505 Insulation Resistance (G Ω) >505 >505 >505 72 71 75 Contact Resistance ($\mu\Omega$) 0.2 0.4 0.2 Arc Interrupter Res.(Ω) Results Satisfactory OK

OK



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 16, 1999		
File Number	6621	Tested By	AS, AN		
Location	361A Old Finch Ave., Scarborough, Ontario				
Equipment I.D.	Entrance Facilities Transformer T-7				
Substation Entrance/ Administration Building					

High Voltage Power Fuse

	Fuse Holder N	ameplate Data	w., -	.73
Manufacturer	S&C	Voltage	34.5	kVolt
Туре	SM-5S	Current	300E	Amps
Style/Cat #	86644R1	Serial #		
	Fuse Link Na	meplate Data		
Туре	SM-5	TCC	153-4	

 Type
 SM-5
 TCC
 153-4

 Style/Cat #
 86644R1
 Amps
 15E

Mechanical Inspections Description of Inspection Status Comments **Operating Mechanism** OK **Contact Surfaces** OK **Contact Penetration OK** Contact Alignment OK OK Fuse Barrel **Connector Condition** OK **Insulator Condition** OK **Phase Barrier Condition OK Support Structure Condition** OK In Cell Door Spare Fuses OK

Electrical Tests						
Test Description	φA	φ Β	φC	A/B	B/C	C/A
Insulation Resistance (G Ω)	>505	>505	>505	>505	>505	>505
Contact Resistance (μΩ)	5276	5318	5400			1.64
Results Satisfactory	OK				· · · ·	

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Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 15, 1999			
File Number	6621	Tested By	AS			
Location	361A Old Finch Ave., Scarborough, Ontario					
Equipment I.D.	Entrance Facilities Transformer T-7					
Substation	station Entrance/ Administration Building					

Power Transformer -Electrical

		Na	meplate Data	ang t	y a saidhead a dheadan	
Manufacturer	er Westinghouse Vector Group			Wye Wye		
Туре	LNAN		Serial #.	827694		
Neutral	Solid		Liquid Type/Vol	Askarel	200	Gal
Rating	225	kVA	Total Weight	6450		lbs.
Impedance	5.9	%	Primary Voltage	27.6 Y		kVolt
Phase	3	ф	Secondary Voltage	120/ 208		Volt
Frequency	60	Hz	BIL	150		kVolt

Insulation Tests

Insulation Re @ 5k / 1	esistance k VDC			Prim. & Sec. To Ground	
ΜΩ		30	30		
Corrected to	o 20 °C.				
a pro-u					
	CH-L + G	CH-G	CH-L	CL-(G CL-H+G
Cap (pF)					
Corr. 20 °C					
		Mark Service		. 4	
Dis. Fact.(%)					
Corr. 20 °C.					

Turns Ratio Tests

Тар	Primary Volts	Calculated Ratio	<u>X0-X1</u> H0-H1	<u>X0-X2</u> H0-H2	X0-X3 H0-H3
1					
2					
3	27,600	0.753	0.748	0.748	0.748
4					
5					

Tap Position Found & Left	3 (27,600V)
Results Satisfactory	OK

T.S. P_Trans_Elect



TECHNICAL FIELD SERVICE DEPARTMENT

Special Projects Group

Client Information

Customer	Toronto Zoo	Sample Date	June 15, 1999	
File Number	6621	Sampled By	TL	
Location	361A Old Finch Ave., Scarborough, Ontario			
Equipment I.D. Entrance Facilities Transformer T-7				
Substation	Entrance/ Administration Building			

Oil Analysis

Transformer Data						
Manufacturer Westinghouse Primary Volts 27.6/16 kVolts						
Type	LNAN	Rating	225	kVA		
Serial No.	827694	Liquid Volume	200	Gals.		

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	D877	30 kV	49.4
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.004
Interfacial Tension	D971	32 Dynes/ Cm Min.	N/A
Specific Gravity	D1298	0.84 - 0.91	1.420
Colour	D1500	≤3.5	0.5
Visual Condition	D1524	Clear	Clear
Water Content	D1533	30 ppm (<69kV)	
Power Factor	D924	1.0 % Max @ 25 °C	
PCB Content	D4059	50 ppm Max.	
Inhibitor	D2668	≥0.20%	
Furans	D5837	<100 ppb	
Hydrogen (H2)			
Oxygen & Argon			
Nitrogen (N2)			
Methane (CH4)			
Carbon Monoxide (CO)			
Carbon Dioxide (CO2)			
Ethylene (C2H4)			
Ethane (C2H6)			
Acetylene (C2 H2)			
Total Gas Content			

Comments

Chemical Properties	OK
PCB Content	PCB Insulating Fluid
Dissolved Gas Content	

T.S. Oil_Analysis



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 15, 1999	
File Number	6621	Tested By	AS, AN	
Location 361A Old Finch Ave., Scarborough, Ontario				
Equipment I.D.	Entrance Facilities Transformer T-8			
Substation	Entrance/ Administration Building			

High Voltage Air/Load Break Switch

	Nameplate D	ata		
Manufacturer	S&C	Voltage	27.6	kVolts
Type	SM Alduti Indoor	Current	600	Amps
Style #		B.I.L.	150	kVolts
Cat #	34563R4-T2	Serial #		

Mechanical Inspections

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Description of Inspection	Status	Comments				
Key Interlock	N/A					
Operating Mechanism	OK	·				
Operating Handle Grounding	OK	·				
Grounding Mat	N/A					
Stationary Contact Surfaces	OK					
Moving Contact Surfaces	OK					
Arcing Contact Surfaces	OK					
Contact Alignment	OK					
Arcing Interrupter	OK					
Connector Condition	OK					
Insulator Condition	OK					
Phase Barrier Condition	OK					
Support Structure Condition	OK					

Electrical Tests

Test Description	φA	φB	φC	A/B	B/C	C/A
Insulation Resistance (GΩ)	>505	>505	>505	>505	>505	>505
Contact Resistance (μΩ)	43	49	43	ep engles i		
Arc Interrupter Res.(Ω)	0.3	0.3	0.4			
Results Satisfactory	OK					· · · · · · · · · · · · · · · · · · ·

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Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 16, 1999	
File Number	6621	Tested By	AS, AN	
Location	361A Old Finch Ave., Scarborough, Ontario			
Equipment I.D. Entrance Facilities Transformer T-8				
Substation	Entrance/ Administration Building			

High Voltage Power Fuse

	Fuse Holder Na	meplate Data		
Manufacturer	S&C	Voltage	34.5	kVolt
Туре	SM-5S	Current	300E	Amps
Style/Cat #	86644R1	Serial #		
	Fuse Link Nan	neplate Data		
Туре	SM-5	TCC	153-4	
Style/Cat #	13440R4	Amps	25E	

Miecnanical Inspections				
Description of Inspection	Status	Comments	····	
Operating Mechanism	OK			
Contact Surfaces	OK			
Contact Penetration	OK			
Contact Alignment	OK			
Fuse Barrel	OK			
Connector Condition	OK			
Insulator Condition	OK			
Phase Barrier Condition	OK			
Support Structure Condition	OK			
Spare Fuses	OK	In cell door		

Electrical Tests						
Test Description	ф.4	φΒ	φC	A/B	B/C	C/A
Insulation Resistance (G Ω)	>505	>505	>505	>505	>505	>505
Contact Resistance (μΩ)	2439	2412	2451			ere grant v
Results Satisfactory	OK					
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T.S. HV_Fuse

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 15, 1999	
File Number	6621	Tested By	AS	
Location	361A Old Finch Ave., Scarborough, Ontario			
Equipment I.D.	Entrance Facilities Transformer T-8			
Substation	Entrance/ Administration Building			

Power Transformer -Electrical

		Na	meplate Data		
Manufacturer	Westingh	ouse	Vector Group	Wye Wye	
Туре	LNAN Serial #.		850912		
Neutral	Solid		Liquid Type/Vol	Askarel 240	Gal
Rating	500	kVA	Total Weight	8500	lbs.
Impedance	6.7	%	Primary Voltage	27.6 Y	kVolt
Phase	3	ф	Secondary Voltage	600	Volt
Frequency	60	Hz	BIL	150	kVolt

	CH-L+G	CH-G	CH-L	CL-G	CL-H+G
Cap (pF)					
Corr. 20 °C					
Ma lifornia de 188					a e Arganesco
Dis. Fact.(%)					

Dis. Fact.(%)
Corr. 20 °C.

Гар	Primary Volts	Calculated Ratio	<u>X0-X1</u> H0-H1	<u>X0-X2</u> H0-H2	<u>X0-X3</u> H0-H3
1					
2					
3	27,600	2.173	2.178	2.178	2.178
4					
5					-

Tap Position Found & Left	3 (27,600V)	
Results Satisfactory	OK	
T.S.		

T.S. P_Trans_Elect



TECHNICAL FIELD SERVICE DEPARTMENT

Special Projects Group

Client Information

Customer	Toronto Zoo	Sample Date	June 15, 1999	
File Number	6621	Sampled By	TL	
Location	361A Old Finch Ave., Scarborough, Ontario			
Equipment I.D.	Entrance Facilities Transformer T-8			
Substation	Entrance/ Administration Building			

Oii Analysis

Transformer Data					
Manufacturer Westinghouse Primary Volts 27.6/16 kVolts					
Туре	LNAN	Rating	225	kVA	
Serial No.	850912	Liquid Volume	240	Gals.	

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Res	ılte
Type of Test	ASTITIO.	Acceptable Limits	1 CSU NCS	99
Dielectric Breakdown	D877	30 kV	<u> </u>	49.0
Neutralization Number	D974	0.05 Max. Mg Koh/G		0.004
Interfacial Tension	D971	32 Dynes/ Cm Min.		N/A
Specific Gravity	D1298	0.84 - 0.91		1.520
Colour	D1500	≤3.5		0.5
Visual Condition	D1524	Clear		Clear
Water Content	D1533	30 ppm (<69kV)		
Power Factor	D924	1.0 % Max @ 25 °C		
PCB Content	D4059	50 ppm Max.		
Inhibitor	D2668	≥0.20%		
Furans	D5837	<100 ppb		
Hydrogen (H2)				
Oxygen & Argon				
Nitrogen (N2)				
Methane (CH4)				
Carbon Monoxide (CO)				
Carbon Dioxide (CO2)			·	
Ethylene (C2H4)				
Ethane (C2H6)				
Acetylene (C2 H2)				
Total Gas Content				

Comments

Chemical Properties	OK
PCB Content	PCB Insulating Fluid
Dissolved Gas Content	

r.s.

T.S. Oil_Analysis



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 18, 1999
File Number	6621	Tested By	KH
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.			
Substation	Zoological		

High Voltage Air/Load Break Switch

	Nameplate Dat	ta		
Manufacturer	S&C	Voltage	29	kVolts
Туре	Alduti Rupter Indoor	Current	600	Amps
Style #		B.I.L.	150	kVolts
Cat #	CDT-2768678	Serial #		

Mechanical Inspections

Description of Inspection	Status	Comments
Key Interlock	OK	
Operating Mechanism	OK	
Operating Handle Grounding	N/A	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

φA	ϕB	φC	A/B	B/C	C/A
				,	_
60	58	56	2 mg/3 to 12	a a dila	
1.3	1.1	1.5	7147	100	K Company
	60	60 58 1.3 1.1	60 58 56 1.3 1.1 1.5	12 VS 5 (23)	60 58 56 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4

T.S. HV_ABS



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 18, 1999	
File Number	6621	Tested By	KH	
Location	361A Old Finch Ave., Scarborough, Ontario			
Equipment LD.				
Substation	Zoological			

High Voltage Power Fuse

a januar 1965. – Programski saktori Programski saktorija	Fuse Holder Na	meplate Data		
Manufacturer	S&C	Voltage	34.5	kVolt
Туре	SM-5	Current	600	Amps
Style/Cat #	86644R2	Serial #		
	Fuse Link Nar	neplate Data		
Туре	SM-5	TCC	153-4	

 Type
 SM-5
 TCC
 153-4

 Style/Cat #
 134025R4
 Amps
 15E

Status OK	Comments
OK	
OK	3 Spares in Cell
	OK OK OK OK OK OK OK OK OK

Electrical Tests					
φA	φB	φC	A/B	B/C	C/A
>999	>999	>999	>999	>999	>999
5130	4865	5065	Sold State Apple		
OK					
	\$4 >999	φ A φ B >999 >999	φ <i>A</i> φ <i>B</i> φ <i>C</i> >999 >999	\$\phi A\$ \$\phi B\$ \$\phi C\$ \$A/B\$ >999 >999 >999 >999	\$\phi A\$ \$\phi B\$ \$\phi C\$ \$A/B\$ \$B/C\$ >999 >999 >999 >999

Special Projects Group

Client Information

Customer	Toronto Zoo Date June 18, 1999				
File Number	6621 Tested By KH/TA				
Location	361A Old Finch Ave., Scarborough, Ontario				
Equipment I.D.	nipment I.D. Zoological				

			istribution Trai	asform	1er	
gar Gari	n e e e e e e e e e e e e e e e e e e e	Transfort	ner Nameplate Data	transferra	本書は食い食の	
Manufacturer	CARTE		Year Built	1985		·
Type	ONAN		Serial #	NO790	-1	
Neutral	Solid		Liquid Type/Vol	Oil	872	Litres
Rating	300	kVA	Total Weight	1909		Kg
Impedance	4.58	%	Primary Voltage	27.6/ 16	5	KVolt
Phase(s)	3	ф	Secondary Voltage	208/ 12	0	Volt
Frequency	60	Hz	BIL	150		kVolt
Insulation Resist	ance (MΩ)					

Oil Analysis						
	Lab	oratory Tests	्रकार्यकार्यः अस्य राष्ट्रकारम् सङ्ग्रहेताः			
Type of Test	ASTM No.	Acceptable Limits	Test Results			
			1999			
Dielectric Breakdown	D877	30 kV Min.	36.3			
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.014			
Interfacial Tension	D971	32 Dynes/ Cm Min.	31,3			
Specific Gravity	D1298	0.84 - 0.91	0.859			
Colour	D1500	≤3.5 Max.	<0.5			
Visual Condition	D1524	Clear	Clear			

	Observations & Comments
Comments:	
refre to the length of the field	Control of the Charles Control of Control of the Co
Results Satisfactory:	OK

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Technical Field Service Department	Technical	Field Service	Department
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31 Pullman Court, Scarborough, Ontario M1X 1E4. Phone: (416)-298-9977 Fax: (416)-298-2907

Service Building



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 15, 1999	
File Number	6621	Tested By	JC/ EJ	
Location	361A Old Finch Ave., Scarborough, Ontario			
Equipment I.D.	Feeder to Main Switchgear			
Substation	Service Building			

High Voltage Air/Load Break Switch

1.500 p	The Carlo Made of the Carlo	Nameplate Data	the second		
Manufacturer	S&C		Voltage	27	kVolts
Туре	Alduti		Current	600	Amps
Style #			B.I.L.	150	kVolts
Cat#	34063		Serial #		

Cat # 34063 Serial #

Mechanical Inspections

Description of Inspection Status Comments

Key Interlock N/A

Operating Mechanism OK

Operating Handle Grounding OK

Grounding Mat N/A

Stationary Contact Surfaces OK

Stationary Contact Surfaces OK **Moving Contact Surfaces** OK **Arcing Contact Surfaces** OK **Contact Alignment** OK **Arcing Interrupter** OK **Connector Condition** OK **Insulator Condition** OK OK Phase Barrier Condition **Support Structure Condition** OK

Electrical Tests Test Description A/BB/C C/A ϕB Ø C ϕA Insulation Resistance (M Ω) Contact Resistance ($\mu\Omega$) 58 59 57 0.3 0.3 Arc Interrupter Res.(Ω) 0.3 Results Satisfactory OK



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 15, 1999	
File Number	6621	Tested By	JC/ EJ	
Location	361A Old Finch Ave., Scarborough, Ontario			
Equipment I.D.	Feeder to North America Pavilion			
Substation	Service Building			

High Voltage Air/Load Break Switch

	Nameplate Data		Andrews	
Manufacturer	S&C	Voltage	27	kVolts
Туре	Alduti	Current	600	Amps
Style #		B.I.L.	150	kVolts
Cat #	34063	Serial #		· · · · · · · · · · · · · · · · · · ·

Mechanical Inspections

1// Testablear Inspections						
Status	Comments					
N/A						
OK						
OK						
N/A						
OK						
OK						
OK						
OK						
OK		•				
OK						
OK						
OK						
OK						
	Status N/A OK OK OK OK OK OK OK O	Status Comments N/A				

Electrical Tests

Test Description	ϕA	φB	φC	A/B	B/C	C/A
Insulation Resistance (M Ω)						
Contact Resistance (μΩ)	56	55	57			
Arc Interrupter Res.(Ω)	0.5	0.6	0.5	100000		

T.S. HV_ABS



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 15, 1999	
File Number	6621	Tested By	JC/ EJ	
Location	361A Old Finch Ave., Scarborough, Ontario			
Equipment I.D.	Paddock Feeder WEST/ EAST	·		
Substation	Service Building			

High Voltage Air/Load Break Switch

	Nameplate	Data		
Manufacturer	S&C	Voltage	27	kVolts
Туре	Alduti	Current	600	Amps
Style #		B.I.L.	150	kVolts
Cat#	34563R4-T5	Serial #		

Mechanical Inspections

Description of Inspection	Status	Comments
Key Interlock	OK	
Operating Mechanism	OK	
Operating Handle Grounding	OK _	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	WEST	EAST		
Insulation Resistance (M Ω)				
Contact Resistance (μΩ)	57	60		Contract Co
Arc Interrupter Res.(Ω)	0.6	0.7		
Results Satisfactory	OK. Sin	gle phase fo	eeds x2	

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T.S. HV_ABS



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 15, 1999	
File Number	6621	Tested By	JC/ EJ	
Location	361A Old Finch Ave., Scarborough, Ontario			
Equipment I.D.	Paddock Feeder WEST/ EAST			
Substation	Service Building			

High Voltage Power Fuse

	Fuse Holder Na	meplate Data	च्यास्त्र	
Manufacturer	S&C	Voltage	34.5	kVolt
Type	SM-5S	Current	300	Amps
Style/Cat #		Serial #		. • · · · · · · · · · · · · · · · · · ·
	Fuse Link Nan	neplate Data		
Туре	SM-5	TCC	153-4	
Style/Cat #	134125R4	Amps	80E	

 Type
 SM-5
 TCC
 153-4

 Style/Cat #
 134125R4
 Amps
 80E

 Mechanical Inspections

Description of Inspection	Status	Comments
Operating Mechanism	OK	
Contact Surfaces	OK	
Contact Penetration	OK	
Contact Alignment	OK	
Fuse Barrel	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	
Spare Fuses	OK	

T.S. HV_Fuse



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 15, 1999
File Number	6621	Tested By	JC/ EJ
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Feeder to Service Building		
Substation	Service Building		

High Voltage Air/Load Break Switch

Nameplate Data					
Manufacturer	S&C	Voltage	27	kVolts	
Туре	Alduti	Current	600	Amps	
Style #		B.I.L.	150	kVolts	
Cat #	34563R4-T2	Serial #			

Mechanical Inspections

Description of Inspection	Status	Comments
Key Interlock	N/A	
Operating Mechanism	OK	
Operating Handle Grounding	OK	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK.	
Arcing Interrupter	OK.	7-7-
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	ϕA	φB	φC	A/B	B/C	C/A
Insulation Resistance (M Ω)						
Contact Resistance (μΩ)	51	50	46	-72.11	C - (3) (4)	Haran Fr
Arc Interrupter Res.(Ω)	0.3	0.3	0.3			stricted a

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T.S. HV_ABS



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 15, 1999
File Number	6621	Tested By	JC/ EJ
Location	361A Old Finch Ave., Scar., Ontari	io	
Equipment I.D.	Feeder to Service Building X-Form		
Substation	Service Building		

High Voltage Power Fuse

	Fuse Ho	lder Name	plate Dat	a (1)		
Manufacturer	S&C			Voltage	34.5	kVolt
Type	SM-5S			Current	300E	Amps
Style/Cat #	86644R1			Serial #		
	Fuse Li	ink Namep	late Data			
Type	SM-5			TCC	153-4	<u> </u>
Style/Cat #	134100R4			Amps	65E	
	Mech	anical Insp	ections	<u> </u>		
Description of Ins	Status		Cor	nments		
Operating Mechanism		OK			· · · · · · · · · · · · · · · · · · ·	
Contact Surfaces		OK				·
Contact Penetration		OK				
Contact Alignment		OK				
Fuse Barrel		OK				
Connector Condition		OK				
Insulator Condition		OK				
Phase Barrier Condition)	OK				
Support Structure Cond	lition	OK	1			
Spare Fuses		OK				
	E	lectrical Te	ests			
Test Description	фА	φ <i>B</i>	φC	A/B	B/C	C/A
Insulation Resistance (G		>505	>505	>505	>505	>505
Contact Resistance ($\mu\Omega$)	1136	1044	1021			
Results Satisfactory	OK					

T.S. HV_Fuse

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 15, 1999
File Number	6621	Tested By	JC/ EJ
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	T1 27.6kV-600V 3\phi 4W From HV Board		
Substation	Service Building		

Power Transformer - Electrical

Manufacturer	Hammond		Vector Group	Wye W	ye	
Туре	ANN/ AFN		Serial #.	DB93F		
Neutral	Solid		Liquid Type/Vol	Dry	Туре	Ga
Rating	1500/2000	kVA	Total Weight	16500		lbs.
Impedance	5.7	%	Primary Voltage	27.6/ 15	5.935	kVolt
Phase	3	ф	Secondary Voltage	600/ 34	7	Volt
Frequency	60	Hz	BIL	150	•	kVolt

	2 46.2		5 E 2 S 5 E 5 F 16	Salar Salar	
	CH-L+G	CH-G	CH-L	CL-G	CL-H+G
Cap (pF)					
Corr. 20 °C					
The second second	Committee Succession				
Dis. Fact.(%)					

Corr. 20 °C.

Тар	Primary Volts	Calculated Ratio	<u>X0-X2</u> H1-H2	X0-X3 H2-H3	<u>X0-X1</u> H3-H1
1	28,980				
2	28,290				
3	27,600	2.177	2.174	2.174	2.174
4	26,910				
5	26,220				

Tap Position Found & Left	3-4 (27,600V)
Results Satisfactory	OK
7.0	

T.S. P_Trans_Elect

CHARLES THE FAIR WAS

TECHNICAL FIELD SERVICE DIVISION

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 15, 1999
File Number	6621	Tested By	JC/ EJ
Location	361A Old Finch Ave., Scar., Ontario		
Equipment I.D.	Secondary Breaker from T1		
Substation	Service Building		

Low Voltage Air Circuit Breaker

	Namepla	te Data		
Manufacturer	FPE	Voltage	600	Volts
Туре	75H-3	Frame Rating	3000	Amps
Serial #	BH-45339-93	Int. Rating	65	kAmps
Relay Type	USR	Sensors Ratio		Amps
Rating Plug.		Limiter Rating	N/A	Amps

Relay Calibration Results

	Sett	Settings		ϕA		φ B		φC						
	P/U	T.D	P/U	T.D.	P/U	T.D.	P/U	T.D.						
Long Time	2x	1.1x												
Short Time	3X	0.3												
Instantaneous	OFF					,								
			P/U	T.D.		•								
Ground Fault	0.6	0.45												

Mechanical Inspections

Description of Inspection	Status	Comments
Main & Arcing Contacts	OK	
Arc Chutes	OK	
Phase Barriers	OK	
Bus & Grounding Stabs	OK	
Interlocks	0K	
Manual Operation	OK	
Electrical Operation	N/A	

Electrical Tests

Test Description	φA	ϕB	φC	A/B	B/C	C/A
Insulation Resistance (M Ω)	>999	>999	>999	>999	>999	>999
Contact Resistance ($\mu\Omega$)	26	25	25			
Results Satisfactory	OK					



Technical Field Service Department
31 Pullman Court, Scarborough, Ontario M1X 1E4. Phone: (416)-298-9977 Fax: (416)-298-2907

Eurasia Pavilion



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 18, 1999		
File Number	6621	Tested By	RPM		
Location	361A Old Finch Ave., Scarborough, Ontario				
Equipment I.D.	Feeder to Main Switchgear				
Substation	Eurasia Pavilion				

High Voltage Air/Load Break Switch

	Namepla	te Data		
Manufacturer	S&C	Voltage	27	kVolts
Туре	Alduti	Current	600	Amps
Style #		B.I.L.	150	kVolts
Cat#	34063R2	Serial #		

Mechanical Inspections

Description of Inspection	Status	Comments
Key Interlock	N/A	
Operating Mechanism	OK	
Operating Handle Grounding	N/A	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

L		• • • • • • • • • • • • • • • • • • • •				and the second second
Test Description	φA	φ Β	φC	A/B	B/C	C/A
Insulation Resistance (G Ω)	236	232	278	>505	>505	>505
Contact Resistance (μΩ)	48	52	61			
Arc Interrupter Res.(Ω)	1.2	1.3	1.6	468.5		
	·					
Results Satisfactory	l ok					

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T.S. HV_ABS



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 18, 1999	
File Number	6621	Tested By	RPM/ AN	
Location	361A Old Finch Ave., Scarborough, Ontario			
Equipment I.D.	Feeder to Entrance Facilities			
Substation	Eurasia Pavilion			

High Voltage Air/Load Break Switch

e deservices	Nameplate Data			
Manufacturer	S&C	Voltage	27	kVolts
Type	Alduti	Current	600	Amps
Style #		B.I.L.	150	kVolts
Cat#	34063R2	Serial #		

Mechanical Inspections Description of Inspection Status Comments N/A **Key Interlock** Operating Mechanism OK **Operating Handle Grounding** N/A N/A **Grounding Mat** OK **Stationary Contact Surfaces** OK **Moving Contact Surfaces Arcing Contact Surfaces** OK OK **Contact Alignment** Arcing Interrupter OK **Connector Condition** OK OK **Insulator Condition Phase Barrier Condition** OK **Support Structure Condition** OK

Electrical Tests						
Test Description	ϕA	φ <i>B</i>	φC	A/B	B/C	C/A
Insulation Resistance (G Ω)	236	232	278	>505	>505	>505
Contact Resistance (μΩ)	39	42	40	1000	W12	0.0
Arc Interrupter Res.(Ω)	3.1	2.0	3.6	PART COLUMN TO THE STATE OF THE		
	Т					
Results Satisfactory	OK					

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Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 18, 1999	
File Number	6621	Tested By	RPM/ AN	
Location	361A Old Finch Ave., Scarborough, Ontario			
Equipment I.D.	Paddock Feeders (Centre & South)			
Substation	Eurasia Pavilion			

High Voitage Air/Load Break Switch

	Nameplate D	ata		
Manufacturer	S&C	Voltage	27	kVolts
Туре	SM-Alduti-Indoor	Current	600	Amps
Style #		B.I.L.	150	kVolts
Cat #	34363R4-T5	Serial#		

Mechanical Inspections

Description of Inspection	Status	Comments
Key Interlock	POOR	Kirk RE12023 & RE12019
Operating Mechanism	OK	
Operating Handle Grounding	N/A	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	
	Electrical Tes	ts

ϕA	φB	φC	A/B	B/C	C/A
60		58			
1.9		0.6	120000		a di angalente
	(0)	60	60 58	60 58	60 58 44.54.44.45

Results Satisfactory See Deficiencies.



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 18, 1999	
File Number	6621	Tested By	RPM/ AN	
Location	361A Old Finch Ave., Scarborough, Ontario			
Equipment LD.	Paddock Feeders (Centre & South)			
Substation	Eurasia Pavilion			

High Voltage Power Fuse

Fuse Holder Na	meplate Data		
S&C	Voltage	34.5	kVolt
SM-5S	Current	300E	Amps
	Serial #		
Fuse Link Naı	neplate Data		
SM-5	TCC	153-4	
134125R	Amps	80E	
	S&C SM-5S Fuse Link Nar SM-5	S&C Voltage SM-5S Current Serial # Fuse Link Nameplate Data SM-5 TCC	S&C Voltage 34.5 SM-5S Current 300E Serial # Fuse Link Nameplate Data SM-5 TCC 153-4

Mechanical Inspections Description of Inspection Status Comments Operating Mechanism OK **Contact Surfaces** OK **Contact Penetration** OK Contact Alignment OK Fuse Barrel OK **Connector Condition** OK **Insulator Condition** OK **Phase Barrier Condition** ŌΚ **Support Structure Condition** QΚ Only One Spare Present in Cell **Spare Fuses** Fair

Electrical Tests						
Test Description	φA	ϕB	φC	A/B	B/C	C/A
Insulation Resistance (M Ω)						
Contact Resistance (μΩ)	966		1286		10.60	
						<u>.</u>
Results Satisfactory	Fair. See Recommendations.					

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Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 18, 1999	
File Number	6621	Tested By	RPM	
Location	361A Old Finch Ave., Scarborough, Ontario			
Equipment I.D.	Eurasia Pavilion Transformer –T1			
Substation	Eurasia Pavilion			

High Voltage Alr/Load Break Switch

	Nameplate Data			
Manufacturer	S&C	Voltage	27.6	kVolts
Туре	SM-Alduti-Indoor	Current	600	Amps
Style #		B.I.L.	150	kVolts
Cat #	34563R4-T2	Serial #		

Mechanical Inspections

TACCHAINCAL ANS DECIDIES					
Description of Inspection	Status	Comments			
Key Interlock	N/A				
Operating Mechanism	OK				
Operating Handle Grounding	N/A				
Grounding Mat	N/A				
Stationary Contact Surfaces	OK				
Moving Contact Surfaces	OK				
Arcing Contact Surfaces	OK				
Contact Alignment	OK				
Arcing Interrupter	OK				
Connector Condition	OK				
Insulator Condition	OK.				
Phase Barrier Condition	OK	V-10-01-01-01-01-01-01-01-01-01-01-01-01-			
Support Structure Condition	OK				

Electrical Tests

Test Description	ϕA	φB	φC	A/B	B/C	C/A
Insulation Resistance (GΩ)	236	232	278	>505	>505	>505
Contact Resistance (μΩ)	41	42	44			
Arc Interrupter Res.(Ω)	0.9	1.2	0.4	71 1,92 19	ententent	Carlighaede

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T.S. HV_ABS



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 18, 1999	
File Number	6621	Tested By	RPM/ AN	
Location	361A Old Finch Ave., Scarborough, Ontario			
Equipment I.D.	Eurasia Pavilion Trans. #1			
Substation	Eurasia Pavilion			

High Voltage Power Fuse

	Fuse Holder Na	meplate Data		e Bejand
Manufacturer	S&C	Voltage	34.5	kVolt
Type	SM-5S	Current	300E	Amps
Style/Cat #	86644R1	Serial #		
	Fuse Link Nan	neplate Data		
Туре	SM-5	TCC	153-4	
Style/Cat #	134025R4	Amps	15E	

Mechanical Inspections				
Description of Inspection	Status	Comments		
Operating Mechanism	OK			
Contact Surfaces	OK			
Contact Penetration	OK			
Contact Alignment	OK			
Fuse Barrel	OK			
Connector Condition	OK			
Insulator Condition	OK			
Phase Barrier Condition	OK			
Support Structure Condition	OK			
Spare Fuses	OK	3 Spares in Cell		

	Eld	ectrical Te	ests			
Test Description	φA	ϕB	φC	A/B	B/C	C/A
Insulation Resistance (M Ω)	>999	>999	>999	>999	>999	>999
Contact Resistance (μΩ)	6020	5940	6080	19444	e grande g	
Results Satisfactory	ОК					

T.S

T.S. HV_Fuse

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 18, 1999	
File Number	6621 Tested By RPM/TL			
Location	361A Old Finch Ave., Scarborough, Ontario			
Equipment I.D.	Eurasia Pav. Trans. T-1			
Substation	Eurasia Pavilion			

Power Transformer -Electrical

		Na	meplate Data			
Manufacturer	Westinghou	ise	Vector Group	Y-Y		
Туре	LNAN		Serial #.	849380		
Neutral	Solid		Liquid Type/Vol	Askarel	200	Gal
Rating	225/ 252	kVA	Total Weight	6450		lbs.
Impedance	5.9	%	Primary Voltage	27.6/ 16		kVolt
Phase	3	ф	Secondary Voltage	208/ 120	•	Volt
Frequency	60	Hz	BIL	150/45		kVolt
		In	ulation Tests			

Insulation Resistance	Prim. With	Sec. With	Prim. & Sec.
@ 5k / 500 VDC	Sec. Grounded	Prim. Grounded	To Ground
ΜΩ	40.0	34.2	
Corrected to 20 °C.	112.0	95.8	
		The second second	

	CH-L+G	CH-G	CH-L	CL-G	CL-H+G
Cap (pF)					
Corr. 20 °C					
The second	and the state of		注:"按定位的16516"	在在 教 理(表面)	1.00
Dis. Fact.(%)					

Corr. 20 °C.

Turns	Ratio	Tests
-------	-------	-------

Primary Volts	Calculated Ratio	<u>X0-X1</u> H0-H1	<u>Х0-Х2</u> Н0-Н2	<u>Х0-Х3</u> Н0-Н3
27,600	0.754	0.746	0.746	0.746
	Volts	Volts Ratio	Volts Ratio H0-H1	Volts Ratio H0-H1 H0-H2

Tap Position Found & Left	3 (27,600V)
Results Satisfactory	OK
TC	

 $^{^{}T.S.}\ P_Trans_Elect$



TECHNICAL FIELD SERVICE DEPARTMENT

Special Projects Group

Client Information

Customer	Toronto Zoo	Sample Date	June 18, 1999		
File Number	6621	Sampled By	TL		
Location	361A Old Finch Ave., Scarborough, Ontario				
Equipment I.D.	T-1				
Substation	Eurasia Pavilion				

Oil Analysis

Transformer Data					
Manufacturer Westinghouse Primary Volts 27.6/16 kVo					
Туре	LNAN	Rating	225/ 252	kVA	
Serial No.	849380	Liquid Volume	200	Gals.	

Laboratory Tests

	A COTA A N		T 4 D 14 -
Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	D877	30 kV	48.8
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.008
Interfacial Tension	D971	32 Dynes/ Cm Min.	N/A
Specific Gravity	D1298	0.84 - 0.91 (Oil)	1.520
Colour	D1500	≤3.5	0.5
Visual Condition	D1524	Clear	Clear
Water Content	D1533	30 ppm (<69kV)	
Power Factor	D924	1.0 % Max @ 25 °C	
PCB Content	D4059	50 ppm Max.	
Inhibitor	D2668	≥9.29%	
Furans	D5837	<100 ppb	
Hydrogen (H2)			
Oxygen & Argon			
Nitrogen (N2)			
Methane (CH4)			
Carbon Monoxide (CO)			
Carbon Dioxide (CO2)			
Ethylene (C2H4)			
Ethane (C2H6)			
Acetylene (C2 H2)			
Total Gas Content			
			•

Chemical Properties OK

PCB Content PCB fluid

Dissolved Gas Content ---

^{1.5.}

T.S. Oil_Analysis



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 18, 1999
File Number	6621	Tested By	TL
Location	361A Old Finch Ave., Scarborough, Or	itario	
Equipment I.D.	Eurasia Pavilion Transformer T-1		
Substation	Eurasia Pavilion		

Power Transformer - Mechanical

Description of Inspection		Inspect	Comments
Breather & Silica Gel		/A	Comments
Explosion Vent Gaskets		/A	
Pressure Relief Device)K	
Conservator Tank Gaskets		/A	
Inspection Cover Gaskets		K	· <u></u>
Main Cover Gaskets		7/A	**************************************
Primary Bushing Gaskets		K	
Primary Bushing Porcelain		OR	H3 top skirt split/ cracked
Primary Bushing Connections		K	
Secondary Bushing Gaskets		K	
Secondary Bushing Porcelain	C	K	
Secondary Bushing Connections		K	
Secondary Throat Gaskets	C	K	
Radiator	C	K	
Pressure Gauge	C	K	-0.8 PSI Vacuum
Gas Relay	N	/A	
Oil Level	C)K	
Oil Leaks	C)K	None Visible
Tank Vaives	С)K	
Oil Temperature Gauge	C)K	
Oil Temperature Run/Max	34	41°C	
Winding Temperature Gauge	N	//A	
Winding Temperature Run/Max		<u> </u>	
Tap Changer			Unit Locked: Inoperable
Paint Condition	C	K	
Pad	C)K	
Grounding	C	K	One-point grounding
Fan Operation	N	/ A	
Control Wiring	N	/A	

T.S. P_Trans_Mech



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 18, 1999
File Number	6621	Tested By	TL
Location	361A Old Finch Ave., Scarbo	rough, Ontario	
Equipment I.D.	T-1 Secondary		
Substation	Eurasia Pavilion		

Bus Duct

	Nameplate Data				
Manufacturer	Square D	Voltage	600	Volts	
Туре	I-Line	Current	800	Amps	
Style	3 Phase, 4 Wire	B.I.L.		kVolts	
Cat #	AF-510-23-FES	Serial #	T1	•	

Mechanical Inspections Description of Inspection Status Comments **Bus Insulation** OK Type of Bus Insulation OK **Support Insulators** OK Interior Clean OK Visible Sections Only Visible Sections Only Interior Dry OK **Bus Duct Enclosure** OK **Bus Duct Enclosure Ventilated** N/A Bus Joints Clean & Dry OK **Bus Joints Torqued** OK Gaskets at Joints OK Grounding OK **Enclosure Paint Condition** OK **Support Structure** OK

lectrical	Tests				
ϕB	φC	N	A/B	B/C	C/A
1990	2250		4780	4980	5500
	· · · · · · · · · · · · · · · · · · ·				

T.S. Bus_Buct



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 18, 1999
File Number	6621	Tested By	RPM
Location	361A Old Finch Ave., Scar., Ontario		
Equipment I.D.	Main Secondary C.B.		
Substation	Eurasia Pavilion		

Low Voltage Air Circuit Breaker

	Nameplate Data					
Manufacturer	ITE	Voltage	600	Volts		
Туре	K-1600	Frame Rating	1600	Amps		
Serial #	98013	Int. Rating	65	kAmps		
Relay Type	OD4 Dashpots Only	Sensors Ratio	800	Amps		
Rating Plug.		Limiter Rating	N/A	Amps		

Relay Calibration Results Settings φC φB T.D. P/U T.D P/U P/U T.D. P/U T.D. 800A Long Time Inst. **Short Time** 3200A Instantaneous P/U T.D. **Ground Fault**

Mechanical Inspections Description of Inspection Status Comments Main & Arcing Contacts OK OK Arc Chutes **Phase Barriers** OK **Bus & Grounding Stabs OK** Interlocks OK Rack Out Only Manual Operation OK **Electrical Operation** N/A

	Ele	ectrical To	ests			
Test Description	φA	φB	φC	A/B	B/C	C/A
Insulation Resistance (M Ω)	>999	>999	>999	>999	>999	>999
Contact Resistance (μΩ)	58	64	52	COSTS		
Results Satisfactory	OK					
T.S.						

T.S. LV_ACB

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 18, 1999
File Number	6621	Tested By	KH
Location	361A Old Finch Ave., Scarborough, (Ontario	
Equipment I.D.	Weston Station Transformer		

Padmounted Distribution Transformer

Manufacturer	Federal Pio	neer	Year Built	1976			
Туре	ONAN		Serial #	A11808	-1		
Neutral	Solid		Liquid Type/Vol	Oil	260		Gal
Rating	225	kVA	Total Weight	4650		lb	S.
Impedance		%	Primary Voltage	27.6/ 16		k	Volt
Phase(s)	3	•	Secondary Voltage	208/120)	V	olt
Frequency	60	Hz	BIL			k	Volt
Insulation Resist	ance (MΩ)		* *				

Oii Analysis

Laboratory Tests							
Type of Test	ASTM No.	Acceptable Limits	Test Results				
			1999				
Dielectric Breakdown	D877	30 kV Min.	37.4				
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.014				
Interfacial Tension	D971	32 Dynes/ Cm Min.	27.1				
Specific Gravity	D1298	0.84 - 0.91	0.853				
Colour	D1500	≤3.5 Max.	0.5				
Visual Condition	D1524	Clear	Clear				

Observations & Comments					
Comments:	IFT of the oil is marginal.				
1	This station's switchgear was reported to be in POOR condition				
Results Satisfactory:	FAIR/ Poor				

T.S. P_Trans_Elect



Technical	Field Service	Department
T CCITITION	I SUSH DUI FELL	DCP40 +IIIVII

31 Puliman Court, Scarborough, Ontario M1X 1E4. Phone: (416)-298-9977 Fax: (416)-298-2907

Indo-Malaya Pavilion



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 17, 1999	
File Number	6621	Tested By	KH	
Location	361A Old Finch Ave., Scarborough, Ontario			
Equipment I.D.	Loop Feeder to Entrance Facilities			
Substation	Indo-Malaya Pavilion			

High Voltage Air/Load Break Switch

en grande de la companya de la compa	Nameplate	Data	e de la	
Manufacturer	S&C	Voltage	27	kVolts
Туре	Alduti	Current	600	Amps
Style #		B.I.L.	150	kVolts
Cat #	34063	Serial #		

Mechanical Inspections

Description of Inspection	Status	Comments
Key Interlock	N/A	
Operating Mechanism	OK	
Operating Handle Grounding	N/A	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	Fair	Bø terminator skirt broken off.
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	ϕA	φB	φC	A/B	B/C	C/A
Insulation Resistance (GΩ)	438	>505	>505	>505	>505	>505
Contact Resistance (μΩ)	55	47	52			
Arc Interrupter Res.(Ω)	0.9	0.6	0.7	Markey Co	1-70 min	46.0460

Results Satisfactory OK/ Fair. See Deficiencies.

1.5

T.S. HV_ABS

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 17, 1999		
File Number	6621	Tested By	KH		
Location	361A Old Finch Ave., Scarborough, Ontario				
Equipment I.D.	Feeder to Africa Pavilion				
Substation	Indo-Malaya Pavilion				

High Voltage Air/Load Break Switch

		Nameplate Data			
Manufacturer	S&C		Voltage	27	kVolts
Туре	Alduti		Current	600	Amps
Style #			B.I.L.	150	kVolts
Cat #	34063		Serial #		

Comments

Mechanical InspectionsDescription of InspectionStatusKey InterlockN/A

OK Operating Mechanism **Operating Handle Grounding** N/A N/A Grounding Mat OK **Stationary Contact Surfaces** OK **Moving Contact Surfaces** OK **Arcing Contact Surfaces** Contact Alignment OK OK Arcing Interrupter **Connector Condition** OK **Insulator Condition** OK

Phase Barrier Condition OK
Support Structure Condition OK

Electrical Tests						
Test Description	φA	φB	φC	A/B	B/C	C/A
Insulation Resistance (M Ω)						
Contact Resistance (μΩ)	62	56	52			
Arc Interrupter Res.(Ω)	0.6	0.7	0.5	a de avoir	eric of texts	And Pro-

T.S. HV_ABS



Special Projects Group

V. 5 - 1 - 2 - 5 - 1

Client Information

Customer	Toronto Zoo	Date	June 17, 1999		
File Number	6621	Tested By	KH		
Location	361A Old Finch Ave., Scarborough, Ontario				
Equipment I.D.	Indo-Malaya Paddock Feeder				
Substation	Indo-Malaya Pavilion				

High Voltage Air/Load Break Switch

	Nameplate	Data	•	
Manufacturer	S&C	Voltage	27.6	kVolts
Туре	SM-Alduti	Current	600	Amps
Style #		B.I.L.	150	kVolts
Cat #	34563R4-T5	Serial #		

Mechanical Inspections

Description of Inspection	Status	Comments
Key Interlock	OK	
Operating Mechanism	OK	
Operating Handle Grounding	N/A	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	OK	
Contact Alignment	OK	
Arcing Interrupter	Роот	Operator is defective
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	

Electrical Tests

Test Description	φA	φB	φC	A/B	B/C	C/A
Insulation Resistance (M Ω)						
Contact Resistance (μΩ)			62	17 19 9 1	nasaya sa	
Arc Interrupter Res.(Ω)			*	Grane a	6.0	

Results Satisfactory Fair. See Deficiencies

T.S. HV_ABS

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 17, 1999
File Number	6621	Tested By	KH
Location	361A Old Finch Ave., Scarborous	gh, Ontario	
Equipment I.D.	Indo-Malaya Paddock Feeder		
Substation	Indo-Malaya Pavilion		

High Voltage Power Fuse

	Fuse Holder Na	meplate Data		Sing Free
Manufacturer	S&C	Voltage	34.5	kVolt
Туре	SM-5	Current	300	Amps
Style/Cat #	86644R1	Serial #		
	Fuse Link Nar	neplate Data		
Туре	SM-5	TCC		
Style/Cat #		Amps		

Mechanical Inspections Description of Inspection Status Comments Operating Mechanism OK **Contact Surfaces** OK OK **Contact Penetration** OK Contact Alignment Fuse Barrel OK **Connector Condition** OK **Insulator Condition** OK **Phase Barrier Condition** OK **Support Structure Condition** OK No Spares in Cell Spare Fuses Poor

Electrical Lests						
Test Description	6 A	φB	φC	A/B	B/C	C/A
Insulation Resistance (M Ω)						
Contact Resistance ($\mu\Omega$)			1015			Maria ya sa
Results Satisfactory	Fair. Spa	are links r	equired.		<u>-</u>	
Results Satisfactory	Fair. Spa	are links r	equired.			

T.S. HV_Fuse



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 17, 1999
File Number	6621	Tested By	KH
Location	361A Old Finch Ave., Scarborough, C	Intario	
Equipment I.D.	Indo-Malaya Transformer T2		
Substation	Indo-Malaya Pavilion		

High Voltage Air/Load Break Switch

	Nameplate Data			
Manufacturer	S&C	Voltage	27	kVolts
Туре	SM - Alduti	Current	600	Amps
Style #		B.L.L.	150	kVolts
Cat #	34563R4-T2	Serial #		

Mechanical Inspections

Description of Inspection	Status	Comments
Key Interlock	N/A	
Operating Mechanism	OK	
Operating Handle Grounding	N/A	
Grounding Mat	N/A	
Stationary Contact Surfaces	OK	
Moving Contact Surfaces	OK	
Arcing Contact Surfaces	Fair	Surfaces pitted
Contact Alignment	OK	
Arcing Interrupter	OK	
Connector Condition	OK	
Insulator Condition	OK	
Phase Barrier Condition	OK	
Support Structure Condition	OK	
	170 1 . 11 . TEC	4

Electrical Tests Test Description ϕC A/B B/C C/A ϕB ϕA Insulation Resistance (M Ω) Contact Resistance (μΩ) 50 48 46 Arc Interrupter Res.(Ω) 1.0 0.5 0.8 OK **Results Satisfactory**

TS

T.S. HV_ABS

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 17, 1999
File Number	6621	Tested By	KH
Location	361A Old Finch Ave., Scarboroug	h, Ontario	
Equipment I.D.	Indo-Malaya Transformer T2		
Substation	Indo-Malaya Pavilion		

High Voltage Power Fuse

	F	use Hole	der Namer	late Data	a	Professional	
Manufacturer	S&C				Voltage	27.6	kVolt
Туре	SM-5S				Current	300E	Amps
Style/Cat #					Serial #		
		Fuse Lir	ık Namepl	ate Data	eriteria. T		Y41
Туре	SM-5				TCC	153-4	
Style/Cat #	134040	R4			Amps	25E	
	* 1 *	Mecha	nical Insp	ections			***
Description of Inspection Status				Cor	nments		
Operating Mechanism			OK				
Contact Surfaces			OK				
Contact Penetration			OK				
Contact Alignment			OK				
Fuse Barrel			OK				
Connector Condition			OK				
Insulator Condition			OK				
Phase Barrier Conditio	n		OK				
Support Structure Con	dition		OK				
			OK	3 Spa	ares in Cell		
		El	ectrical Te	sts			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Test Description		ф4	φB	φC	A/B	B/C	C/A
Insulation Resistance (ΜΩ)						
Contact Resistance (μΩ	2)	3024	3055	3148	10,000,000	remark and	DOM:

OK

Results Satisfactory

T.S. HV_Fuse



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 17, 1999
File Number	6621	Tested By	TL
Location	361A Old Finch Ave., Scarbon	ough, Ontario	
Equipment I.D.	Indo-Malaya Pavilion Trans.	7-2	
Substation	Indo-Malaya Pavilion		

Power Transformer -Electrical

Manufacturer			Vector Group	Y-Y		
Туре			Serial #.	795156		
Neutral	Solid		Liquid Type/Vol	Askarel	220	Ga
Rating	500/ 560	kVA	Total Weight	8500		lbs.
Impedance	7.1	%	Primary Voltage	27.6/ 16		kVolt
Phase	3	φ	Secondary Voltage	208/ 120		Volt
Frequency	60	Hz	BIL	150/45		kVolt

Insulation Tests Prim. With Sec. With Prim. & Sec. Insulation Resistance Prim. Grounded To Ground @ 5k / 1k VDC Sec. Grounded 28.0 24.2 $M\Omega$ 78.4 67.8 Corrected to 20 °C. and the second of the second o

	CH-L+G	CH-G	CH-L	CL-G	CL-H+G
Cap (pF)					
Corr. 20 °C					
77. 连轮头线	the comment	29	Contract that		Berthells -
Dis. Fact.(%)					
Corr. 20 °C.					

Turns Ratio Tests Tap **Primary** Calculated X0-X1 X0-X2 X0-X3 H0-H2 Н0-Н3 Ratio H0-H1 Volts 1 2 0.746 0.746 0.754 0.746 3 27,600 4 5

Tap Position Found & Left	3 (27,600V)	
Results Satisfactory	OK	
TC		

T.S. P_Trans_Elect



TECHNICAL FIELD SERVICE DEPARTMENT

Special Projects Group

Client Information

Customer	Toronto Zoo	Sample Date	June 17, 1999			
File Number	6621	Sampled By	TL			
Location	361A Old Finch Ave., Scarborough, Ontario					
Equipment I.D.	T-2	T-2				
Substation	Indo-Malaya Pavilion					

Oli Analysis

Transformer Data							
Manufacturer	Westinghouse	Primary Volts	27.6/ 16	kVolts			
Туре	LNAN	Rating	500/ 560	kVA			
Serial No.	795156	Liquid Volume	220	Gals.			

Laboratory Tests **Test Results** Type of Test ASTM No. Acceptable Limits 1999 30 kV 48.1 Dielectric Breakdown **D877** 0.012 **Neutralization Number** D974 0.05 Max. Mg Koh/G 32 Dynes/ Cm Min. N/A Interfacial Tension D971 Specific Gravity 0.84 - 0.91 (Oil) 1.420 D1298 0.5 Colour D1500 ≤3.5 Clear Visual Condition D1524 Clear Water Content D1533 30 ppm (<69kV) **Power Factor** D924 1.0 % Max @ 25 °C 50 ppm Max. **PCB Content** D4059 ≥0.20% Inhibitor D2668 <100 ppb Furans D5837 Hydrogen (H2) Oxygen & Argon Nitrogen (N2) Methane (CH4) Carbon Monoxide (CO) Carbon Dioxide (CO2) Ethylene (C2H4) Ethane (C2H6) Acetylene (C2 H2)

Chemical Properties OK
PCB Content PCB fluid
Dissolved Gas Content ---

Total Gas Content

T.S. Oil_Analysis



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 17, 1999		
File Number	6621	Tested By	TL		
Location	361A Old Finch Ave., Scarborough, Ontario				
Equipment I.D.	T-2				
Substation	Indo-Malaya Pavilion				

Power Transformer -Mechanical

Description of Inspection	Sta	itus	Comments
Breather & Silica Gel	N	/A	
Explosion Vent Gaskets	N.	/A	
Pressure Relief Device	0	K	
Conservator Tank Gaskets	N	/A	
Inspection Cover Gaskets	0	K	
Main Cover Gaskets	N	/A	Welded Top
Primary Bushing Gaskets	О	K	
Primary Bushing Porcelain	0	K	
Primary Bushing Connections	0	K	
Secondary Bushing Gaskets	О	K	
Secondary Bushing Porcelain	0	K	
Secondary Bushing Connections	C	K	
Secondary Throat Gaskets	С	K	
Radiator	C	K	
Pressure Gauge	С	K	-0.5 lb. Vacuum
Gas Relay	N	/A	
Oil Level	C)K	
Oil Leaks	C)K	None Present
Tank Valves	C)K	
Oil Temperature Gauge	C)K	
Oil Temperature Run/Max	37	40°c	
Winding Temperature Gauge	N	/A	
Winding Temperature Run/Max			
Tap Changer			Unit Locked: Inoperable
Paint Condition	C)K	
Pad)K	
Grounding	C)K	One-point grounding
Fan Operation	N	/ A	
Control Wiring	N.	/A	

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T.S. P_Trans_Mech

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 17, 1999			
File Number	6621	Tested By	TL			
Location	361A Old Finch Ave., Scarborough, Ontario					
Equipment I.D.	T-2 Secondary					
Substation	Indo-Malaya Pavilion					

Bus Duct

1.1.	Nameplate Da	ıta .	1883	
Manufacturer	FPE	Voltage	120/208	Volts
Туре	Power Clad	Current	1600	Amps
Style	3 Phase, 4 Wire	B.I.L.		kVolts
Cat#	08-01599	Serial #		
	Mechanical Inspe	ections		建筑机

Mechanical Inspections Description of Inspection Status Comments Bus Insulation OK Type of Bus Insulation OK **Support Insulators** OK OK Visible Sections Only Interior Clean Visible Sections Only Interior Dry OK Bus Duct Enclosure OK Bus Duct Enclosure Ventilated N/A Bus Joints Clean & Dry OK **Bus Joints Torqued** OK Gaskets at Joints OK Grounding OK **Enclosure Paint Condition** OK **Support Structure** OK

1 × 1 × 1 × 1 × 1 × 1 × 1 × 1	E)	ectrical '	Tests	<u> </u>	+* +	<u> </u>	1.5
Test Description	ϕA	φB	φC	N	A/B	B/C	C/A
Insulation Resistance (M Ω)	1260	1140	1090		1980	2160	3280
Comments							
Results Satisfactory OK							
TC							

T.S

T.S. Bus_Buct



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 17, 1999
File Number	6621	Tested By	RPM
Location	361A Old Finch Ave., Scar., Ontario		
Equipment I.D.	Main Secondary C.B.		
Substation	Indo-Malaya Pavilion		

Low Voltage Air Circuit Breaker

	Nameplate Data			
Manufacturer	FPE	Voltage	600	Volts
Туре	50H-2	Frame Rating	1600	Amps
Serial #	TH-4123.72	Int. Rating	50	kAmps
Relay Type	Carriere FB600E	Sensors Ratio	1600:1	Amps
Rating Plug.		Limiter Rating	N/A	Amps
	Relay Calibration Re	sults		

	Settings		φA		φ <i>B</i>		φC	
	P/U	T.D	P/U	T.D.	P/U	T.D.	P/U	T.D.
Long Time	0.9x	7.5		5.809		5.881		5.963
Short Time	6x	0.40		0.451		0.445		0.450
Instantaneous	10x			0.055		0.065		0.064
			P/U	T.D.				
Ground Fault	0.4x	0.4		0.415				

Mechanical Inspections

Comments
Front Barrier Missing
Rack Out Only

Electrical Tests

Test Description	ØA	φB	φC	A/B	B/C	C/A
Insulation Resistance (M Ω)	>999	>999	>999	>999	>999	>999
Contact Resistance (μΩ)	14	17	22			
Results Satisfactory	OK/ Fair				<u> </u>	

T.S. LV_ACB

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 17, 1999
File Number	6621	Tested By	RPM
Location	361A Old Finch Ave., Scar., Ontario		
Equipment I.D.	DP MB		
Substation	Indo-Malaya Pavilion		

Low Voltage Air Circuit Breaker

	Nameplate	Data		,
Manufacturer	FPE	Voltage	600	Volts
Type	50H-2	Frame Rating	1600	Amps
Serial #	TH-4124/72	Int. Rating	50	kAmps
Relay Type	Carriere FB600E	Sensors Ratio	1600:1	Amps
Rating Plug.		Limiter Rating	N/A	Amps

Relay Calibration Results

	Sett	ings	4	A	(þ B	9	b C
	P/U	T.D	P/U	T.D.	P/U	T.D.	P/U	T.D.
Long Time	0.65x	7.5		5.945		6.204		6.110
Short Time	4x	0.25		0.282		0.300		0.284
Instantaneous	6x			0.124		0.104		0.108
			P/U	T.D.				
Ground Fault	0.4x	0.4		0.26				

Mechanical Inspections

Description of Inspection	Status	Comments
Main & Arcing Contacts	OK	
Arc Chutes	OK	
Phase Barriers	Fair	Front Barriers Cracked
Bus & Grounding Stabs	OK	
Interlocks	OK	Rack Out Only
Manual Operation	Poor (as found)	Mechanism restored to operation
Electrical Operation	N/A	

Electrical Tests

Test Description	ϕA	φB	φC	A/B	B/C	C/A
Insulation Resistance (MΩ)	>999	>999	>999	>999	>999	>999
Contact Resistance (μΩ)	32	24	28	narrit !	的的地位	

Results Satisfactory T.S. Fair as found.



31 Pullman Court, Scarborough, Ontario MIX 1E4. Phone: (416)-298-9977 Fax: (416)-298-2907

Cable Tests

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 14-18, 1999		
File Number	6621	Tested By	RPM/ KH		
Location	361A Old Finch Ave., Scarborough, Ontario				
Equipment I.D.	Loop Feed Underground Power Cab	les			
Substation	Various				

Power Cable Inspection

Cable Nameplate Data							
Manufacturer		Voltage	28	kVolts			
Insulation Type	XLPE	Ambient Temp.		oC_			
Conductor Type	Copper (CU)	Humidity		%			

Electrical Test Insulation Resistance (M Ω) B/C C/A Feeder Identification A/B фΑ φВ φС 7,700 4,900 34,000 Incoming Outdoor 27.6kV Feeder 68,000 725 18,100 Main Switchgear to Eurasia Pavilion 750 790 785 3,960 4,080 3,920 Main Switchgear to Service Building 805 4,180 3,700 3,760 800 680 Service Bld. to N. America Pavilion 680 710 660 3,400 3,400 3,200 N. America to Africa Pavilion 670 715 680 3,500 3,600 3,380 Africa to Indo-Malaya Pavilion 665 555 665 3,000 3,000 3,340 Ent./ Admin. to Eurasia Pavilion 396 402 2,040 2,100 2,040 386 (with Lightning Arrestors connected) 3,980 3,940 Ent./ Admin. to Indo-Malaya Pavilion 760 810 760 4,080

Results Satisfactory

1.3

T.S. Power_Cable

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 28, 1999		
File Number	6693	Tested By	RPM		
Location	361A Old Finch Ave., Scarborough, Ontario				
Equipment LD.	Loop Feed to Indo-Malaya Pavilion (tested after &B splice repair)				
Substation	Africa Pavilion				

Cable High-Potential Test

	Cable N	ameplate Data		
Manufacturer		Voltage	28	kVolts
Insulation Type	XLPE	Conductor Size	3/0	MCM
Conductor Type	Copper (CU)	Temp. & Hum.	28	oc
	and the second second	inical Test		。 反為於 其為於2.15

Test Voltage @ 25 kVdc.		Leakage Current	
Voltage Increments	φA	φB	φC
5 kV	17 -	14	13
10 kV	35	33	39
15 kV	55	47	27
20 kV	45	50	32
25 kV	64	68	46
Time at Test Voltage			
30 Seconds	46	48	27
1 Minute	43	46	25
2 Minutes	39	44	23
3 Minutes	36	43	20
4 Minutes	35	42	18
5 Minutes	34	41	17
6 Minutes			
7 Minutes	•		
8 Minutes			
9 Minutes		·	
10 Minutes			
11 Minutes			
12 Minutes			
13 Minutes			
14 Minutes			
15 Minutes			

<u> </u>						
Test Description	44	φB	φC	A/B	B/C	C/A
Insulation Resistance (M Ω)	675	436	1270	1210	1530	1880
Results Satisfactory	φC in bes	t conditio	n of 3 cabl	es tested.		
T.S.						

T.S. HV_Hypot

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 25, 1999	
File Number	6693	Tested By	RPM	
Location	361A Old Finch Ave., Scarborough, Ontario			
Equipment I.D.	Loop Feed to North America Pavilion (tested after oB splice repair)			
Substation	Africa Pavilion			

Cable High-Potential Test

Cable N	ameplate Data		
Pirelli	Voltage	28	kVolts
XLPE	Conductor Size	3/0	MCM
Copper (CU)	Temp. & Hum.	28_	oC
	Pirelli XLPE Copper (CU)	Pirelli Voltage XLPE Conductor Size Copper (CU) Temp. & Hum.	Pirelli Voltage 28 XLPE Conductor Size 3/0

Test Voltage @ 25 kVdc.		Leakage Current	
Voltage Increments	φА	φB	φC
4 kV	63 -	87	35
8 kV	80	79	43
12 kV	141	98	57
16 kV	149	142	63
20 kV	157	124	105
Time at Test Voltage			
30 Seconds	0.8	48	8
1 Minute	0.7	46	0
2 Minutes	0.7	44	0
3 Minutes	0.8	43	0
4 Minutes	0.9	42	0
5 Minutes	0.7	41	0
6 Minutes			
7 Minutes			
8 Minutes			
9 Minutes			
10 Minutes			
11 Minutes			
12 Minutes			
13 Minutes			
14 Minutes			
15 Minutes			<u> </u>

Test Description	\$4	φΒ	φС	A/B	B/C	C/A
Insulation Resistance (M Ω)						
Results Satisfactory	φC in bes	t conditio	n of 3 cabl	es tested.		
T.S.						

T.S. HV_Hypot



Technical	Field	Service	De	partment
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31 Pullman Court, Scarborough, Ontario MIX 1E4. Phone: (416)-298-9977 Fax: (416)-298-2907

SUBMERSIBLE Distribution Transformers

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 15, 1999
File Number	6621	Tested By	KH/RPM
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #1		

Submersible Distribution Transformer

Manufacturer	Westinghou	ıse	Year Built	1973		
Туре	ONAN		Serial #	971935		
Neutral	Solid		Liquid Type/Vol	Oil	16	Ga
Rating	25	kVA	Total Weight	465		lbs.
Impedance	1.9	%	Primary Voltage	16		kVolt
Phase(s)	1	ф	Secondary Voltage	120/ 24	10	Volt
Frequency	60	Hz	BIL	125		kVol
Insulation Resist	ance (MΩ)					

Oil	An	alv	/sis
~			

	Oil An		
A Property of the Control of the Con	Laborat	ory Tests	
Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	D877	30 kV Min.	36.5
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.014
Interfacial Tension	D971	32 Dynes/ Cm Min.	32.9
Specific Gravity	D1298	0.84 - 0.91	0.848
Colour	D1500	≤3.5 Max.	0.5
Visual Condition	D1524	Clear	Clear

	Observations & Comments
Comments:	 H1B elbow burnt. Elbow & transformer bushing insert should be replaced.
on a such distribution of	The Property of the Control of the C
Results Satisfactory:	POOR

T.S. P_Trans_Elect

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 15, 1999		
File Number	6621	Tested By	AS/TA		
Location	361A Old Finch Ave., Scarborough, Ontario				
Equipment I.D.	Vault #2				

Submersible Distribution Transformer

Manufacturer	McGraw Ed	lison	Year Built			
Туре	ONAN		Serial #	336007	-2	
Neutral	Solid		Liquid Type/Vol	Oil	255	Lit
Rating	100	kVA	Total Weight	522		Kg
Impedance	1.7	%	Primary Voltage	16		kVolt
Phase(s)	1	ф	Secondary Voltage	120/ 24	0	Volt
Frequency	60	Hz	BIL	125		kVolt
Insulation Resist	ance (MΩ)					

Oil Analysis

Laboratory Tests					
Type of Test	ASTM No.	Acceptable Limits	Test Results		
			1999		
Dielectric Breakdown	D877	30 kV Min.	39.5		
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.007		
Interfacial Tension	D971	32 Dynes/ Cm Min.	29.5		
Specific Gravity	D1298	0.84 - 0.91	0.860		
Colour	D1500	≤3.5 Max.	1.0		
Visual Condition	D1524	Clear	Clear		

Observations & Comments					
Comments:	-Red phase connection found loose at the tankIFT is borderline. Monitor for deterioration.				
Results Satisfactory:	OK/ Fair				



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 14, 1999		
File Number	6621	Tested By	RPM		
Location	361A Old Finch Ave., Scarborough, Ontario				
Equipment I.D.	Vault #6				

Submersible Distribution Transformer

Manufacturer	Westinghou	ıse	Year Built	1973		
Туре	ONAN		Serial #	861979		
Neutral	Solid		Liquid Type/Vol	Oil	16	G
Rating	25	kVA	Total Weight	465		lbs.
Impedance	1.9	%	Primary Voltage	16		kVo
Phase(s)	1	ф	Secondary Voltage	120/ 240)	Volt
Frequency	60	Hz	BIL	125		kVo
Insulation Resist	ance (MΩ)					

Oil Analysis

Laboratory Tests					
Type of Test	ASTM No.	Acceptable Limits	Test Results		
			1999		
Dielectric Breakdown	D877	30 kV Min.	35.8		
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.014		
Interfacial Tension	D971	32 Dynes/ Cm Min.	31.8		
Specific Gravity	D1298	0.84 - 0.91	0.849		
Colour	D1500	≤3.5 Max.	0.5		
Visual Condition	D1524	Clear	Clear		

·	Observations & Comments
Comments:	
er i de la companya d	
Results Satisfactory:	OK

T.S. P_Trans_Elect

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 14, 1999		
File Number	6621	Tested By	RPM/JRK/TA		
Location	361A Old Finch Ave., Scarborough, Ontario				
Equipment I.D.	Vault #7				

Submersible Distribution Transformer

Manufacturer	Westinghou	ıse	Year Built	1973		
Туре	ONAN		Serial #'s	White	861975 Ø: 86198 : 871930	0
Neutral	Solid		Liquid Type/Vol	Oil	16	Gal
Rating	25	kVA	Total Weight	465		lbs.
Impedance	1.9	%	Primary Voltage	16		kVolt
Phase(s)	1	ф	Secondary Voltage	120/ 24	Ю	Volt
Frequency	60	Hz	BIL	125		kVolt
Insulation Resist	ance (MΩ)					

Oil Analysis

Laboratory Tests Acceptable Limits Test Results Type of Test ASTM No. White Blue Red 37.7 49.4 45.1 D877 30 kV Min. Dielectric Breakdown 0.021 **Neutralization Number** D974 0.05 Max. Mg Koh/G 0.028 0.014 31.7 Interfacial Tension D971 32 Dynes/ Cm Min. 31.9 31.4 Specific Gravity 0.849 D1298 0.84 - 0.910.849 0.849 0.5 0.5 Colour 0.5 D1590 ≤3.5 Max. Visual Condition D1524 Clear Clear Clear Clear

Observations & Comments							
Comments:	Below marginal oil levels on all units.						
n in entre veganje se namen i se							
Results Satisfactory:	Fair.						

T.S. P_Trans_Elect

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 16, 1999		
File Number	6621	Tested By	RPM/TL		
Location	361A Old Finch Ave., Scarborough, Ontario				
Equipment I.D.	Vault #8				

Submersible Distribution Transformer

Manufacturer	Westingho	use	Year Built	1973		_	
Туре	ONAN		pe ONAN Serial #'s	Serial #'s	Red Ø: 871939 White Ø: 871938 Blue Ø: WO38300		
Neutral	Solid		Liquid Type/Vol	Oil	27	Ga	
Rating	50	kVA	Total Weight	770		Lbs.	
Impedance	1.9	%	Primary Voltage	16		KVol	
Phase(s)	1	ф	Secondary Voltage	120/ 24	40	Volt	
Frequency	60	Hz	BIL	125		KVol	
Insulation Resist		1111	1 DEL	1		1 12 7 0	

Oil Analysis

Laboratory Tests						
Type of Test	ASTM No.	Acceptable Limits	Test Results			
			Red	White	Blue	
Dielectric Breakdown	D877	30 kV Min.	42.5	43.1	43.0	
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.007	0.021	0.020	
Interfacial Tension	D971	32 Dynes/ Cm Min.	30.9	31.4	26.6	
Specific Gravity	D1298	0.84 - 0.91	0.850	0.853	0.859	
Colour	D1500	≤3.5 Max.	0.5	1.0	<0.5	
Visual Condition	D1524	Clear	Clear	Clear	Clear	

·	Observations & Comments
Comments:	-Red phase oil level is marginalBlue phase vault initially inaccessible. The water level in this vault
	does cover the transformer at timesBlue phase IFT is borderline.
	-White phase vault ground to lid is off.
Results Satisfactory:	

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 16, 1999		
File Number	6621	Tested By	TA		
Location	361A Old Finch Ave., Scarborough, Ontario				
Equipment I.D.	Vault #11				

Submersible Distribution Transformer

Manufacturer	Westinghouse		Year Built	1973			
Туре	ONAN		Serial #	861953			
Neutral	Solid		Liquid Type/Vol	Oil	34	G	Gal
Rating	75	kVA	Total Weight	1080		lbs.	,
Impedance	20	%	Primary Voltage	16		kVo	olt
Phase(s)	1	ф	Secondary Voltage	120/24	0	Volt	it
Frequency	60	Hz	BIL	125		kVo	olt
Insulation Resist	ance (MΩ)						

Oil Analysis

Type of Test	ASTM No.	Acceptable Limits	Test Results
* #			1999
Dielectric Breakdown	D877	30 kV Min.	47.5
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.034
Interfacial Tension	D971	32 Dynes/ Cm Min.	34.8
Specific Gravity	D1298	0.84 - 0.91	0.848
Colour	D1500	≤3.5 Max.	0.5
Visual Condition	D1524	Clear	Clear

Observations & Comments				
Comments:	No lock on lid Both hinges broken			
The state of the s	2 Detailinges broken			
Results Satisfactory:	OK			

T.S. P_Trans_Elect

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 16, 1999	
File Number	6621	Tested By	TA	
Location	361A Old Finch Ave., Scarborough, Ontario			
Equipment I.D.	Vault 11A			

Submersible Distribution Transformer

Carte		Year Built	1988		
ONAN		Serial #	Q1431-	-28	
Solid		Liquid Type/Vol	Oil	186	Lit
75	kVA	Total Weight	451		Kg
2.29	%	Primary Voltage	16		kVolt
1	ф	Secondary Voltage	120/ 24	Ю	Volt
60	Hz	BIL	125		kVolt
	ONAN Solid 75 2.29 1	ONAN Solid 75 kVA 2.29 % 1 ф	ONAN Serial # Solid Liquid Type/Vol 75 kVA Total Weight 2.29 % Primary Voltage 1 \$\oldsymbol{\phi}\$ Secondary Voltage	ONAN Serial # Q1431- Solid Liquid Type/Vol Oil 75 kVA Total Weight 451 2.29 % Primary Voltage 16 1	ONAN Serial # Q1431-28 Solid Liquid Type/Vol Oil 186 75 kVA Total Weight 451 2.29 % Primary Voltage 16 1 φ Secondary Voltage 120/240

Oil Analysis

	Laborat	ory l'ésite and acceptant	And the same of
Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	D877	30 kV Min.	46.7
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.013
Interfacial Tension	D971	32 Dynes/ Cm Min.	35.2
Specific Gravity	D1298	0.84 - 0.91	0.876
Colour	D1500	≤3.5 Max.	0.5
Visual Condition	D1524	Clear	Clear

	Observations & Comments
Comments:	No lock on vault
Results Satisfactory:	OK

T.S. P_Trans_Elect



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 14, 1999
File Number	6621	Tested By	RPM/JRK/TA
Location	361A Old Finch Ave., Scarborough, C	Ontario	
Equipment I.D.	Vault #12		

Submersible Distribution Transformer

NAN		Serial #'s	Red Ø:		
ONAN Solid			Blue Ø:	9:861963 861987	
		Liquid Type/Vol		27	Gal
0	kVA	Total Weight	ght 770		lbs.
.9	%	Primary Voltage	16	16	
	ф	Secondary Voltage	120/ 240		Volt
60 Hz		BIL	125		kVolt
	0 .9	0 kVA .9 % 6 0 Hz	0 kVA Total Weight .9 % Primary Voltage	0 kVA Total Weight 770 .9 % Primary Voltage 16	0 kVA Total Weight 770 .9 % Primary Voltage 16

Oil Analysis

Laboratory Tests Type of Test ASTM No. **Acceptable Limits Test Results** Red White Blue Dielectric Breakdown 30 kV Min. 38.4 42.8 37.1 **D877** 0.014 0.014 **Neutralization Number** D974 0.05 Max. Mg Koh/G 0.028 30.0 30.4 **Interfacial Tension** D971 32 Dynes/ Cm Min. 30.1 0.850 0.851 0.849 Specific Gravity 0.84 - 0.91 D1298 0.5 0.5 0.5 Colour D1500 ≤3.5 Max. Clear Visual Condition D1524 Clear Clear Clear

	Observations & Comments
Comments:	- Oil levels marginal.
Results Satisfactory:	OK

T.S. P_Trans_Elect

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 16, 1999		
File Number	6621	Tested By	KH		
Location	361A Old Finch Ave., Scarborough, Ontario				
Equipment I.D.	Vault #13 - Old Elephant House				

Submersible Distribution Transformer

Manufacturer	Westinghouse		Year Built	1973			
Туре	ONAN		Serial #'s	White	: 861950 Ø: 861-9 : 861951	54	
Neutral	Solid		Liquid Type/Vol	Oil	34	Gal	
Rating	75	kVA	Total Weight	1080		lbs.	
Impedance	2.0	%	Primary Voltage	16		kVolt	
Phase(s)	1 6		Secondary Voltage	e 120/240		Volt	
Frequency	60 Hz		BIL			125lt	
Insulation Resist	ance (MΩ)						

Oil Analysis

Type of Test	ASTM No.	Acceptable Limits	· T	S	
			Red	White	Blue
Dielectric Breakdown	D877	30 kV Min.	47.4	38.7	42.7
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.028	0.028	0.041
Interfacial Tension	D971	32 Dynes/ Cm Min.	32.7	32.4	30.6
Specific Gravity	D1298	0.84 - 0.91	0.484	0.847	0.853
Colour	D1500	≤3.5 Max.	0.5	0.5	1.0
Visual Condition	D1524	Clear	Clear	Clear	Clear

Observations & Comments						
Comments:	- Blue phase oil level below manufacturer's indication line.					
rije vijaja nestija, ku erijaš ir dijaj	and the state of the second of the contract of the second					
Results Satisfactory:	OK.					

T.S. P_Trans_Elect



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 16, 1999
File Number	6621	Tested By	TA
Location	361A Old Finch Ave., Scarborough, (Ontario	
Equipment LD.	Vault #13A		

Submersible Distribution Transformer

Manufacturer	Westinghouse		cturer Westinghouse Year Built		Year Built	1982				
Туре	ONAN		Serial #'s	White	: LG3798 Ø: LG37): LG379	991				
Neutral	Solid		Liquid Type/Vol	Oil	70		Gal			
Rating	25	kVA	Total Weight	240		lk)\$.			
Impedance	1.8	%	Primary Voltage	16		k	Volt			
Phase(s)	1	ф	Secondary Voltage	120/ 240		V	'olt			
Frequency	60 H z		BIL	125		k	Volt			

Oil Analysis

Type of Test	ASTM No.	Acceptable Limits	Test Results		
			Red	White	Blue
Dielectric Breakdown	D877	30 kV Min.	44.4	47.6	41.8
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.014	0.021	0.027
Interfacial Tension	D971	32 Dynes/ Cm Min.	30.0	25.7	29.5
Specific Gravity	D1298	0.84 - 0.91	0.856	0.853	0.856
Colour	D1500	≤3.5 Max.	0.5	0.5	0.5
Visual Condition	D1524	Clear	Clear	Clear	Clear

	Observations & Comments
Comments:	 The oil levels of these units were noted as marginal during the inspection. Note the marginal White \$ IFT. The White phase unit subsequently failed and was replaced. (See following Oil test sheet for new unit lab results)
Results Satisfactory:	

Black & MCDonald

TECHNICAL FIELD SERVICE DEPARTMENT

Special Projects Group

Client Information

Customer	Toronto Zoo	Sample Date	June 28, 1999		
File Number	6621	Sampled By	JRK		
Location	361A Old Finch Ave., Scarborough, Ontario				
Equipment I.D.	Vault #13A Pachyderm Centre/ White phase				
Substation	Outside Elephant Paddock (Fed from Africa Pavilion)				

Oil Analysis

Transformer Data				
Manufacturer	Cam Tran Co.	Primary Volts	27.6/ 16	kVolts
Type	ONAN Submersible	Rating	100	kVA
Serial No.	99C0846101	Liquid Volume	194	Litres

Laboratory Tests

Type of Test	ASTM No.	Acceptable Limits	Test Results	
			1999	
Dielectric Breakdown	D877	30 kV	42.1	
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.027	
Interfacial Tension	D971	32 Dynes/ Cm Min.	37.7	
Specific Gravity	D1298	0.84 - 0.91	0.818	
Colour	D1500	≤3.5	<0.5	
Visual Condition	D1524	Clear	Clear	
Water Content	D1533	30 ppm (<69kV)		
Power Factor	D924	1.0 % Max @ 25 °C	0.014%	
PCB Content	D4059	50 ppm Max.		
Inhibitor	D2668	≥0.20%		
Furans	D5837	<100 ppb		
Hydrogen (H2)	est the tea			
Oxygen & Argon				
Nitrogen (N2)				
Methane (CH4)				
Carbon Monoxide (CO)		多数数据表示 (1981年)		
Carbon Dioxide (CO2)				
Ethylene (C2H4)		7.77		
Ethane (C2H6)				
Acetylene (C2 H2)		STATE OF THE PERSON OF		
Total Gas Content				
	Com	monte		

	Comments
Chemical Properties	OK
PCB Content	N/A
Dissolved Gas Content	



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 17, 1999		
File Number	6621	Tested By	KH		
Location	361A Old Finch Ave., Scarborough, Ontario				
Equipment I.D.	Vault #14				

Submersible Distribution Transformer

Manufacturer	Westinghouse ONAN		nufacturer Westinghouse		Year Built	1973		
Туре			Serial #	861970)			
Neutral	Solid		Liquid Type/Vol	Oil 16		Gal		
Rating	25	kVA	Total Weight	465		lbs.		
Impedance	1.9	%	Primary Voltage	16	-	kVolt		
Phase(s)	1	ф	Secondary Voltage	120/ 24	Ю	Volt		
Frequency	60	Hz	BIL	125		kVolt		
Insulation Resist	ance (MΩ)							

Oil Analysis

Type of Test	ASTM No.	Acceptable Limits	Test Results
-			1999
Dielectric Breakdown	D877	30 kV Min.	44.1
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.028
Interfacial Tension	D971	32 Dynes/ Cm Min.	33.4
Specific Gravity	D1298	0.84 - 0.91	0.848
Colour	D1500	≤3.5 Max.	0.5
Visual Condition	D1524	Clear	Clear

	Observations & Comments
Comments:	
Results Satisfactory:	OK .

T.S. P_Trans_Elect

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 16, 1999		
File Number	6621	Tested By	KH/TL/AN		
Location	361A Old Finch Ave., Scarborough, Ontario				
Equipment I.D.	Vault #16				

Submersible Distribution Transformer

Manufacturer	Transform Westinghouse		Year Built	1973			
Туре	ONAN Solid		Serial #'s	White	: 861969 Ø: 86197): 861977	8 -	
Neutral			l Solid Liquid Type/Vol	Liquid Type/Vol	Oil	16	
Rating	25	kVA	Total Weight	465		lb	8.
Impedance	1.9	%	Primary Voltage	16		k	Volt
Phase(s)	1	ф	Secondary Voltage	120/ 24	10	V	olt
Frequency	60 Hz		BIL	125		k	Volt
Insulation Resist	ance (MΩ)				1		

	Oil	Analysis			
i i	Lab	oratory Tests	en de la secono de La secono de la secono dela secono de la secono dela secono de la secono dela secono dela secono dela secono de la secono dela secono dela secono de la secono de la secono de la secono dela secono de la secono de la secono de la secono de la secono dela secono de la secono de la secono de la secono de la secono dela secono de la secono dela se	r yr y \$50 tae'd an	67 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5
Type of Test	ASTM No.	Acceptable Limits		est Result	
			Red	White	Blue
Dielectric Breakdown	D877	30 kV Min.	43.9	37.9	46.2
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.028	0.014	0.021
Interfacial Tension	D971	32 Dynes/ Cm Min.	31.9	32.1	32.8
Specific Gravity	D1298	0.84 - 0.91	0.849	0.849	0.849
Colour	D1500	≤3.5 Max.	0.5	0.5	0.5
Visual Condition	D1524	Clear	Clear	Clear	Clear

	Observations & Comments
Comments:	
un com programme de la company	The second of th
Results Satisfactory:	OK

T.S. P_Trans_Elect

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 16, 1999	
File Number	6621	Tested By	KH	
Location	361A Old Finch Ave., Scarborough, Ontario			
Equipment I.D.	Vault #16			

Submersible Distribution Transformer

Manufacturer	Westinghor	ıse	Year Built	1974			
Туре	ONAN		Serial #	861966			
Neutral	Solid		Liquid Type/Vol	Oil	27		Gal
Rating	50	kVA	Total Weight	770		lb	S
Impedance	1.9	%	Primary Voltage	16		k\	Volt
Phase(s)	1	•	Secondary Voltage	120/24	0	V	olt
	60	Hz	BIL	125		k	Volt
Frequency Insulation Resist		Hz					

Oil Analysis

Section 1 Section 1	Laborat	ory l'ests 😅 😘 🙀	
Type of Test	ASTM No.	Acceptable Limits	Test Results
-	•		1999
Dielectric Breakdown	D877	30 kV Min.	44.8
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.034
Interfacial Tension	D971	32 Dynes/ Cm Min.	30.2
Specific Gravity	D1298	0.84 - 0.91	0.850
Colour	D1500	≤3.5 Max.	0.5
Visual Condition	D1524	Clear	Clear

	Observations & Comments
Comments:	IFT is borderline
Results Satisfactory:	OK

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 16, 1999
File Number	6621	Tested By	TL/RPM
Location	361A Old Finch Ave., Scarbord	ough, Ontario	
Equipment I.D.	Vault #16A		

Submersible Distribution Transformer

Manufacturer	Westinghosue ONAN		rer Westinghosue Year Built		Year Built	1973		
Туре			ONAN Serial#	861974				
Neutral	Solid		Liquid Type/Vol	Oil 16		Ga		
Rating	25	kVA	Total Weight	465		lbs.		
Impedance	1.9	%	Primary Voltage	16		kVolt		
Phase(s)	1	ф	Secondary Voltage	120/ 24	Ю	Volt		
Frequency	60 Hz		ВП	125		kVolt		
Insulation Resist	ance (MΩ)							

Oil Analysis

Type of Test	ASTM No.	Acceptable Limits	Test Results
Type of Test	ABIMINO.	Acceptable Limits	1999
Dielectric Breakdown	D877	30 kV Min.	41.9
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.028
Interfacial Tension	D971	32 Dynes/ Cm Min.	32.3
Specific Gravity	D1298	0.84 - 0.91	0.849
Colour	D1500	≤3.5 Max.	0.5
Visual Condition	D1524	Clear	Clear

	Observations & Comments
Comments:	Oil level is acceptable
groupers sent all Market con	
Results Satisfactory:	OK

T.S. P_Trans_Elect

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 18, 1999			
File Number	6621	Tested By	TL/RPM			
Location	361A Old Finch Ave., Scarborough, Ontario					
Equipment I.D.						

Submersible Distribution Transformer

Carte		Year Built	1983			
ONAN		Serial #	L0721-1			
Solid		Liquid Type/Vol	Oil	35		Gal
75	kVA	Total Weight	889		lb	8.
2.4	%	Primary Voltage	16		k'	Volt
1	ф	Secondary Voltage	120/24	0	V	olt
60 Hz		BIL	125		k	Volt
	ONAN Solid 75 2.4 1	ONAN Solid 75 kVA 2.4 % 1 ф	ONAN Serial # Solid Liquid Type/Vol 75 kVA Total Weight 2.4 % Primary Voltage 1 φ Secondary Voltage	ONAN Serial # L0721- Solid Liquid Type/Vol Oil 75 kVA Total Weight 889 2.4 % Primary Voltage 16 1 φ Secondary Voltage 120/24	ONAN Serial # L0721-1 Solid Liquid Type/Vol Oil 35 75 kVA Total Weight 889 2.4 % Primary Voltage 16 1 φ Secondary Voltage 120/ 240	ONAN Serial # L0721-1 Solid Liquid Type/Vol Oil 35 75 kVA Total Weight 889 lb 2.4 % Primary Voltage 16 kV 1 φ Secondary Voltage 120/240 V

Oil Analysis

Type of Test	ASTM No.	Acceptable Limits	Test Results
Type of Test	ASIMINO.	Acceptable Limits	1999
Dielectric Breakdown	D877	30 kV Min.	38.2
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.034
Interfacial Tension	D971	32 Dynes/ Cm Min.	18.2
Specific Gravity	D1298	0.84 - 0.91	0.857
Colour	D1500	≤3.5 Max.	1.0
Visual Condition	D1524	Clear	Clear

Observations & Comments						
Comments:	IFT is marginal					
COMPRESSOR AND ACTION						
Results Satisfactory:	Fair					

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 17, 1999		
File Number	6621	Tested By	TL/RPM		
Location	361A Old Finch Ave., Scarborough, Ontario				
Equipment I.D.	Vault #20 – Eurasia Fed	···			

Submersible Distribution Transformer

Manufacturer	Westinghou	ise	Year Built	1973			
Туре	ONAN		Serial #	861944			
Neutral	Solid		Liquid Type/Vol	Oil	38		Ga
Rating	100	kVA	Total Weight	1300		lb	8.
Impedance	1.8	%	Primary Voltage	16		k	Volt
Phase(s)	1	•	Secondary Voltage	120/ 24	0	V	olt
Frequency	60	Hz	BIL	125		k	Volt

Oil Analysis

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	D877	30 kV Min.	43.3
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.014
Interfacial Tension	D971	32 Dynes/ Cm Min.	36.1
Specific Gravity	D1298	0.84 - 0.91	0.847
Colour	D1500	≤3.5 Max.	0.5
Visual Condition	D1524	Clear	Clear

	Observations & Comments
Comments:	
Results Satisfactory:	· ·

T.S. P_Trans_Elect

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 17, 1999
File Number	6621	Tested By	KH
Location	361A Old Finch Ave., Scarborough, 6	Ontario	
Equipment I.D.	Vault #21		

Submersible Distribution Transformer

Manufacturer	Westinghou	ıse	Year Built	1973		
Туре	ONAN		Serial #	861981	·	
Neutral	Solid		Liquid Type/Vol	Oil	16	Gal
Rating	25	kVA	Total Weight	465		lbs.
Impedance	1.9	%	Primary Voltage	16		kVolt
Phase(s)	1	ф	Secondary Voltage	120/ 24	Ю	Volt
Frequency	60	Hz	BIL	125		kVolt
Insulation Resist	ance (MΩ)					

Oil	An	aly	sis
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The State of the S	DETOCAL	ory Tests	
Type of Test	ASTM No.	Acceptable Limits	Test Results
,			1999
Dielectric Breakdown	D877	30 kV Min.	30.7
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.014
Interfacial Tension	D971	32 Dynes/ Cm Min.	33.3
Specific Gravity	D1298	0.84 - 0.91	0.849
Colour	D1500	≤3.5 Max.	0.5
Visual Condition	D1524	Clear	Clear

	Observations & Comments
Comments:	 Had to pump water out of vault Dielectric of oil is borderline
Results Satisfactory:	OK

T.S. P_Trans_Elect

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 17, 1999
File Number	6621	Tested By	KH
Location	361A Old Finch Ave., Scarborough,	Ontario	
Equipment I.D.	Vault #22		

Submersible Distribution Transformer

Westinghor	use	Year Built	1973		
ONAN		Serial #	861973		
Solid		Liquid Type/Vol	Oil	16	Gal
25	kVA	Total Weight	463		lbs.
1.9	%	Primary Voltage	16		kVolt
1	•	Secondary Voltage	120/ 24	0	Volt
60	Hz	BIL	125		kVolt
	ONAN Solid 25 1.9 1	Solid 25 kVA 1.9 % 1 \$\operatorname{0}{0}	ONAN Serial # Solid Liquid Type/Vol 25 kVA Total Weight 1.9 % Primary Voltage 1 \$\oplus \text{ Secondary Voltage}\$	ONAN Serial # 861973 Solid Liquid Type/Vol Oil 25 kVA Total Weight 463 1.9 % Primary Voltage 16 1 \$\phi\$ Secondary Voltage 120/24	ONAN Serial # 861973 Solid Liquid Type/Vol Oil 16 25 kVA Total Weight 463 1.9 % Primary Voltage 16 1 \$\phi\$ Secondary Voltage 120/240

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	Laborat 🖟 🖟	ory Tests	
Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	D877	30 kV Min.	42.4
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.041
Interfacial Tension	D971	32 Dynes/ Cm Min.	33.8
Specific Gravity	D1298	0.84 - 0.91	0.848
Colour	D1500	≤3.5 Max.	0.5
Visual Condition	D1524	Clear	Clear

Observations & Comments						
Comments:	Over one foot of water pumped out of vault.					
Barris de California						
Results Satisfactory:	OK					

T.S. P_Trans_Elect

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 15, 1999
File Number	6621	Tested By	JC
Location	361A Old Finch Ave., Scarboro	ugh, Ontario	
Equipment I.D.	Vault #23		

Submersible Distribution Transformer

Manufacturer	Westinghou	ıse	Year Built		–		
Туре	ONAN		Serial #	871931			
Neutral	Solid		Liquid Type/Vol	Oil	16		Gal
Rating	25	kVA	Total Weight	465		11)5.
Impedance	1.9	%	Primary Voltage	16		k	Volt
Phase(s)	1	ф	Secondary Voltage	120/ 240)	V	olt
Frequency	60	Hz	BIL	125		k	Volt
Insulation Resist	ance (MΩ)						

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and the second second second	Laborat	ory Tests	
Type of Test	ASTM No.	Acceptable Limits	Test Results
7 - 7			1999
Dielectric Breakdown	D877	30 kV Min.	36.1
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.021
Interfacial Tension	D971	32 Dynes/ Cm Min.	30.6
Specific Gravity	D1298	0.84 - 0.91	0.849
Colour	D1500	≤3.5 Max.	0.5
Visual Condition	D1524	Clear	Clear

	Observations & Comments
Comments:	
Company of the Section 2	
Results Satisfactory:	OK

T.S. P_Trans_Elect

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 17, 1999
File Number	6621	Tested By	TL/ RPM
Location	361A Old Finch Ave., Scarborough,	Ontario	
Equipment I.D.	Vault #24 – Eurasia Fed		

Submersible Distribution Transformer

Westinghouse ONAN		Year Built	1974			
		ONAN Serial #	Serial #	861964		
Solid		Liquid Type/Vol	Oil	27	(Gal
50	kVA	Total Weight	770		lbs	•
1.9	%	Primary Voltage	16		kV	olt
1	ф	Secondary Voltage	120/ 24	Ю	Vo	lt
60	Hz	BIL	125		kV	olt
	ONAN Solid 50 1.9	ONAN Solid 50 kVA 1.9 % 1 \$\phi\$	ONAN Serial # Solid Liquid Type/Vol 50 kVA Total Weight 1.9 % Primary Voltage 1 φ Secondary Voltage	ONAN Serial # 861964 Solid Liquid Type/Vol Oil 50 kVA Total Weight 770 1.9 % Primary Voltage 16 1 \$ Secondary Voltage 120/24	ONAN Serial # 861964 Solid Liquid Type/Vol Oil 27 50 kVA Total Weight 770 1.9 % Primary Voltage 16 1 φ Secondary Voltage 120/240	ONAN Serial # 861964 Solid Liquid Type/Vol Oil 27 0 50 kVA Total Weight 770 lbs 1.9 % Primary Voltage 16 kV 1 φ Secondary Voltage 120/240 Vo.

Oil Analysis					
	Laborat	ory Tests	**************************************		
Type of Test	ASTM No.	Acceptable Limits	Test Results		
			1999		
Dielectric Breakdown	D877	30 kV Min.	49.4		
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.021		
Interfacial Tension	D971	32 Dynes/ Cm Min.	31.2		
Specific Gravity	D1298	0.84 - 0.91	0.850		
Colour	D1500	≤3.5 Max.	0.5		

Observations & Comments					
Comments:	 Slight mark/ burn on H1B elbow. Some secondary cables were found cut off. These ends were taped off by our personnel. 				
Results Satisfactory:	OK (as left)				

D1524

Clear

Clear

T.S.

Visual Condition

T.S. P_Trans_Elect



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 15, 1999
File Number	6621	Tested By	KH/RPM
Location	361A Old Finch Ave., Scarborough,	Ontario	
Equipment I.D.	Vault #26		

Submersible Distribution Transformer

Manufacturer	Westinghouse		Year Built	1974		
Туре	ONAN		Serial #	861962	,	
Neutral	Solid		Liquid Type/Vol	Oil	Oil 27	
Rating	50	kVA	Total Weight	770		lbs.
Impedance	1.9	%	Primary Voltage	16		kVolt
Phase(s)	1	ø	Secondary Voltage	120/ 24	Ю	Volt
Frequency	60	Hz	BIL	125		kVolt
Insulation Resist	ance (MΩ)					

Oil Analysis

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	D877	30 kV Min.	40.4
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.014
Interfacial Tension	D971	32 Dynes/ Cm Min.	31.1
Specific Gravity	D1298	0.84 - 0.91	0.848
Colour	D1500	≤3.5 Max.	0.5
Visual Condition	D1524	Clear	Clear

Observations & Comments					
Comments: - Corrosion present on untaped Neutral bus/ bushing.					
	- Sand present in vault via primary cable duct.				
Results Satisfactory:	OK				

T.S. P_Trans_Elect

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 15, 1999
File Number	6621	Tested By	KH/ RPM
Location .	361A Old Finch Ave., Scarborough, (Ontario	
Equipment LD.	Vault #27		

Submersible Distribution Transformer

Manufacturer	Westingho	use	Year Built	1973		
Туре	ONAN		Serial #	871926		
Neutral	Solid		Liquid Type/Vol	Oil	16	G
Rating	25	kVA	Total Weight	465		ibs.
Impedance	1.9	%	Primary Voltage	16		kVol
Phase(s)	1	•	Secondary Voltage	120/24	0	Volt
Frequency	60	Hz	BIL	125		kVol

Oil	Analysis
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Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	D877	30 kV Min.	35.8
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.014
Interfacial Tension	D971	32 Dynes/ Cm Min.	32.5
Specific Gravity	D1298	0.84 - 0.91	0.848
Colour	D1500	≤3.5 Max.	0.5
Visual Condition	D1524	Clear	Clear

Observations & Comments					
Comments:	Comments: • Elbows taped by our personnel. • Vault lid has no securing nuts holding grate.				
CONTROL CONTROL					
Results Satisfactory:	OK				

T.S. P_Trans_Elect



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 15, 1999
File Number	6621	Tested By	AS/TA
Location	361A Old Finch Ave., Scarborough, Ontario		
Equipment I.D.	Vault #28		

Submersible Distribution Transformer

Manufacturer	Westinghor	use	Year Built	1973		
Туре	ONAN		Serial #	871934	871934	
Neutral	Solid		Liquid Type/Vol	Oil	16	Gal
Rating	25	kVA	Total Weight	465		lbs.
Impedance	1.9	%	Primary Voltage	16		kVolt
Phase(s)	1	ф	Secondary Voltage	120/ 24	Ю	Volt
Frequency	60	Hz	BIL	125		kVolt
Insulation Resist			1 DAL	1	•	1 2 7 0 1

Oil Analysis

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Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	D877	30 kV Min.	40.8
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.014
Interfacial Tension	D971	32 Dynes/ Cm Min.	30.7
Specific Gravity	D1298	0.84 - 0.91	0.848
Colour	D1500	≤3.5 Max.	0.5
Visual Condition	D1524	Clear	Clear

	Observations & Comments
Comments:	
The second second	
Results Satisfactory:	OK

T.S. P_Trans_Elect

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 16, 1999
File Number	6621	Tested By	JC
Location	361A Old Finch Ave., Scarborough, (Ontario	
Equipment I.D.	Vault # 29		

Submersible Distribution Transformer

Manufacturer	Westinghouse		Year Built				
Туре	ONAN Serial #	861972					
Neutral	Solid		Liquid Type/Vol	Oil	16		Gal
Rating	25	kVA	Total Weight	465		lb	8.
Impedance	1.9	%	Primary Voltage	16		k	Volt
Phase(s)	1	ф	Secondary Voltage	120/ 24	9	V	olt
Frequency	60	Hz	BIL	125		k	Volt
Insulation Resist	ance (MΩ)						

	Oil Ar	alysis	
con productions and the constitutions	. Laborat	ory Tests	
Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	D877	30 kV Min.	39.3
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.021
Interfacial Tension	D971	32 Dynes/ Cm Min.	30.9
Specific Gravity	D1298	0.84 - 0.91	0.848
Colour	D1500	≤3.5 Max.	0.5
Visual Condition	D1524	Clear	Clear

	Observations & Comments
Comments:	
Results Satisfactory:	OK



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 18, 1999
File Number	6621	Tested By	KH
Location	361A Old Finch Ave., Scarborough,	Ontario	
Equipment LD.	Vault #30		

Submersible Distribution Transformer

Manufacturer	Westinghou	ise	Year Built	1973				
Туре	ONAN		rpe ONAN Serial #'s		Serial #'s	Red Ø: 861976 White Ø: 871932 Blue Ø: 871933		2
Neutral	Solid		Liquid Type/Vol	Oil	16	Gal		
Rating	25	kVA	Total Weight	465		lbs.		
Impedance	1.9	%	Primary Voltage	16		kVolt		
Phase(s)	1	ф	Secondary Voltage	120/ 24	10	Volt		
Frequency	60	Hz	BIL	125		kVolt		

Oli Analysis

Laboratory Tests Acceptable Limits Test Results Type of Test ASTM No. White Blue Red 39.1 30 kV Min. 43.0 34.1 D877 Dielectric Breakdown 0.014 0.05 Max. Mg Koh/G 0.007 0.021 **Neutralization Number** D974 33.1 29.6 31.8 32 Dynes/ Cm Min. Interfacial Tension D971 0.848 0.849 0.849 Specific Gravity D1298 0.84 - 0.91 0.5 0.5 0.5 ≤3.5 Max. Colour D1500 Clear Clear Clear Clear Visual Condition D1524

	Observations & Comments
Comments:	
4	
Results Satisfactory:	OK

T.S. P_Trans_Elect

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 16, 1999
File Number	6621	Tested By	KH
Location	361A Old Finch Ave., Scarborough,	Ontario	
Equipment I.D.	Vault #31		

Submersible Distribution Transformer

Manufacturer	Westinghouse		Year Built	1973		
Туре	ONAN		Serial #'s	White	: 861940 Ø: 86194): 861943	
Neutral	Solid		Liquid Type/Vol	Oil	38	Ga
Rating	100	kVA	Total Weight	1300		lbs.
Impedance	1.8	%	Primary Voltage	16		kVolt
Phase(s)	1	ф	Secondary Voltage	120/ 24	10	Volt
Frequency	60	Hz	BIL	125		kVolt
Insulation Resist	ance (MΩ)					

Oil Analysis

Type of Test	ASTM No.	Acceptable Limits	T	Test Results		
			Red	White	Blue	
Dielectric Breakdown	D877	30 kV Min.	40.2	37.0	38.1	
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.021	0.007	0.007	
Interfacial Tension	D971	32 Dynes/ Cm Min.	31.6	31.1	32.3	
Specific Gravity	D1298	0.84 - 0.91	0.850	0.848	0.848	
Colour	D1500	≤3.5 Max.	0.5	0.5	0.5	
Visual Condition	D1524	Clear	Clear	Clear	Clear	

	Observations & Comments
Comments:	
t in the factor of the contraction of the	and the second
Results Satisfactory:	OK

T.S. P_Trans_Elect



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 14, 1999
File Number	6621	Tested By	JRK/RPM/TA
Location	361A Old Finch Ave., Scarborough,	Ontario	
Equipment I.D.	Vault #32		

Submersible Distribution Transformer

Manufacturer	Westinghou	ıse	Year Built	1973		
Туре	ONAN		Serial #'s	Red Ø: 861949 White Ø: 961955 Blue Ø: 861952		
Neutral	Solid		Liquid Type/Vol	Oil	34	Gı
Rating	75	kVA	Total Weight	1080		lbs.
Impedance	2	%	Primary Voltage	16		kVol
Phase(s)	1	ф	Secondary Voltage	120/ 24	Ю	Volt
Frequency	60	Hz	BIL	125		kVol
Insulation Resist	ance (MΩ)					

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Type of Test	ASTM No.	Acceptable Limits	Test Results		
			Red	White	Blue
Dielectric Breakdown	D877	30 kV Min.	38.5	40.7	42.8
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.028	0.028	0.028
Interfacial Tension	D971	32 Dynes/ Cm Min.	32.8	31.4	33.5
Specific Gravity	D1298	0.84 - 0.91	0.848	0.847	0.847
Colour	D1500	≤3.5 Max.	0.5	0.5	0.5
Visual Condition	D1524	Clear	Clear	Clear	Clear

Observations & Comments						
Comments:	Red & Blue phases' oil level marginal.					
	Red φ manhole gasket should be replaced.					
landa de la composición dela composición de la composición de la composición dela composición dela composición dela composición de la composición dela composición de la composición dela						
Results Satisfactory:	OK/ Fair					

T.S. P_Trans_Elect

Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 17, 1999	
File Number	6621	Tested By	KH	
Location	361A Old Finch Ave., Scarborough, Ontario			
Equipment I.D.	Vault #33			

Submersible Distribution Transformer

Manufacturer	Westinghouse ONAN		Year Built	1973		
Туре			Serial #	871937		
Neutral	Solid		Liquid Type/Vol	Oil	16	Ga
Rating	25	kVA	Total Weight	463		lbs.
Impedance	1.9	%	Primary Voltage	16		kVolt
Phase(s)	1	1 6	Secondary Voltage	120/ 24	0	Volt
Frequency	60	Hz	BIL	125		kVolt
Insulation Resist						

Oil Analysis

Type of Test	ASTM No.	Acceptable Limits	Test Results
			1999
Dielectric Breakdown	D877	30 kV Min.	37.7
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.021
Interfacial Tension	D971	32 Dynes/ Cm Min.	36.9
Specific Gravity	D1298	0.84 - 0.91	0.848
Colour	D1500	≤3.5 Max.	0.5
Visual Condition	D1524	Clear	Clear

Observations & Comments							
Comments:	Vault fills over top with water						
or the same and the same state of							
Results Satisfactory:	OK						

T.S. P_Trans_Elect



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 14, 1999		
File Number	6621	Tested By	RPM		
Location	361A Old Finch Ave., Scarborough, Ontario				
Equipment I.D.	Vault #34				

Submersible Distribution Transformer

Manufacturer	Westinghouse ONAN Solid				1973			
Туре					Serial #'s	Red Ø: 861971 White Ø: 871927 Blue Ø: 871936		
Neutral			Solid Liquid Type/Vol	Oil	16	Ga		
Rating	25	kVA	Total Weight	465		lbs.		
Impedance	1.9	%	Primary Voltage	16		kVolt		
Phase(s)	1	ф	Secondary Voltage	120/ 24	10	Volt		
Frequency	60	Hz	BIL	125 k		kVolt		
Frequency Insulation Resist		Hz	BIL	125	····			

Oil Analysis

77		oratory Tests				
Type of Test	ASTM No.	Acceptable Limits	Test Results			
			Red	White	Blue	
Dielectric Breakdown	D877	30 kV Min.	37.7	48.9	42.2	
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.028	0.014	0.014	
Interfacial Tension	D971	32 Dynes/ Cm Min.	32.2	32.3	33.0	
Specific Gravity	D1298	0.84 - 0.91	0.849	0.848	0.848	
Colour	D1500	≤3.5 Max.	0.5	0.5	0.5	
Visual Condition	D1524	Clear	Clear	Clear	Clear	

Observations & Comments						
Comments:	 Blue & White phases' oil levels are marginal. Blue is lower. Signs of "corona" on White φ elbow. Water apparently dropping from above. Red φ vault ground broken off grate. This has been repaired by our personnel. 					
Results Satisfactory:	FAIR					

T.S. P_Trans_Elect



Special Projects Group

Client Information

Customer	Toronto Zoo	Date	June 14, 1999		
File Number	6621	Tested By	RPM/JRK		
Location	361A Old Finch Ave., Scarborough, Ontario				
Equipment I.D.	Vault #35				

		Transform	ner Nameplate Data	1.1.		Barrell Con
Manufacturer	Westingho	use	Year Built	1973		
Туре	ONAN		Serial #'s	Red Ø: 971929 White Ø: 871928 Blue Ø: 871925		8
Neutral	Solid		Liquid Type/Vol	Oil	16	Gal
Rating	25	kVA	Total Weight	465		lbs.
Impedance	1.9	%	Primary Voltage	16		kVolt
Phase(s)	1	ф	Secondary Voltage	120/ 240)	Volt
Frequency	60	Hz	BIL	125		kVolt

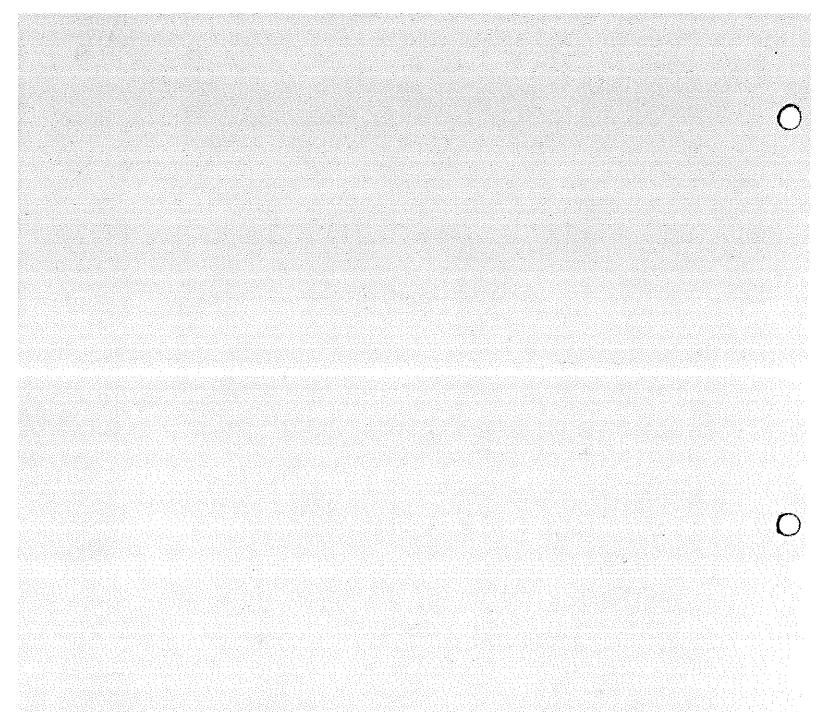
Oil Analysis								
Laboratory Tests								
Type of Test ASTM No. Acceptable Limits				Test Results				
			Red	White	Blue			
Dielectric Breakdown	D877	30 kV Min.	41.8	42.8	38.0			
Neutralization Number	D974	0.05 Max. Mg Koh/G	0.021	0.021	0.021			
Interfacial Tension	D971	32 Dynes/ Cm Min.	32.4	32.7	31.7			
Specific Gravity	D1298	0.84 - 0.91	0.848	0.848	0.848			
Colour	D1500	≤3.5 Max.	0.5	0.5	0.5			
Oisual Condition	D1524	Clear	Clear	Clear	Clear			

Observations & Comments					
Comments:	• Red Ø – oil level is low				
	Blue Ø – oil is marginal				
	and the state of t				
Results Satisfactor	y: Fair				

T.S. P_Trans_Elect

APPENDIX 20

BLACK & McDONALD – SUBMERSIBLE TRANSFORMER FAILURE/REPLACEMENT REPORT DATED AUGUST 1999, REFERENCE NO. 6637





Technical Field Service Division

31 Pullman Court, Scarborough, Ontario MIX 1E4. Phone: (416)-298-9977 Fax: (416)-298-2907

June 8, 1999

Metro Toronto Zoo 361A Old Finch Ave. Scarborough, Ontario M1B 5K7

Attention:

Mr. Dean Evans

Maintenance/ Facilities Supervisor

Subject:

Submersible Transformer Failure / Replacement Report

Our Reference:

6638

Dear Sir:

Further to the power interruption that occurred on May 18th, please find the results of our investigation enclosed herein.

Initial Observations & Action:

- A single phase feed 27.6kV S&C fuse was found to have operated in the Eurasia Pavilion substation. The affected feed supplied three (3) submersible transformer vaults.
- The blown link was replaced and tested.
- The associated lightning arrestor was also tested at 5kVDC and found to be acceptable for continued use.
- The feed was re-energised and the new fuse did not operate.
- The 3 individual submersible vaults were subsequently inspected.
- The transformer adjacent to the "Bird Barn" was found to not be supplying power.
- After confirming that voltage was indeed present at the cable termination point to the transformer, the feed was isolated and the transformer tested.

Transformer Test Results:

- Insulation resistance ("Megger") testing of the transformer 240V secondary winding resulted in a less than acceptable reading

 3.5MΩ. Industry standards require a minimum value of 100MΩ for this type of unit.
- Dissipation factor readings measured beyond the readable scale of the test set.
- High capacitance readings on the secondary winding confirmed this as the point of failure.
- Sampling of the transformer oil immediately gave evidence of internal failure by the oil's black/yellow colour (due to carbonisation).
- The dielectric breakdown of the oil was laboratory tested at 18.6kV a clear failure by any accepted standard.

Technical Field Service Division

31 Paliman Court, Scarborough, Ontario M1X 1E4. Phone: (416)-298-9977 Fax: (416)-298-2907

Remedial Action Taken:

- As a result of the clear failure of the existing submersible transformer, it was removed from service.
- A new, compatible unit was sourced, supplied, tested, and installed.
- The failed transformer was removed from site and is being evaluated for repair or replacement.
- The old unit has been confirmed as being PCB-free.

I trust that this report will meet your requirements. We thank you for this service opportunity and invite any questions you may have. If there are any further concerns, please do not hesitate to contact the undersigned or Fred Tanguay (Tech. Service Manager) at any time.

Regards,

BLACK & McDONALD LIMITED

R.P. (Rodger) Morgan

Utility Technical Field Services



Special Projects Group

Client Information

Customer	Metro Toronto Zoo	Date	May 18, 1999
File Number	6638	Tested By	R. Morgan
Location	Scarborough, Ontario	.,	
Equipment I.D.	Submersible Transformer (Old Unit)		
Substation	Bird Barn Submersible Vault		

Power Transformer -Electrical

Nameplate Data							
Manufacturer	Westingh	ouse	Vector Group	Vector Group 240/1			
Туре	ONAN		Serial #.	861942			
Neutral	Solid Ground		Liquid Type/Vol	Oil	38	Gal	
Rating	100	kVA	Total Weight	1,300		lbs.	
Impedance	1.8	%	Primary Voltage	16		kVolt	
Phase	1	ф	Secondary Voltage	240/12	20	Volt	
Frequency	60	Hz	BIL	125	•	kVolt	

Insulation Tests Prim. With Insulation Resistance Sec. With Prim. & Sec. @ 5k / 500 VDC Sec. Grounded Prim. Grounded To Ground 87,000 65,500 $M\Omega$ 3.46 Corrected to 20 °C.

	CH-L+G	CH-G	CH-L	CL-G	CL-H+G
Cap (pF)	122	117	4	3000	3000
Corr. 20 °C					
		N Charles		ers organización	t e geografie
Dis. Fact.(%)	11.22	13.00		>39.99	>39.99

Corr. 20 °C.

Тар	Primary Volts	Calculated Ratio	<u>X0-X2</u> H1-H2	<u>X0-X3</u> H2-H3	<u>X0-X1</u> H3-H1
1					
2					
3					
4					
5					
					,

Tap Position Found & Left Results Satisfactory NO

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